

Articles Published Between 2002 and 2013 on Strategic Issues

These articles provide insights into assessments made by Robbin Laird and his colleagues in the first decade of the 21st century on a variety of military developments during this time of transition. The articles were published in a variety of U.S. and allied defense publications.

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Innovation + Acquisition = Transformation

Capabilities-Based Procurement: The Coast Guard Leads the Way

By ROBBIN F. LAIRD

Dr. Robbin F. Laird is senior adviser on international security policy for the Center for Security Strategies and Operations at Anteon Corporation, Fairfax, Va.

The Bush administration has focused from the beginning of its time in office upon the goal of military transformation. The innovative application of technology to develop revolutionary increases in military capability is a fundamental element in this transformation but, as Secretary of Defense Donald H. Rumsfeld and others have explained, the process also requires the adoption of new organizational designs and intelligent risk taking.

Rumsfeld hopes to encourage a series of transformations that, taken together, will help to redefine how war is fought. Seeking to confront the uncertain national-security challenges of the 21st century, for example, the Department of Defense (DOD) has shifted its force-structure planning from a threat-based approach to a capabilities-based model.

The events of 9/11 and combat operations in Afghanistan have dramatically accelerated this effort and posed a new problem: how to fuse domestic and global national-security requirements into a seamless web of national-security policy.

At the core of Rumsfeld's vision of military transformation is the need for the armed forces to adopt performance- and capabilities-based procurement methodology in the design, development, and acquisition of platforms, weapons, and systems. Rather than each branch of the armed forces replacing aging assets on a one-for-one basis, it is necessary to identify the core competencies and capabilities that the nation requires in its national-security programs.

The Defense Acquisition Board and the Joint Requirements Oversight Council guide each service in this process and ensure that all systems will be interoperable in a joint-service environment, but Rumsfeld's top deputies argue that more fundamental change is needed in the way that DOD designs and procures its weapons and systems if transformation is to become a reality.

With its June contract award for the Integrated Deepwater System, the U.S. Coast Guard has demonstrated that it is in the forefront of the effort to follow a capabilities-based approach to military procurement. Although by law one of the U.S. armed services, the fact that the Coast Guard is, for the time being, a part of the Department of Transportation perhaps gave it greater flexibility in adopting a more innovative acquisition strategy.

Facing block obsolescence of its core maritime and air assets, the Coast Guard followed a "mission-based acquisition" approach based on an integrated "system-of-systems" concept. As Lt. Cdr. Michael Anderson, then communications director for the Coast Guard's Deepwater Project, said, "Rather than focusing on specific hardware, like a class of cutter or aircraft, the Coast Guard has developed a performance specification that describes the fundamental capabilities the service needs to perform all of its missions in the deepwater regions worldwide."



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With its selection of the Lockheed Martin/Northrop Grumman team's Deepwater proposal, the Coast Guard and its new Integrated Coast Guard Systems partners in industry eventually will transform and/or replace the current force with fully integrated mission-designed assets complete with the life-cycle support systems needed. To do this the Coast Guard and its new joint-venture team will compare and evaluate various proposed platforms and technical solutions against mission requirements and needed capabilities. If fewer helicopters are required than fixed-wing aircraft, for example, or if more cutters are necessary than aviation assets--or if a UAV (unmanned aerial vehicle) might best serve a given task--there will be an opportunity to weigh the various merits of such choices.

Since 11 September, the Coast Guard's role in the defense of the U.S. homeland, and in the overall national-security infrastructure, has been vividly demonstrated and more widely appreciated than ever before--by Bush administration officials and the public alike.

The president's proposed creation of a new Department of Homeland Security further validates the national need for the IDS program. Because the system is network-centric, not platform-based, IDS is built primarily around much-needed upgrades to C4ISR (command, control, communications, computers, intelligence, surveillance, and reconnaissance) systems, followed by the progressive modernization of air and sea platforms. As a result, the already heavily tasked multimission Coast Guard will gradually possess the greatly improved interagency capabilities needed to counter maritime threats to U.S. national security at home and abroad.

In short, although the Coast Guard's acquisition approach for IDS was forged well before 11 September and the emergence of any real national debate about the critical relationship between U.S. domestic and international security, the service has provided an especially valuable model that the Department of Defense might well follow to achieve its transformation goals for tomorrow's military. *

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Industry Transformation

Company Efforts Can Help Allies Reshape Military

Military transformation in the United States rests in part upon the pursuit of capabilities-based procurement policies. Ending investment in selected legacy U.S. programs and relying on new system-integration models with global partners could accelerate transformation of allied forces as well.

The old export model of taking 20 years to develop a product

and then compete in the marketplace serves neither American nor European interests. New technologies and opportunities for change can be created by nurturing multiple partnerships among the Euro-Atlantic prime contractors.



By Robbin Laird, senior adviser on international security policy for the Center for Security Strategies and Operations at Anteon Corp., Fairfax, Va.

Combat Systems, Boeing Co. and SAIC, will be building not a product but a capability for the U.S. Army. This is an opportunity to enhance their European partnerships — a major German firm already is involved — to blend command, control and communications with an in-

telligence, surveillance and reconnaissance approach to ground combat with European ground systems as well.

Rather than selling a product, the U.S. companies, with European and U.S. government cooperation, are developing a capability for allied forces. Indeed, after the initial Afghan operation, unmanned aerial vehicles (UAVs) have become a key focal point of Pentagon thinking about transformation opportunities.

A decline in manned systems, a better use of intelligence, surveillance and reconnaissance, and integration of space, air and ground capabilities are on offer from the rapid development of UAVs and armed UAVs.

Notably, the United Kingdom has focused upon their Watchkeeper UAV program as a key part of their future integrated combat system.

Similarly, the agreement between Northrop Grumman Corp. and the European Aerospace, Defence and Space Co. to develop a Eurohawk variant of Global Hawk provides an opportunity to build up the number of UAVs available to U.S. and allied forces, and to allow Europeans as well as Americans to develop their

own modular packages within the common UAV platform.

Joint capabilities clearly can emerge from this; but without common platforms the U.S. goal of having a global sensor system to detect various ballistic and cruise missiles worldwide would be even more complicated.

An especially compelling case of the advantages of blended programs for military transformation has been the IZAR-Bath-Lochheed Martin partnership to build Aegis frigates. This effort began with a competition to build the F100 Spanish Aegis frigate.

The partnership then allowed the team to bid for the Norwegian frigate program and to create a smaller platform which also will carry Aegis.

This will lead to at least nine Aegis frigates emerging from Europe, which will certainly prove useful to Euro-Atlantic naval and aerospace operations. Now Izar has led the way to build an even smaller, 2,500-ton frigate which is Aegis-capable and is available for export.

The main opportunities might come in the Asia-Pacific region. When one adds the new frigates populating selected Asian allied navies with the Japanese Aegis

programs, the benefits to the United States as well as to allies are obvious.

The Joint Strike Fighter (JSF) program has instituted a new approach to international procurement. The new production model is rooted in production for the global market; foreign companies participating in the program are not doing so on a work-share basis. Companies are specializing in producing key capabilities for the JSF for the overall global production of the aircraft.

Also, there is a single production line, but participants in the program build subsections for the entire global buy of JSF, which then are flown to Lockheed Martin Corp. facilities in Fort Worth, Texas, for final assembly. Commercial approaches to logistics are an important part of the JSF model, which explains in part the agreement between Fort Worth and Airbus on logistics issues.

The overall effort to develop ballistic missile defense command, control and communications is an area where blended systems could become significant indeed. There is a need for ground, air and space-based sensors networked to provide re-

gional and global coverage against ballistic, air and cruise missile threats.

With the formation of open architecture ballistic missile command, control and communications, the U.S. government would be in the position to work with allied governments to let the key U.S. and European primes develop and network their systems to provide for national, European, American and global sensor capabilities.

By pursuing a family-of-systems approach, global allied command, control and communications would be enhanced, allowing the United States and its allies to mix and match specific shooter systems to support the global sensor net.

Programs like the Medium Extended Air Defense System among Germany, Italy and the United States will be part of the shooter network and clearly could be reworked to fit into a family-of-systems approach. Aegis upgrades and inclusion in the global sensor network will be important as well to European and Asian navies participating in the Aegis program.

In short, developing an innovative relationship between industry and government and fostering greater European capacity to leverage a trans-Atlantic defense market are key tools for driving change within European defense and promoting interallied transformation. ■

Transformation and the Defense Industrial Base: A New Model

by *Robbin F. Laird*

Overview

American force transformation is about building a new expeditionary model with flexible, modular forces that can be managed on a global basis to protect U.S. interests. Breaking the tyranny of geography on military forces is a key aspect to change.

Transformation represents a shift in the demand side of the defense industrial business to provide for these new capabilities. The Department of Defense (DOD) is seeking system-of-systems management to deliver capabilities to the services and for joint military operations. This represents a shift from the past emphasis upon platforms and a primary focus upon service-specific technologies and programs.

As the demand side of the equation has shifted, so has the supply side. Defense consolidation in the 1990s dealt with scarcity; now the newly emerged mega-primers are asked to play the role of lead systems integrators (LSIs) or system-of-systems managers to deliver capability to DOD for transformed operations.

DOD moved to a different way of doing business before the transformation effort emerged as a core priority. Now that the transformation agenda is dominating the shift in the relationship between industry and government, working through LSI roles in shaping capabilities-based procurement will be especially important.

Additionally, the new LSI and system-of-systems management model is shaping a new approach to allies. The new model can allow industry to shape new capabilities on a transatlantic basis. Rather than the old export-after-production model, the new LSI model, coupled with a transformation emphasis, leads to the shaping of new opportunities for developing capabilities before core series production decisions would be taken.

Transformation Drives Models

The United States is moving from an older model of forces directed by service chiefs to a more flexible model in which systems operate interactively to provide global capabilities for U.S. intervention. The process of building a new model for U.S. forces is being

forged with several key building blocks. The synergy among these building blocks is crucial in building a net-enabled force to operate globally. The shift is from platforms serving single-service roles to systems of systems that deliver capabilities in support of joint and combined forces operations worldwide.

Transformation is focusing upon where joint forces and global capability are expected to be 20 years from now and working back to the present. This represents a significant shift in how the Department of Defense (DOD) would like to shape its industrial base.

At the heart of the transformation effort is a key focus upon an ability to fuse data and deliver common operational pictures to the forces.¹ To do so will require a shift in the DOD acquisition approach. One idea is to increase the role for Joint Forces Command and emphasize the role of combatant commanders in acquiring fusion technologies.²

Building Blocks for the New Global Expeditionary Model

- Crisis management and antiterrorism efforts
- Development of global logistics support
- Development of global information technology capabilities
- Global "weaponization" or the ability to resupply worldwide with a coalition of U.S. and allied defense industrial firms and depots
- Interoperability across U.S. forces, allies, and coalition partners
- Plug-and-play forces for strategic insertion on a global basis
- Space-enablers for joint forces
- Intelligence, surveillance, and reconnaissance focused primarily on supporting the warfighter
- Active defense to protect the insertion of forces
- Strategic mobility to support the movement of Army and Marine Corps forces
- Expeditionary mindset and focus

Equipment priorities in the transformation approach are not placed on service-specific equipment choices. Rather, they are placed on those capabilities that can emerge from multiservice needs and requirements. In other words, DOD will want industry to deliver equipment and systems that allow for enhanced modularity, global management capabilities, and new approaches and technologies that are most beneficial to the widest range of operations.

Finally, technology that reduces manpower and allows for breakthroughs in life-cycle support costs is favored. Total cost of ownership is a key principle in favor of choosing weapon systems and capabilities. Rather than prioritizing the most advanced platform or subsystems, DOD is looking to the strength of the overall system of combat to provide superiority. Within this calculus, individual parts of the system need to be cost-effective from a life-cycle support perspective.

In short, central to the new transformation approach is a shift in the demand that DOD is placing upon its defense industrial base. A capabilities-based procurement requires lead systems integrators (LSIs) and system-of-systems managers to work with DOD to deliver broad-based families of systems.

A New Model

The consolidation of the defense industry over the past decade has been a response to the downsizing of Western defense budgets. Consolidation was a necessity due to reduced demand for equipment in the procurement pipeline. Military forces were being downsized and redesigned for new peacekeeping missions and reduced threats from traditional adversaries.

The result of the defense restructuring process of the late 20th century has been to put in place a small number of mega-primes that can provide comprehensive systems integration and management capabilities at the disposal of the U.S. Government. This process was put in motion to deal with declining markets and scarcity; now the challenge is to make good use of the new situation to enhance U.S. and allied security.

Before the Bush administration came to power and before September 11, a new consolidated industry had emerged to deal with and manage reduced demand. That industry must respond to a different set of circumstances. A dramatic increase in defense and security spending provides a near-term opportunity for industry; the shift to a different focus—transformation—provides uncertainty about how that industry will be redesigned to work with the new demands of the Federal Government.

At the core of the new effort is a new relationship between Government and industry in building systems architectures. An industrial prime works with the Government in shaping requirements and approaches for building a system of systems, or a group of system capabilities, that needs to be networked in creating an evolving synergistic joint and combined military capability.

Through a public-private partnership in shaping requirements, the U.S. Government then lets a contract for constructing the

system-of-systems approach to be used in a particular military or national security domain. Presumably, the contractor, which has worked with the Government in developing the overall systems architecture, is well positioned to play the role of executing the system-of-systems approach. Clearly, profitability for the firm is limited in building the architecture and is enhanced in the second phase in which it manages the systems architecture.

Within a system-of-systems approach, a number of firms work with the prime contractor and the Federal Government to provide systems and subsystems elements and components. Rather than simply providing parts, the systems and subsystems providers are participating in the execution of the systems architecture and shaping the real-world performance of the system-of-systems capability for combat, military, or national security systems.

Finally, there are component suppliers to the prime contractor and to systems and subsystems providers. In other words, the classic division of defense industry into tiers is being modified to reflect a new division of labor. At the top level are the firms that work with the Government in a public-private partnership to create systems architectures. These primes are then able to execute and manage a system-of-systems capability for the Government. At the next level are those firms that provide (through business units of the primes or by separate commercial or military firms) system and subsystem capabilities within the system of systems. Lastly, there are the component suppliers that work with primes and nonprimes alike in executing the system-of-systems business plan.

In effect, a new pattern of five relationships has emerged in the wake of the consolidation process. (1) The DOD procurement process focuses upon defining the new capabilities that the Department wants so that it can meet transformation requirements. (2) DOD does this in interaction with the market. (3) In turn, the market supports defense firms that have predictable and steady streams of revenue from the Federal Government, and the mega-primes have the flexibility to move within and among programs to provide for financial stability. (4) LSI and system of systems managers work with the Government to establish the range of choices in the marketplace to provide the systems, subsystems, and components available to meet architectural or overall systems requirements. (5) New mission capabilities thus emerge from the interaction between the private sector and the DOD procurement system to provide for the needs of a new Pentagon in its transformation quest.

To elaborate the basic characteristics of the new defense industrial model further, three cases of the emergence of the new capabilities-based approach to procurement will be briefly examined. The first case is the adoption of the Deepwater approach by the Coast Guard, which was forged before the DOD transformation effort but anticipated much of this effort. The second case is the future combat systems (FCS) approach to land warfare. The third case is the Joint Strike Fighter (JSF) and its role with allies in the system-of-systems management model.

Deepwater and USCG Transformation

Even before transformation was a key theme for the new relationship between Government and industry, the U.S. Coast Guard (USCG) was working on its own solution. As the USCG faced block

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The Top 10 Defense Firms Worldwide

Company	2001 Defense Revenue (Millions of US \$)
Lockheed Martin	22,502.0
Boeing	19,000.0
BAE SYSTEMS, plc	14,491.8
Raytheon	11,969.0
Northrop Grumman	9,337.5
General Dynamics	7,784.0
Thales Group	5,581.8
EADS, NV	5,504.6
TRW	5,200.0
Rosoboronexport	4,200.0

Source: *Defense News*, November 11–17, 2002

obsolescence of its core maritime and air assets, the decision was made to pursue a mission-based acquisition approach, which was built around an integrated approach to procurement. As written in *Naval Engineers Journal*,

Rather than focusing on specific hardware, like a class of cutter or aircraft, the Coast Guard has developed a performance specification that describes the fundamental capabilities the service needs to perform all of its missions in the deepwater regions worldwide.³

The USCG sought to take a wide look at its needs in relationship to its missions. Performance-based acquisition was the result: define requirements in light of mission needs and provide systems to meet those needs. No longer would there be one-to-one platform replacements; there would now be decisions made on putting systems in place to provide the capabilities that the USCG would need. The Integrated Deepwater System (IDS) is the designation for this approach to system-of-systems management. At the heart of the IDS effort is an approach to industry relationships. The Coast Guard competed the contract among three teams, each playing the role of an LSI in further defining how the USCG might most effectively put its system-of-systems approach together.

The Coast Guard sought a public-private partnership, which could allow LSI to assist the USCG in getting past the near-term procurement requirements to consider long-term mission and capabilities requirements. How best to provide for the integration of assets in meeting evolving challenges?

With the signature of the Deepwater contract in June 2002, the new industrial relationship with the Coast Guard has been set in motion. The Integrated Coast Guard Systems Joint Venture between Lockheed Martin and Northrop Grumman is the prime for the Deepwater contract working in partnership with the USCG Program Executive Office for Deepwater. Now the task is to provide for a system-of-systems management approach.

The challenge is to mix and match different elements in the Coast Guard universe of platforms, systems, and responsibilities. Integration is often about products; a system-of-systems management approach is about delivering capabilities. Rather than being captured by a single-user community, the new management approach allows

one to take a big-picture approach to how capabilities might be provided to meet evolving challenges best. If fewer helicopters are required than fixed wings, if more cutters are necessary than aviation assets, or if an unmanned aerial vehicle (UAV) would best serve the task in a given area, there will be an ability to weigh such choices. The Pentagon is seeking to do what the USCG is positioning itself to do with IDS—that is, to be able to trade among platforms and integration options. This is the integration implied by Deepwater.

Systems integration is different from system-of-systems management. With systems integration, the focus is on a product and the mastery of the development and delivery of an integrated product (for example, building a good fighter aircraft or a good ship is about starting with a platform and integrating more effective systems into it). System-of-systems management is not product-focused; instead, it is capability-focused. What capabilities does the client need? What products—platforms or systems—are available in the global marketplace to provide for those capabilities best? Moreover, how might those products or systems best be meshed to provide for capabilities current and future? It is crucial to this approach to look forward, as well as back, to anticipate change rather than simply respond to past approaches to meeting needs.

This is a different type of business organization and a radically different approach for the Federal Government to work with industry. On the business side, the systems manager pursues an open business model in the development of the core partnerships necessary to provide for Coast Guard needs. On the Government side, it is crucial to be able to make decisions and to identify and communicate mission requirements and needs. There also must be commitment and stability on the Government side.

The post-September 11 challenge has elevated the significance of the Coast Guard in the defense of the Nation and its security interests—and, with it, the new procurement approach. The dramatically enhanced importance of port and maritime security to the survival of the Nation has underscored the salience of the role of the Coast Guard and the need for it to have an approach that allows it to meet this role much more effectively. Prior to September 11, IDS was about service approach to procurement; since September 11, it has been an innovative approach to national survival.

President George W. Bush's creation of the Department of Homeland Security (DHS) has underscored the importance of the USCG decision to pursue IDS. At the core of the DHS mission is the ability to enhance maritime and port security and to provide for an integrated data fusion for all participants in the homeland security process. As President Bush stated:

The Department would fuse and analyze intelligence and other information pertaining to threats to the homeland from multiple

New Defense Industrial Model

- System-of-systems managers and strategic enablers
- Capability providers for effects-based operations and participants in evolving system-of-systems architectures
- Component providers operating as a global supply base

sources... The Department would merge under one roof the capability to identify and assess current and future threats to the homeland, map those threats against our current vulnerabilities, issue timely warnings and immediately take or effect appropriate preventive and protective action.⁴

The IDS approach fits right in to the Presidential demand for interoperability of communications and data sharing within DHS. IDS is network-centric, not platform-based. A new commercial off-the-shelf and Navy-compliant command, control, communications, computers, intelligence, surveillance, and reconnaissance (C⁴ISR) system that nets the various assets of the Coast Guard to increase maritime domain awareness dramatically is at the heart of the system of systems. As Bruce Stubbs and Scott Truver have argued, "the Coast Guard's leadership role in addressing current and emerging transnational maritime security threats will require seamless C⁴ISR connectivity with not only its own operating forces, but those of myriad governmental agencies and nations allied with the United States in confronting those threats."⁵

President Bush has argued for a proactive approach to dealing with the threat of terrorism: "Homeland defense and missile defense are part of a stronger security. They're essential priorities for America. Yet the war on terror will not be won on the defensive. We must take the battle to the enemy, disrupt his plans and confront the worst threats before they emerge."⁶

The IDS approach will allow such a proactive approach. According to the USCG Deepwater Web site,

By identifying and eliminating threats well before they reach our shores, the impact can be mitigated. Deepwater is critical to ensuring the Coast Guard has the capabilities it needs to stop threats to our homeland before they arrive and the effective response capability to deal with maritime security needs.⁷

The formation of a new Department of Homeland Security will better enable the USCG to play this role.

Consider this scenario: If the Coast Guard stops a ship at sea for inspection and finds illegal immigrants on it, the USCG relies on the Immigration and Naturalization Service to enforce U.S. immigration law and to prevent entry. If the Coast Guard finds potentially dangerous cargo, it relies on the Customs Service to seize it. However, these organizations may not always share information as rapidly as necessary. So instead of arresting potential terrorists and seizing dangerous cargo at sea, our current structure can allow these terrorists to enter our ports and thus the Nation at large. The system might also allow the dangerous cargo to enter our ports and threaten American lives. Under the President's proposal, the ship, the potentially dangerous people, and the dangerous cargo would be seized, at sea, by one department—a department that has no question about either its mission or its authority—to prevent them from reaching our shores.⁸

In other words, the IDS approach was forged well before September 11 and the emergence of any real national debate about the connection between domestic and global security. The data fusion requirements of homeland security are at the heart of the IDS system. A new approach to procurement to mix and match assets to meet missions and the national security challenge is also a major contribution of USCG thinking to future national security.

Army Transformation, FCS, and LSI

The key test of transformation is what happens with land power. How much innovation can be generated quickly and effectively in getting the future capabilities of a global force into deployed capabilities? How much integration with other aspects of joint and combined power can be enhanced by the new approaches? How much authority will land forces have in directing other elements of joint power in operating on a global basis to ensure effective military operations?

Before the Bush administration, Army leadership had already crafted a transformation plan. The planned Army transition has been from the legacy force (heavy and slow) to an interim force (light and deployable) to the Objective Force 21 by 2030, which will be flexible, agile, integrated, and sustainable. The legacy force is built around heavy armor (60–70 tons, 650 cubic feet, and carried by a C–5 or C–17 strategic airlift aircraft) to new armor (20 tons, 300 cubic feet, and capable of being carried by a C–130). The Objective Force will be able to be integrated into either the air-based or sea-based force approach, although maximum operational flexibility seems to be linked to innovations in joint and combined basing at sea.

The new Army would be able to operate within a system-of-systems context and to provide for the global striking power necessary for a new expeditionary model. The Bush administration has sought to accelerate the development of the Objective Force at the expense of modernization or pipeline equipment upgrades in the legacy force. The administration has also questioned whether the interim force should not be altered to put in place elements of the future combat systems (FCS) much earlier than envisaged prior to the defense buildup after September 11.

For example, the Bush administration decision to cancel the Crusader artillery system was rooted in its inability to move quickly into theater operations. It was judged too big and its logistics tail too long to be sustained for rapid, flexible operations. At the same time, the administration has supported FCS, a new Army and Defense Advanced Research Projects Agency (DARPA) initiative that is to provide networked ground strike forces able to be inserted rapidly and with both strategic and operational flexibility.

The Objective Force and its core systems development program—FCS—are at the center of developing an architectural roadmap for the role of land power integrated within the ground-to-air evolution. The Army adopted the USCG Deepwater model as a baseline to provide a capabilities-based approach to its future needs to operate globally. The goal of the FCS program is to develop network-centric concepts for a multimission combat system that will be overwhelmingly lethal, strategically deployable, self-sustaining, and highly survivable in combat through the use of an ensemble of manned and unmanned ground and air platforms.

This system-of-systems design is being crafted by using modeling and simulation and experimentation to evaluate competitive concepts. The FCS will be capable of adjusting to a changing set of missions, ranging from warfighting to peacekeeping. An FCS-equipped force will be capable of providing mobile-networked C⁴ functionalities; autonomous robotic systems; precision direct and indirect fires; air-borne and ground organic sensor platforms; precision, three-dimensional air defense; and nonlethal and adverse-weather reconnaissance, surveillance, targeting, and acquisition.

The U.S. Army LSI contract awarded to the team of Boeing Space and Communications and Science Applications International Corporation was granted with an eye to increasing the speed of realizing a future Objective Force with FCS by 2010. COL William Johnson (program manager and FCS and Army project manager for Objective Force) recently noted that the Boeing role is to bring all of the systems together so that they will be interoperable. The architecture focuses on informing the soldiers and synchronizing the entire Army around the Objective Force.⁹

The logic behind giving the LSI role to a space company (Boeing) is rooted in the key role that space and related information systems will have for the future of the Army as a global force. The Army decided that it needed a team that was capable of a system-centric and not a platform-centric approach, one based on an integrated C⁴ISR architecture.

The FCS program is not following the classic sequential development path to acquisition. Rather, the development of various aspects of a mature FCS system is envisaged and pursued in parallel. The most mature aspects of development will enter the force earlier than others but in line with an evolving open architecture of developing technologies in the system-of-systems environment.

The core LSI responsibility is managing the parallel development process. According to LTG John Riggs, director of the Objective Force Task Force for the Army,

The LSI is definitely involved in every aspect of this program and I think it's paying off. They're involved in assisting with requirements-development activities; they're involved in the architecture of the work; they're involved in the integration work that is associated with formulating an acquisition strategy—just about every aspect of it in this particular phase.¹⁰

Riggs went on to argue that the core benefit of the LSI arrangement was that an ability to leap to future capabilities is greatly facilitated. "But from my perspective," Riggs stated, "the LSI arrangement has greatly assisted us in cutting years—not months, years—off what would normally be expected in this phase of a major equipment program."¹¹

The LSI is responsible for a number of key aspects in FCS development, including awarding contracts to system, subsystem, and component providers for the development of specific technologies and concepts. By June 2003, the LSI must provide the DARPA-Army client with an initial system-of-systems architecture, C⁴ISR architecture, and platform architecture.¹²

In short, rather than building a set of stovepiped products, the prime contractors for the future combat systems are orchestrating the development of a set of capabilities for the U.S. Army. There is an opportunity as well to enhance their European partnerships—a major German firm is already involved—to blend a C⁴ and ISR approach to ground combat with European ground systems as well. Rather than selling a product, the U.S. companies with U.S. and European government cooperation could develop capabilities for allied forces.

Joint Strike Fighter

The JSF program, managed jointly by the U.S. Air Force and the Department of the Navy, represents the most mature transformation program for the development of new U.S. combat capabilities. The

JSF system is interservice in character. It is designed to build joint rather than separate service systems capabilities. It spans three administrations and represents a commitment to change in providing a global capacity for the U.S. military with simplified logistics, weaponization, and worldwide interoperability with key allies.

The JSF program has instituted a new approach to international procurement. The program is modeled in part after the Airbus approach to building commercial aircraft. There is a single production line, but participants in the program build subsections for the entire global buy of JSF, which are then flown to Fort Worth, Texas, for final assembly. Commercial approaches to logistics are an important part of the JSF model that explains in part the agreement between Fort Worth and Airbus on logistics issues.

Boeing and Lockheed Martin competed to provide the architecture for the JSF combat system for the U.S. Government. Now that Lockheed has won the JSF contract, it is working closely with the Government to establish a system-of-systems management approach for the launch of the JSF system. The participants in the JSF program provide systems, subsystems, and components in a radically different approach from the F-16 or F-18 model. Historically, subcontractors provided parts; in JSF, partners provide systems and subsystems.

The international approach revolves around participation at different levels of partnership, ranging from level one to level three partnerships; levels depend on the amount of investment and involvement through technology sharing and government-to-government agreements.¹³

Industrial participation is not through industrial offsets but participation within a global production run of the program. For example, rather than the Dutch simply producing parts for their JSF, Dutch industry participating in JSF will produce system or subsystem components for the entire global production run of the Joint Strike Fighter, regardless of production specifically for the United States or another country. Such an approach is much more akin to a commercial effort than a classic military aircraft production approach and thus more like the Airbus model than the classic F-16 approach.

The JSF production model is in many ways the testbed of change in the role of industry in leading transformation. If technology sharing can be framed by multinational licensing and a new relationship between the U.S. prime and its systems and subsystems providers, a new type of Airbus model can be introduced in the military air combat domain.

The JSF is designed to operate as a provider of missions in an integrated battlespace. The shift is from providing a pure platform to becoming a full-spectrum provider—one that is customer-driven and able to provide air combat capabilities, ranging from future new aircraft to full-service field maintenance.

This concept rests in part on the ability to leverage the commercial and global markets in order to be able to provide the best customer solution at the most affordable price. Specific to the JSF, the objective is to provide tailored customer solutions, teaming with the global customer, suppliers, and partners.

Using this emerging business model, the defense industry—like its commercial counterparts began doing almost a decade ago—will have to be more involved in maintaining the products they build. Increasingly, military acquisition policy is focusing on total ownership cost. Bundling of a product's total life cycle is far more cost-efficient

and less expensive than acquiring the product and then seeking to support it throughout its life cycle with a series of one-off contracts. This new model seeks to provide integrated combat missions to global customers with government/industry teams providing cradle-to-grave support for military aircraft and related air combat systems.

But for the JSF model to fulfill its promise, the logistics, information technology, and weaponization capabilities associated with the model will have to become truly global, which means conducting overseas operations and support with allies playing key roles in operations as well as production and maintenance. Thus, the Italians, after making their commitment to JSF, have argued for a European JSF support center. Certainly, the leading European missile firm, MBDA, will be in a position to weaponize JSFs for European as well as American use. It would be advantageous for the United States to have alternative sources of supply for weapons in combat situations where European suppliers are closer at hand than American ones.

The Allied Dimension

The new defense industrial model is generating opportunities for cooperation and an ability to provide for enhanced allied capabilities. At the systems architecture development or system-of-systems management level, it is difficult to see anything but a national U.S. or European approach. But with regard to systems and subsystems capabilities plugging into architectures and system-of-systems approaches, European, Asian, and American firms could contribute equally to American or allied capabilities.

The new primes in Europe—notably, EADS, BAES, and Thales—can provide an ability to shape a European architecture or system-of-systems approach for European allies. System or subsystems capabilities, which might contribute to either U.S. or European architectures, would enhance the ability of inter- and intra-allied operations. Interactive military transformation would be the result.

The key challenge for allied governments is to shape policies that allow the major companies to work with one another to provide capabilities available to allies. By allowing the small number of primes on both sides of the Atlantic to pursue goals to meet common needs, transformation could be promoted. The old export model of taking 20 years to develop a product and then compete in the marketplace serves neither American nor European interests. Nurturing multiple partnerships among the Euro-Atlantic primes can create new technologies and opportunities for change.

Developing an innovative relationship between industry and government and fostering greater European capacity to leverage a transatlantic defense market are key tools for driving change within European defense and promoting inter-allied transformation. As Gordon Adams recently argued,

Prague has opened a new door to a transformed alliance. But the ambitious goals set out at the summit will be doomed to failure without major steps in the U.S. trade regime that will make trans-Atlantic industrial and technological cooperation possible.¹⁴

Several examples further illustrate the changes under way. UAVs have become a key focal point for DOD thinking about transformation opportunities after the initial Afghan operation. Drawdown in manned systems, a better use of ISR, and integration of space, air, and

ground capabilities are on offer from the rapid development of UAVs and then unmanned combat aerial vehicles (UCAVs).

Notably, the United Kingdom has focused on the Watchkeeper UAV program as a key part of its integrated combat system of the future. At the core of the Watchkeeper program will be the formation of a network warfare solution, and, almost certainly, U.S. firms such as Northrop Grumman, General Atomics, or Lockheed Martin will be involved in the Ministry of Defense solution.

The aim is to focus attention on binding the systems together—as well as integrating them within the developing British information, surveillance target acquisition, and reconnaissance (ISTAR) system-of-systems network—using the expertise of the group as the glue. The system must be able to interface seamlessly with Bowman, the new British digital communications network, the Royal Air Force (RAF) airborne stand-off radar (ASTOR), and other ISTAR systems. The data generated by Watchkeeper must ultimately be disseminated to shooters such as RAF (or coalition) aircraft operating in the close air support role, the WAH-64D Longbow attack helicopter, and artillery units.¹⁵

To promote inter-allied capabilities on unmanned systems further, the United States and the United Kingdom have recently signed an agreement to share technologies. Notably, the agreement will allow the United Kingdom to have access to developing technologies for the Boeing X-45 UCAV program.¹⁶

Also, the Northrop Grumman and EADS agreement to develop a Eurohawk variant of Globalhawk provides an opportunity to build up the number of UAVs available to U.S. and allied forces and to allow Europeans as well as Americans to develop their own modular packages within the common UAV bus. Joint capabilities can clearly emerge from this, and without common buses, the U.S. goal of having a global sensor system to detect various ballistic and cruise missile worldwide would be even more complicated.

An especially compelling case of the advantages of blended programs for military transformation has been the IZAR-Bath-LMC partnership to build Aegis frigates. This effort began with a competition to build the F-100 Spanish Aegis frigate. The partnership then allowed the team to bid for the Norwegian frigate program and to create a smaller platform, which also will carry Aegis. This will lead to at least nine Aegis frigates emerging from Europe, which will certainly prove useful to Euro-Atlantic naval and aerospace operations. Now that IZAR has led the way to build an even smaller 2,500-ton frigate, which is Aegis-capable and available for export, the main opportunities might come in the Asia-Pacific region. When one adds the new frigate populating selected Asian allied navies with the Japanese Aegis programs, the benefits to the United States as well as allies are obvious.

Global missile defense is another example of a transformation area in which blended programs can become significant. The medium extended air defense system (MEADS) program among the United States, Germany, and Italy will be part of the shooter network. Aegis upgrades and inclusion in the global sensor network will be important as well.

But the overall effort to develop ballistic missile defense C³ is an area in which blended systems could become significant indeed. There is a need for ground-, air-, and space-based sensors networked to provide regional and global convergence against ballistic, air, and cruise missile threats. With the formation of an open battle management,

command, control, and communications (BMC³) architecture, the U.S. Government would be in the position to work with allied governments to allow the key U.S. and European primes to develop and network their systems to provide for national, European, American, and global sensor capabilities.

Boeing recently has signed agreements with EADS, BAES, and Alenia to pursue the possibility of developing common capabilities in the global missile defense area. EADS and Boeing have capabilities in both the sensor and launcher areas of interest to build a global missile defense system. BAES is one of the world's leading companies in ISR capabilities, and its strong presence in both Europe and the United States makes it an ideal partner for pursuing strong transatlantic missile defense efforts.

James Albaugh, president and chief executive officer of the newly formed Boeing Integrated Defense Systems unit, commented on the Alenia agreement:

Boeing is the prime on integrated missile defense. We have established the MOU [memorandum of understanding] that provides an open framework for industrial cooperation. The intent is to establish long-term relationships between Boeing and Alenia Spazio in global missile defense.¹⁷

By promoting industrial cooperation in the wake of the termination of the Antiballistic Missile (ABM) Treaty, Washington seeks to promote global missile defense capabilities. According to *The Washington Times*, "U.S. officials have said that the participation of allies in creating a missile-defense system could extend its range, defray some costs and allow the United States to test and deploy sensors, radar or missile interceptors closer to enemy countries."¹⁸

Among the most vocal of these officials has been David Martin, Missile Defense Agency (MDA) deputy for strategic relations. Martin has underscored the significance of the new opportunities opened by the end of the ABM Treaty for U.S.-allied cooperation, and not only with Europeans. MDA also is pursuing work with Israel, Russia, and Japan.¹⁹

The new industrial model also means that Europe can pursue its systems architecture and system-of-systems approach where it meets its needs rather than simply following American leads. Then partnership among primes in shaping participation of system and subsystem suppliers can allow for the emergence of greater Euro-Atlantic capabilities.

For example, if Europe goes ahead with the A400M airlifter, it could pursue a variant of the approach of General John Jumper, U.S. Air Force chief of staff, which is to build smart capabilities into lifters and tankers. Here Europeans would build common C² and other network systems on the lifters that would allow them to work together in joint interventions.

The controversial Galileo system is an example of Europe trying to build a common architecture, which could involve American participation at the system and subsystem levels. Perhaps the only way the United States might avoid Galileo would be the engagement of Europe as a key stakeholder at the global positioning system (GPS) table, something that was envisaged in the GPS II process.

The European Union and the European Space Agency (ESA) have jointly launched the development and validation phase for their

global competitor to the American GPS system. On March 26, 2002, the European Transport Council approved its part of the joint funding, so the new phase is under way. This is the first time that the European Union and ESA have worked together, and the cooperation represents a key management test of joining these two public entities. At the same time, a common program management office, which will include the private sector, is being launched.

Many space companies across the European Union see great economic potential from the program, ranging from building hundreds of components for the 30-satellite constellation to providing ground equipment and services down the Galileo value chain.

For Europeans, the launching of Galileo will allow them independence from the United States. European space and telecommunications industries will receive a much-needed boost in a time of economic downturn; and for the first time, the space industry will be able to tap European transport infrastructure funds.

In short, the new defense industrial model in Europe and the United States means that a small number of consolidated primes will be the gatekeepers for Europe in building architectures and system-of-systems management approaches. Global relationships between U.S. and European primes can frame ways to enhance inter-allied capabilities as America pursues its transformation approach. The United States will then be able to implement its new global military model more effectively as well.

Conclusion

The system-of-systems approach is at the core of the U.S. Government approach to transformation. The effort to get beyond support for discrete systems in the pipeline—to examine comprehensively where one wants to be in future joint operations and to work backwards—is crucial for the transformation effort. Having mega-primes aligned with this vision and, in fact, directing a strategic redesign of military and security capabilities are key aspects of a successful transformation strategy.

For this to work, the relationship between the mega-primes and the Government needs to become more effective. Industry needs to play its leadership role in sorting out the range of possible technical and organizational choices that best serve a system-of-systems approach; the Federal Government needs to provide guidance on where it wants to go in this process and to generate support for innovation.

Sponsoring innovation will occur in several ways: Government research and development (R&D) provided in laboratories are key parts of the equation for innovation. Defining the relationship between the LSIs and the laboratories will be a main challenge for the Government. Sponsoring black-box innovation, via DARPA and similar agencies, is important as well. But what will the relationship be between the limited profit made on Federal Government black-box R&D and the prospects for much greater profit on series production items?

In other words, how does one avoid vertical integration practices of the large firms, which squelch innovation, and yet use the LSIs to work with small and mid-size firms essential for innovation? How does the Government define profit structures for the relationships between the LSIs and system-of-systems managers and the

system, subsystem, and component suppliers and the R&D drivers to the process of innovation?

Pierre Chao of Credit Suisse has underscored the tensions between the U.S. Government and industry in trying to make the LSI model work:

There are two major obstacles to getting a defense industrial base capable of meeting the Pentagon's transformation goals. The first is cultural. The new system-of-systems and Lead Systems Integrator approach to defense contracting hinges on one critical element...the ability for the industry and the Department of Defense to work as partners. This, however, flies in the face of decades of conditioning that prizes maintaining an adversarial relationship with industry and a media that is looking for any signs of the insidious military-industrial complex that Eisenhower supposedly warned us about. The second set of obstacles are the laws, rules, and regulations in place that make it difficult to create a true partnership with industry.²⁰

Defining pathways for commercial firms to provide technologies of increasing value to the Federal Government is another issue for transformation. Here, the United States could seek to deal with commercial firms, which have limited interest in dealing with the Government as a customer, or to find ways to use the larger firms as gatekeepers for commercial firms to provide the systems or subsystems relevant to system-of-systems management. The challenge is not only to recognize that large firms are necessary to play LSI roles but also to ensure that competitive processes are generated within the system-of-systems management effort.

Above all, the new defense industrial model contains elements of its own dynamics for further change. As Byran Callan of Merrill Lynch and his colleagues have put it, long-term defense industrial restructuring is probable as DOD seeks to deal with consolidation and innovation challenges. First, DOD will seek to enhance competition and innovation by engaging small to medium-sized defense firms and seeking to attract commercial information and electronics firms. Secondly, global systems models could devolve as "companies will probably need to concentrate on systems engineering or focus more on dominating particularly product and system markets."²¹

In short, we have already crossed the Rubicon. Even with the augmented U.S. defense and national security budget after September 11, there is only enough money to support a small number of defense primes in interaction with a global systems and supply base. At the same time, these primes and the systems and subsystems suppliers will provide the means through which transformation will be executed.

Transformation will be generated through a new defense industrial model, which is built around public-private partnerships in creating systems architectures, managing system-of-systems approaches, and working with U.S. and allied systems and subsystems providers.

The transformation process emphasizes joint as well as combined military capabilities pursuing network solutions. Industry is crucial to frame ways for the United States and its allies to anchor a transformation process. Any serious treatment of military transformation must consider how industry leads, interacts with, and supports this process.

Notes

¹ *Fusion* is the ability to link intelligence and surveillance sensors and combine their products into a single battlefield picture.

² Donald H. Rumsfeld, memorandum to the Chairman of the Joint Chiefs of Staff, October 22, 2002: "Options should include, but not be limited to, (a) creation of an agency which would address, fund, and implement aspects of battle management and control [sic] (BMC²) interoperability and connectivity; and (b) allocation of money directly to all Combatant Commanders to buy 'joint' BMC² systems; and (c) authority and allocation of money directly to JFCOM to buy 'joint' BMC² systems to support combatant commanders." Quoted in David A. Fulghum, "Rumsfeld Pushes Network Warfare," *Aviation Week and Space Technology* 157, no. 20 (November 11, 2002), 32–33.

³ Michael Anderson, Diane Burton, M. Steven Palmquist, and J. Michael Watson, "The Deepwater Project—A Sea Change for the U.S. Coast Guard," *Naval Engineers Journal* 111, no. 3 (May 1999), 125–131.

⁴ George W. Bush, The Department of Homeland Security (June 2002), 3.

⁵ Bruce Stubbs and Scott C. Truver, *America's Coast Guard: Safeguarding U.S. Maritime Safety and Security in the 21st Century* (Washington, DC: United States Coast Guard, 1999), 107.

⁶ George W. Bush, commencement address, United States Military Academy at West Point, June 1, 2002.

⁷ United States Coast Guard, Integrated Deepwater System Program: Maritime Domain Awareness, accessed at <<http://www.uscg.mil/deepwater/>>.

⁸ Bush, Department of Homeland Security, 5.

⁹ Stuart McCutchen, "Army Says 'Lead Systems Integrator' Approach Will Expedite FCS Implementation," Infobase Web site (March 13, 2002).

¹⁰ John G. Roos, "Army Transformation: Objective Force Vision Encompasses Much More than Hardware," *Armed Forces Journal International*, October 2002, 38–44.

¹¹ *Ibid.*, 42.

¹² For a good treatment of the lead systems integrators in relationship to the future combat system, see Daniel Gouré, "The Army's FCS Gamble: Robots Could Out-number Soldiers in the Service's Planned Future Combat Systems," *Armed Forces Journal International*, October 2002, 46–54.

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¹⁵ Nick Cook, "Watchkeeper Contest Set for a Showdown," *Interavia* 57, no. 665 (July-August 2002), 30–32.

¹⁶ Andrew Chuter, "U.K., U.S. to Share UAV Technology," *Defense News*, December 9–15, 2002, 1, 8.

¹⁷ "Boeing and Alenia Announce Transatlantic Partnership for Missile Defense," *Business Wire*, July 23, 2002.

¹⁸ "Boeing Inks Pact with Three Firms in Europe," *The Washington Times*, July 24, 2002.

¹⁹ Kerry Gildea, "U.S. Japan Review Options for Future Sea-based Missile Defense Work," *Defense Daily International*, July 12, 2002.

²⁰ Personal communication with author, November 18, 2002.

²¹ Merrill Lynch, *Defense and Aerospace* (June 27, 2002).

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EUROPE WANTS TO MAINTAIN ITS INTERNATIONAL CREDIBILITY

Europe Takes Step To Create A Defense Armaments Agency

The willingness of the United States to wage wars without the consent of many of its allies in Europe has spurred the European Union to start the process of creating a new defense organization. By a vote of 33 to 15 on March 27, the European Parliament's Foreign Affairs Committee has adopted a wide-ranging program that would present to the world a single European voice on international security issues and create a "European Armaments, Research and Development" agency within the European Union. Such an agency would initially conduct research and development relating to new defense technologies

that have potential commercial spinoffs, but would evolve into a more substantial and viable entity with a force of up to 60,000 troops.

The European Parliament's Committee on Foreign Affairs also suggests such an organization would be given the legal authority to "buy European" and develop a European war college. These would "ensure better interoperability and sow the requisite seeds within both the armed forces and the civilian population to ensure the emergence of a common defense culture."

The European Parliament's "Resolution on a New European Security and Defense Architecture" would give the European Union a military capability "to enhance the credibility of its foreign policy objectives and to create the ability to launch and conduct EU-led military operations in response to international crises," says the Foreign Affairs Committee.

(Continued on page four)

Nanotechnology is making positive financial contributions to companies in traditional industries, says

Alan Marty of JP Morgan Partners, a San Francisco-based venture capital firm. "America's store shelves have sunscreens, tennis rackets and cell phones with nanotechnology elements bettering them," he told a recent hearing of the House Science Committee. Carbon nanotube flat screens, advanced military sensors and other electronic products enabled with nanotechnologies will be in the market within 18 months. "As production of nano-products becomes

Nanotech Emerges From The Laboratory

easier, faster and cheaper, every market sector will begin to feel their impact," says Marty.

Marty, who joined a panel of other expert

witnesses in endorsing new legislation that would authorize the "Nanotechnology Research and Development Act of 2003" (HR-766) says that nanotechnology is generating revenue for companies "faster than anyone imagined." Only five years ago, there were only a handful of companies pursuing the technology — IBM, HP and TI among them. Today, most manufacturing companies in the Fortune 500

(Please turn to page six)

Students, Teachers, Mayors — You Name Them — They Just Don't Care About Manufacturing

There are not many students, parents, educators, governors, mayors, policy makers or anybody in the U.S. society for that matter who have a positive impression of manufacturing jobs and the potential they hold for a new generation of workers, according to new research done by the National Association of Manufacturers' Center for Workforce Success.

Having gone into the country to find people's views on manufacturing and the job potential, "we came back very sobered" by what was found, says Phyllis Eisen, vice president of NAM's Manufacturing Institute. "Our bones were chilled by what we heard. We don't have to worry about the decline of manufacturing jobs because nobody wants to go into them."

There is a "complete" misperception as to the nature of manufacturing jobs in the country among students, parents and educators, Eisen found. Virtually everyone contacted had a negative view of manufacturing jobs, and there was no connection made between economic growth and the need for a strong manufacturing sector.

Speaking at the Forum on New Directions in Manufacturing sponsored by the National Academies of Science in late March, Eisen asked the audience how many people had children. Most raised their hands. She then asked who would want their children to take a job in a manufacturing plant. She counted seven hands, and commented that this was better than most audiences she addresses.

Most people view a job in a manufacturing plant as being dead end and not worthy of any child or student. "No one understood the pay or the quality of life" of those who work in manufacturing plants, Eisen said. Students described such a job as like "being a rat in

a cage" and other descriptions that were "equally horrific." These descriptions never varied, no matter where the students were located in the country. Yet the average age of many workers in manufacturing plants is between 55 and 58, and the jobs pay relatively well, with 78 percent of all manufacturing workers having a 401k or other retirement package and 95 percent receiving health care.

With an estimated shortfall of manufacturing workers projected to be 10 million by 2020, the Center for Workforce Success has decided to start an "extraordinary" public education campaign that will be kicked off on April 24, says Eisen. It plans on following the lead of other industries such as health care and create an advertising and public relations campaign to improve the image of manufacturing jobs and "make manufacturing a preferred career choice by 2010," says Eisen. It will try to fill the "information void" that exists in career centers at schools. And it will implore manufacturers to open their factories to tours, so students, teachers and parents can understand that manufacturing no longer provides dirty, boring, low-paying, repetitious, tedious, dangerous jobs to people who are "serving life sentences" and working like "robots" on an assembly line, say Eisen.

Newport News Pushes Lean Down Into Its Supply Chain

Northrop Grumman's Newport News division will introduce lean techniques to its supply chain. The Virginia navy yard has signed an agreement with the A.L. Philpott Manufacturing Extension Partnership to provide lean training and rapid improvement events to its nationwide suppliers. "The program involves a unique cost sharing relationship, where Northrop Grumman Newport News and the suppliers share equally in the initial investment towards achieving best-in-class capabilities," says the A.L. Philpott center.

The program is initially targeting 23 suppliers of valves, pipes and fittings for Newport News's submarine and aircraft carrier construction and overhaul operations. "Northrop Grumman Newport News and VPMEP personnel are working collaboratively with suppliers to understand their barriers, develop lean processes, agree on common measures and ultimately improve quality, delivery and overall cost performance," says Bill Donohue, operations manager for VPMEP. "We are fortunate to be able to deliver this cost effective program nationwide using the extensive resources of our NIST-MEP affiliates."

For more information on the project, contact Barbara Dixon of Northrop Grumman Newport News at 757-380-2734 or Linda Lancaster at VPMEP at 276-666-8890 ext. 226.

Big Questions Hover Over U.S. Space Industry

U.S. space policy is at a turning point. At the 19th National Space Symposium held in Colorado Springs last week, the nation's top space policy officials outlined many of the challenges confronting the space industry. Presentations by NASA Administrator Sean O'Keefe, Admiral James Ellis (U.S. Strategic Command), Gen. Lance Lord, USAF (U.S. Space Command), Gen. Ed Eberhard, USAF (Commander-in-Chief of Northcom), Secretary of the Air Force James Roche and Air Force Chief of Staff General John Jumper, as well as senior analysts and executives from key space firms, provided a baseline for the discussion of the challenges facing U.S. policy.

Space has become a key enabler for U.S. military operations and not just a facilitator. Indeed, the use of space has become transparent for the ground forces. The story was told of a marine who said he did not need space systems so long as he had his rifle and the little box he carried that told him where he was. The box was his global positioning system.

To continue using space in more demanding ways in the future three challenges must be met. First, there is a growing disconnect between the amount of money available to pay for a national security system based upon space and the demands for replacing the current infrastructure. Second, there is the desire not to replace the current infrastructure but to design a radically new architecture that would drive program choices. (The key cases discussed at the conference were global missile defense and transformational communication systems.) Third, there is a crisis in finding the skilled engineers who are needed to design the complex "system-of-systems"

BY ROBBIN LAIRD

required for the new architectures. Associated with the manpower shortage is the inability of commercial companies to generate profits from their space activities. A depleted space industrial base would not be capable of implementing the transformation vision.

Two correlative problems shaping the future of U.S. space policy emerged as well. The first was defining a stable future for NASA after the Shuttle disaster. There was little discussion from the podium of the tradeoffs between manned and unmanned flight. NASA administrator O'Keefe reiterated President Bush's pledge of continuing manned flight. But private conversations with senior analysts at the conference suggested that the future of unmanned space operations would yield more promising results both for military and non-military operations in the mid-term. How NASA shapes its policies towards the International Space Station and its science missions will have a significant

impact on the United States's global partners in space: Europe, Japan and Russia.

The second correlative problem concerns the future of commercial space and of public-private partnerships in shaping U.S. options. In satellite communications, data delivery, remote sensing and related technologies, the commercial sector continues to provide capabilities that provide an alternative to national security space packages.

How will the U.S. national security community shape its policies towards the commercial sector? The discussion of "transformational" communication systems focused upon the integration of a U.S.-only national security space program. Yet, commercial broadband and other communications systems will provide increasingly robust capabilities as well. Will the Pentagon focus on its own definition of standards or will its new architecture be more robust and take into account commercial and global standards as well?

—Dr. Robbin Laird is president of ICSA, LLC, a firm specializing in aerospace and defense industrial analysis. He can be reached at 703-820-1669.

More Overseas Ports Adopt Customs Service Oversight Program

An increasing number of ports shipping containers to the United States have signed up with the U.S. Customs Service for its Container Security Initiative. The program entails U.S. Customs Service officials being deployed in the host nations' ports to gather intelligence and use technology to screen high-risk cargo containers prior to their being shipped to the United States. Participating ports are also encouraged to use smarter, tamper-proof containers.

To date, 18 of the largest 20 ports shipping to the United States are participating including — by container cargo volume: Hong Kong, Shanghai, Singapore, Rotterdam, Pusan, Bremerhaven, Tokyo, Genoa, Yantian, Antwerp, Nagoya, Le Havre, Hamburg, La Spezia, Felixstowe, Algeciras, Kobe and Yokahama. Globally, more than 48 million full cargo containers move between major ports every year, with 6 million arriving by ship each year in the United States.

"Now that we have nearly achieved our goal for CSI at most of the top 20 ports, we are quickly expanding CSI to all ports that ship substantial amounts of cargo to the United States and that have the infrastructure and technology in place to participate in the program," says Customs Commissioner Robert Bonner.

Europe To Create Defense Agency...*(Continued from page one)*

The approved document recommends that the Western European Union be dissolved and that a new "collective defense clause" within the European Union be adopted. The new organization would work closely with NATO but would maintain its independence.

The terrorist attacks of September 11, 2001, have resulted "in a completely new security situation" for the world, says the European Parliament's Foreign Affairs Committee. (The European Parliament is the European Union's legislative body.) As a result of those attacks, "it has to be asked how and with what means Europe will react to the new threats to global peace."

The military campaigns in Iraq, Afghanistan and Kosovo have revealed "the new doctrine of the United States: its ability and decision to conduct wars alone and to seek its coalition partners in light of the mission to be carried out — 'the mission determines the coalition,'" says the "explanatory statement" describing the new defense organization.

The United States has become far more active in Asia and the Middle East, and is limiting its forces at NATO's disposal to 8 percent of its total force. It has also outpaced Europe in the development of a sophisticated defense technology base that is not compatible with European systems.

"All this requires increased military efforts by the Europeans if the European Union wants to become a credible actor on the international scene, a free partner of the United States within an Atlantic Alliance whose leadership Europeans will one day have to assume, agreeing to share with the Americans the burden of defending their common values..." says the European Parliament committee.

If members of the EU do not have the will or "continue leaving it to the Americans to conduct any potential wars, contenting themselves with shouldering the affairs of peace, the Union would have to resign itself to playing the part of the Athenians in Ancient Rome: acceptance of being subject, in the last resort, to the will of a new empire. We know that the vast majority of our fellow citizens reject this."

In order for the EU to achieve international credibility, it will be important for it to speak with "one strong and clear voice," it says. A "credible" military capability will help influence situations of tension, champion its values and assert its interests. New security risks "are perceived differently by the United States, which was shaken to the core by the terrorist attacks of September 2001 and which considers itself to be in a state of war, and by

Europe, where neither the horrors in the Balkans nor the terrorist attacks on New York and Washington, in Bali, Kenya and elsewhere have had the same effect on public opinion," says the Foreign Affairs Committee.

The Atlantic Alliance "will only be maintained through the introduction of a genuine European defense identity" that will come about through the creation of a well-financed defense agency, says the report. It recommends that the union initially create a 6,000-strong military force "kept in a state of permanent readiness for humanitarian operations and to rescue populations under threat."

It calls for a "well reasoned survey" of the EU's military needs to "serve as a frame of reference for a common procurement and production policy." Member states would work together to adopt "a harmonized purchasing policy and to run pilot projects for cooperation among themselves."

It would encourage EU members to gradually create a European armaments market and appeals to them to "apply the principle of 'Community preferences' so as to ensure security of supply." It asks that the EU consider making the European Space Agency part of the organization "which would represent a major step towards establishing the security and defense policy."

It also "pleads" for the creation of a mechanism "to evaluate and improve Member States' commitments by evaluating the portion of their defense budgets in relation to GDP, and in particular the proportion of equipment and research expenditures in the defense budget."

The recommendations have been forwarded to the European Council, the Secretary General of NATO and the president of the NATO Parliamentary Assembly. The report is located at:

<http://www2.europarl.eu.int/omk/sipade2?PUBREF=-//EP/NONSGML+REPORT+A5-2003-0111+0+DOC+WORD+V0//EN&L=FR&LEVEL=2&NAV=S&LSTDOC=Y>

Product Analysis Software Market To Grow

The digital prototyping and analysis software market will grow considerably over the next five years, due to pressures on manufacturing companies to develop digital prototypes of new products that do not require any testing, says Daratech, the Boston-based market research firm. Manufacturing companies are developing complete digital processes from product concept through maintenance and are using software from market leaders MSC Software, LMS International, Fluent and Altair Engineering. These companies, as well as those in the structural analysis market including ANSYS Inc., EDS PLM Solutions and Dassault Systems, will see their market grow by 11.5 percent annually over the next five years to \$2.5 billion in 2007, says the market research firm. For more information, go to <http://www.daratech.com>.

BOOK REVIEW:

The Inside Story Of Wiremold's Success

Better Thinking, Better Results: Using the Power of Lean As a Total Business Solution

By Bob Emiliani with David Stec, Lawrence Grasso and James Stodder. The Center for Lean Business Management, Kensington, Conn.; 305 pages; \$31.50 at Amazon.

"Better Thinking, Better Results" is a powerful story of how a failing traditional American manufacturing company used production philosophies, principles, practices and policies developed by Toyota to become a "lean" enterprise, a firm successful by every financial and human measure. The subject company is Wiremold, a major supplier of electrical and digital distribution wiring, cabling and equipment. Principal author Bob Emiliani brings us the voices of the leaders who between 1990 and 1999 took Wiremold from a firm losing money and customers and on its way out of business, to a vibrant industry leader efficiently delivering customer value while making a lot of money. Emiliani and his co-authors assembled dozens of hours of recollections by

BY FRED STAHL

the principal Wiremold executives and added context and explanation to give us a fascinating tapestry of this business transformation.

This book is more than a good story. It teaches. While there are a hundred books on what a lean manufacturing company looks like, the nuts and bolts of how you turn a traditional business into a lean business is little reported. Art Byrne, Wiremold's CEO, spiritual leader, teacher and straw boss of the changeover, comes from a tradition of methods for changing industrial cultural that traces back to Japan and Tiichi Ohno. If you don't already know, Ohno was the guiding spirit and force behind the Toyota Production System. He was a hard taskmaster. Tales still circulate of his imperious teaching techniques and demeaning treatment of employees, trademarks of a style he defended as necessary to overcome comfortable habits of traditional manufacturing. Ohno's style of kaizen is known as "suzumura-style" or "scary style." The present president of Toyota, Mr. Fujio Cho, favors a softer approach known as "Cho-san-style," translated as "human style".

It is not surprising then that several of Ohno's disciples also left Toyota after Ohno's departure in 1978. Three of them, Mr. Yoshiki Iwata, Mr. Chihiro Nakao and Mr. Akira Takenaka, went on to form a company called Shingijutsu to continue in the master's footsteps. Shingijutsu consultants were active in the United States almost from its inception in 1987. Those three and other Ohno students who subsequently joined them have had an enormous impact on the styles of change masters in this country. They have had long relationships with Pratt & Whitney, Boeing and Danaher, among other firms. They teach by leading kaizen in the factories of their U.S. clients. Their methods shock Americans. They immediately move equipment and machines and throw out inventory to remedy waste. They are legend for impatience with people slow to accept change, famously calling them "concreteheads." But they leave deep, ultimately positive, impressions, ways of thinking and changes that stick.

Some converts in Shingijutsu's American clients have become well-known virtuosos of change to lean: Mike Joyce out of Pratt & Whitney, who became responsible for lean at Lockheed Martin; George Koenigsaecker out of Danaher, now a principal at Simpler Consulting taking on an ambitious transformation of the U.S. Army's maintenance facilities; Bob Emiliani himself out of Pratt & Whitney and now at Rensselaer; and Art Byrne out of Danaher, who took on the CEO job to turn around Wiremold. Altogether, this is a remarkable group of practitioners who have influenced a generation on how to implement lean production.

Emiliani is best when letting the Wiremold people tell their own story. In chapter 7, "Growth Through Acquisitions," we find an insightful financial story of the change required by lean as told by Orry Fiume, Byrne's financial man. It alone is worth the price of the book. Wiremold acquired 19

(Continued on page eight)

Wiremold Core Business Results

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999†
Net Sales Index*	100	99	112	121	142	155	173	203	216	229
Gross Profit Index*	100	102	119	141	164	187	219	261	275	296
Operating Profit Index*	100	237	508	561	711	840	1,145	1,156	1,185	1,343
Net Profit Index*	100	212	484	568	712	850	1,155	1,144	1,191	1,335
Inventory Turnover**	3.4	4.6	8.5	10.0	12.0	14.9	14.3	15.3	16.2	15.8
Sales per Employee (000's)	92	104	130	140	176	188	216	226	238	241

* All values are indexed to 1990 = 100.

** Sales divided by 12 month rolling average inventory values on a first-in, first-out basis.

† 1999 figures include restructuring costs.

Nanotech Emerges From The Lab...(Continued from page one)

have embraced nanotechnology, including significant R&D and product development efforts taking place at GM, GE, Siemens, Intel, NEC, ChevronTexaco, Mitsubishi, Hitachi and Dow.

Startup firms are also proliferating, with more than half of the new companies located in the United States, many of which were founded by researchers from universities, government and corporate labs. "Unlike the dot-com era, nanotech startups are built on physical, chemical and biological science," Marty said in his extended remarks to the Science Committee. "They have real technology and real assets."

More than 60 venture capital firms have invested in nanotechnology-related companies. Last year, almost \$500 million was invested in nanotech startups in the United States.

But the U.S. nanotechnology industry is at a disadvantage compared to European and Japanese rivals, Marty claims. "Many promising entrepreneurs and interesting technologies will not be funded by private equity sources because they cannot bridge the gap from the laboratory to the marketplace," he says. "Venture firms must place funds in a manner that will bring competitive returns to our limited partners. Usually, this means that a startup must make reasonable progress in process reproducibility, product quality and product cost before a venture firm can reasonably invest. Unfortunately, this is often where federal funding has been lacking. The result is that many businesses that could drive the future commercial growth for our country never get their ideas out of the

laboratory."

Startup firms are addressing some of the issues regarding packaging, integration and scaling, "but there are no government programs [that are] properly addressing this vital timeframe in the cycle of research and business," says Marty, who was a senior executive at Hewlett Packard for 13 years and was a White House fellow and special assistant to Defense Secretaries Richard Cheney and Frank Carlucci in the late 1980s. The Commerce Department's Advanced Technology Program is the only program within the federal government's R&D portfolio that addresses commercialization issues, but it pales in comparison to what other countries are doing. "This time period is one that competing nations in Asia and the EU are particularly attuned to addressing and are providing a life-line to many U.S. startups, which sends growth and profits abroad," says Marty.

The United States does not dominate in nanotechnology, "unlike many past waves of technological development," he points out. The Japanese government expects

nanotechnology to restore its economy. "Two weeks ago, Japan held a nanotech event that demonstrated products that were already in the market or were about to be introduced to market," Marty says. The three-day event attracted 25,000 attendees. Eighteen foreign government economic development agencies set up booths, but there was not one there from the United States.

"Most commoditized technology demonstrated at the show was derived from U.S. developed intellectual property — only it was Japanese, German and Korean companies that were commercializing these technologies and advancing them beyond basic research," says Marty.

China is spending between \$300 million and \$400 million a year on nanotechnology. The European NanoBusiness Association "made the claim that nanotech is 'the EU's to lose' and says that they outspend the United States two-to-one," he says. Japan is spending about the same as the U.S. is investing in its National Nanotechnology Initiative (NNI). For information on the NNI, go to www.nano.gov.

Estimated Funding For The National Nanotech Initiative

\$ millions

	FY2001 Enacted	FY2002 Enacted	FY2003 Estimate	FY2004 Request
NNI Total	422	697	774	849
NSF	150	204	221	249
DOD	110	224	243	222
DOE	88	89	133	197
HHS (NIH)	39	59	65	70
NASA	20	35	33	31
DOC (NIST)	10	77	69	62
EPA	5	6	6	5
Dept. HLS. (TSA) ^a	0	2	2	2
USDA	0	0	1	10
Dept. of Justice	0	1	1	1

a. Transportation Security Administration

(Source: Congressional Research Service)

AFL-CIO Weighs In On Reviving Manufacturing

The AFL-CIO has begun its own campaign to restore America's manufacturing base, which it says is in "crisis" and its poor health "could have serious consequences for the nation's economy." To revitalize manufacturing, the U.S. must pursue fair trade policies and trade agreements that require the inclusion of "enforceable workers' rights and environmental standards," says a new policy statement from the AFL-CIO's Industrial Union Council. Tax laws need to be revised to eliminate incentives for corporations to move production overseas "and punish those that do," says the strategy document.

The Bush administration's tax proposals will not revive the manufacturing sector, says Ron Blackwell, director of corporate affairs for the AFL-CIO. The money provided in tax cuts to American families will be spent on products made overseas. "The old ways of solving the problem won't work," Blackwell told the Forum on New Directions in Manufacturing on March 27 at the National Academy of Sciences. The manufacturing-led recession has evolved into a manufacturing restrained recovery and any tax cut "has to be directed at manufacturing."

The trade deficit and the foreign debt Americans are amassing to pay for it, which could skyrocket to 40 percent of GDP by 2006, cannot be sustained by continued borrowing,

Blackwell told the conference. The U.S. can either consume less or "find a way to produce more. This is a critically important question for living standards of America."

Pressured by the financial markets, American companies continue to pursue "low-road" strategies of shifting manufacturing to low-labor countries and "the only winners of this strategy are the shareholders and CEOs," Blackwell said. The country "needs a new set of policies that take that incentive away from businesses. We're in a race to the bottom for labor rights and conditions."

This race is causing labor rates to drop not only in America but also in developing countries. "We don't have a choice but to compete with China," Blackwell said. But trade with China must be predicated on that country's adoption of policies that respect basic human rights and the freedom of opinion and freedom to organize. "Those are the important things. Do we force standards down or raise them?"

Blackwell asks.

The Foreign Sales Corporation tax currently encourages shifting manufacturing jobs overseas and it should be replaced with tax incentives that help American manufacturers create U.S. jobs. Congress needs to pass laws that penalize companies for incorporating overseas and bar them from receiving government contracts. Procurement laws need to be changed to require "buy American" provisions for national defense and homeland security. Health care needs to be reformed and labor laws stiffened to stop the "employer interference and suppression of workers' rights to organize and bargain collectively."

Unionized manufacturing jobs have been particularly hard hit in the current manufacturing recession. "In 1984, there were 5.2 million unionized jobs making up about 28 percent of all manufacturing jobs," the AFL-CIO notes. "By 2001, unionized manufacturing employment fell by almost half, to 2.7 million workers, or only 15 percent of all manufacturing jobs. At the same time, nonunion jobs in manufacturing grew by 1.5 million to more than 15 million jobs."

Laser Shipments Follow Economic Downturn

Industrial laser shipments last year fell by 15 percent to \$423 million, according to the Laser Systems Product Group (LSPG), a division of the Association for Manufacturing Technology. CO₂ laser sales remained level and Nd:YAG lasers were down 30 percent, says the trade group. "It appears that the production equipment market has bottomed out and will begin a recovery in 2003," says a hopeful Dave Plourde, LSPG chairman and vice president of Preco Laser Systems. "Unlike the past three recoveries, in this market lasers are now a mainstream technology that will rebound faster than niche or esoteric technologies."

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Wiremold's Story... (From page

companies. In each case, Byrne would show up on the factory floor or in an office on the first day of Wiremold ownership and lead a kaizen activity to show serious and engaged intent to transform to lean. Fiume gives us a ten-year financial analysis for an acquired business transformed by Wiremold to a lean enterprise. He compares that to an analysis of the company had it continued with traditional business methods.

Those side-by-side comparisons make the most compelling case for lean production I have seen.

After five years, the traditional business returns only \$33 million of the \$80 million purchase price and is staggering under the burden of servicing the debt taken to make the acquisition, leaving little room for misstep. By contrast, through Wiremold's transformation, at the end of five years the company would have no debt, versus \$47 million projected for the traditional business. Sales growth would be 10 percent to 12 percent compared to 4 percent for the traditional. It would have less than half the space; 64 percent higher operating income, 35 percent fewer people and 75 percent less inventory.

With the kinds of results reported here and elsewhere, no rational person can doubt the enormous financial benefits of applying the philosophy, principles and thought processes of lean to traditional businesses. *Manufacturing & Technology News* Editor Richard McCormack's new book "Lean Machines" has in-depth interviews with pioneers in industrial lean (including Byrne) who quote similar results.

There are two implications for you. If you are not earning profits exceeding the market return on capital equivalent to the market value of your business, you will either go out of business or be sold to recover the market price for more efficient use. If sold, you should hope for a lean buyer who will transform your business to one that can pay off the acquisition debt. A lean transformer is the more likely buyer; such firms can afford to pay more for businesses.

The authors are at their best telling the Wiremold story. I found them tedious when they strayed from the story line. Emiliani's repetitive flacking of his own published papers irritated. The introduction asserts that the book "is not theory." Yet in the chapter "Real Lean Vs. Imitation Lean," the authors promote their own theory of change under kaizen, which I found questionable and certainly not part of the

Wiremold experience. This self-indulgent hypothesizing detracts from the book's credibility.

Regrettably, too, the authors' style is too black and white, damning all that is traditional and welcoming all that is lean. I would have liked to have read a more balanced critique of the Wiremold experience. The authors are unstintingly uncritical of Art Byrne and the Wiremold team. And never do they really tell us what goes on in a kaizen activity.

The book declares that the Toyota Production System is a management system. It is patently not. Certainly the philosophies and principles and thought processes for change can be applied in offices and other business venues outside manufacturing — the book delivers a delightful example of doing kaizen on field reps' car trunks. But calling the Toyota Production System a management system inflicts more confusion on a business community that is still trying to figure out whether Six Sigma is a statistical method or a body of preferred management practices.

But these are minor annoyances. Although expensive at thirty to forty dollars for a book that looks like it was printed using a cheap Xerox machine, this book is worth your while. Your biggest cost for any book is the opportunity lost cost of your time to read it.

If you are a business leader, you can do few things of higher value for your time spent than to let yourself be taught by this engaging story of Wiremold and Art Byrne. "Better Thinking, Better Results" is the right title. Making a firm lean is not a physics problem; it is a thinking problem. If you want to think better about industrial efficiency, this book is a great place to start.

Oh, and be sure to read the chapter endnotes. Emiliani has them packed with lore about Toyota, lean and American virtuosos of change.

—Reviewer Fred Stahl can be reached at fredstahl@earthlink.net.

Feds To Study Steel Tariff Impacts

The International Trade Commission has initiated a study to examine the competitiveness of U.S. steel consuming industries due to the cost impacts of steel tariffs. Steel consumers are hopping mad at the Bush administration for adopting the tariffs last year without regard to their competitiveness. Steel industry consumers feel it is unfair for the U.S. government to impose tariffs on steel and not on the imported products that are gaining advantage by using the cheap foreign-subsidized steel.

The investigation, titled "Steel-Consuming Industries: Competitive Conditions with Respect to Steel Safeguard Measures," was requested by the House of Representatives' Ways and Means Committee and will be completed in September.

The ITC will study the impact steel prices are having on employment, wages, profitability, sales, productivity and capital investment of steel consuming industries. It will investigate international competitors; shifts in steel-consuming patterns in the United States, such as whether U.S. companies are purchasing more U.S. produced steel; and run simulation models of the impact steel tariffs are having on the overall economy. The ITC is holding a public meeting on June 19 in Washington and is seeking written comments. To provide input, contact 202-205-1816.

Morgan Stanley Analyst Expects A Double-Dip

A double-dip recession is at hand, thanks to the war in Iraq, continued global uncertainties and the scare of severe acute respiratory syndrome (SARS) in Asia, says Morgan Stanley chief economist Stephen Roach. The economies of Asia, Europe and the United States "appear to have contracted in February and March," says Roach. Economic activity is down not only in the industrial sector but the service sectors as well. "Moreover, around the world, labor markets are softening, higher energy prices are sapping consumer purchasing power and capital spending projects are being put on hold."

SARS has hit Asia hard, with a projected decline in tourist travel of 60 percent over the next three months. "SARS-related impacts could snowball quickly," Roach says.

"There is always a good deal of statistical noise in extracting meaningful information from month-to-month changes in any economy," Roach writes in an April 4 assessment entitled "The Global Double Dip." "In this instance, however, the data fit all too neatly with the script of a world in shock."

Roach does not expect the dip to be a "two-month fluke" that will reverse itself with the end of the Iraq war. Worldwide growth of GDP during the second quarter will be either zero or perhaps even a slight contraction, with "outright contractions" in Europe and Japan, he predicts. "Moreover, with SARS-related disruptions hitting Asia exceedingly hard at the moment, the risks to our second-quarter estimate are decidedly on the downside."

The Morgan Stanley economist has lowered his estimate for global economic growth this year to 2.4 percent, down from 2.5 percent. While this slight downgrade possesses little statistical significance, "the point is more symbolic than anything else," Roach says. "We and others have long

viewed 2.5 percent world GDP growth as the official recession threshold for the global economy. Prior to this latest cut, our baseline estimates depicted a world right on the cusp of renewed recession. This reduction now takes the world as a

whole into the recession zone — marking the second global downturn in three years. It's a fractional breach of that threshold, to be sure, but I maintain the view that there could well be more to come on the downside of our revised global prognosis." A global growth rate of 2 percent is possible this year, says Roach, whose e-mail is stephen.roach@morganstanley.com.

Semi Equipment Makers In Tailspin

Companies making wafer fabrication equipment had a tough year in 2002. The industry recorded a 31.6 percent decline in sales last year, dropping from \$24.1 billion in 2001 to \$16.5 billion in 2002. It is the second year in a row sales have declined by more than 30 percent.

"The dire outcome of 2002 was the result of slower-than-anticipated end-user demand and an increasing level of macroeconomic uncertainty that hit semiconductor vendors rapidly in the second half of 2002," said Klaus-Dieter Rinnen, vice president for Gartner's semiconductor research group. "Consequently, spending plans were adjusted downward, projects were delayed or shelved, and equipment orders were either pushed out or cancelled."

ASML was the only vendor able to grow last year, enabling it to jump to the number three position in world sales, pushing past KLA Tencore and Nikon. Applied Materials retained the top position of all vendors, with \$3.7 billion in revenue, a decline of 25 percent from 2001 revenue of \$4.9 billion. Europe's market dropped by 46 percent in 2002; Japan's market fell by 45 percent; Taiwan suffered a decline of 10 percent, says Gartner. For more information, go to: http://www.gartner.com/1_researchanalysis/focus/semimkt_fa.html.

New Jersey Embraces Nanotechnology

The New Jersey Nanotechnology Consortium (NJNC) has opened for business at a former Bell Labs nanofabrication facility in Murray Hill, N.J. With corporate, academic and government participation, the consortium hopes to develop and commercialize nanotechnology devices across a variety of industries, including the pharmaceutical, biomedical, electronic materials, optical, defense, aerospace, energy, industrial and semiconductor sectors.

The consortium, which received \$2 million from the state of New Jersey, will conduct research at the \$400 million Bell Labs' submicron facility with a fully operational 200mm wafer fab. Users will be able to work with the facility's process development engineering team, which has experience in the fields of electronics, optoelectronics and micro-systems.

"The NJNC will help speed nanotechnology products to market by offering immediate, cost-effective access to world-class fabrication facilities, design and prototyping services and volume manufacturing processes that will enable the rapid commercialization of nanotechnology devices intended for use in the drug discovery, disease detection and electronics industries," says Omkaram Nalamasu, the consortium's chief technology officer. "The NJNC will prove to be a significant player in bridging the gap between nanotechnology research and the marketplace." The NJNC's Web address is www.njnano.org.

CALENDAR OF UPCOMING EVENTS

April 22 - 23 Center for Advanced Polymer & Composite Engineering Technical Review Meeting, Tallahassee, Fla., www.iucrc.eng.fsu.edu.

April 23 - 25 International Security Challenges and Strategies in the New Era, Albuquerque, N.M. Sponsored by Sandia National Labs, <http://www.intlsecconf.sandia.gov/>.

April 26 - 29 Bearing Specialists Association Annual Meeting, Pasadena, Calif., <http://www.bsahome.org/>.

April 28 - 29 OECD Forum: Economic Growth — What the Statistics Do and Do Not Tell Us? <http://www1.oecd.org/forum2003/programme>.

April 30 - May 2 Strategic Directions for the Motors and Drives Industry, Santa Barbara, Calif. Sponsored by the Motor & Motion Association, <http://www.smma.org>.

May 3 - 7 Material Handling Equipment Distributors Association Annual Meeting and Manufacturers' Fair, San Antonio, Texas, <http://www.mheda.org/>.

May 5 - 6 Manufacturing Matters!, Milwaukee, Wisc. Sponsored by the Wisconsin Manufacturing Extension Partnership, www.wmep.org.

May 5 - 9 Federal Laboratory Consortium's National Meeting, Tucson, Ariz. <http://www.federallabs.org>.

May 6 - 7 Maryland Plant Engineering & Maintenance Show, Baltimore, Md., <http://www.proshows.com/mpem>.

May 6 - 8 Automated Manufacturing Exposition, Greenville, S.C. Sponsored by the Association for Manufacturing Excellence, www.am-expo.com.

May 6 - 8 Southeastern Lean Manufacturing Conference, Greenville, S.C. Sponsored by Automated Manufacturing Exposition & Conference, <http://www.am-lean.com/greenville/confinfo.htm>.

May 12 - 16 Shingo Prize Conference, Detroit, Mich. Go to www.shingoprize.org.

May 12 - 16 International Dimensional Workshop, Nashville, Tenn. Sponsored by the Oak Ridge Metrology Center. For information, contact Ed Pritchard, 865-574-4261.

May 13 - 14 Advanced Manufacturing Technologies for the Automotive Industry, London, Canada. Sponsored by the National Research Council of Canada, http://imti-itfi.nrc-cnrc.gc.ca/AMT_2003_e.html.

May 13 - 15 Rapid Prototyping & Manufacturing, Chicago, Ill. Sponsored by SME: <http://www.sme.org/rapid>.

May 14 - 15 Design for Six Sigma, Toronto. Sponsored by the ICQP Canada, www.iqpc-canada.com.

May 15 - 16 European Institute of Printed Circuits

Spring Conference, Prague, Czech Republic: <http://www.ipc.org/>.

May 17 - 19 Industrial Supply Manufacturers Association Spring Convention, New Orleans, La., <http://www.ida-assoc.org/>.

May 17 - 21 National Association of Electrical Distributors annual meeting, Atlanta, Ga. Contact 314-991-9000.

May 18 - 21 QAD User Conference, Explore 2003, Orlando, Fla. www.qad.com.

May 18 - 21 Institute for Supply Management's 88th Annual Conference, Nashville, Tenn., <http://www.ism.ws>.

May 19 - 22 Optical Fabrication Exhibition, Rochester, N.Y. Sponsored by the International Society for Optical Engineering, www.spie.org/exhibitions/optifab.

May 20 - 23 Eastec Advanced Productivity Expo, Springfield, Mass., <http://www.sme.org/eastec>.

May 27 - 30 Electronic Components and Technology Conference 2003, New Orleans, La. Sponsored by the Electronic Industries Alliance (EIA), www.ectc.net.

May 28 - 29 First International Machine Tool Conference: The Dominance of Spindle Performance, <http://www.sme.org/annualmeeting/spindles>.

May 29 Beyond Lean: Product Lifecycle Management From Design to Disposal, Dearborn, Mich., <http://www.sme.org/managementforum>.

June 2 - 4 Medical Design & Manufacturing East 2003, New York, N.Y., www.mdmeast.com.

June 4 - 6 Instrumentation, Systems and Automation Society's Process Control Conference, King of Prussia, Penn., <http://www.isa.org/pcc/>.

June 5 - 6 Product Safety and Liability Prevention, Washington, D.C. Contact Randall Goodden at rgoodden@go.com.

June 9 - 11 Surface Mount Technology Association Conference, Boston, Mass., <http://www.smta.org>.

June 10 - 12 Twin Cities Apex Advanced Productivity Exposition, Minneapolis Convention Center. Sponsored by SME: <http://www.sme.org/twincities>.

June 11 - 13 International Society of Six Sigma Professionals Annual Leadership Conference, Scottsdale, Ariz., <http://www.issp.com>.

June 11 - 13 LeanSigma Exchange, Minneapolis, Minn. Sponsored by TBM Consulting Group, <http://www.tbmcg.com/exchange>.

June 16 - 17 OECD Seminar On External Funding

(Continued on next page)

Should Tool & Die Industry Look To Feds For Help?

The U.S. tool and die industry is facing unprecedented challenges, but if it started getting involved with government programs in place to help it, the industry could benefit, says a new Commerce Department "Tooling Industry White Paper."

The Bush administration "is prepared to assist tooling producers with strategies to increase domestic and export market share through a variety of programs and to address foreign trade practices through bilateral consultation, trade remedy counseling and by giving the U.S. tooling industry a seat at the table during trade policy formulation," says the White Paper presented to Rep. Phil English (R-Penn.). "Tooling companies are encouraged to work with the U.S. government to determine ways in which to improve their international competitiveness and prosperity."

But tool and die industry lobbyists in Washington, D.C., who have looked at the programs aren't sure they're enough to turn around a dire situation. The industry is

currently plagued with 40 percent overcapacity. The Commerce Department White Paper notes that some industry executives believe that 50 percent of the country's tool and die makers could be out of business within the next five years. "While economic downturns caused by business cycles are common to the industry, these latest trends are largely perceived as a permanent restructuring," says the White Paper.

The Commerce Department believes the industry, which is comprised mostly of small companies, needs to become far more aggressive in export markets, and that it should start taking advantage of U.S. government programs that assist small businesses in exporting their products. The White Paper says the International Trade Administration's Trade Development unit "would be most interested in consummating a formal public-private partnership with the National Tooling and Machining Association and other tooling trade associations to develop

and promote the exportation of U.S. tooling."

The White Paper also says the federal government is helping U.S. companies restructure their business in order to compete with lower-cost overseas suppliers. It says its Trade Adjustment Assistance (TAA) program helps companies in need. But the program is small (\$10.5 million) and is structured for firms that have been negatively impacted by unfair overseas competitors and are on the brink of bankruptcy. The Commerce Department White Paper also says tool and die firms should be using the resources of the Manufacturing Extension Partnership centers located throughout the country. The Commerce Department has not requested any funding for the national centers for the past two years.

The White Paper and its prescriptions "are comical — farcical at best," says one Washington-based tool and die industry lobbyist. "I thought it was a step in the right direction, but it's not even that." For a copy of the White Paper, send an e-mail to *Manufacturing & Technology News* at editor@manufacturingnews.com and we'll forward you a copy.

Calendar... (Continued from page 10)

and University Autonomy, Oslo, Norway. Sponsored by the OECD. Go to <http://www.oecd.org> and click on Upcoming Events.

June 16 - 19 ASME Turbo Expo 2003 — Power for Land, Sea and Air, Atlanta, Ga. For information, go to www.asme.org.

June 19 - 20 Lean Extended: World Class Manufacturing in an Era of Hypercompetition, Minneapolis, Minn., <http://www.shingoprize.org> or call Paul Spitzer at 435-797-2279.

July 29 - August 1 Sustainability and Industry: Increasing Energy Efficiency and Reducing Emissions, Rye Brook, N.Y. Sponsored by the American Council for an Energy-Efficient Economy, 302-292-3966.

August 18 - 21 Diminishing Manufacturing Sources and Material Shortages. Hosted by the U.S. Air Force Materials and Manufacturing Directorate, Air Force Research Laboratory: <http://www.dmsms2003.utcd Dayton.com/pages/call.html>.

September 9 - 11 Midwest Machine Tool Show,

Detroit, Mich. Sponsored by SME: <http://www.sme.org>.

September 9 - 13 MTA2003, International Exhibition on Precision Engineering, Machine Tools and Metalworking Technology, Singapore, www.mta-asia.com.

September 21 - 25 Surface Mount Technology Association International, Rosemont, Ill. Go to <http://www.smta.org>.

September 23 - 25 International Construction and Utility Equipment Expo, Louisville, Ky., www.icuee.com.

Sept. 23 - 25 Enterprise Integration Expo 2003, Tysons Corner, Va. Sponsored by the Association for Enterprise Integration and the National Defense Industrial Association, <http://www.afei.org/brochure/3af6/>.

October 1 - 3 Breakthrough Six Sigma, University of Wisconsin, Madison. Go to <http://www.uwexced/advancedmanagement>.

October 14 - 16 Cleveland Advanced Productivity Expo, Cleveland, Ohio. Sponsored by SME: <http://www.sme.org>.

Rep. Manzullo Offers Replacement For The Foreign Sales Corporation

The Foreign Sales Corp. could soon be replaced with a tax credit for manufacturers committed to producing products in the United States. House Small Business Committee chairman Don Manzullo (R-Ill.), a champion of manufacturing in Congress, has introduced a bill with House Ways and Means Committee members Phil Crane (R-Ill.) and Charles Rangel (D-N.Y.) that would replace the FSC with a tax rate reduction for companies making products in the United States.

Manzullo has introduced legislation (HR 1769) that would reduce the corporate income tax rate from 35 percent to 31.5 percent if a company produces products solely in the United States. Other companies would receive a sliding-scale effective rate reduction based on the value of their U.S. production of eligible products compared to the value of their worldwide production.

"It's an attempt to provide tax relief to U.S. manufacturers while at the same time reward them for keeping their jobs here in America," says a Manzullo staff aide.

The FSC was ruled by the World Trade Organization to be an unfair trade subsidy for U.S. companies. If it's not replaced, the European Union has permission to retaliate by placing \$4 billion of tariffs on U.S. products. Manzullo, whose district in Illinois includes a plethora of small- and medium-sized manufacturing companies, wants a tax rate reduction specifically for U.S. manufacturers.

"We're trying to convince the USTR that this is the best way to

go," says the staff assistant. Ways and Means Committee chairman Bill Thomas (R-Calif.) has proposed a replacement, "but we're concerned about it because we fear it encourages U.S. companies to manufacture overseas instead of here," says the Manzullo aide. "The whole idea is to replace it with something that allows our manufacturers the ability to compete." Manzullo expects to start introducing other legislation over the course of the next few months aimed at improving conditions in the manufacturing sector. "We must put our manufacturers back to work if we are to have a real economic recovery in America," says Manzullo.

Firms Must Position Themselves For Turnaround

Companies that will prosper after the economy begins to brighten are finding ways to retain their workforce rather than cutting staff and hoping to rehire when the economy revives, says John Challenger, president of Challenger, Gray & Christmas. Innovative companies pressed by the downturn are putting staff on four-day work weeks, instituting across-the-board pay cuts of 5 percent and continuing college recruitment efforts. "Companies looking ahead to recovery and beyond are returning to college campuses in hopes of gaining an important edge over their competition," says Challenger. "Companies foregoing campus recruiting risk losing the relationships they will need when the economy fully recovers. Taking steps to preserve one's staff tells customers that the company is committed to providing quality customer service, which can only be offered by maintaining an organization of well-trained and experienced individuals." Companies must also maintain or even increase spending on R&D to put them in a strong competitive position when the recovery is underway.

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Korea Increases Investment In Manufacturing R&D To Combat China's Growth

The growth of Chinese industry is forcing South Korea to respond with more aggressive industrial strategies aimed at retaining and promoting high-value-added manufacturing. "There are many difficulties in our industrial sector [similar] to other developed countries," says Doug-young Joo, president of the Korea Institute of Industrial Technology. "Problems we need to overcome are everywhere."

Labor costs have gone up, land prices have escalated and environmental regulations are restricting the growth of industry. Companies in the foundry industry, for instance, are being offered exceptionally good terms to move their plants to China, which they are doing.

In order to hold off the Chinese competitive threat and achieve its goal of doubling per capita income to \$20,000 by 2010, South Korea is stepping up its strategy of investment in manufacturing research and development.

Korea's economy is now the 12th largest in the world. Korea's success "didn't happen by chance," Joo told a recent meeting of the international Intelligent Manufacturing Systems (IMS) program in Italy. "It happened through R&D and significant technological breakthroughs in manufacturing." These

manufacturing breakthroughs were applied in the automobile, shipbuilding, electronics, machinery, iron and steel, petroleum and textile industries, all of which have experienced "quantitative growth" over the past 40 years, said Joo. Korea now wants to achieve "qualitative growth" through the "transformation of its global production center into an R&D

(Continued on page eight)

'Buy American' Raises Its Head Once Again; This Time In A Battle Over Defense 'Offsets'

The simmering debate over the complicated issue of defense offsets — when foreign countries require U.S. companies to transfer technology or manufacturing capacity to their country in order to receive a contract — is reaching the highest levels of Washington policy makers.

Rep. Duncan Hunter (R-Calif.), chairman of the House Armed Services Committee, has inserted language in the latest Defense Authorization bill that requires "defense trade reciprocity" with foreign nations buying American-made weapons. The language is causing heartburn among large defense contractors who must play the offset game in order to win overseas contracts.

(Continued on page 11)

Textile Associations From Around Globe Unite Against A Common Foe: China

Textile and apparel industry trade associations from around the world are galvanizing behind a proposal to request that the World Trade Organization postpone the planned January 1, 2005, phase-out of textile and apparel quotas from developing nations.

Fear is growing throughout the world that when the quotas are removed, China will overwhelm markets with high-quality cheap textiles and apparels and put as many as 30 million employees out of work in places like Bangladesh, Philippines, Zambia, Laos, Peru,

(Continued on page six)

Wal-Mart Makes Progress On RFID Pilot Project

Wal-Mart is expanding its plans to require suppliers to implement a new radio frequency identification (RFID) tagging system. In a meeting held in mid-June with its 300 largest suppliers, Wal-Mart chief information officer Linda Dillman said the company's top 100 suppliers and 37 other volunteer companies are on track toward reaching a January 2005 milestone to be live with an RFID system in North Texas. Once that pilot is complete, Wal-Mart expects to have working systems in at least six distribution centers and up to 250 Wal-Mart stores by June 2005. By October 2005, the company says its top 100 suppliers will be deploying the technology in 13 distribution centers and up to 600 stores.

"We discussed implementation plans with our next top 200 suppliers," says Dillman. "By January 2006, [our] next top 200 suppliers begin tagging cases and pallets."

Wal-Mart launched its RFID implementation on April 30 in North Texas. Cases and pallets of 21 products from eight suppliers marked with RFID tags are being shipped to Wal-Mart's Sanger, Texas, distribution center and then to seven local "Supercenters."

The project "is progressing as planned," says Dillman. "We're seeing the positive results we expected. We also anticipated hitting a few minor bumps in the road, which has happened. The whole reason for a pilot is to fix any last-minute issues and clear the path for a smooth implementation. That's what we're doing and we're looking forward to January 2005 with great expectations."

Some of those bumps, according to analysts, are tag performance problems, difficulties with liquid and metal and the lack of standards.

Wal-Mart consumers will soon see products displaying the "Electronic Product Code" (EPC) symbol. Initially, these will be on electronics goods and large items such as bicycles and lawnmowers.

Manufacturers In Ohio Form Political Action Group To Change Trade Policies

The City Council of Cleveland has passed a resolution supporting American manufacturing and has called on Congress to take immediate action to help restore the health of U.S. industry. Members of the newly formed Northeast Ohio Campaign for American Manufacturing (NEOCAM) along with the Cleveland City Council say they want Congress to pressure China to stop manipulating its currency. They ask that Congress repeal tax subsidies for offshore manufacturing production and enact a tax incentive for firms that manufacture in the United States. And they demand that Congress restore funding to the Manufacturing Extension Partnership (MEP) program at \$106 million.

NEOCAM is organizing a broad coalition of manufacturing organizations representing more than 800 firms and 36,000 employees in northeast Ohio. The group is working to educate the public and elected officials about the importance of manufacturing. Similar efforts are under way in Lorain, Elyria, Akron and other Ohio cities.

"It is important that our local governments step up to the plate in many ways to support domestic production," says John Colm, executive director of WIRE-Net and a NEOCAM steering committee member. "We are not asking anyone to build walls or to pretend that global markets won't continue to develop, but we do need support from local government so that decision makers in Washington start to get the message that manufacturing is important to our communities."

NEOCAM was organized to give a voice to manufacturing companies that employ fewer than 500 people, and which usually have no seat at the table when trade policy is established. It is mobilizing its members to contact members of Congress and President Bush regarding issues important to domestic manufacturing. NEOCAM's member Associations include the following:

- American Electroplaters & Surface Finishers
- American Mold Builders Association
- CAMP, Inc.
- Cleveland Industrial Retention Initiative
- Metal Service Center Institute, Eastern Chapter
- National Tooling & Machining Association (NTMA), Cleveland
- National Tooling & Machining Association (NTMA), Akron
- Ohio Association of Metal Finishers
- Summit County Machine Shop Group
- Westside Industrial Retention & Expansion Network (WIRE-Net)

Fewer Workers Being Sent Overseas

Companies in the United States are having a more difficult time relocating employees overseas, according to the National Foreign Trade Council. The U.S. is among the "most challenging" countries, along with China and Japan, for moving workers offshore.

"Overall, companies reported major shifts in all aspects of relocation, costs, timeframes and number of family members accompanying employees," says the council. There are "ever-increasing concerns over employee security and company costs."

Up to 70 percent of employees transferred overseas have an assignment length of one year or less, "a sharp increase from the historical average of only 13 percent with a one-year-or-less transfer," says the council.

Fewer relocating employees plan to bring their children with them on the transfer: only 51 percent this year. The United Kingdom, United States and France experienced the greatest reductions in expatriate activity.

For a copy of the "Global Relocation Trends Survey," set your browser to: <http://www.nftc.org/default/hr/GRTS%202003-4.pdf>.

PRODUCTION CAPACITY WILL INCREASE TO TWO BILLION ROUNDS

Bullet Industry Is On The Rise Due To Wars And Increased Training Needs

The federal government is in a dash to increase U.S. production capacity of small caliber ammunition. Surging use of ammo due to training requirements and wars in Iraq and Afghanistan has caused demand for small caliber ammo to skyrocket by more than 400 percent over the past four years. As a result, the U.S. has turned to Israel and Britain to make up for the shortfall in U.S. production.

In 2000, total production of small ammo rounds (5.56 mm used in the M-16, 7.62 mm and .50 caliber rounds) from government-owned, contractor-operated factories was 350 million rounds per year. Demand is now 1.3 billion rounds per year and the Army expects demand to grow to between 1.5 billion and 1.7 billion rounds per year. The Army wants production capacity in place to surge to 2 billion rounds of small ammo per year.

Stepped up military and training operations throughout the world "are consuming large quantities of small caliber ammunition and are putting a strain on the associated industrial base," Army Maj. General Buford Blount and Brig. Gen. Paul Izzo said in a joint statement to the House Armed Services Committee on June 24.

Total rounds consumed by U.S. soldiers in Iraq between the invasion in March 2003 and May 2004 were 74 million. Consumption in Iraq is now averaging around 5.5-million rounds per month. In Afghanistan, 21 million rounds of small ammo were fired from October 2001 to May 2004.

The government's primary provider of small ammo has not been able to keep up with the surge. The Army's Lake City Army Ammunition Plant in West Virginia run by Alliant Techsystems has increased its output from 350 million rounds a year four years ago to 1.2 billion rounds. But the Army needs more.

"To fulfill the urgent requirement for ammunition, some contracts have been awarded to foreign sources," say the two Army generals.

The Army is now taking deliveries from Olin-Winchester of East Alton, Ill., Israeli Military Industries (IMI) and the UK Ministry of Defense. "They will provide a buffer against immediate ammunition requirements," say Izzo and Blount. "While there is a current gap between the total annual requirement and the available inventory, it does not impact on current operations or our ability to ramp up to a major combat operation."

U.S.-based companies have expressed desire to invest in production to help meet military demands. "However, without some assurance of a return on their investment, even a modest investment would be a difficult decision for private industry when the government's proposed acquisition strategy offers no minimum annual production," says Richard Palaschak, director of operations for the Munitions Industrial Base Task Force, a trade association of 18 companies involved in the U.S. ammunition industry.

Once capacity is added at the Lake City plant "offshore production should not be necessary, nor should it be an option," says Palaschak. "An acquisition strategy that engages private industry's capabilities to supplement Lake City's capabilities has both historical precedents and provides insurance against some future change in requirements. It also provides a relief valve as Lake City modernizes its production capabilities and expands both its capacity and its workforce....A prudent enhancement of commercial

capabilities in addition to the expansion of Lake City's capacity is needed."

The Army is planning to hire a contractor next year to develop a plan to create secondary sources for its ammo within the private sector. "The Army does not want to repeat its history of building capacity during wartime only to dismantle the capacity in peacetime," say Izzo and Blount.

The Army's Lake City plant has increased its workforce from 650 people in 2000 to 1,950 people today. The facility has 1,800 suppliers and is implementing lean production systems and Six Sigma quality control practices. But the plant is old.

The majority of the equipment used to make 7.62-mm and .50-mm ammo was built the 1940s. "The process is heavily operator-dependent and the equipment has little flexibility to shift between calibers," says Karen Davies, president of the Alliant Lake City Small Caliber Ammunition Company, which runs the plant.

The primer facility has not been automated. The 5.56-mm production equipment was last updated in the late 1970s and uses 1980s computer controls. A new small ammo production plant would cost about \$400 million to build, says Davies.

Congress has been coming to the plant's rescue. In the past three years, Congress has added more than \$125 million for industrial base upgrades and increased ammo production. This year, Congress increased small caliber procurement by \$79 million, or 30 percent more than the Bush administration's budget request. For next year, the House of Representatives approved an increase of \$59 million over the Bush administration's request for \$148 million for investing in production upgrades.

Manufacturing Employment Takes Unexpected Dip In June

The long trend of lost manufacturing jobs reared its head again in June. The U.S. lost 11,000 manufacturing jobs during the month, after three months of gains totaling 75,000 new manufacturing jobs. The job loss number for manufacturing caught economists and other observers by surprise. Many had been predicting continued increases in manufacturing jobs, given strong economic growth and anecdotal evidence that was positive.

"It's the first time I've heard my people say we have to hire: jobs, jobs, jobs, we need more people. We can't do this work without more people," Don Wainwright, CEO of Wainwright Industries, told a press gathering recently on Capitol Hill that included the Secretary of Commerce Don Evans and House Majority Whip Rep. Tom DeLay (R-Texas). "We are starting to hire. It's the first time in four years I've heard my people say that and...it's great."

At the same event, Commerce Secretary Don Evans said: "It is now the strongest economy in my 30-year career in the private sector and maybe the strongest economy in my lifetime. The jobs are coming back...The tax relief over the last three years has led to these kinds of economic conditions that is broad based, deep and growing at this point in time."

David Huether, chief economist at the National Association of Manufacturers, said the loss of

manufacturing jobs in June "is a temporary setback and not a trend...Without question, the 11,000 drop in manufacturing employment was also an unwelcome surprise. However,

one month does not make a trend and I do expect the employment recovery in manufacturing to get back on the positive track in short order because domestic manufacturing production has been accelerating in recent months and our members have generally been optimistic on the employment front."

Since August of last year 1.5 million jobs have been created in the U.S. economy, but manufacturing has lost a net of 6,000 jobs during that period. Since June of last year, manufacturers have shed 122,000 jobs. From its peak in June 1999, U.S. manufacturing employment has dropped by 3,226,000, from 17,708,000 to 14,482,000 in June of this year.

Series Id: CEU3000000001
Not Seasonally Adjusted
Super Sector: Manufacturing
Industry: Manufacturing
Data Type: ALL EMPLOYEES, THOUSANDS

Manufacturing Employment 1994 - 2004
(Source: Bureau of Labor Statistics)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1994	16722	16744	16799	16855	16932	17104	16992	17183	17222	17226	17239	17230	17021
1995	17132	17159	17178	17207	17233	17342	17177	17335	17341	17290	17248	17251	17241
1996	17084	17130	17114	17137	17211	17323	17180	17361	17349	17332	17313	17308	17237
1997	17184	17222	17268	17288	17355	17486	17351	17552	17550	17563	17597	17614	17419
1998	17511	17536	17568	17579	17607	17708	17405	17640	17632	17552	17503	17475	17560
1999	17325	17305	17303	17291	17316	17394	17303	17363	17335	17314	17316	17300	17322
2000	17179	17193	17236	17249	17262	17403	17319	17364	17278	17251	17227	17200	17263
2001	16993	16934	16870	16750	16646	16615	16392	16332	16185	16010	15847	15723	16441
2002	15475	15414	15375	15340	15335	15399	15273	15272	15195	15096	15010	14919	15259
2003	14744	14675	14654	14566	14563	14604	14449	14488	14441	14398	14374	14340	14525
2004	14213	14219	14272	14319	14392(p)	14482(p)							

p : preliminary

Foreign Investment In U.S. Outstrips Investment Overseas

Foreigners are investing a lot more in the United States than Americans are investing overseas. The U.S. net international investment position at the end of 2003 was a negative \$2.431 trillion, reports the Commerce Department. The net investment position became \$197.7 billion more negative from 2002 to 2003, mainly due to large net foreign purchases of U.S. securities. Foreign acquisition of assets in the United States increased from \$768 billion in 2002 to \$829 billion in 2003. U.S. acquisitions of assets abroad in 2003 were \$283 billion, up from \$198 billion in 2002, and down from a record \$570 billion in 2000. The report is located at <http://www.bea.doc.gov/bea/newsrelarchive/2004/intinv03.htm>.

NIST Opens Advanced Measurement Laboratory

The National Institute of Standards and Technology has opened a new Advanced Measurement Laboratory, "the most technically advanced research facility of its kind in the world," it says. The 536,507-square-foot facility has been under construction since 2000 at a cost of \$235 million. Two of its five wings are buried 39 feet underground, enabling researchers to conduct precise atomic measurements needed by the industrial and scientific communities involved in nanotechnology, semiconductors, biotechnology, advanced materials, quantum computing and advanced manufacturing. Air quality, temperature, vibration and humidity can all be closely monitored.

Another Consultancy Tells Its Clients To Quickly Abandon U.S. Production

Large industrial companies must become more aggressive in moving their production to low-cost countries (LCCs), according to the Boston Consulting Group. The biggest problem companies face in the era of globalization is "being overly cautious and sensitive" in moving factories offshore, says BCG. "Industrial companies that benefit most from LCC operations generally take the boldest, most aggressive approach. They operate from the premise that everything is probably better produced in LCCs, and then work backward to identify what absolutely must be kept at home."

Companies that are increasingly competitive by moving to China, India and elsewhere have strong leadership that is closely involved in planning and moving production offshore. "Realizing global advantage via LCC operations requires a large amount of cross-border and cross-departmental cooperation and thus requires the leadership of someone with significant, company-wide responsibility and authority," says the Boston Consulting Group. "No industrial company can afford not to plan and act now."

Companies that are most competitive are moving their highest-profit and value-added operations offshore. "Companies can gain the most advantages not from moving less dynamic, lower-growth, higher volume categories and operations to LCCs, but from sourcing high-growth, high-margin, innovative categories and operations in LCCs where there is the most

vendors overseas.

Thousands of companies have sprung up to serve U.S. firms. The Carrier division of United Technologies "reviewed 1,600 bids before awarding a certain contract in China," says BCG.

Companies must also be aware of the costs involved in setting up operations in low-cost countries.

They must be savvy at establishing logistics, securing tooling, and training workers, which can add 10 percent to 40 percent to the costs of goods sold in the first year from a new operation. Companies must also manage the costs of closing down U.S. production, including asset write-downs, site cleanup programs and worker severance

packages.

Finally, companies must address the risks of creating "long-term bad will" in the United States. "Moving operations offshore can inspire negative reactions in companies' home

"No industrial company can afford not to plan and act now."

countries, including lost productivity from disgruntled employees, hostile unions impairing labor flexibilities and damaged relationships with home-country government agencies," says the report "Capturing Global Advantage."

China Accused Of Fabricating Trade Data

China is producing misleading trade data that is distorting the degree to which it is manipulating its currency, according to the Fair Currency Alliance. China estimated its trade surplus with the United States last year at \$60.3 billion, while the United States statistical agencies said the U.S. suffered a trade deficit with China of \$125 billion, a difference of \$64.6 billion.

After studying trade statistics from 43 different nations, the Fair Currency Alliance concluded that China's statistical agencies can't be trusted. "Overall, use of partner-country data shows that the Chinese government's published data significantly understate exports from China to the world and overstate Chinese imports from the world," says the alliance. China claims its surplus with the 43 nations was \$45.1 billion in 2002, while the data from the 43 nations pegs that amount at \$189.9 billion, a 319 percent divergence.

"These China-world trade surpluses are becoming more pronounced and show consistent under-reporting by China no matter which one of several calculation methodologies is used," says the alliance. "Based on the selected trading partners' data when adjusted for Hong Kong's re-exports, China's surplus has increased from \$119.6 billion in 1999 to \$175.8 billion in 2002, an astounding 47 percent increase over just three years. More important, the surplus was three to four times larger than that reported by China over the same period.... China's data are too unreliable to use as a basis for methodologies estimating undervaluation of the yuan or to evaluate whether China's policies to support the yuan's peg to the U.S. dollar constitute currency manipulation."

The Fair Currency Alliance, which was rebuffed by the Bush administration in its plan to file an unfair currency manipulation case against China, says that China should "promptly" revalue the yuan upward by 40 percent. Says alliance spokesman David Hartquist: "The U.S. government should pressure them to do so before more damage is done to our manufacturers and jobs."

Textile Associations Unite Against China... (From page one)

Mexico, Switzerland, Sri Lanka, the United States and dozens of other countries.

Ninety-one textile and apparel trade associations from 49 countries have now endorsed the "Istanbul Declaration," which calls on the WTO to hold an emergency meeting to address the threat posed by China's potential global export surge. The group, which includes five U.S. trade associations, met in Brussels, Belgium, in mid-June to coordinate their efforts and heighten awareness of the "certain catastrophic fallout" that will come when quotas are removed. Supporters of the effort note that in the past two years, U.S. importers have increased orders from China by 830 percent in 29 apparel categories in which China was removed from quotas.

The latest evidence of China's surging exports came when the U.S. hosiery industry filed a China "safeguard" petition with the Commerce Department claiming that surging imports are decimating the industry. Imports of Chinese socks have increased from one million dozen pair in 2001 to 22 million dozen pair in 2003, an increase of 2,153 percent, says the petition. During that time, U.S. production fell from 207 million dozen pair to 166 million dozen pair. The U.S. market share for U.S. producers fell from 64 percent to 44 percent. U.S. companies eliminated 17 percent of their employees, or 4,000 workers, and closed 30 factories. Meanwhile, the average cost of a dozen pair of socks from China fell from \$9.00 to \$4.15. The retail price of socks did not decline, which means U.S. importers and retailers are swimming in profits, say petitioners. "The nature of the U.S. retail distribution system, dominated by big-box retailers who employ global reverse auction bidding, simplifies import penetration," says the Hosiery Association. "The top three U.S. retailers control 52 percent of the U.S. retail sock market, while no such widespread, easily accessible retail distribution exists in China for U.S. sock exports."

The sock industry "is the same classic story that is going to impact many more industries," says one textile industry executive.

Developing countries were intended to benefit from the elimination of quotas, which was agreed upon in the 1994 Uruguay round of world trade negotiations. These nations are now among those most opposed to the phase out.

"There are so many jobs at stake in so many countries it is an issue that the WTO can't ignore," says Lloyd Wood, a spokesman with the American Manufacturing Trade Action Coalition in Washington. Adds Suleyman Orakcioglu, chairman of the ITKIB Association in Turkey: "The expiration of quotas represents a crisis of unprecedented worldwide proportions."

China was not part of the Uruguay round of negotiations, but was allowed to be part of quota relief when it was accepted into the WTO.

The trade associations involved in the Istanbul Declaration now need a government to petition the WTO to hold an emergency meeting on the issue. That is expected to occur within a month. The United States government will not submit that petition, but its reaction to the filing will be closely watched, particularly in a tough election year in which the issues of job loss in the manufacturing sector and China's trade practices have become important in industrial swing states and the Carolinas. President Bush's office of the United States Trade Representative can endorse the petition, oppose it outright or "ignore" it. If the USTR does nothing, it will allow the process to move forward.

Those involved say there is a lot at stake beyond the possible loss of tens of thousands of jobs in the United States. If a similar magnitude of jobs are lost in Mexico and throughout Central and South America due to a surge of imports from China, the United States could get swamped by thousands of additional illegal immigrants. If countries like Jordan, Pakistan, Egypt and other Muslim nations on the front lines on the war on terror lose significant market share to China, the loss of jobs could further exacerbate national security concerns. "The story is getting hotter by the day," says Wood. The creation of a vast international network of trade associations working together is unique and could set the stage for how other industries will deal with global trade challenges. "We have people who have been at each other's throats for 30 years who are now coming together" to work on a common challenge, Wood notes. "It's a new model for approaching trade issues."

"There are so many jobs at stake in so many countries it is an issue that the WTO can't ignore."

Demographics: Hispanic Population Reaches 40 Million

The nation's Hispanic and Asian populations continued to grow at much faster rates than the population as a whole, according to the U.S. Census Bureau. The population of Hispanics reached 40 million on July 1, 2003, accounting for about one-half of the 9.4 million residents added to the nation's population since 2000. Hispanics' growth rate of 13 percent over the 39-month period was almost four times that of the total population (3.3 percent).

The number of people who reported being Asian grew 12.5 percent to 13.5 million. The growth rates for blacks increased 4.4 percent, to 38.7 million; while that of whites increased by 2.8 percent, to 237.9 million.

Working-age adults (18- to 64-year-olds) totaled 182 million. There were 36 million people age 65 and over and 4.7 million people were older than 85. The full report is located at: <http://www.census.gov/Press-Release/www/releases/archives/race/001839.html>.

Companies Are Not Taking Advantage Of Economic Development Incentive Programs

Manufacturers are not taking advantage of millions of dollars of tax credits, grants, incentives and other economic development programs being offered by federal, state and local governments.

"Given all the different [business incentive] programs that have proliferated since the mid-1970s, there are a lot of them that have slipped between the cracks that people aren't aware of," says Mark Hilpert, head of the economic development practice at Dykema Gossett. "A whole set of federal programs are laid over a patchwork of state and local programs."

Manufacturing companies in Michigan can apply for the state's alternative energy tax benefit, yet only 18 applications were submitted by early this year. "Nearly all manufacturing facilities in most states qualify for tax abatements for pollution control equipment, yet few apply," says Dykema Gossett, a legal services and public policy consulting firm.

Companies should learn what is available before negotiating deals with government agencies. "Don't jump into one without knowing how it will interact with others," Hilpert recommends. Companies need to "develop a culture of perusing the incentives before they start signing leases or breaking ground" on new facilities.

Taking advantage of economic development incentives "is usually an afterthought and afterwards companies realize they would have been able to get a break if they had known about it." If local and state authorities already know a company is planning an expansion in their area, "they're not going to offer you" much in the way of incentives, says Hilpert.

Some companies have taken advantage of incentives. A common one among states allows companies to pay less property or sales tax on equipment that is used to control air or water pollution. It has been interpreted liberally by both companies and tax collectors. One grocery store purchased a baler for

cardboard boxes instead of burning the boxes in an incinerator and was able to exempt the baler because it abated air pollution.

There are federal funds for companies that are located in communities that have a heavy economic dependence on military bases. Brownfield programs and tax credits encourage companies to utilize old industrial and commercial buildings. Empowerment zones offer companies additional incentives and are located throughout the country.

"In some cases, the savings are very substantial," says Hilpert. There is a brownfield credit in Michigan that allows companies to take an income tax credit of 10 percent of the money spent on a

building. "So on a \$10-million building, you can take a \$1-million corporate income tax credit and you can even assign that credit to leasees and fractional equity partners if you can't use the credit," Hilpert explains. "There are a lot of other things that can go with it to make the deal even better."

In some cases, all the credits in the world won't help a company. Electolux decided to close its Greenville, Mich., refrigerator factory and shift 2,700 jobs to a new plant in Ejido San Isidro, Mexico. The company said its labor costs in Mexico are one-tenth what they are in Michigan. "It's difficult to make up for that kind of cost structure with incentives," says Hilpert, who can be reached at 517-374-9137.

Rep. English Wants A 'Revolution' In United States Trade Policy

The U.S. manufacturing base is "reaching a meltdown" and must be protected through a "revolution in U.S. trade policy," says Rep. Phil English (R-Penn.). The U.S. government "can no longer stand on the sidelines advocating a free-trade status quo without aggressively intervening to make sure that American workers and American companies aren't facing an artificial disadvantage in competing with other countries," English told the Hermitage Rotarians in Pennsylvania. A trade deficit running at 5 percent of the country's GDP cannot be sustained without a decline in the nation's standard of living. April's record \$48 billion trade deficit "demands an immediate response from Washington policymakers," English said.

But there is little desire to change trade policy "because to do so entails undertaking reforms in a whole range of sensitive areas," English told his audience. The country needs stronger and more enforceable trade agreements; fundamental reform of existing trade laws; stronger customs enforcement in dealing with imports; commercial assistance for companies; and an overhaul of international institutions that oversee the trade rules, such as the World Trade Organization (WTO). China also needs to be addressed because it is "sapping our industrial base by illegally manipulating its currency, stealing intellectual property and using its tax and regulatory system to subsidize its products," English said.

The Pennsylvania Republican has introduced legislation designed to address some of the problems facing manufacturers: The Trade Law Reform Act (H.R. 2365) would make it easier for American companies to seek relief from unfair trade; The Non-Market Economy Bill (H.R. 3716) would allow U.S. employers to file complaints about illegal subsidization from China and other non-market economies; and the CHINA Act (H.R.-3058) would punish Chinese currency manipulation by allowing tariffs of up to 40 percent to be levied on Chinese imports if directed by the U.S. Department of Treasury.

Korea Embraces Manufacturing R&D... (From page one)

center.”

The rapid development of an advanced economy based upon manufacturing productivity and technological innovation was accomplished through large-scale manufacturing R&D projects. One involved six research institutes, 27 universities and 70 companies with an investment of \$200 million a year for 10 years in computer integrated manufacturing, flexible manufacturing systems and intelligent manufacturing systems. The result: productivity growth increased by 300 percent for the companies involved and innovation spread throughout industry.

Investments in manufacturing R&D “changed Korea from a long-time debtor country to a surplus country.”

“This proves that manufacturing and production technologies have taken on a major role in developing the Korean economy rather than [investments in] the basic sciences,” says Joo.

The technological breakthroughs that propelled Korea onto the world economic stage were its development of high-definition television, the commercialization of CDMA mobile phone technology and

advanced digital manufacturing techniques, he said.

Research and development spending aimed specifically at manufacturing productivity and processes accounts for 83 percent of the nation’s total investment in R&D, says Joo. The Korean government invested \$4.6 billion in R&D last year, an amount that “will increase considerably in coming years,” Joo added.

The Korean government investment “paved the way for us in dominating the global market for digital display TVs and monitors.” Investments in manufacturing R&D “changed Korea from a long-time debtor country to a surplus country,” with exports amounting to \$400 billion last year. “The main driver for that was manufacturing and production technologies,” Joo said.

Further evidence of the positive results of South Korea’s strategy was the announcement in May by JD Power & Associates that Hyundai joined Toyota and Honda this year atop the firm’s prestigious initial automobile quality survey.

South Korea has started a new e-manufacturing project for the strategically important mold industry. It is working with Hyundai Heavy Industries and 13 small- and medium-sized companies on developing new processes for the seamless exchange of designs, manufacturing programs, engineering data and changes. If it is successful “we will apply it to other sectors,” said Joo.

The Korean government is also investing in the rapid implementation and application of new digital bio- and nanotechnologies.

Paper Recycling Reaches Record High; More Needed

For the first time in history, more than half of the paper consumed in the United States is being recycled, according to the American Forest & Paper Association. During 2003, 49.3 million tons of paper was recycled, an increase of 69 percent since 1990, when 33.5 percent of the paper consumed in the United States was recycled. Americans are now recycling 339 pounds of paper for every person in the country, up from 233 pounds per person in 1990.

Recovered paper now represents 37 percent of the raw material used to make new paper and paper products. But the industry needs more used paper in its production process. “As domestic and export demand for U.S. recovered paper continues to grow, domestic supply will be squeezed by an anticipated 50 percent surge in U.S. exports of recovered paper,” says AF&PA. “Most of that demand will come from Asia, particularly China.”

Americans “need to do more” to recycle paper, says Fred von Zuben, chairman of the AF&PA recovered fiber committee and chairman of the Newark Group. The paper association wants Americans to recycle 55 percent of all paper consumed by 2012.

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NEWS ANALYSIS

Redesigning The Space Industrial Base: Reflections On The Aldrige Commission

BY ROBBIN LAIRD

President Bush created a commission headed by Edward Aldrige, former Undersecretary of Defense for Acquisition and a former astronaut, to assess how his vision of space exploration could best be implemented. At the heart of the requirements facing the commission was a request for it to develop ways to do so within limited budgetary means, the "go as you can pay approach."

Press coverage of the report has largely focused on the reforms recommended for redesigning NASA into a lean structure oriented towards the future.

Headquarters would be slimmed down and become a coordinator of the NASA Centers, which would be rebuilt around the model of the federally funded research and development centers. Private organizations would manage the NASA centers to pursue efficiencies and new approaches to research and development.

Aldrige's Commission on Implementation of United States Space Exploration Policy also addressed the question of the current health of the space industrial base. The Commission argued that NASA needs to rely on a revitalized space industry and that it must provide incentives for the private sector to work with NASA. It said that NASA should rely on the private sector for its low-earth orbit requirements.

Indeed, the commission differentiated the aerospace industry from the space industry. "A true space industry would consist of a variety of contributors, each vigorously pursuing their own diverse agendas, not tied to or dependent upon government contracts, but not excluding those activities either," it said. "Achieving such a state requires the breaking down of barriers to commercial and entrepreneurial activities in space, as well as a cultural shift towards encouraging and incentivizing more private-sector business in space."

The commission identified three key aspects necessary for such an industry to emerge. First, NASA would need to do a much better job of tapping private-sector technology and pursue technology transfer. Second, NASA needs to pursue approaches that encourage and nurture private-sector space activities. An example would be the use of prizes to develop new capabilities. Third, greater international participation along the lines of the Joint Strike Fighter program could be encouraged in the development of the U.S. space exploration vision.

The Commission is to be applauded for underscoring the need for a restructuring of the space

industry to meet the new requirements, but what is required is much more radical than it admits. The reality confronting the U.S. space industry is strikingly different. Ignoring these realities means the vision will not be met.

The hope of the Clinton administration was that the commercial space industry would provide the government with many of its requirements. However, the collapse of launch demand has led to growing reliance by the U.S. industry upon U.S. government contracts. At the same time, the rigid pursuit of a sanctions policy has led to a growing isolation of U.S. industry from the global marketplace and relationships with its closest allies.

Aerospace subcontracting or "insourcing" is a key to the vitality of U.S. industry and is crucial to the global competitiveness of U.S. companies. But the U.S. pursuit of sanctions is killing the U.S. satellite and space industry. These sanctions are undercutting the industry's ability to provide the commercial products and services that the Aldrige Commission is calling for to support a new U.S. space policy.

In addition, the U.S. government has found it very difficult to innovate in space industrial policy. For example, the government developed a policy in the mid-1990s to rely on two launch providers — Lockheed Martin and Boeing — via the EELV program to pay for services rather than programs.

The key assumption upon which this policy was based was the emergence of a robust global launch market. The assumption proved to be wrong, yet U.S. government policy persists in supporting two aerospace launch providers. The costs of the program have escalated with little ability of the U.S. to limit costs. Indeed, the Pentagon had to re-certify the EELV this year because it had breached Congressional limits on spending and has requested a significant price increase for the program with little end in sight.

The proposed approaches to engage international partners are questionable as well. The international space station — a program to be eliminated or dramatically redefined in the vision — has been the cornerstone of U.S. international space policy. Migrating space station policy into something else is not a unilateral decision of the United States. And the Joint Strike Fighter model that is used in the report as the model for collaboration is under increased scrutiny from foreign partners, which see the limits of U.S. technological controls more clearly than the benefits of mutual developments.

(Continued on page 10)

Analysis Of Aldrige Commission Report...(Continued from page nine)

How might a new space industrial model be created?

First, the United States government could shift dramatically how it acquires space services. DOD and the U.S. government still pursue a fragmented approach to the acquisition of space communications. This needs to end. Large contracts to two- to three-service providers in space communications should be the norm, not the pursuit of unique government requirements. The Defense Department should recognize the reality of global cell phone and telecom standards and encourage U.S. companies working with foreign companies to provide for U.S. and allied military deployments.

Second, the U.S. government needs to find ways to end contracts. The Commission referred to the possibility of innovations in the Department of Defense that might be adapted for NASA requirements. Notably, the lead systems integrator concept might be used.

In the lead system integrator (LSI) approach, the government devolves to the LSI many of the tasks of managing integration of the sub-system providers. The jury is still out on how well this is working in DOD. The Pentagon has found no way to end the EELV contract or to slim to one provider. If innovation is to be pursued effectively, ways must be found to incentivize companies to work with NASA, and for NASA to end contracts when failure seems evident.

Third, the government could recognize reality. The United States no longer dominates the global technology market. U.S. government money should be provided to leverage the future not simply orient U.S. companies to providing what can be acquired elsewhere. Working with international partners means trading equities and assets. Notably, the big space providers in Europe expect trades in prime status and the U.S. government needs to organize itself for such trades: GPS and Galileo mutated into a new variant of GPS III; or the use of Ariane rockets for backup military missions much like Ariane relies on Boeing for backup of some of its commercial missions.

Fourth, U.S. global technological leadership is at stake and just pushing money to the big aerospace companies is unlikely to provide for such leadership. Innovation needs to be rewarded rather than quashed by government contracts to the biggest as opposed to the leanest and most agile.

For example, the Department of Defense could shift its emphasis on space control and assured access from an over-reliance upon big satellites and large launchers. Small satellites built on the Iridium model of constructing products rapidly around single or limited purpose functions could be prioritized.

When the U.S. goes to war or inserts forces into a high priority crisis situation, small communications satellites or other single-function satellites could be

placed into low-earth orbit for a limited duration mission. These satellites could be replaced as needed with new electronics and new capabilities as technology evolves, rather than simply relying on the larger satellites that have aging electronics the minute they are launched.

Smaller launchers could support the small satellites.

The recommendation of the Aldrige Commission to rely on the private sector for NASA's low-earth orbit requirements could be joined with a DOD priority to build a robust small launch industry in the United States.

In short, the United States needs to find ways to innovate in public-private partnerships and to design a realistic global technology policy in order to pursue a new and innovative space industrial policy. But such a policy would require a radical redesign of export laws to focus on capabilities more than widgets. It would require a successful approach to global partnering for U.S. firms. It means adoption of a sensible "insourcing" and "outsourcing" policy. And it would recognize that the United States is not going to dominate space by itself. The United States needs an allied space policy that allows for leadership rather than unilateralism.

The Report of the President's Commission on Implementation of United States Space Exploration Policy, A Journey to Inspire, Innovate, and Discover is located at http://www.nasa.gov/pdf/60736main_M2M_report_small.pdf.

—Robbin Laird is director of ICSA llc, an Arlington, Va.-based firm specializing in aerospace and defense. He can be reached via e-mail at RLaird@aol.com.

Fact-Finding Tour Planned For Mfg. Extension Program

The Commerce Department's National Institute of Standards and Technology is planning a cross-country series of workshops to gather input on what it should do with its Manufacturing Extension Partnership (MEP) program. The agency has been requested by the Bush administration to re-compete the extension centers. An assessment completed recently by the National Academy of Public Administration has called on NIST to create a "next generation" MEP program based on a new business model.

NIST is planning public meetings to solicit comments in Philadelphia (July 13), Cleveland (July 19), Detroit (July 20), Minneapolis (July 21), Orlando (July 26), Dallas (July 27), Los Angeles (July 28), and Washington, D.C. (Aug. 2). Webcasts are planned for July 14, July 23 and Aug. 3. You can register for a meeting or a Webcast at <http://www.mep.nist.gov/competition/intro.htm>.

CONGRESS EXPECTS A BATTLE OVER OFFSETS... (FROM PAGE ONE)

Hunter calls offsets a form of "economic bribery."

"It is the policy of the Congress that procurement regulations used in the conduct of trade in defense articles and defense services shall be based on the principle of fair trade and reciprocity consistent with United States national security, including the need to ensure comprehensive manufacturing capability in the United States defense industrial base for military system essential items," states the opening paragraph of the section (811) in the authorization bill addressing the issue of offsets.

The offset language in the House bill (HR-4200), which has no counterpart in the Senate version, requires the Secretary of Defense to develop an "acquisition trade policy" that creates incentives to eliminate offset agreements. The bill would prohibit the Defense Department to enter into a contract or to permit a subcontract with a foreign firm unless that company's home country agrees to have an offset policy similar to that of the United States. (The United States does not require offsets.)

The Secretary of Defense would have the authority to make an exception to the rule if done so in writing and published in the Federal Register. "The authority of the Secretary to apply the exception...may not be delegated to any officer or employee in a position at a lower level than the position of the Under Secretary of Defense for Acquisition, Technology and Logistics," says the House authorizing bill.

House and Senate staff members involved in the issue say Congress risks not having an authorization bill pass this year due to the offset language. "We're looking at a similar situation to last year," when Hunter's "Buy American" provisions were hotly contested for months before being dropped, said one Senate staffer. Hunter "is not going to let up," adds one aide on the House side. The health of the U.S. defense industrial base is a pressing, ongoing concern of Hunter's. "He's going to attack this from many different angles," said the staff member. Last year, it was a requirement that the Pentagon increase American-made content of weapons systems from 50 percent to 65 percent. "This year, it's offsets," says the aide.

On the Senate side, Sen. John Warner (R-Va.) has taken an aggressive stand against anything ringing of "Buy American." "He is willing to give up on [the authorization bill] if it means getting rid of the Hunter language," said one Senate aide. Added another Washington lobbyist: "This is going to be a very long conference."

Industry is weighing in on the debate. The Defense Trade Reciprocity provision "is nothing more than a poorly camouflaged attempt to institute some of the more onerous provisions of 'Buy America' Act legislation," said Dan Heinemeier, president of the Government Electronics & Information Technology Association. "If the House language prevails, we could see serious damage done to our relations with key allies, such as Great Britain. This could lead to retaliatory policies by our allies that bar our industry from the ability to compete for important contract opportunities

abroad."

The Aerospace Industry Association opposes the inclusion of the offset provision in conference. "We don't support offsets as a concept, but it's a cost of doing business in a global marketplace," says AIA vice president of legislative affairs Jon Etherton. "We recognize the distorting effect offsets have on trade, the only issue is what are the mechanisms for dealing with them? We can't just drop out of the marketplace."

Hunter is holding hearings and admits that the issue is "a very complex problem that once was small but has now reached a level that demands that it be brought under control." The big defense contractors, must not be at a competitive disadvantage, but also should not be allowed "to leverage away someone else's market share in order to compete in the global defense trade," he said at a hearing held on June 17.

Small- and medium-sized defense manufacturing companies with little or no Washington lobbying skills are losing business to offset arrangements. They are becoming more vocal as large contractors are signing deals that often shift more than 100 percent of the cost of the contracts to overseas facilities. Hunter said Lockheed Martin's sale of 48 F-16 fighters to Poland for \$3.5 billion carried with it offsets worth \$9.7 billion, 2.6 times the value of the F-16s. "Any way you look at this sale, we gave away much more than the Polish government purchased," Hunter said.

Lockheed Martin lined up about 20 U.S. companies to be engaged in the Poland deal, even though some of them had nothing to do with the production of the F-16s. Pratt & Whitney purchased a Polish factory, modernized it and created a manufacturing line that made engine components for the F-16s. "These components and assemblies are then shipped back to the U.S. for assembly into the engine," Hunter pointed out. Polish companies were able to sell tooling for Cessnas, components for land-moving equipment to Caterpillar, "roll-on roll-off" ships from a Polish shipyard, aircraft and helicopter parts, automotive parts, pressure-cast aluminum parts and electronic parts.

Even the U.S. Chamber of Commerce was involved in Lockheed Martin's F-16 contract. As one offset provider, the Chamber worked with Sandia National Laboratories in a deal with Krajowa Izba Gospodarcza to create an "export support system for small-and medium-sized Polish businesses for exports to the United States," according to documents from the House Armed Services Committee. United Technologies Corp. created a Materials Research Center at Poland's Air Institute in a deal with Instytut Lotnictwa of Warsaw.

"The free-trade mantra is for free and open competition," said Hunter. "Does anyone really think that American shipyards had fair and open competition for the ships included in this deal?"

At the June 17 hearing on the issue (another is planned for July 8), Hunter heard sad stories of U.S. companies having to agree to shift manufacturing production as recently as weeks ago to Spain and Japan as a result of those governments' demands for offsets.

(Continued on next page)

Offset Debate...(Continued from page 11)

The Spanish government even has an agency "that enforces these requirements," said Rick Edger, president and CEO of Jared Industries, a company with 100 workers based in Brunswick, Ga. "The ultimate effect of offset requirements...is to shift manufacturing jobs out of the U.S.," Edger said. "For too long our government has simply watched our manufacturing businesses decline while our technology and our jobs are transferred to other countries, raising our defense costs here in the U.S. To some it may seem like an academic exercise, but to those of us who make up the defense industrial base it is both a critical business issue and a critical national security issue."

Senate aides working on offsets said they were expecting Sen. Chris Dodd (D-Conn.) to introduce a companion bill to Hunter's. But Sens. Warner and John McCain (R-Ariz.) are bulldogs on the issue, effectively defeating any variant of the "Buy American" provision being debated.

If an offset provision had been introduced and defeated in the Senate, then Hunter would have had no chance of negotiating his language into the final conference committee report. "It was well known that anything that has to do with Buy American this year was an attack on Warner and his ability to negotiate effectively with Hunter in conference," said one Senate aide.

Additional interest in the issue might pick up when the Commerce Department's Bureau of Industry and Security releases a report on

offsets in August. That report should provide insight into how large the problem has become.

The Department of Defense also has its own study under way, due out next spring. That report, required in the FY 2004 Defense Appropriations bill, requires the Secretary of Defense to assess the impact offsets are having on the industrial base and report all of them to Congress.

"We're in the very beginning stages of where we are going to go on this," said one Senate aide.

DOE Seeks Contractor For Los Alamos

The Department of Energy (DOE) has initiated a process to compete the management and operating contract for Los Alamos National Laboratory (LANL) in New Mexico. It is the first time since the lab's creation in 1943 that its operator will be selected through a competitive bid. DOE's National Nuclear Security Agency is preparing a request for proposals and draft contract terms for release later this year. It has created a Web site to disseminate information related to the competition: <http://www.doeal.gov/LANLContractRecompete/Default.htm>. The RFP release date will be announced on the Web site.

Letter To The Editor

The headline about Wal-Mart importing more than manufacturers export is wildly inaccurate (*MTN*, June 18, 2004). About half of manufactured imports come here in containers, but only about one quarter of our manufactured exports leave here in containers. About 35 percent of our exports go by air, and another 38 percent via other means, such as trucks or self-propelled exports such as airplanes. Secondly, the "junk on the high seas" gives the false impression that most of what we export is low value. In 2003, 63 percent of U.S. manufactured exports were comprised of transportation equipment, computers and electronic products, machinery and intermediate/final chemical products — 40 percent of which was pharmaceuticals and other medicines.

— *David Huether, Chief Economist, National Association of Manufacturers*

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November 29, 2004

Rules to Navigate the Way Ahead in Military Space

< ROBBIN LAIRD >

U.S. military space policy is at a crucial crossroads. We need to decide whether "visions," unrealistic expectations of spending trends budgets and unrealistic expectations about our near-term technological capabilities, are going to shape policy or whether we can take a more realistic approach to the transformation of U.S. military's capabilities.

What we need are policies that will ensure that we are making the most of limited resources and creating a technology development strategy that allows us to upgrade our systems more quickly rather than allow technological wishful thinking bog us down.

The current fiscal limits are real and will only grow as Congress is forced to grapple with the budget deficit and the looming crisis in the social security system. There is as well an increasing menu of technical choices being offered by competitors to space-based systems, notably manned and unmanned air-breathing systems, which force reconsideration of what is truly essential to do in space. Some things might well best be done in the air and on the ground.

Six principles should guide a policy of space realism.

First, build complexity only where it is easiest to upgrade; don't build complicated networks in space if they are better done via

other systems, notably unmanned vehicles and ground systems. Technology — particularly software and communications technology — advance rapidly, so putting 15-year satellites in space should be done only where truly essential.

The best way to make it possible to keep up with technology is to keep the complexity in the air and on the ground where it can be changed without a trip to orbit. And

SBIRS was to subsume ought to have been kept in place via upgrades as a first choice, with a SBIRS option only prepared for the long term.

And evolving GPS 2 may be more important than moving too quickly to GPS 3. Remember better is often the enemy of good.

Third, avoid the temptation of believing that capability in principle is capability

What we need are policies that will ensure that we are making the most of limited resources and creating a technology development strategy that allows us to upgrade our systems more quickly rather than allow technological wishful thinking bog us down.

ground systems should be designed so they can be upgraded without needing to be replaced.

Second, make certain that the truly essential space infrastructure is kept in good repair by maintaining evolutionary programs in place and only replace them when real alternatives exist. The tale of the Space Based Infrared System (SBIRS) is significant. The core capabilities which

Fourth, build redundancy across systems rather than rely on a single space-based system. Because of the dynamics of change in the network environment, redundancy is achievable via the use of a variety of systems, military, commercial and global.

Fifth, think joint and coalition when focusing on the customer base. Capabilities which work only for a limited number of users are expensive; make certain that the expense is justified. Remember that the wide range of missions which joint and coalition forces need to deal with require accessible systems. Avoid strategic autism as we build the new networks.

Sixth, leverage the efforts of others, commercial industry, NASA and allies. The temptation of the recent increases in military spending has been to believe that this is a long-term trend. It is not. Building a policy that precludes leverage is short-sighted and will lead the Pentagon to a policy of believing that the preparation for space warfare is more central than co-opting others into a global security network.

In short, a realistic space policy can lead to real transformation. But the danger is to confuse the adjective with the noun; "transformational" in front of a program does not make it so.

Robbin Laird is a Washington-based defense analyst.

CONVERGENCE

EU-US Co-Opetition: 10 Trends for the Future

By Dr. Robbin F. Laird,
ICSA, LLC, Washington DC and Paris.

Ten Key Trends are reshaping American and European defense industry and will shape the future of Euro-Atlantic collaboration.

The American and European defense industries are highly interactive in nature. They operate in a globally competitive world and tap into a common commercial global base. The changing nature of security and military operations also shifts demand for the types of products and capabilities which customer's desire. And the rise of new global competitors – both state and non-state – shapes the relationships as well.

Looking at the decade ahead, a number of key trends are likely to shape the interaction between the industries.

First: The Transformation Drive

The American firms will benefit from a significant disparity in funds which allows big project innovations to be funded. But at the same time, these projects are likely to be placed

in an American context of “transformation” or within American shaped networks, and therefore will limit the ability of the U.S. firms to have platforms or products easily sold into the global market. (See graph 1).

Second: Market Restrictions May Isolate the Benefits of Transformation

The American firms are increasingly hamstrung by uncertain U.S. export rules and the difficulty of getting the government to adopt a perspective appropriate to the business-to-business relationships which shape modern defense industry.

Third: New industrial Leadership for Collaborative Capabilities

Major deals on a Euro-Atlantic basis will be conducted more at the com-

pany level than at the government level. As companies shape portfolios relevant to transformed militaries on both sides of the Atlantic, they will seek to provide joint capabilities. The challenge for governments on both sides of the Atlantic will be to adapt to the new industrial leadership.

Fourth: European Global Market Offensive

European firms are offering first-rate products on the global market. Platforms of the type of Eurofighter, Tiger, military satellites, tankers, radios, and precision weapons are on par with U.S. products. Given that the U.S. will bundle its new platforms within U.S. networks, European companies are likely to find a significant strategic opportunity to market worldwide specific platforms and weapon systems.

Fifth: Focus on logistics as Definer of Core Market Discriminators

Global customers seek to be engaged in the life cycle support of any



Graph 1. U.S. Transformation Drives Change in U.S. Industry .

new weapon systems. A general trend is for logistics to become central to the capability of any new platform and weapon system. If European and American firms seek to sell to each other and/or outside of the Atlantic area, the firms which can craft global logistic companies to support their products will win.

Sixth: **Shift in Emphasis to Conventional and Homeland Security Capabilities**

The changing nature of demand poses a key factor of change as well. For the United States, military operations in Iraq and the counter-terrorism requirements of homeland security underscore the need to shift money away from excessive expenditures on high tech war, to managing the security situations of the world in which the Americans are engaged.

Co-opetition

Co-opetition is a term used in the business literature about the need to compete and to cooperate to achieve market leadership.

"In most of the modern theories of business, competition is seen as one of the key forces that keep firms lean and drive innovation.

That emphasis has been challenged by Adam Brandenburger of the Harvard Business School and Barry Nalebuff of the Yale School of Management. They suggest that businesses can gain advantage by means of a judicious mixture of competition and cooperation. Cooperation with suppliers, customers and firms producing complementary or related products can lead to expansion of the market and the formation of new business relationships, perhaps even the creation of new forms of enterprise".

Source: Michael Quinion, Worldwide Words

The U.S. will continue to develop a sophisticated high-technology tool kit for reducing the requirements necessary to prevail in short wars. At the same time, much more attention,

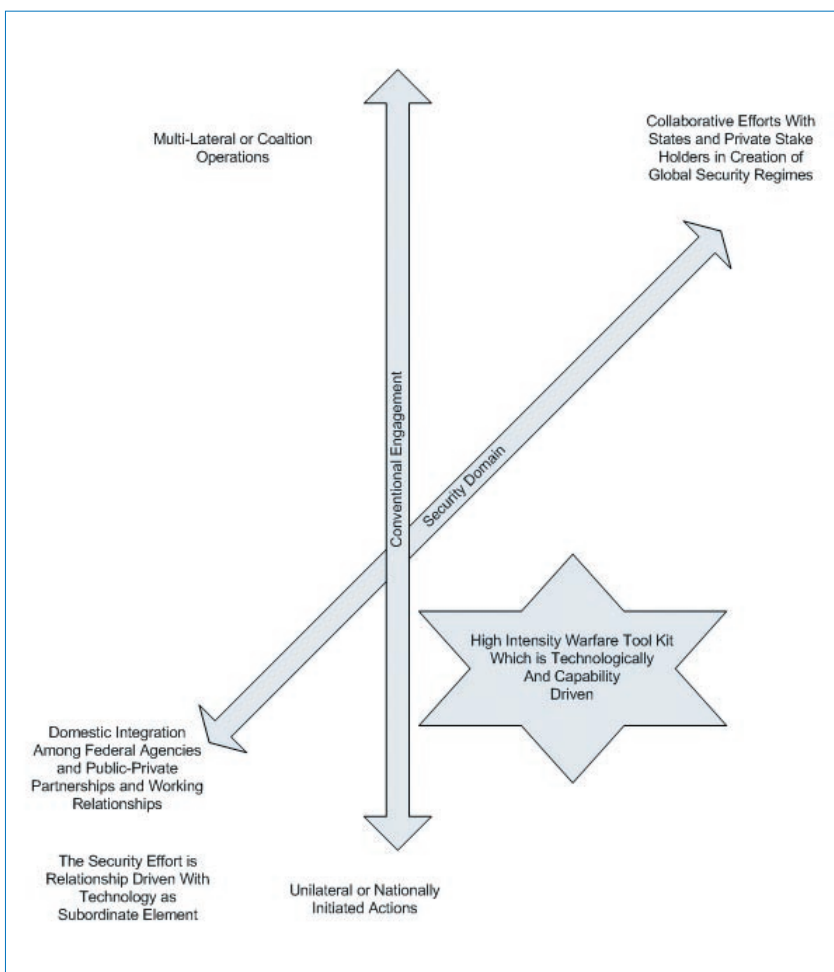
money and effort will go into deal with conventional and homeland security operations. (See graph 2).

Seventh: **Without More Investments Europe Will Not Have an Adequate High Intensity Warfare Tool Kit**

European militaries will have to be given more resources to perform high technology warfare better. It is not a question of matching U.S. resources – it is a question of building the decision-making systems able to take advantage of the precision strike revolution as well as to build the common infrastructures to move force rapidly into short war operations, and to network national and common forces. Europe simply does not spend enough money to play in this domain.

Eighth: **From Pure Defense to National Security Companies**

The homeland security challenge is altering as well the European and American defense industrial domains. Increasingly, national and European security capabilities are required. These capabilities draw on commercial technologies, communication systems and decision making systems.



Graph 2. New Defense and Security Dynamics.

Nine: **Networks Require Interoperability Which Generates Joint Business Models**

Building European-wide networks is clearly a task for the bigger companies but with the mix of participation of mid-size European as well as American companies. The Airbus analogy is obvious. Airbus is a systems integrator within which American companies play a key role. For European security such a model would work. At the same time, European companies like Sagem already play a significant role in the U.S. homeland security market. Working the new networks shaping the transformation of American and European militaries is a joint business area.

Both sides of the Atlantic have to adapt to new market

Neither Europeans nor Americans can create interdependence by themselves.

Tenth: **The Emergence of the New Public-Private Partnership Approach**

Europe needs to shape a response to the new public-private partnership approach which the United States is evolving to provide for new defense capabilities. The key elements of this strategy include the funding of lead-systems integrators (future combat systems, deepwater), the central role of an agency in funding innovative defense research (DARPA), the generation of a new space vision for NASA

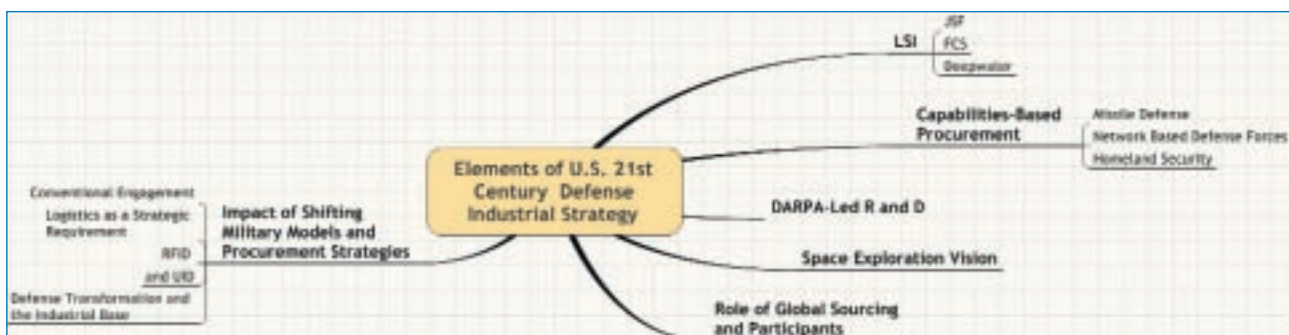
to shake-up the space industrial establishment (something the new NASA Administrator will surely do), and the significant impact of changes in Pentagon procurement and funding priorities on the industrial base (new logistics requirements, such as RFID and UID, a shift towards spiral development, a shift towards global sourcing, a shift towards low-intensity and special forces operations). (See Graph 3).

In short, the future is both competitive and collaborative for the American and European firms. Because each society faces many of the same challenges, we face the challenge which Benjamin Franklin oft warned: "We either hang separately or we hang together." ■

The Interoperability Challenge

- The interoperability challenge also reflects the challenge of defining the right mix of missions facing modern forces and how best to address them.
- The more the interoperability challenge is rooted in dealing with civilian-oriented tasks (extended homeland security, peacekeeping and peace stabilization), the more one can rely on global commercial and collaborative standards from which to build interoperability.
- The more the interoperability challenge is defined from the perspective of high intensity warfare the more likely are unique military standards to be used in defining solutions to national interoperability with the resultant problem of seeking ways to transition national to coalition interoperability.
- The great American weakness is to assume that building the second creates the first; the war against terrorism with a global reach, notably in the domain of air and maritime security is prioritizing the second.

Dr. Laird is President of ICSA, LLC. The company works on national security strategic issues with the U.S and European governments as well as working with key aerospace and defense firms on selected issues in both Europe and the United States.



Graph 3. The U.S. Builds a New Public-Private Partnership Approach.

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NASA Budget Request Puts Aeronautics R&D In A Tailspin

A House Science subcommittee heard some grim assessments last week upon delving into "The Future of Aeronautics at NASA" and, more specifically, the potential consequences of Bush administration plans to cut the agency's budget for aeronautics research significantly through the end of the decade.

"I think this program is on its way to becoming irrelevant to the future of aeronautics in this country and, perhaps, in the world," declared John Klineberg, a former director of NASA's Ames and Goddard research centers, testifying before the Subcommittee on Space and Aeronautics of the House Science Committee on March 16.

Klineberg, who headed a National Academy of Sciences review of NASA aeronautics activities published last year, rated as "a disaster, unmitigated," the proposed fiscal year 2006 budget request, which would drop funding for NASA's Aeronautics Research Mission Directorate (ARMD) to \$852 million in 2006 from \$906 million in the current fiscal year.

According to the 2006 budget request, funding for ARMD — whose domain ranges from advancing aircraft technology to designing the nation's system of air-traffic management — is slated to

drop to between \$717.6 million and \$730.6 million in the years 2007 to 2010, 20 percent below its 2005 allocation. And even this year's level is more than 50 percent below levels of a decade ago.

Subcommittee background materials, noting that "no other federal agency supports research on civilian aircraft," stated that "the cuts would come at a critical time for the U.S. aviation industry.

"The sole surviving American

manufacturer of large civil aircraft, Boeing, is facing ever stiffer competition from its European competitor, Airbus," which now holds around one-half of the world market for commercial airliners. "The two U.S. turbine engine manufacturers, General Electric and Pratt and Whitney, also face tough competition."

The implications for the nation's economy are striking. In 2004,

(Continued on page 12)

China Commission Wants To Know China's True Impact On U.S. Economy

The United States-China Economic and Security Review Commission, which is chartered by Congress, has issued a request for proposals for the creation of a "formal econometric model examining the impact of China on the U.S. economy" and specific industrial sectors. The commission wants to hire a contractor to undertake a multi-year project to create a forecast of what China's growth means for the "future standard of living and growth of the U.S. economy," it says in a request for bids.

The model should be able to project China's economic development and its industrial policies on U.S. employment in the manufacturing and service sectors; manufacturing output; impacts on wages and income distribution; the U.S. trade deficit; imports from and exports to China; U.S. personal income and corporate profits; U.S. energy and commodity prices; and total U.S. investment spending and its composition.

The commission wants the model to assess the impact China's

(Continued on page 11)

Disillusionment Over R&D Budget Request Spreads Into Republican Ranks

The members of the House Science Committee are known for preserving a bipartisan spirit that has grown increasingly rare on Capitol Hill.

But unusual even for them was the degree to which they carried bipartisanship in issuing the panel's annual "Views and Estimates" on the administration's proposed budget earlier this month, as the panel's Democrats joined its Republicans in a scathing appraisal of the research and development funding levels set for fiscal year 2006.

"In the past, the Democrats have written and submitted separate Views and Estimates as a critique," noted a statement from the committee's minority. "However, the Administration's fiscal year 2006 research and development budget request elicited such universal concern that Democrats could comfortably support the Republican-drafted document."

The committee wastes no time setting the tone for this year's version, which goes to the Budget Committee in compliance with the 1974 Budget Act. An increase in overall R&D funding for 2006 placed by the committee at 1 percent, which the administration has touted as bringing federal spending in the category to an "all-time high" of \$132.3 billion, comes in for debunking.

"The proposed R&D budget increases are heavily weighted toward development (a 2 percent increase), while applied research would remain flat, and basic research would decline by 1.2 percent," the panel observes, stating it "believes the proposed funding for basic research is insufficient."

The word "insufficient" and some synonyms provide the document a refrain. Funding for the Manufacturing Extension Partnership (MEP) at the Commerce Department (DOC) is also termed

BY KEN JACOBSON

"insufficient." Funding for the Department of Energy's Office of Science, for its user facilities, and for R&D related to energy efficiency and alternative energies, as well as funding for the National Science Foundation (NSF): all "inadequate." Support for R&D at the Federal Aviation Administration: "tepid."

The Committee's concern is evident, too, in the way its assessment goes toe to toe with administration claims. It points out that funding breakdowns for some "multi-agency R&D priorities" that the budget "highlights" reveal proposed cuts in their resources for 2006.

Showcasing funding of "science and engineering research" through NSF, administration documents point out that two of these interagency initiatives — in

nanotechnology and in networking and information technology — would receive impressive sums in 2006.

But the Science Committee points out that behind the \$803 million that would go to NSF for networking and infotech, a 1 percent rise from 2005, lurks a 7 percent decrease across the five participating agencies it oversees. The downturn holds at that percentage when budgets for the initiative's two remaining participants, the Departments of Health and Human Services and Defense, are taken into account.

Similarly, nanotech may be slated for a 2 percent boost at NSF, to \$344 million in 2006 from \$338 million this year, but the initiative as a whole would drop back by around 2.5 percent. A \$27 million decrease in funding for it at the Pentagon would precisely match its overall decline.

NSF served as a platform for yet other administration claims questioned by the committee. While the White House pointed to a 2.4 percent increase that would bring NSF's funding to the "record" level of \$5.6 billion in 2006, the Science Committee points out that "the proposed increase includes money

(Continued on page 13)

Senate Endorses Advanced Tech Program

The Advanced Technology Program (ATP) may have few friends in the Bush administration, but it has more than half the Senate in its corner if last week's passage of a resolution urging Senate appropriators "to make efforts to fund" the Department of Commerce program is a true indication.

The measure (S.AMDT. 238), offered by Sen. Carl Levin (D-Mich.) as a "sense of the Senate" amendment to the budget bill (S.Con.Res. 18), won by a margin of 53-46 in a March 17 vote.

Although voting went largely along party lines, nine Republicans plus Independent Sen. Jim Jeffords of Vermont joined all but one Democrat — Sen. Russ Feingold of Wisconsin — in supporting the amendment.

Yeas on the GOP side came from Sens. George Allen and John Warner of Virginia, Norm Coleman of Minnesota, Mike DeWine and George Voinovich of Ohio, Kay Bailey Hutchison of Texas, Richard Shelby of Alabama, Olympia Snowe of Maine, and Arlen Specter of Pennsylvania. Only Sen. Rick Santorum, Specter's GOP colleague from Pennsylvania, cast no vote.

Speaking for the measure on the Senate floor, Levin called ATP "one of the few federal programs available to help American manufacturers remain competitive in the global economy" while reminding his colleagues that the U.S. had "lost nearly 2.8 million manufacturing jobs" since the beginning of 2001.

"This high octane economic development engine," as he called ATP, "should be supported by Democrats and Republicans alike. If we want [the National Institute of Standards and Technology] to continue making these important job-creating ATP awards, we have to fund it."

— KEN JACOBSON

Assessment Of Industrial Base Assessments: There Is Little To Worry About, Or Is There?

The U.S. defense industrial base is healthy and vibrant, though there are a number of specific areas of weakness that need to be addressed, says the Department of Defense.

"The Department does not concur with concerns raised by some that the U.S. defense industrial base is in crisis," says the "Annual Industrial Capabilities Report To Congress" released this month. "Concerns that the Department is acquiring military materiel overseas to the detriment of national security and the U.S. defense industrial base also appear misplaced. Certainly, the Department is committed to acquiring the best for the warfighter — not just the best from the *American* industrial base or the *defense* industrial base."

The U.S. defense industry is financially healthy and more profitable than most other industrial sectors. Defense and aerospace companies benefit from lower capital requirements, progress payments that reduce inventory and the shared use of facilities, which reduces capital investments, says the report, prepared by the Office of the Deputy Under Secretary of Defense for Industrial Policy, Suzanne Patrick.

"Venture capitalists have a growing appetite for defense investments, and numerous boutique investment firms have sprouted around the D.C. beltway to service this interest," it says. "Finally, defense assets are plenty attractive to the merger and acquisition communities. As measured by our antitrust and foreign investment reviews, \$33.4 billion in defense-related assets changed hands in 2004."

Foreign companies are busy purchasing U.S. companies. Last year, the Defense Department reviewed 53 foreign acquisitions of U.S. companies worth a total of \$27 billion. It found that 15 percent of the transactions involved U.S. firms that possessed critical defense technologies. "In most cases, the Department, acting under its own industrial security regulations or other means, remedied its concerns by imposing measures on the acquiring firms to reduce risks of foreign ownership, control and influence on national security," says DOD.

A review of dozens of industrial base studies conducted last year by the military services and defense agencies indicates that a variety of needs are not being met by U.S. industry. For instance, there is not enough domestic capacity "to meet all of the Defense Logistics Agency's armor plate steel requirement," says

the report. As a result, DOD "authorized a domestic source waiver to ensure timely availability."

Other deficiencies in the industrial base have prompted DOD to take action, the report notes. One program initiated last year to sustain semiconductor capabilities was a take-or-pay contract signed with IBM for the "Trusted Foundry Access Program." This program, which has not been disclosed by the Pentagon nor discussed in the media, "assures access to leading-edge integrated circuit products that can be trusted for use in sensitive defense systems," says the report. "It also is the first step in a broader strategy to maintain long-term access to leading-edge integrated circuit products and to ensure that defense-specific integrated circuits built for sensitive DOD systems can be trusted."

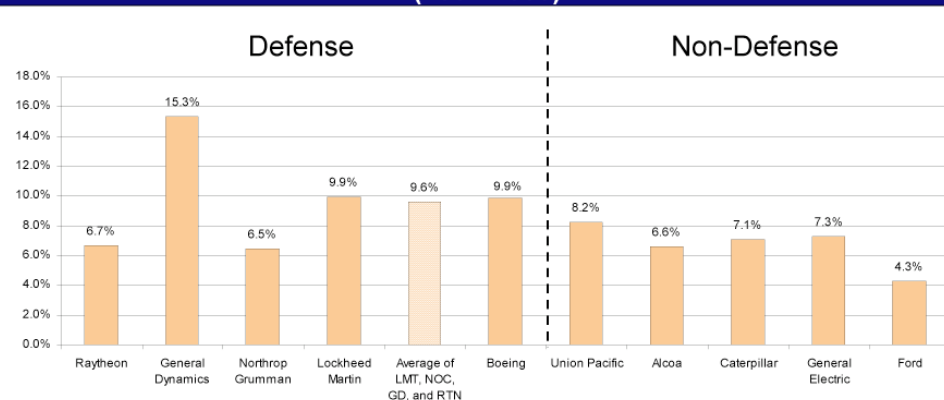
The Army undertook a large-scale assessment of the industrial base needed for its "Future Force" and found deficiencies in advanced materials such as high energy density capacitors and silicon carbide; software ("maintaining existing software takes more time than designing new systems"); power and energy systems; sensors ("there currently is no established industrial base for perception sensors in support of the Autonomous Navigation System"); night vision goggles ("there are risk areas associated with technology, maturity, capacity and financial viability"); chem-bio defense; aerial vehicles; and robotics.

Last year, the Army completed studies on small caliber ammunition (Jan. 2004); Jammer production capability (June 2004); surge contracting (Aug. 2004); engines for medium combat vehicles (Oct. 2004); light weight armor and aramid materials (Dec. 2004); and heavy transmissions (Dec. 2004).

The Navy completed industrial base assessment studies on the surface combatant shipbuilding industry (March 2004), which found that the transition from DDG52 to

(Continued on page four)

3-YEAR AVERAGE RETURN ON INVESTED CAPITAL, CROSS-INDUSTRIAL COMPARISON (2001-2003)



Sources: Company Filings, Standard & Poor's, and FactSet

Defense Industrial Base Assessments... (From page three)

DD(X) production "has the potential to negatively impact workload at the surface combatant shipyards." The Navy also completed industrial base assessments of compressor airfoils durability (May 2004); the Joint Standoff Weapon (Oct. 2004); the heavy lift replacement helicopter industry (Nov. 2004); and the microwave tube industry (Nov. 2004), which says "investments are needed for future applications."

The Air Force completed industrial base studies on the Lightweight Integrated Suit Technology (Jan. 2004); Laser Detection and Ranging Seeker (Jan. 2004); and power sources (April 2004), in which it found strong foreign competitors and many small U.S. manufacturers that "are rated as moderate or high financial risks due to declining sales, foreign competition and limited investment in both R&D and infrastructure," says the report.

The Air Force also completed an assessment of the space industry (May 2004) in which its financial analysis of 21 companies comprising the majority of systems and subsystems manufacturers found that "only two of the companies should be considered as other than low risk." A trough of production in the 2005 to 2010 timeframe "will most likely result in further reduction/consolidation of manufacturing capability across the sector, while straining the available engineering workforce" says the analysis of the report. "The decline in the space market has had the most notable impact on niche components and technologies provided by smaller manufacturers. Domestic suppliers in areas such as propellant chemicals, space-qualified electronics, space power sources (batteries and photovoltaics) and specialty materials have consolidated to where there are only one or two qualified sources in each area. Frequently these suppliers are finding it difficult to justify the business case to continue production."

The Air Force also completed a study on the financial health of the missiles and munitions industry

(Sept. 2004) in which it described 11 of the 19 companies in this segment as being medium or high risk. Lack of R&D spending and flat sales "will further impact an already weak group of component suppliers," says the report.

The Defense Contract Management Agency completed industrial base assessments of the weapons battery industry (Feb. 2004); aircraft transparency (May 2004); aerial target industry (May 2004); aircraft flexible shafts and couplings (July 2004); seamless stainless steel tubing munitions capability (Sept. 2004); crew crashworthy seat (Oct. 2004); and energy constraints (Nov. 2004).

The Defense Logistics Agency completed industrial base

assessments of the lithium battery industry (Sept. 2004); tray pack rations (Oct. 2004); meals ready to eat (Oct. 2004); textiles and apparels (Oct. 2004); extreme cold weather clothing (Oct. 2004); and the Joint Services Lightweight Suit technology (Oct. 2004).

DLA's report on textiles apparel and footwear said the industry "may be negatively impacted when import quotas affecting this industry are lifted to comply with World Trade Organization agreements. If the domestic industry falters, the Department may be unable to source certain items from domestic sources."

The 53-page Annual Industrial Capabilities Report to Congress is located at <http://www.acq.dod/ip>.

Foreign Direct Investment in the United States -- Annual Flow			
	1992-1995	1996-1999	2000-2003
Overall			
Volume	\$173,752	\$645,663	\$566,110
% Change		272%	-12%
Aerospace			
Volume	\$894	\$1,158	\$3,448
% Change		30%	198%

(Source: "Annual Industrial Capabilities Report To Congress," Feb., 2005)

Robots Become More Prevalent Worldwide

Worldwide purchases of industrial robots surged by 19 percent in 2003 to 81,800 units, according to the United Nations Economic Commission for Europe. In the first half of 2004, orders for robots were up another 18 percent to the highest level ever recorded. Sales of industrial robots in the United States were up by 28 percent in 2003 to 12,700 units.

There are between 800,000 and 1,090,000 industrial robots working worldwide, with an estimated 350,000 in Japan, 250,000 in the European Union and 112,000 in North America. The UN expects sales to grow at an annual rate of 7 percent from 2004 to 2007.

"In Germany, the prices of robots relative to labor costs have fallen from 100 in 1990 to 35 in 2003 and to 15 when taking into account the radically improved performance of robots," says the report. "In America, the relative price dropped to 28 and to about 12 if quality improvements are taken into consideration."

At the end of 2003, there were more than 600,000 autonomous vacuum cleaners and lawn-mowing robots in operation, with another four million units projected to be added between 2004 and 2007. The report, "World Robotics 2004," is located at http://www.unecce.org/press/pr2004/04stat_p01e.pdf.

Logistics Is An Emerging Strategic Issue For Military Planners

Although it is much sexier to debate the future of combat aircraft and space warfare, the Department of Defense has been jolted to reality by operations in Iraq and Afghanistan. A new approach to expeditionary operations is required; one that allows the Pentagon to move forces quickly in smaller groups that are supported by a more coherent and integrated logistics system. While priorities have been placed on the "transformation" of systems, now the stubborn reality of counter-terrorism, urban warfare and conventional engagements requires logistics to be placed at the core of Pentagon thinking.

In part, the renewed attention to logistics has been rooted in the challenges encountered in Operation Iraqi Freedom (OIF). The DOD's own review of OIF in March 2004 found that shortfalls occurred at every transaction point in the supply chain — from strategic-level transportation to tactical-level distribution.

Recently, the Government Accountability Office in its annual series on areas of high risk in the federal government identified DOD supply chain management as a prime candidate. According to the GAO's January 2005 report, DOD "has experienced significant weaknesses in its ability to provide efficient and effective supply support to the warfighters."

There are many excellent Powerpoint slides presented by Pentagon briefers during the past decade revealing a shift to new logistics management and better transparency in supply-chain linkages. But briefing slides do not a capability make.

The trendy phrase to describe the transition is "focused logistics," which is defined by DOD as being "the ability to provide the joint force the right personnel, equipment and supplies in the right place, at the right time and in the right quantity across the full range of military operations." To those of us who try to use English as opposed to Pentagonese, this would seem to be the role of logistics, "focused" or not.

There are a number of key elements of a real re-think underway.

- First, the Quadrennial Defense Review and the Joint Staff Guidance

BY ROBBIN LAIRD

are both focusing upon logistics provisions as a core component in the ability to provide for effects-based operations. In other words, logistics is not simply the last item in providing for force structure capability. It is at the heart of any real force structure design.

The Joint Staff considers logistics to be one of the eight key pillars of effects-based operations. Logistics is considered as part of the process and network of capability. It is an interrelated part of operations, not an afterthought. It should be noted that the Joint Forces Command's experimentation directorate (J9) includes significant logistics experimentation and lessons learned. But to go from today's realities to future plans will take some doing.

- Senior DOD leaders have shifted requirements to encourage or force suppliers to provide tools for better asset visibility within the supply chain. Acting Undersecretary

Michael Wynne last July 30 signed memos that require radio frequency ID (RFID) and other identifying tools to be part of the initial provision of weapons and supplies.

"DOD components will immediately resource and implement the use of high data capacity active RFID in the DOD operational environment," said Wynne. "DOD components must ensure that all consolidated shipments moving to, from, or between overseas locations are tagged, including retrograde, and must expand the active RFID infrastructure to provide global in-transit visibility."

Wynne understands that technology alone will not solve the problem, but believes that technology can be developed to assist in asset management. This guidance was to go into effect on January 1, 2005, but suppliers have been slow to comply.

RFID initiatives associated with homeland security and container shipping makes it clear that the future direction of asset visibility must include a key element of security as well.

- Major new programs for DOD are being designed with logistics as a key structural element. The Joint Strike Fighter, Littoral Combat Systems and the Deepwater U.S. Coast Guard programs are a few

(Continued on next page)

Science Academy Studies Defense R&D

Defense Department funding of basic research is not being siphoned off into weapons projects that are further along in development, according to a study from the National Academy of Sciences. But the study, the result of concerns raised by universities and research laboratories that DOD funding intended for basic research was being used elsewhere, found that the Pentagon is not as interested in pursuing basic research.

"There has been a trend within DOD for reduced attention to unfettered exploration in basic research programs," says the study. "Near-term DOD needs are producing significant pressures to focus basic research in support of those needs. DOD needs to realign the balance of its basic research more in favor of unfettered exploration." The 70-page report, "Assessment of Department of Defense Basic Research," is located at <http://books.nap.edu/catalog/11177.html>.

Catching The Next 'Wave' In Renewable Energy

The generation of electricity from wave energy may be economically feasible in the near future, according to the Electric Power Research Institute. "Wave energy conversion may be economically feasible within the territorial waters of the United States as soon as investments are made to enable wave technology to reach a cumulative production volume of 10,000 to 20,000 megawatts," says EPRI.

Conceptual designs for 300,000 megawatt-hour (MWh) plants (nominally 120 megawatt plants operating at 40 percent capacity factor) were performed for five sites: Waimanalo Beach, Oahu, Hawaii; Old Orchard Beach, Cumberland County, Maine; WellFleet, Cape Cod, Mass.; Gardiner, Douglas County, Ore.; and Ocean Beach, San Francisco County, Calif.

EPRI found that wave energy will become commercially competitive with land-based wind turbines "at a cumulative production volume of 10,000 or fewer MW in Hawaii and northern California, about 20,000 MW in Oregon and about 40,000 MW in Massachusetts," said Roger Bedard, EPRI's ocean energy project manager. "Maine is the only state in the five-site study whose wave climate is such that wave energy may never be able to economically compete with a good wind energy site."

Conversion of ocean wave energy to electricity is believed to be one of the most environmentally benign ways to generate electricity, says the Palo Alto, Calif.-based research consortium. "Offshore wave energy offers a way to minimize the 'not in my backyard' (NIMBY) issues that plague many energy infrastructure projects," it says. "Wave energy conversion devices have a very low profile and are located far enough away from the shore that they are generally not visible."

Wave energy is also more

predictable than solar and wind energy, "offering a better possibility of being dispatchable by an electrical grid systems operator and possibly earning a capacity payment," according to EPRI. "A characteristic of wave energy that suggests that it may be one of the lowest cost renewable energy sources is its high power density."

EPRI's offshore wave energy report can be accessed at <http://www.epri.com/targetWhitePaperContent.asp?program=267825&value=04T084.0&objid=297213>.

Climate Change Task Force Calls For Doubling Of Clean Energy R&D

"Left unmitigated, the impacts of climate change are expected to be devastating," says the International Climate Change Taskforce.

"Urgent action is needed." The group, co-chaired by Sen. Olympia Snowe (R-Maine), calls on governments to establish requirements that 25 percent of electricity come from renewable energy sources by 2025.

Governments from the industrialized nations should double their spending by 2010 on research, development and demonstration of advanced technologies for energy-efficient and low- and zero-carbon energy supplies. The task force calls for the creation of a G-8 Climate Group to pursue technology agreements and initiatives that will lead to large emissions reductions.

The report, published by the Institute for Public Policy Research in London, The Center for American Progress in Washington, D.C., and the Australia Institute, is located at <http://www.americanprogress.org/atf/cf/{E9245FE4-9A2B-43C7-A521-5D6FF2E06E03}/CLIMATECHALLENGE.PDF>.

Logistics... (Continued from page five)

examples of the requirement to build in logistics provision from the beginning of program development.

- DOD is turning to rapid procurement modification acquisition to provide for conventional engagement in Iraq. In a number of areas, procurement modifications are taking logistics issues into account. For example, in December Lt. Gen. Claude Christianson, the Army's deputy chief of staff for logistics, commented about the replacement of the Humvee in 2007-2010 as follows: "The way we thought we would use trucks five or six years ago is different than the way we are using them today. We had planned and organized our forces so that we would have an area that we owned, and we'd have boundaries, and we'd have a front line, and we'd have a rear area. The trucks that we use to deliver supplies would be driving along roads that were relatively secure. Today's battlefield is not like that."

- The budget downturn and redirection of Pentagon spending has the major Pentagon suppliers rethinking their approach to logistics as well. Robert Stevens, the CEO of Lockheed Martin, recently commented that if the big spend on systems is over, the company would shift focus toward determining "how to contribute to a broader market area that includes sustainability, logistics and streamlining."

A number of important military service contractors, such as CACI, Anteon and related firms, will certainly consolidate their capabilities to provide a more comprehensive logistic solution to the Pentagon.

In short, a strategic shift is underway. Logistics is moving from being the last thought to a front-burner issue in designing systems and providing for effects-based operations and security capabilities.

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U.S. Gets Clobbered By Euro Imports Due To Tax Treatment, Says MAPI

"During the past decade, Western Europe has used aggressive 'tax competition' to nearly double its exports to the rest of the world — far faster than [the United States'] export growth — and has built a substantial trade surplus with the United States," says the Manufacturers Alliance/MAPI. Western Europe has reduced corporate income tax rates, while rebating value-added taxes (VATs) on its exports and is using the WTO's "arbitrary rules to thwart effective responses by the United States."

To combat this advantage, the President's Advisory Panel on Federal Tax Reform "should consider how this nation's corporate income tax disadvantages U.S. companies and their workers against foreign rivals operating VATs," says MAPI. There is a "destructive synergy among Europe's border-adjustable VATs; the high U.S. corporate income tax that applies to worldwide income; and the arbitrary WTO rules that allow border adjustments for VATs but not for income taxes."

Europe's dominance in exports due to high U.S. corporate tax rates has hurt U.S. workers more than U.S. investors, MAPI argues. "While American workers are left with the lower pay that follows less demand for their services, today's highly computerized financial markets allow investors around the world to seek out the country that offers the highest after-tax rates of return."

The report, "How the U.S. Corporate Income Tax, Foreign Border-Adjustable Value-Added Taxes and International Trade Rules Team Up To Disadvantage U.S. Companies and Their Workers" (ER-584e), can be ordered at http://www.mapi.net/html/prelease.cfm?release_id=1764.

Commodity Prices Boost U.S. Minerals Industries

The value of the all mineral materials processed in the United States "soared" last year to \$418 billion, up 13 percent from 2003, says the United States Geological Survey. It was the largest year-to-year increase since 1988. The total value of raw, non-fuel mine production rose to \$44 billion, up 12 percent from 2003.

"The story this year is the escalating demand from emerging industrial giants China and India, and how this demand is reverberating through the world economy," said USGS director Chip Groat. "These materials represent the underpinnings of the economy and our national security because they are used to make all kinds of manufactured products," said Groat. "Because mining is the first step in producing nearly anything that isn't farmed, these statistics are a key early indicator of a nation's economic performance."

The 199-page report, "Mineral Commodity Summaries 2005," which summarizes market trends for about 90 individual mineral commodities, is located at <http://minerals.usgs.gov/minerals/pubs/mcs/2005/mcs2005.pdf>.

Recent Studies — Resources Of Interest

RADIO FREQUENCY IDENTIFICATION: LITTLE DEVICES MAKING BIG WAVES, a 16-page report from the Progressive Policy Institute, is located at http://www.ppionline.org/documents/RFID_1006.pdf.

ECONOMIC IMPACT OF INADEQUATE INFRASTRUCTURE FOR SUPPLY CHAIN INTEGRATION, (190 pages) produced by RTI International for the National Institute of Standards and Technology, is located at <http://www.nist.gov/director/prog-ofc/report04-2.pdf>.

THE BEST MANUFACTURING PRACTICES CENTER OF EXCELLENCE has released survey reports of Forest City Gear of Roscoe, Ill.; Tomak Precision of Lebanon, Ohio; and RB Tool and Manufacturing Co. of Cincinnati, Ohio. The best practices surveys are on the BMP Web site by clicking on "Best Practices Surveys": <http://www.bmpcoe.org>.

ADDING VALUE...GROWING CAREERS, THE EMPLOYMENT OUTLOOK IN TODAY'S INCREASINGLY COMPETITIVE IT JOB MARKET, from the Information Technology Association of America, is located at <http://www.ita.org/eweb/upload/04workforcestudy.pdf>.

THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION has identified 14,000 workplaces with high injury and illness rates. These locations are prime targets for an OSHA inspection this year. The list is available for public viewing: http://www.osha.gov/as/opa/foia/hot_11.html.

WHAT INDIANA MAKES, MAKES INDIANA, a 19-page report from the Indiana Manufacturers Association describing the importance of manufacturing to Indiana's economy, is available at http://www.imaweb.com/news_pdfs/IN%20Mfg%20Report%20Exec%20Sum%20Final.pdf.

UNITED STATES PATENT AND TRADEMARK OFFICE 2004 PERFORMANCE AND ACCOUNTABILITY REPORT: <http://www.uspto.gov/web/offices/com/annual/2004/index.html>.

EUROPEAN UNION'S TECHNOLOGY PLATFORMS program and the descriptions of "large-scale" research proposals for 22 industries: <http://www.cordis.lu/technology-platforms/>.

COSTS OF DEVELOPING A FOREIGN MARKET FOR A SMALL BUSINESS: THE MARKET AND NON-MARKET BARRIERS TO EXPORTING BY SMALL FIRMS, from the Small Business Administration, is located at <http://www.sba.gov/advo/research/rs241tot.pdf>.

INNOVATE AMERICA, NATIONAL INNOVATION INITIATIVE REPORT: THRIVING IN A WORLD OF CHALLENGE AND CHANGE, from the Council on Competitiveness, is located at: http://www.compete.org/pdf/NII_Final_Report.pdf.

THE AFL-CIO'S JOB EXPORT DATABASE PROJECT (JEDP) has issued five state reports that list company layoffs and the number of jobs impacted in each of the states. The Ohio

(Continued on page eight)

Recent Reports... (From page seven)

report is located at http://www.afl-cio.org/issuespolitics/manufacturing/upload/ohio_jobexports.pdf; Pennsylvania is at http://www.afl-cio.org/issuespolitics/manufacturing/upload/pa_jobexports.pdf; Washington is at http://www.afl-cio.org/issuespolitics/manufacturing/upload/wa_jobexports.pdf; Wisconsin is at http://www.afl-cio.org/issuespolitics/manufacturing/upload/wi_jobexports.pdf; and Minnesota is at http://www.afl-cio.org/issuespolitics/manufacturing/upload/mn_jobexports.pdf.

THE 2005 TRADE POLICY AGENDA AND THE 2004 ANNUAL REPORT OF THE PRESIDENT ON THE TRADE AGREEMENTS PROGRAM, a report from the United States Trade Representative, outlines the Bush administration's trade initiatives for the coming year. The report also contains the congressionally mandated five-year assessment of the World Trade Organization. It is located at: <http://www.ustr.gov>.

Government Accountability Office Reports:

DEFENSE ACQUISITIONS: Changes in the Air Force's E-10A Acquisition Strategy Are Needed Before Development Starts, <http://www.gao.gov/new.items/d05273.pdf>.

DEFENSE MICROELECTRONICS: DOD-Funded Facilities Involved in Research Prototyping or Production, <http://www.gao.gov/new.items/d05278.pdf>.

BROWNFIELDS REDEVELOPMENT: Stakeholders Report that EPA's Program Helps to Redevelop Sites, But Additional Measures Could Complement Agency Efforts, <http://www.gao.gov/new.items/d05294.pdf>.

TECHNOLOGY DEVELOPMENT: New DOD Space Science and Technology Strategy Provides Basis for Optimizing Investments, But Future Versions Need to Be More Robust, <http://www.gao.gov/new.items/d05155.pdf>.

TACTICAL AIRCRAFT: Air Force Still Needs Business Case to Support F/A-22 Quantities and Increased Capabilities, <http://www.gao.gov/new.items/d05304.pdf>.

The Defense Department's Under Secretary of Defense for Industrial Policy has recently issued the following reports: **INDUSTRIAL CAPABILITIES REPORT TO CONGRESS** (March, 2005); **DEFENSE INDUSTRIAL BASE CAPABILITIES STUDY: PROTECTION** (Dec. 2004); **FOREIGN SOURCES OF SUPPLY: ASSESSMENT OF THE U.S. DEFENSE INDUSTRIAL BASE** (Nov. 2004); **DEFENSE INDUSTRIAL BASE CAPABILITIES STUDY: FORCE APPLICATION** (Oct. 2004); **THE VERTICAL LIFT INDUSTRIAL BASE: OUTLOOK 2004-2014** (July 2004); and **DEFENSE INDUSTRIAL BASE CAPABILITIES STUDY: COMMAND & CONTROL** (June, 2004). They are located at <http://www.acq.osd.mil/ip/>.

EPA AND STATES NOT MAKING SUFFICIENT PROGRESS IN REDUCING OZONE PRECURSOR EMISSIONS IN SOME MAJOR METROPOLITAN AREAS (Report 2004-P-00033), a 103-page report from EPA's inspector general, is located at <http://www.epa.gov/oig/reports/2004/20040929-2004-P-00033.pdf>.

VOLUNTARY REPORTING OF GREENHOUSE GASES 2003, from the Energy Information Administration, found that 234 U.S. companies and organizations initiated 2,188 projects to reduce emissions, resulting in the reduction of 268 million metric tons of carbon dioxide. The 90-page report is located at [http://www.eia.doe.gov/oiaf/1605/vrrpt/pdf/0608\(03\).pdf](http://www.eia.doe.gov/oiaf/1605/vrrpt/pdf/0608(03).pdf).

LIMITING CARBON DIOXIDE EMISSIONS: PRICES VERSUS CAPS, a March 15, six-page Congressional Budget Office report, is located at <http://www.cbo.gov/ftpdocs/61xx/doc6148/03-15-PricesVSCaps.pdf>.

AN OCEAN BLUEPRINT FOR THE 21ST CENTURY FINAL REPORT FROM THE U.S. COMMISSION ON OCEAN POLICY is available at <http://oceancommission.gov/welcome.html>.

Federal Trade Commission rule changes regarding **HART-SCOTT-RODINO** acquisitions and mergers have gone into effect and are located at <http://www.ftc.gov/opa/2005/02/fyi0516.htm>.

VALUE CHAIN ANALYSIS OF THE U.S. PROPANE INDUSTRY finds that the propane industry contributes \$11.7 billion annually to the U.S. economy and employs 50,000 workers. The report, from the National Propane Gas Association, is located at <http://www.npga.org>.

AN INTEGRATED PLAN FOR DEVELOPMENT AND PROCESSING OF LOW-COST TITANIUM MATERIALS AND ASSOCIATED MANUFACTURING PROCESSES, a report from the Department of Defense, can be received from *Manufacturing & Technology News* by sending a request to editor@manufacturingnews.com.

PUBLIC EDUCATION FINANCES 2003 describes how much each state spends on public elementary school education. The 129-page report from the Census Bureau is located at <http://ftp2.census.gov/govs/school/03f33pub.pdf>.

OUTSOURCING AMERICA: HOW OUTSOURCING AND OPEN BORDERS ARE DESTROYING THE AMERICAN MIDDLE CLASS, by Paul Streitz, a 341-page book, claims that outsourcing is "destroying the American middle class." The \$22.50 book (including postage) can be purchased from Outsourcing America, P.O. Box 2360, Darien, Conn., 06820.

FIRM SIZE DATA FROM THE SMALL BUSINESS ADMINISTRATION describes the number of establishments, employees and annual payroll by industry and state for various sizes of firms. The data show that the number of large companies declined, and the number of small businesses rose in 2002. The report is located at <http://www.sba.gov/advo/research/data.html>.

2005 INDEX OF ECONOMIC FREEDOM from the Heritage Foundation and the Wall Street Journal finds that the United States does not rank among the world's 10 freest economies in the world for the first time in the index's 11-year history. The U.S. is in 12th place. Hong Kong was first. Worldwide the scores of 86 countries improved, the scores of 57 declined and the scores of 12 remained the same. For a copy of the 414-page, \$24.95 book, go to <http://www.heritage.org/index>.

THE STANDARD OF LIVING IN RIGHT TO WORK STATES finds that workers in right-to-work states — typically southern states that are not conducive to the creation of unions — have higher household incomes as compared to workers in "forced union" states, when adjusting for cost-of-living indexes and state and local taxes. The 23-page report from the National Institute for Labor Relations Research, is located at <http://www.nilrr.org/Poulson%20SOL%20Study.pdf>.

Over The Past Decade, Quality Index Experiences A 'Dramatic Drop'

Quality has improved over the past decade, but customers' expectations have increased by a greater amount. The American Society for Quality (ASQ) is now 10 years into measuring customer satisfaction with hundreds of goods and services. The survey, which costs about \$5 million a year to produce, has tracked a "decade of decline," says the professional society based in Milwaukee.

The American Customer Satisfaction Index "provides evidence of a dramatic drop in service quality along with an apparent stabilization in product quality," says ASQ. Overall customer perceptions of quality have declined by 0.8 percent over the past decade. Product quality has been stable, though it declined from 86.9 percent in 1994 to 86.3 percent in 2004. The problem is in the service category, which dropped from 80.3 percent in 1994 to 78.3 percent in 2004, a 2 percent drop.

"Corporations that provide services versus products have traditionally been slower to adopt quality improvement programs," says ASQ. "It's now 'catch up' time as more nonmanufacturing, service-based corporations begin to incorporate quality systems into their operations and adopt quality programs such as Six Sigma to meet customer needs."

Service companies that have adopted Six Sigma quality programs — like Starwood Hotels, which registered a 7.1 percent gain — are doing well.

Airlines, restaurants and cellular phone services are

the lowest rated industries. Local and long-distance phone companies did the worst over the decade, dropping 9 percent. Airlines were next, dropping 5.8 percent, with Southwest declining 5.7 percent. "It appears customers have not reduced their expectations as rapidly as the airlines have reduced their service," says ASQ. McDonald's rating dropped 5.7 percent.

Perceived quality in the personal computer sector declined by 5.5 percent over the past decade, with Compaq, HP and IBM experiencing the largest declines. Dell's perceived quality improved by 4.4 percent.

In the automobile category, perceived quality fell 2.1 percent, with U.S. companies continuing to struggle against Asian and European competitors. "U.S. automakers are driven to compete on price, while the Euro and Asian competition compete on quality," says ASQ. "Competing on price alone is not a viable, long-term business success strategy." Hyundai's perceived quality score increased by 7.6 percent.

For information on the survey, go to <http://www.asq.org>.

Manufacturing & Technology News editor Richard McCormack spoke with former ASQ president Jack West about the 10-year analysis of perceived quality and the latest trends in the quality field. West can be reached at sixsigmadventures@msn.com. Here is what he had to say:

Q: If the quality of goods has improved dramatically over the decade, then what do companies have to do in order to satisfy customers with even higher expectations?

West: When you poll people about the quality of a product such as a PC, an automobile or a television set, they generally perceive the quality to be very high. But then you throw in the service component and ask: What was your experience with the dealer? What was your experience when you called the help line for the computer you purchased? When you ask those questions, quality plummets. When you put the two together, which constitutes the whole experience of buying a car or computer, then the net is not good. That's what we're seeing: the net has suffered because of the service component.

In service areas where they have ineffectively tried to put automation in place, quality has deteriorated. People don't like to beep through 17 phone trees.

Q: One of the important business strategies today is for companies to stress services as the growth component for their operations. For manufacturers, service is where they hope to see future growth. What do low marks in service mean for them?

West: In B-to-B, they're working on selling more in

the way of consulting services, but that's not what is happening on the B-to-C side. A big trend is to contract out the service part such as telephone response and customer support systems. Since the quality isn't there yet some companies like Dell are bringing it back, whereas others are saying, "To heck with you, customers, suffer."

It will be interesting to see if the B-to-C companies continue to outsource the services even though customers aren't happy because if you look at where companies make their money they make their money on repeat customers.

Q: What are the big trends you've noticed following customer quality expectations over the past 10 years?

West: What you see are splits in the marketplace, where customers go high end or low end. An easy example to think about is coffee. Starbucks is packed and its coffee is three times more expensive than the McDonald's price. The same is happening with Lexus, which has a waiting list, while General Motors can't sell a car to save its life. People are willing to buy high end.

The high end is doing okay with the heavy service component and the hand-holding. The low end seems

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QUALITY... (From page nine)

to be okay because they are squeezing the price very hard and people don't expect much when they pay low prices. The guys in the middle are getting hurt.

Q: But there are a lot of guys in the middle. The middle is big.

West: That's where most of the business is.

Q: What do the guys in the middle do?

West: They have a couple of options. One is you can't tell people to expect a Lexus and sell them a Volkswagen. That's what is driving a lot of the low satisfaction. They tell people that this is a wonderful experience, everything is going to be perfect and then they find out that it's not. I don't know how you tell people not to expect perfect when they buy your product, but that is where you start seeing the difficulty. Personal computers are a classic example. They are so much better than they were a few years ago, but the advertisement says plug and play and you get it home and you plug and it doesn't play.

Q: Is there a successful strategy for companies to use in this quality dilemma? Should they go high or should they go low?

West: There is equal success at both ends. An example is in retail. Two retail companies that are very high in customer satisfaction are Nordstrom and Costco. They are at the complete opposite ends of the spectrum. Both delineate the expectations clearly and then meet them effectively.

Q: Then you have all those middle-ground retailers.

West: That's why Sears got killed. They couldn't decide if they were upscale or downscale and they tried to do both and just got killed. When you're in a declining market share situation, you don't have any extra resources to start pumping into improved services and quality, and consequently you're in a situation of trying to pull yourself up by your bootstraps.

Q: What are the latest trends in the quality arena?

West: The major thrust has been the incorporation of the synergy between two quality improvement toolsets: one is the Toyota Manufacturing System, which most people call Lean, with the fusion of Six Sigma. You see many of the traditional manufacturers using them to work on the product side of the house and now they are using them on what the Lean folks call above the floor — the white collar, service side of the house. It's making a big difference.

Q: Is it a noticeable, measurable difference?

West: Yes, it is a noticeable, measurable difference, and you see it in the organizations that have been working it for a while.

Q: Any come to mind?

West: On the service side, Sheraton Hotels has been using Six Sigma for quite a while and their quality scores

have been going up; Bank of America — same kind of thing there; Target and Home Depot in the retail arena. You also see it in General Electric's service side and they've been doing it pretty aggressively for 10 years and they have a lot of experience. They are doing very well at it. Ford Motor Co. has been at it for a couple of years, but it doesn't show up in the measures. You're seeing it in terms of their internal efficiency measures, but the customer isn't seeing it yet.

Q: Is there a way to measure the implementation rate of these two techniques — Lean and Six Sigma — throughout the U.S. business enterprise? Is it still a small percentage of companies adopting these programs?

West: There is a lot of anecdotal evidence that says that virtually every industry is experimenting with them, but there is no place you go to register that says I've started doing Six Sigma like there is for the ISO standard. So the bottom line is I can't help you there.

Q: The quality movement has gone through TQM, TOS, Lean, Six Sigma, Baldrige and ISO 9000. Is there something new coming along?

West: Not that I know of; I wish I knew. The only thing I'm seeing is the fusion of Lean and Six Sigma and the broadening of the application to health care, education and the service areas. I haven't seen anything in the manufacturing area that I can say, "Here is the next thing that is emerging." Six Sigma has been around for 20 years and lean for 15 — since *The Machine that Changed the World* was published in 1990. They continue to evolve and grow, but I don't see the next revolution.

Q: Does anybody care about the Baldrige National Quality Award nowadays?

West: The companies that use Baldrige — and there are still a lot of them that do — tend to use it as an internal mechanism because they see the cost of applying [for the award] as being fairly significant, and it is. It takes several man-months of effort to put together an application. You don't see very many applications from the Fortune 500 any more.

Q: Why?

West: I think it's because it costs a lot of money. It takes a lot of effort. Then you have to ask yourself where is the return on the investment from winning?

Q: You have to do a lot of show-and-tells.

West: Yes, a lot, because I worked for Westinghouse when they were a winner and we did a lot of them.

Q: How is the American Society for Quality doing?

West: Okay. The quality discipline has been hurt somewhat as the manufacturing area has gone down. So there are more quality professionals in manufacturing than there were in service. But now we're starting to pick up membership from the service arena. If you look at the entire set of the professional societies we're doing very well, but compared to where we were six or seven years ago, we're not as healthy.

Choosing the Manufacturing Extension Partnership (MEP) as its vehicle, a House Science subcommittee last week embarked on an attempt to remedy at least one aspect of the discontent that the committee has expressed with the administration's budget request for programs within its purview.

On March 15, its Subcommittee on Environment, Technology, and Standards approved by voice vote, and apparently without opposition, the Manufacturing Technology Competitiveness Act of 2005 (H.R. 250), which would authorize \$110 million for MEP in fiscal year 2006.

That sum is more than twice the \$46.8 million requested in the administration's proposed budget and improves slightly on the current-year appropriation of \$107.5 million. In addition, the bill would provide MEP slight increases for the following two years, to \$115 million in 2007 and \$120 million in 2008.

The tenor of the markup and the result of the vote left little doubt of the agreement within the panel that more should be done to support technology than the White House has proposed. Still, differences between Republicans and Democrats — in tactics, if not necessarily in goals — were likewise discernible.

The panel's ranking minority member, Rep. David Wu of Oregon, noted that although the Science Committee is "a strong supporter" of the Advanced Technology Program (ATP), no funding for the imperiled program was included in the bill. This omission, he argued, "implicitly endorses the president's decision to eliminate ATP."

But the subcommittee's chairman, Rep. Vernon Ehlers of Michigan, said his fear that "adding ATP might jeopardize the passage of the bill and the authorization of MEP" had proved out with the demise in the Senate of a very similar bill last year.

The version of that measure passed by the House had no ATP provision, he recalled, but after the program's Senate champion, then-Sen. Ernest Hollings (D-S.C.), had added one, the bill died there. Ehlers, describing himself as a supporter of ATP as well as of MEP, indicated that he was reluctant to see that happen again.

Besides, he suggested that a "positive impact on ATP" might result from a provision in the bill calling for a pair of reports from the Secretary of Commerce on the possible financial burden of ATP's elimination on the laboratory programs at the Commerce Department's National Institute of Standards and Technology (NIST), where ATP is housed.

The cost to NIST of an orderly shutdown of ATP has been estimated at between \$70 million and \$90 million: \$12-18 million in employee severance; \$13 million in funding that has come to NIST's labs from ATP on an annual basis; and an additional \$40-60 million if ATP honors existing grants in full.

Manufacturing Bill Starts Its Way Through Congress

BY KEN JACOBSON

None of these "substantial costs" is mentioned in President Bush's 2006 budget request, said Ehlers, expressing the hope that the reporting requirement might affect the administration's perspective on ATP by

focusing its attention on them.

But Rep. Mark Udall (D-Colo.) countered that congressional appropriators may well have acted before the first report, to be due within three months of the enactment of the bill, arrives. The delivery of the second report would coincide with the presentation of the president's 2007 budget to Congress.

Udall, noting "widespread support for ATP" within the Science Committee, pronounced himself "ready, willing, and charged up to work" on getting the program funded — a declaration perhaps meant to draw GOP colleagues toward what the panel's Democrats see as their own, more proactive stance.

Authorization for funding of the NIST labs is contained in H.R. 250 as well, and it mirrors the administration's budget request to the penny, calling for \$426.3 million for laboratory activities and \$58.9 million for construction. These sums would subsequently rise slightly under the bill, the former reaching \$447.6 million in 2007 and \$457 million in 2008, the latter \$61.8 million in 2007 and \$63.4 in 2008.

Other provisions of H.R. 250 would:

- "Establish an Interagency Committee on Manufacturing Research and Development to coordinate federal manufacturing R&D efforts." The committee's description conforms remarkably to that of the existing Interagency Working Group on Manufacturing R&D, chaired by Undersecretary of Commerce for Technology Phil Bond [see March 9 *M&TN*, p.7].

- "Establish a three-year cost-shared, collaborative manufacturing R&D pilot grant program at NIST, funded at \$10 million per year for FY 2006, FY 2007, and FY 2008.

- "Establish a post-doctoral and senior research fellowship program in manufacturing sciences at NIST, funded beginning at \$1.5 million in FY 2006 and increasing to \$2 million in FY 2008."

China Commission...(Continued from page one)

industrial development will have on U.S. R&D spending, "and the implications of that impact for future innovation and U.S. technological leadership." It would analyze China's influence on the U.S. financial sector, including financial markets, stock values, long-term interest rates and the U.S. inflation rate.

The commission says it "expects the model to provide estimates of short- and long-term impacts of various modeling outcomes. To the extent it is possible to provide them, the commission is interested in estimates of various outcomes over one, three, five, 10 and 25 years."

The due date for proposals is April 29. To view the RFP, go to <http://www.uscc.gov>.

Aeronautics R&D...*(From page one)*

airplanes and parts improved the U.S. trade balance by \$23.7 billion, mitigating an overall deficit of \$37 billion in what the Commerce Department defines as "advanced technology products," according to an analysis of trade data by Charles McMillon of MBG Information Services.

"While U.S. aeronautics research and test programs are declining, countries in Europe and elsewhere are investing heavily in aeronautics research," observed Rep. Jo Ann Davis, a Republican who represents the Virginia district in which one of NASA's main aeronautics facilities, NASA Langley Research Center, is located.

Rep. Dennis Kucinich, a Democrat whose Ohio district is home to another such facility, NASA Glenn, stated that "NASA's aeronautics research is important because NASA is able to develop long-term, high-risk enabling technologies that the private sector is unwilling to perform because it's too risky or too expensive," adding: "This has historically been the role of government-sponsored research."

Other expressions of concern were aired at the hearing. According to John Hansman, director of MIT's International Center for Air Transportation, although the nation's air-transportation system received a respite when air traffic fell off in the wake of 9/11, it is again as stretched as it was in 2000 and 2001, when "air traffic control delays were...[a] critical problem."

"We actually project that the system will go into gridlock, probably in the summer either of 2007 or 2008," he noted. "We'll see issues emerging next summer." For a country whose citizens and businesses are highly dependent on air transportation — aviation is estimated to account for around 8 percent to 9 percent of the economy — the prospect is anything but welcome.

In the face of such misgivings, Victor Lebacqz, NASA's associate administrator for Aeronautics Research, told the panel that the 2006 budget request "fully supports aeronautics program priority research in the areas of reducing aircraft noise, increasing aviation safety and security and increasing the capacity of the national airspace system."

To make sure that its research is fully funded despite the 6 percent budget cut, ARMD intends to rein in the research's scope, especially in the largest of its three programs, the Vehicle Systems Program (VSP).

As part of an effort at "transforming itself" that may prove a model for ARMD's two other programs, Airspace Systems and Aviation Safety & Security, VSP will reduce investment in numerous areas, among them conventional subsonic aircraft technology, and eliminate rotorcraft research, whose expansion the report by Kleinberg's NAS panel urged.

Instead, VSP will focus on research in four areas it sees as promising "breakthrough flight demonstrations" in the relatively near future: subsonic noise reduction; sonic-boom mitigation; a "revolutionary" zero-emissions hydrogen fuel-cell powered aircraft with cryogenic electronic motors embedded in its wings; and a High-Altitude Long-Endurance Remotely Operated Aircraft (HALE ROA) capable of flights of two weeks' duration above 18,000 feet.

Still, VSP has to compensate for a budget that is projected to decline steeply over four years: From \$641.4 million in fiscal year 2004, it dropped to \$568.6 million in 2005; has seen a request of \$459.1 million for 2006; and is to fall to \$373.6 million in 2007. The administration's 2006 budget request seems to recognize that there could be consequences.

Notwithstanding VSP's 2006

(Continued on next page)

U.S. Aeronautics Research: Is It Seed Corn Or Is It Whiskey?

Last week's House Science subcommittee hearing on NASA's research in aeronautics was not without a partisan scuffle. But the tiff, rather than being a classic Democratic-Republican tussle, pitted partisans of the agency's aeronautics mission against a partisan of its space plans.

After Reps. Jo Ann Davis (R-Va.) and Dennis Kucinich (D-Ohio) had displayed bipartisan accord in testifying against budget cuts that would affect NASA aeronautics research conducted in their districts, subcommittee member Dana Rohrabacher (R-Calif.) switched on his microphone.

A longtime space-program enthusiast whose district houses aerospace industry interests, Rohrabacher pointedly asked his two colleagues "which part of the NASA budget they would like to take the money from in order to bolster" NASA's aeronautics activities.

Not satisfied when neither even came close to naming an offset, Rohrabacher declared: "It's very easy to advocate spending more money. It's very difficult to find prudent ways of trimming things from the budget. I've been here 16 years now, and I don't remember even one witness who was able...to come up with some idea of where" money was not "being spent wisely" and thus would be "better spent on the program they were advocating."

Kucinich, who had just represented aeronautics as "the one area where we can grow our economy" and called NASA "the path out of a budget deficit," replied: "What we're doing would be akin to asking a farmer to save money by throwing away some of his seed corn."

"Or maybe to get rid of the whiskey allotment that he uses for holidays?" Rohrabacher suggested.

"I think that NASA can hardly be accused of spending money like someone who is interested in self-enjoyment," replied Kucinich, who appeared somewhat astonished.

Rep. Randy Forbes (R-Va.) jumped between the two. "I think Mr. Rohrabacher is exactly right, this should be about looking at priorities," he stated. "I just don't believe that aeronautical research is quite akin to a whiskey allotment."

R&D Budget...*(From page two)*

provided to foot the bill for ice breaking expenses currently paid by the U.S. Coast Guard, so the increase for NSF in reality comes to about 1.5 percent."

On top of that, the panel says, this raise would leave the overall budget at NSF, which took a 3.1 percent cut in the current fiscal year, at 1 percent below its 2004 level. "The Foundation now funds only about 20 percent of the proposals it receives," it observes, "down from the 33 percent level that had held for many years."

And while the administration says "the President's Budget seeks to attract the most promising U.S. students into science and engineering programs by providing more competitive graduate stipends" through NSF, the committee points out that the agency's "overall investment in education" would fall 12 percent, from \$841.4 million in 2005 to \$737 million in 2006 — a prospect that leaves it "especially disturbed."

When it comes to the Department of Commerce's long-embattled Advanced Technology Program (ATP), rather than "disturbed" the panel is "disappointed" and

"concerned": "disappointed that the Administration has again included no funds for the program in the budget request," and "concerned that the proposed budget does not even fund the costs associated with closing the program."

As a consequence, it argues, apparent increases for the laboratories of the National Institute of Standards and Technology (NIST), which manages ATP, would be corroded. The \$20 million cost of terminating ATP employees "would have to be absorbed" by the labs, which would also lose about \$13 million in annual income derived from ATP's own use of lab facilities.

Also leaving the Science Committee "disappointed" was the administration's request for MEP, another program managed by NIST. At \$47 million, the proposed funding would cut a 56 percent hole in the current \$107 million appropriation for MEP, described by the panel as having "demonstrated its effectiveness as the only program that offers direct technical assistance to small- and medium-sized manufacturers to help them in a globalized economy."

Even where the panel pronounces itself "pleased," as it does in the case of a 23 percent proposed increase in funding for the Science & Technology Directorate at the Department of Homeland Security (DHS), it can't avoid furrowing its brow a bit.

"The Committee remains concerned about the balance between short- and long-term research programs at DHS," it states. "The requested funding for university programs and for research on emerging threats is flat. The Committee is concerned that if DHS does not make and maintain investments in longer-term basic research, including research at universities, the next generation of homeland security technologies will not be available to counter the next generation of threats."

The Views and Estimates of the House Committee on Science can be found in their entirety at <http://www.house.gov/science/committeeinfo/06Views.pdf>.

Aeronautics...

(Continued from page 12)

transformation cum reduction, the "Risk Management" section of the request signals the eventuality of further research cuts: "Given significant cost overrun/schedule slip in a project deliverable," it warns, "there is the possibility that lower priority activities may be descoped or eliminated."

The paucity of funds for aeronautics at NASA stands in sharp contrast to the overall picture at the agency, whose proposed 1.6 percent increase "after a much larger boost in 2005" constitutes "favored treatment in the federal budget," according to an analysis by the American Association for the

Advancement of Sciences (AAAS). But the reduction in support for aeronautics research, as well as "steep cuts in environmental, biological, and physical sciences research" at NASA were proposed by the administration "in order to shift resources toward solar system exploration and R&D on moon and Mars mission technologies."

NASA's strategy clearly left the ranking minority member of the subcommittee, Rep. Mark Udall of Colorado, unimpressed. Describing Lebacqz's obligation to win over legislators as a "somewhat thankless task," he said of NASA's direction: "We seem to be headed down a path that could result in the loss of a vital national capability if we aren't careful."

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Equipment Manufacturers Claim Steel Industry's Gain Is Their Loss

"Distortions in the steel market, including the record high price of steel, are being fostered by the U.S. government and are causing a crisis that has impacted automotive and heavy duty suppliers across the country, triggering unprecedented bankruptcies and job losses," says a new report from the Motor & Equipment Manufacturers Association (MEMA).

U.S. steel producers had record earnings in 2004, leading to market value increases of 60 percent or more for the largest companies. "Meanwhile, automotive suppliers continue to face bankruptcies and worker layoffs," says MEMA. This disparity is expected to continue through 2005, with the steel industry able to raise prices and pass increased raw material costs to customers, MEMA worries.

"Automotive suppliers do not have the market power to pass their higher steel costs onto their customers, particularly in view of the competition that suppliers face from imports of automotive parts," says MEMA, the largest trade group representing automotive suppliers.

Steel industry capacity utilization is at a 10-year high, rising to 94 percent in 2004, up from 79 percent in 2001. "Utilization rates are

forecast to be near 100 percent globally by 2005," says MEMA. "Automotive suppliers by contrast are seeing their utilization decline due in part to decreased availability, reduced quality and delayed deliveries of steel."

Steel prices in the United States remain higher than in the rest of the world, the automotive trade group complains. The cost of hot-rolled steel in January 2005 was \$695 per

ton, compared to \$575 per ton on the world spot market and \$515 per ton in China, which is now the world's largest consumer and producer of steel.

In hearings this month and next, MEMA will tell the International Trade Commission to sunset anti-dumping and countervailing duty orders on specific steel commodities as a first step to providing a level playing field for U.S. companies that use steel.

To view the MEMA analysis, go to <http://www.mema.org/news/releasedetail.php?id=116>.

Welcome Ken Jacobson

Joining the editorial staff with this issue is Ken Jacobson. His arrival at *Manufacturing & Technology News* marks a professional reunion with Editor Richard McCormack, as the two worked side by side at King Publishing Group in Washington, D.C., a decade ago. In 1993, Richard handed the reins of *New Technology Week* to Ken, who then served as editor until 1998.

As you will soon discover by reading his work, Ken is a pro. Before plunging into the world of Washington journalism in the early 1990s, Ken had been a wire service reporter in the Netherlands, a general business reporter in Paris, and the editor of a New York-based publication covering the mining and metals industries. In a career that began with a job writing sports in his San Francisco Bay Area hometown, he has also reported on assignment from Latin America and published a work of non-fiction.

Feel free to call Ken in his Washington office at 202-462-2472. He can be reached by e-mail at ken@manufacturingnews.com. Both Ken and I are available for breakfast, lunch, dinner, coffee or drinks — "off the record" — at any time.

— RICHARD MCCORMACK

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COOPERATION

Maritime Security: New Requirements for Global Collaboration

By Dr. Robbin F. Laird,
ICSA, LLC, Washington DC and Paris.

Significant growth in global maritime trade, coupled with the heightened threat of terrorism, require a new collaborative security regime.



Security Disruptions.

80% of international trade is carried by sea without effective counter-terrorism protection.

Much has been changed by the new scope of trade from Asia, and by the role of that trade in the new Western manufacturing and supply models. With the significant trans-shipment of goods from Asia over American territory to Europe, a new dimension to European-American collaboration has now emerged. The present challenge is to provide the tools and capabilities needed for security within a changing European-American context.

Although globalization is discussed frequently, the underlying reality of

**Providing security
in maritime trade hubs
is a key challenge
for Euro-Atlantic
collaboration**

maritime commerce is not. This is paradoxical, since the vast majority of goods that make globalization a reality travel by sea. And a new manufacturing model in the West ties Western economies more closely to Asia. But this model rests on the security of maritime trade.

Containerization

Shipping is at the heart of global trade. Most international trade – about 80% of the total by volume – is carried by sea. About half of the world's trade by value and 90% of general

Region	% of World Seaborne Trade (2003) ¹
Asia	37.2%
Europe	25.1%
United States	20.7%
Africa	8.9%
Oceania	8.0%

cargo are now transported in containers. Asia is the continent with by far the largest share of the world tonnage of seaborne loaded goods – 37.2%, followed by Europe and the United States.

About half of the world's trade by value and 90% of its general cargo is now transported in containers. The containerization of cargos and the growth in size of cargo ships are important forces for change as well.

Containerization has been both a cause and consequence of shifts in the nature of the global supply chain. Logistic supply chains that feed components and finished products to users on a just-in-time and just-enough basis have become critical to modern manufacturing and service industries. Seaborne trade and its land connections in the global supply chain have become increasingly efficient, large-scale and thus open.

Not only has there been a dramatic growth in the percentage of container traffic, but the size of the containers is increasing as well. This means that the Pacific ports in the United States are drawing a significant pro-

portion of the trade which goes from Asia to Europe. This trans-shipment route presents an alternative to the use of the Panama Canal.

Megaports

Another part of the containerization phenomenon has been the rise mega-ports. The top 20 container terminals in 2002, led by Hong Kong, Singapore and four other East Asian ports, accounted for 54% of world sea container throughput in 2002 – 127 million TEUs, out of a total of 237 million TEUs. In 2000, the top 20 terminals handled 109 million TEUs, 47% of the global total of 232 million TEUs.

The conjunction of a dramatic increase in the volume of trade, a shift towards containerization, the shift in manufacturing and production models and the rise of mega-ports has created a new maritime security situation. With the insertion

not only of the threat of piracy but of terrorists able to gain access to weapons of mass destruction, the nature of that maritime security challenge has been transformed.

Asia is at the heart of all of these maritime developments: dynamic economic growth and development leading to greater reliance on shipping, containerization, megaports and crucial interdependencies with the United States and Europe.

A virtual conveyer belt of goods is moving from Asia to the United States, and a significant portion of those goods are transshipped across the United States, to be sent to Europe. Whether as the final destination or middle man, the United States is a key node in the Asian maritime commercial system. Building an effective maritime security system must start with the challenge of security for the conveyer belt.

Weak Points

In other words, the challenges to protecting the backbone of maritime trade can be understood from two related perspectives. The first is the protection of the conveyer belt of goods to and from Asia, to the United States, to Europe. The second is to provide security for the hubs within the trading system.

Building an effective maritime security system must start with the challenge of security for the conveyer belt. A key weakness built into the maritime system is the use of flag of convenience to carry the bulk of the shipping. Currently, there is virtually no relationship between a ship's genuine ownership and control, and the flag it flies.

Michael Richardson describes this challenge to maritime security as follows:

"Japan is an example of the potentially dangerous movement of ships from national to open or flag of convenience registers. After Greece, Japan owns more commercial ships than any other country: nearly 14 per cent of the world total, measured in deadweight tonnage in January 2002. Yet only 793 of Japan's nearly 3,000 ships remain on the Japanese national register. In terms of the deadweight tonnage of vessels owned by Japan, over 86 per cent were registered under a foreign flag of convenience in 2002. Some 43 per cent of Japanese-owned ships fly the flag of Panama, 7 per cent the flag of Liberia, and 1 per cent each the flags of Bahamas, Malta and Cyprus.

With so much of the Japanese commercial fleet on foreign registers and manned by non-Japanese crews, it is quite possible that a ship domiciled in Japan and owned by a Japanese company but flying a flag of convenience could be leased or time-chartered to a front firm for a terrorist organization without the Japanese authorities being in a position to know anything about it — even if the ship were to be used to carry a nuclear or

MEGAPORTS IN EUROPE

Major Commercial Ports

1	Rotterdam	350 Mt
2	Antwerp	143 Mt
3	Hamburg	106 Mt
4	Marseille	95 Mt
5	Le Havre	71 Mt
6	Amsterdam	65 Mt
7	Algeciras	60 Mt
8	Genoa	52 Mt
9	London	51 Mt

Major Containers Ports

Rotterdam
Antwerp
Bremen
Gioia Tauro
Felixstowe
Algeciras
Valencia
Le Havre
Barcelona

Rotterdam ranks 2nd after Singapore. With a 5% growth in the first half of 2005, Rotterdam transit is almost the equivalent of the 3 other first European ports (Antwerp, Hamburg and Marseille) combined.

70% of the inbound flow originates from Asia; over 80% of the outbound flow is destined for Europe. In 2004, the number of Ship arrivals was 30,695 and ships movements amounted to 84,884.

The port offers direct employment to around 60,000 people in Rotterdam as well as to an additional 250,000 people in the rest of the country. Direct port activities generated more than 6 billion Euros in 2004.

Source: Port of Rotterdam

EUROPEAN MARITIME DEPENDENCY

Over 90% of Europe's external trade and some 43% of its internal trade transit by sea.

More than 1 billion tonnes of freight a year are loaded and unloaded in EU ports.

European maritime companies control one third of the world's fleet. The maritime transport sector (including shipbuilding, ports, fishing and related industries and services) employs around 2.5 million people in the European Union.

Source European Commission

radiological bomb into a major Japanese port².

An additional key problem is the management of port disruptions. Given the centrality of megaports, the challenge of maintaining a steady stream of reliable commerce through those ports is crucial to the economic viability of the global system. Labor disruptions, security threats, processing of cargo manifests, and law enforcement challenges associated with drug smug-

gling or illegal immigration are simply some of the challenges which can create mega-port disruptions.

A third key force weakening the maritime trade backbone is the problem of piracy.

The recent rise in the number of boarding and piracy attacks worldwide, accompanied by the disturbing trend toward the use of firearms and violence once the vessel has been boarded, make maritime piracy a matter in need of increasing attention.

And the piracy problem quickly becomes connected with the threat of maritime terrorism which mimics piracy as well. The piracy and terrorism threat converge to make maritime security a problem for the 21st century. As one analyst has put it:

"There is a significant growth and persistence of a modern form of extra-national piracy that plagues large swaths of the ocean and has escaped every sea-based effort at control. On a global scale, this sort of piracy is more a nuisance than a threat, and typically it has been overblown in the

press, but it is a significant phenomenon nonetheless, because it requires no base and it mimics normal operations where even legitimate ships fly false flags and swap names. Though it is apolitical by nature, it is structurally very similar to the stateless terrorism now faced by government forces.³"

Maritime Terrorism

The threat of maritime terrorism is real. Terrorists function as a virus within the trade system, able to hide within the vast system of trade, and can mimic pirates or illegal immigrants. But their goal is to bring significant destruction to their enemies, via disruption, destruction of key facilities or tankers, or the introduction of weapons of mass destruction through sea-based means.

The global challenge of dealing with the new terrorism affects maritime activities in a number of ways closely associated with the evolution of maritime trade itself. Among these challenges are the following:

- **Growing Importance of Undersea Infrastructure.** Undersea critical infrastructures such as oil and gas pumping stations and telecommunication cables are increasingly important as part of the global economy.
- **Attacks from the Sea as an Emerging Threat.** State and non-state groups will be capable of mounting UAV, short-range ballistic, and cruise missile attacks, possibly employing weapons of mass destruction, from U.S. and allied waters.
- **Lack of Security Between Ports as a Growing Concern.** Smuggling by private craft with small payloads and delivered outside port facilities are extremely likely. Terrorists could employ these means to bypass existing security regimes⁴.

Finally, significant environmental degradation is a serious threat due to the high volume of maritime trade



From Safety to Security.

Harbour Coordination Center in Rotterdam. (Photo Port of Rotterdam).



Main Ports in Europe.

Source: Port of Rotterdam.

THE CONTAINER SECURITY INITIATIVE (CSI)

Mission

CSI was launched in January 2002 by the US Border and Custom Protection Agency. The program is intended to help **increase security** for containerized cargo shipped to the United States from around the world.

The CSI consists of four core elements:

- defining security criteria to identify high-risk containers
- pre-screening containers before they arrive at US ports
- developing technology to pre-screen high-risk containers
- developing and using 'smart' secure containers

Cooperation

As a **reciprocal program**, CSI offers its participant countries the opportunity to send their customs officers to major U.S. ports to target ocean-going, containerized cargo to be exported to their countries. U.S. customs officials are already stationed at major EU ports.

The US maintains bilateral CSI arrangements with **8 EU Member States** and currently, **20 European ports** cooperate in the CIS framework:

- Rotterdam in The Netherlands
- Bremerhaven & Hamburg in Germany
- Antwerp and Zeebrugge in Belgium
- Le Havre and Marseille in France
- Gothenburg in Sweden
- La Spezia, Genoa, Naples, Gioia Tauro, and Livorno in Italy
- Felixstowe, Liverpool, Thamesport, Tilbury, and Southampton in UK
- Piraeus in Greece
- Algeciras in Spain

The traffic from these ports covers approximately 85% of all maritime container traffic from the EU to the US.

Source: US Customs and Borders Protection

fuelling the Asian economic miracle, and transit to and from the United States and Europe. Given the central role of the great circle routes and the use of waters close to or within U.S. territory as well as the central role of the European mega ports the challenge of providing for environmental security is going up as well.

In short, providing security to the global maritime system is of growing importance. The need to promote global solutions through increased European and American collaboration with the core Asian nations is enhanced as well. At the heart of the challenge is to provide security for the conveyor belt of goods going from Asia to Europe and back again, often over U.S. territory. ■

1- Review of Maritime Transport, 2004 (New York and Geneva: UNCTAD Secretariat, 2004), p. 4.

2- Michael Richardson, *A Time Bomb for Global Trade* (Singapore, Institute of Southeast Asian Studies, 2004), pp. 109-110.

3- William Langewiesche, *The Outlaw Sea: The World of Freedom, Chaos, and Crime* (New York: North Point Press, 2004), page, 44.

4- See, James J. Carafano and Anne Kochems, eds., *Making the Sea Safer* (Washington D.C.: The Heritage Foundation, 2005).

September 4, 2006

The NRO and the USAF: Integration in Search of a Purpose

◀ ROBBIN LAIRD ▶

Some new perspective is needed in the seemingly endless debate about the integration of so called black and white space, a term that usually refers to getting the National Reconnaissance Office (NRO) and the U.S. Air Force (USAF) to accomplish their very different missions in space without excess duplication of effort.

During the tenure of former Deputy Secretary of the Air Force Peter B. Teets, he served as a single point of contact for intelligence and space systems. After his departure, they were separated again with the NRO and Air Force seeking alternative ways to provide for greater integration of the acquisition of space assets. But the core question of any integration effort is to determine why one is integrating, for what purpose and what capability one seeks to deliver from an integrated effort.

The goal of merging black and white space is not to bring together two historically significant organizations that had been built up for Cold War needs and turn them into a new mutant variant that is still more relevant to history than the future. The core requirement is to provide for a single architecture to meet the needs of disparate national security users — both military and civilian. What has changed in the post-Cold War environment is the nature of those needs. Civilian, intelligence and military agencies all have requirements for global situational awareness, actionable intelligence and a capability to support timely and effective actions against evolving global threats. Fixed sights and targets are of reduced importance.

Non-state actors have enhanced significance. An ability to share information with civilian and commercial partners, such as in the maritime security domain, is reducing

the salience of the black versus the gray world of intelligence. And most significantly, in an era of network operations the decision-making system is becoming more decentralized with a dramatic shift in the need to support differentiated decision-making systems.

In effect, a shift is in place from a primacy on infrastructure construction and management to becoming a service sector. The space-based domain of the NRO and the U.S. Air Force space command is becoming more network and cyber-oriented. Air-breathing systems and ground support capabilities are becoming of equal significance to the global enterprise of actionable intelligence.

The term actionable intelligence is a bit of a misnomer — the key requirement is to reshape decision-making systems so that timely actions can be taken against evolving threats. This recalls the ancient Greek concept of ethos — the challenge of determining whether an argument is valid or not. The errors in judgment about the weapons of mass destruction in Iraq was not a failure of intelligence but a failure of ethos — an ability for decision makers to determine correctly a valid argument in a sea of conflicting data.

The U.S. intelligence community and its U.S. Air Force space counterparts continue to stovepipe acquisition systems. There clearly can never be a service culture when hardware or program decisions are dominated by System Program Offices, that have no strategic context within which to determine how decisions can be taken that augment the capability of new systems to contribute to an overall architecture serving all user needs.

Don Kerr, the new NRO director, clearly

understands the imperative of shifting his organization towards a service culture. "Today's users are fundamentally different. They now demand information, not data. Furthermore, they want fused, multi-discipline, multi-phenomenology information tailored to their specific areas of interest and particular problems. And they want it now," states the NRO Strategic Framework, released in April.

But to do what Kerr wants requires an integrated architecture supporting the community of national security users, civilian, commercial, military and intelligence. The growing gap between the U.S. government and the global community — notably, the commercial and homeland security communities — will only exacerbate the need to shape an appropriate integrated architecture for intelligent action, rather than provide for intelligence shaped as actionable by a rigidified systems. The danger is that the United States will rely more on advancing technology and less on collaborative relationships to provide for intelligent decisions.

A single national security space organization clearly needs to be created to shape an integrated architecture and to provide a clear set of acquisition rules and approaches. The patchwork of programs that have historically made up the national security space community needs to be terminated.

Capabilities-based procurement needs to become the order of the day. Only with the creation of a strategic organization can a strategic dialogue with the user community become effective. The national security space organization needs to have a core user panel shaping strategic choices and guiding capabilities-based procurement. The current National Security Space Office could be transformed and give more power

in order to be able to perform these joint functions. And the national security space organization must be better connected with the air-breathing and ground-based ISR (intelligence, surveillance and reconnaissance) providers in the national security community as well.

The evolution of the space business suggests changes which the national security space community needs to make as well. Historically, space companies have been shaped by the launch and satellite manufacturing businesses. The evolution of the space business over the decade ahead will be shaped by constellations, systems, software and service models. And the commercial sector will drive change in the service approaches, which the national security community must adapt to as well, notably in the communications, weather and sensor domains.

In short, the purpose of integration is to create a service-oriented national space community. The community would be built around the provision of capabilities to an expanding set of service clients. The space architecture would be crafted around capabilities-based procurement, not stovepiped programs. The architecture would be complementary in character to the evolving non-space systems — this complementary approach would be shaped by a dramatic expansion in the role of the user communities.

The goal would not be to provide for the most advanced technologies providing data to cloistered intelligence analysts; rather the focus would be upon providing the most effective information to timely decision-making.

Robbin Laird is a Washington- and Paris-based defense aerospace consultant.

In response to Donald Beattie's reopened discussion of our nation's vision for space exploration ["Letter: Are NASA's Space Exploration Goals Right?" July 10, page 18], I think it's important to look at the fundamental characteristics of true exploration. As demonstrated by Christopher Columbus, Lewis and Clark, and most recently Wernher von Braun, true exploration requires two lead roles: the undaunted explorer with a vision and a true desire to go where no one has ever gone before; and the financier to make it happen.

It's interesting to note that the motivations of the explorer and the financier do not have to be consistent. Take Sergei P. Korolev for example. He was funded for developing missiles, but managed to squeeze Sputnik into the project, consistent with his own vision of space exploration. So, how does this view of exploration relate to our current situation? To answer this, I think we need to look at the motivations of both the explorer and the financier.

The first question is, who is the

explorer, and what is that explorer's motivation? In the absence of von Braun, who now leads our nation's vision for exploration? Personally, I think it's most likely Robert Zubrin. After reading the *Case for Mars*, I am convinced he has a clear vision for exploration. It is a vision motivated by a desire to explore the unexplored, to explore new methods of exploration, and truly a vision that will challenge a whole new generation of Americans.

On the other hand, perhaps we don't have a single explorer identified at this time. Perhaps he or she is waiting in the wings, just looking for an opportunity to be heard. If that's the case, then we must find that person. I'm convinced that exploration by committee is not going to achieve much.

What about the financier?

Clearly, it is Congress. Congress must answer to the American public, and I think it's safe to say that space exploration is not high on the nation's list of programs to fund. The only reason it ever was high on the list had so much more to do with our nation's security than it did exploration. Is our nation's current security, standard of living or prominence in the world dependent on our space exploration endeavors? Since we are the leading nation in space exploration, I would say not. So, what is the motivation then?

There are certainly a number of secondary reasons to maintain a space exploration program:

■ Motivate new generations to pursue degrees/careers in science and technology.

■ Develop new technologies that can be applied to Earth-bound problems.

■ Continue to expand our knowledge of the universe, and the beginnings of our own solar system.

As great as these sound, they are still secondary motivations. Therefore, we should expect secondary funding.

The key then, is to find an exploration strategy that is most consistent with the motivations of the explorer and the financier. This strategy should involve exploration of new places, not the old stomping ground. It should involve the development of new technologies that allow us to explore in methods we have not already used, such as in-situ resource utilization. It should allow us to learn more about our solar system, such as we would learn from searching for life on another planet.

At the same time, it must be

funded at a relatively slow and steady rate, consistent with the secondary level of importance in the eyes of the financier. This requires focus and creative use of resources. Instead of the huge flotilla of ships bound for Mars first envisioned by von Braun, what about a building-block approach, allowing us to spread exploration costs over a longer period of time? Instead of returning to the Moon, how about sending a chemical plant to Mars to explore our ability to generate fuel, oxygen and water on another planet? That is true exploration and doesn't require primary level funding.

Whatever is decided, I think the success of the program will depend on how well it satisfies the motivations of both the explorer and the financier. So, let's start by identifying the explorer, and respect the motivations of the financier as we make our future plans.

David L. Ransom is a senior research engineer at the Southwest Research Institute in San Antonio.

Exploration Goals

◀ DAVID L. RANSOM ▶

TRANSFORMED LOGISTICS – THE ART OF “CONFIGURATION CONTROL”

MLI talks to outgoing US Under Secretary of Defense (Acquisition, Technology and Logistics) Michael Wynne about his view of the knotty problems of logistics.

“Basically, I need faster, more efficient, more creative solutions to my logistical problems – what do I do with the thousands of empty pallets sitting on the docks in the Middle East? Right now for instance, we are really opening the market for Radio Frequency Identification – and are busily looking for inventive data solutions to extend this technology beyond this current spectrum. This is high tech, pushing the state of the art – and the market is broad. This is knowledge-based logistics.

“I would also like to point out that the answers to these problems would have far less technology transfer issues. So while the market for platforms continues to face pressure, the market in information usage is expanding.

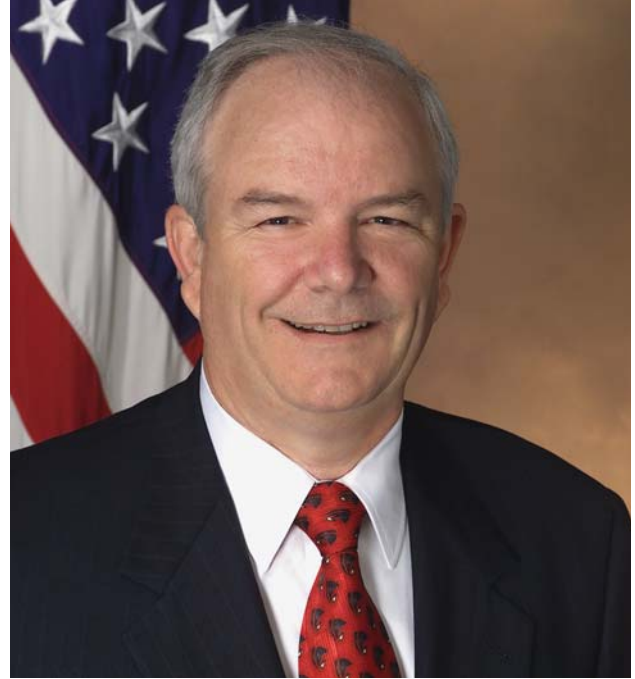
“It’s true that the military is going through a major transformation. Our war fighters are becoming more and more sophisticated and are relying more and more on high tech solutions to aiming and shooting at their targets.

“But they still need clothes, they still need food, they still need shelter. And if we can’t assure them to trust the receipt of sustaining logistics on time, all the high tech gadgets in the world won’t help them to independently manoeuvre and destroy their targets. If you are looking for a wide-open place to do business with the United States Department of Defense, look no further than the field of logistics.”

Remarks by Michael Wynne at the
Royal United Service Institute, 27 October 2004

As both the Deputy Undersecretary and the Acting Undersecretary of Defense for Acquisition, Technology and Logistics, Wynne has viewed logistics reform as a crucial enabler of global operations.

Indeed, Wynne has focused much of his attention on shifting procurement away from the big new programmes towards support for the enablers of conventional operations worldwide. And logistics is the most central of those enablers.



A number of his decisions on the launch of new programmes or the modernisation of older ones has included logistics considerations. For example, the decision to build the new Aerial Common Sensor (ACS) for the Army was turned into a joint requirement with the Navy because Wynne saw the advantages to having the same aircraft used in both services, especially having a common logistics footprint. When the aircraft turned out to be an Embraer product, the advantages logistically were even more evident. Embraer is sold worldwide and as the US changes its basing strategy, many believe that global support would be easier with a widely used commercial product rather than a specialised military one.

Indeed for Wynne, the ability to tap the commercial marketplace is a key part of his logistics vision. A number of his logistics initiatives draw upon commercial technologies. Wynne believes that military specifications are often the enemy of common sense and a key contributor to logistics failures. Thus adopting commercial standards can also help improve logistics.

For this reason, Wynne has been a keen proponent of the Network Centric Operations Industry Consortium (which now has more than 40 members worldwide). Military networks that leverage the commercial standards used by the consortium allows for leveraging common technological investments.

In an interview conducted in February 2005 at his Pentagon Office, Wynne underscored the central significance of logistics to strategy, military capability and procurement reform.

Wynne is well known for placing a strong emphasis upon the importance of logistics in an era of expeditionary operations. At the heart of Wynne's thinking is the challenge for US forces in co-operation with its allies to effectively manage deployments. Logistics reform is at the heart of such an effort. Although he is best known for his championing technical initiatives, such as Radio Frequency Identification (RFID) and Unique Identification (UID), Wynne also believes that organisational innovation is at the heart of overcoming challenges.

Q: Why is logistics so central to your thinking?

“Logistics needs to be the first, not the last, consideration in thinking about military capabilities and programmes. In a sense, logistics has always been important. As Napoleon underscored, an army travels on its stomach. Logistics is an integral component of military structure.

“But what has made the contemporary logistics challenge different is the shift in military doctrine and approach from mass to manoeuvre. Also, the reach of the logistics chain is greater in a global expeditionary framework. Inventory and transportation costs far exceed the cost of producing the goods needed by operational forces.”

Q: How do you shape new approaches?

“First of all, one can rely on modern techniques and approaches to logistics. In the commercial sphere there is an increasing reliance in ‘just-in-time’ delivery. But this rests upon having ‘trusted agents’ or suppliers in the logistic chain. If manufacturers and retailers can rely on their suppliers, they do not have to have significant inventory stored in place.

“A similar approach is necessary for the military. The challenge is to build a trusted agent approach to logistics. If the front line troops have

confidence in and have a ‘transparent’ approach to the supply chain, then they can trust the process. If they trust the process, then they can focus their logistic spending wisely. Every dollar freed up by a knowledge-based or trusted agent system allows more front line capability to be created and supported.”

Q: How do the new ideas in logistics affect military strategy?

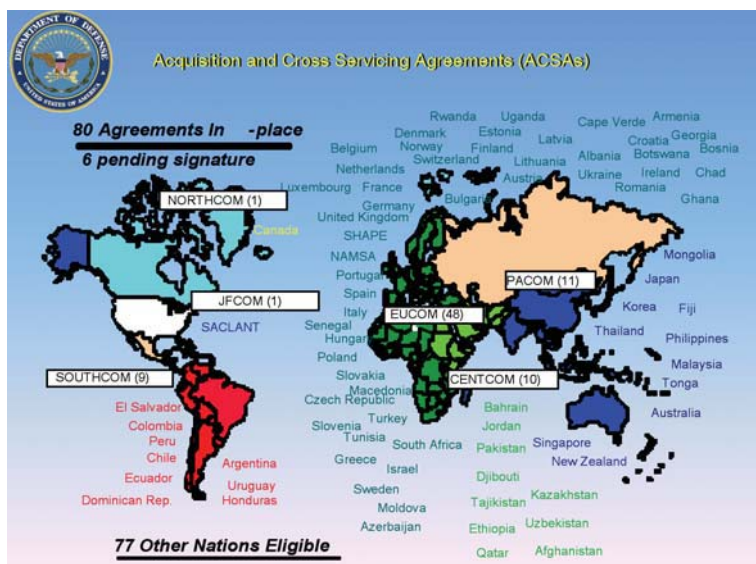
“A new knowledge-based, trusted agent approach to logistics allows faster and more effective manoeuvre capabilities. For example, interviews with captured Taliban forces in Afghanistan underscored the effect of rapidity of supply on military operations. Interviewees underscored that they would rather be pursued by regular US Army units than US Special Forces. Why? The general Army could not move much beyond its bivouac points. Special Forces, on the other hand, moved rapidly and the logistics system followed them. A trusted agent supply system was put in place whereby the Special Forces had confidence that they could move directly against the Taliban with logistics to be provided on route. In other words, logistics allows or limits strategic options for the military and for the evolution of expeditionary capability.”

Q: How important is technology to this process?

“The key challenge is to empower the manoeuvre logistician as the combat power manager. To do this requires the formation of a framework whereby he has the knowledge and systems control to put together a trusted agent system. Technologies like RFID and UID are necessary but not sufficient tools to assist in the process of supporting the manoeuvre logistician.”

Q: But are you not emphasising organisational innovation facilitated by technology and not the other way around?

"Yes. The key objective is configuration control [jargon for managing change]. We need to be able on the operational level to configure forces to the expeditionary task. And a new approach and system of logistics is crucial to this challenge." ■



November 13, 2006

The Challenge to Congress and NASA: Building a Successful Space Program Together

◀ DAVE MCCURDY ▶

NASA and Congress have been given the challenge of designing, authorizing, funding, organizing and executing a successful space program that not only has the broad support of the American public, but also can deliver on the goal of expanding our knowledge base through the further discovery and exploration of space. As the "Report of the Advisory Committee on the Future of the U.S. Space Program" stated, such a program requires a culture of excellence and risk-taking.

In the 1980s, when I served in the U.S. Congress, the House Armed Services Committee panel that I chaired was given the task of addressing several cost issues, which arose during the period of the Reagan era defense buildup. In fact, at that time, a number of major weapon systems appeared to be plagued by a series of cost overruns and schedule delays — most notably the Black Hawk helicopter and Patriot Missile System. The panel's review took place amidst reports that the government had procured \$500 hammers and \$600 toilet seats for the Department of Defense (DoD).

As a result of our review, Congress enacted the Nunn-McCurdy provision as part of the 1983 Defense Authorization Act. This provision established a relatively simple "management by exception" reporting ex-

ception for programs whose cost growth exceeded the acquisition baseline by at least 15 percent.

In 2005, Congress recognized that part of the original problem had been an unwieldy requirements process that had burdened programs with increasing technical challenges which, when unchecked, resulted in increased costs and delays. As a result, Congress revised the Nunn-McCurdy provision to limit the Pentagon's ability to redefine a program's cost baseline against which cost increases are to be measured. It is estimated that next year, more than 50 DoD weapon programs will breach the Nunn-McCurdy thresholds as a result of baseline adjustments and problematic performance. The goal of the original provision remains: to improve oversight through greater transparency and management of major programs.

More recently Congress imposed a new set of cost-control guidelines on NASA, modeled on Nunn-McCurdy. However, the NASA provision goes well beyond Nunn-McCurdy by imposing an automatic ax on those technology programs that experience 30 percent or greater cost overruns. NASA, and other critical space programs in DoD and intelligence, must build systems that will operate in the most extreme conditions and are not — with the exception of Hubble —

repairable. It also does not seem to take into account the fact that the space agency builds and procures a limited number of individual systems as opposed to DoD's massive, multiyear weapons programs. By imposing these stringent limitations, Congress has essentially handcuffed NASA's ability to manage essential but challenging programs.

Although the pursuit of excellence is the goal, the burden still rests with NASA leadership to manage the cost and schedule of programs. The National Polar-orbiting Operational Environmental Satellite System (NPOESS), an important national initiative, has breached the congressionally mandated thresholds. Under Nunn-McCurdy, DoD must certify that the program is essential and bests any alternative approach. It can be argued, however, that NASA management does not have comparable flexibility to get a handle on the program and develop a viable plan to proceed before Congress starts to earmark programs that, in turn, compete for scarce resources. NASA, NOAA, DoD and Congress share the responsibility for deploying critical systems and must work together to design a viable plan, and then adjust contracts and schedules accordingly. NASA has long served as this nation's engine of innovation.

Rather than imposing arbitrary cutoffs

and repeating past mistakes, Congress should instead direct the agencies to review the myriad inter-related causes of program overruns, as well as the implications for innovation and program success. Increased budget pressures, a mismatch between funding and programs, and growing research-and-development costs combine to present enormous future challenges for congressional policymakers.

The key is to reduce risk and contract for performance using contract types and incentive mechanisms consistent with that risk. Congress should allow NASA to spend more on basic research, ensure the development of mature technology and fix requirements before moving ahead to full-scale missions. Congress must also exercise the discipline necessary to reduce the proliferation of parochial earmarks, and move beyond those earmarks to provide management tools that identify critical choices and elevate them to the level at which they will command the attention of politically responsible leaders.

Dave McCurdy is the president and chief executive officer of the Electronic Industries Alliance. He served in the U.S. House of Representatives from 1981-1995. During his tenure in the House, he chaired the Intelligence Committee and subcommittees of the Armed Services and Science & Space Committees.

Realistic Space Power Strategy Needed

◀ ROBBIN LAIRD ▶

The long-awaited Bush Administration national space policy is a statement of the past dressed up 21st century garb. The dramatically changing context of space policy for this century is missing in action. The United States is asserted to be the dominant space player with a right to "freedom of action" in a period of robust national space exploration and commercial space revival. The only thing wrong with this document is its misguided direction. The United States cannot lead if it does not know how to leverage an increasingly dynamic and fluid space environment.

The United States will not be alone in space in the immediate period ahead. This is clearly why concepts such as "freedom of action" and "space control" are becoming problematic. The challenge is to shape a realistic space policy in the context of the growing competition from new space entrants and allies in the space arena.

A negative view can focus upon the threats posed by the expansion of non-U.S. players; adversaries, competitors and allies all provide challenges to U.S. leadership and dominance. A positive view would shift the notion of what U.S. lead-

ership might now become — the ability to work with others, to leverage their approaches, to gain knowledge of what others are doing and to focus U.S. resources on capabilities which others are not likely to duplicate.

The key is to engage in a strategy of "co-opetition" — working with others to better position one for investments in breakthrough capabilities which others are not likely to or not able to invest in. The challenge for U.S. leadership is not to impose an agenda, but to shape it. The challenge is to be able to compete and to cooperate to achieve strategic leadership in the growing presence of other space powers and players. Diversity is the future; assertion of primacy will fail unless accompanied by a clear co-opetition strategy.

Four key requirements are coming to the fore for a U.S. national space policy, none of which are effectively addressed in the space strategy and all of which are crucial for an effective strategy of space power for the 21st century.

First, there is a need to craft an international exploration strategy, not to simply assert the capacity of the United States to fund its own program as if this was the era of the Moon race. Without international

cooperation, space exploration will not be affordable or doable in the two decades ahead. The resources and technology are not there; others will compete with us. Scarce exploration resources will be frittered away; these resources could be combined under an enlightened U.S. exploration approach, which accepts partnership as indispensable to an exploration strategy and not a sideshow to follow the demonstration of U.S. capabilities.

Second, the United States will no longer have a monopoly on key space capabilities such as global positioning systems. In crafting GPS 3 it would be wise to ensure that the European effort on its Galileo system can be tapped as well. The Japanese, Chinese and Indians will probably generate their own regional GPS systems, and the Russian Global Navigation Satellite System, dubbed Glonass, will be strengthened by oil dollars and Russian arms alliances and sales, such as those with India. With the diversity of global positioning systems, how will the United States most effectively shape a leveraging strategy?

Third, there is a need to prepare for the acceleration of a digital space era in which satellite con-

stellations, Internet protocols, Earth observation systems, new communication links and systems supported by new launch systems redefine the commercial space business beyond recognition. With the nano- and micro-electronics revolutions accelerating, accompanied by new materials technologies, new space capabilities will emerge.

The evolution of just-in-time manufacturing, the globalization of research and development, and the movement of maritime and air traffic throughout the globe all rely on the use of space systems. Such reliance will drive growth in commercial space. At the same time, communication, navigation and entertainment systems are evolving to rely more heavily on space as well. The hopes of the 1980s and 1990s will become realities in the 20 years ahead and even more so.

Fourth, the military dimension of space is changing dramatically as well. The ongoing restructuring of U.S. military forces to network-centric warfare will change forever the role of space. Ground-based systems, air-breathing manned and unmanned aircraft, near space and space systems will all compete and contribute to a growth in the networks available to U.S. forces. In-

creased reliance on the middle of the network — especially air-breathing — will shift the requirements for space systems, but not reduce their importance. As the U.S. shifts towards smaller, and more discrete insertion of forces, an ability to link modular force packages together will grow in significance — and space will be the connector. To play this connective role, space policy will require an ability to leverage a diversity of military and commercial space and non-space networks. It is impossible to write a realistic national space policy without regard to the evolution of the non-space enablers and elements of the military network.

In an era of space diversity, the challenge for the United States is to define a realistic notion of leadership, one in which leverage, not hegemony, is the order of the day. An ability to leverage commercial capabilities, shape allied and competitive frameworks, and to work within evolving military networks is the key to 21st century space power. From this perspective, the new national space policy seems more oriented towards the past than the future.

Robbin Laird is a Washington- and Paris-based defense aerospace consultant.

February 13, 2006

It is no secret that space acquisition is in trouble. The unwillingness of Congress to fund key programs is a vote of no confidence in the current acquisition approach. The aspirations of the U.S. acquisition system have been greater than the realities of the performance of the procurement system, the plausible technical capabilities of that system or an ability to leverage other elements of defense transformation and civilian space.

The heart of the problem has been the notion of spiral development. By itself, the concept has its plausibility. But, in reality, requirements creep in the development stage has kept more satellites on the ground than have been launched. Spiral development has become, in practice, synonymous with the structural incapacity to launch sufficient or adequate capability at a reasonable price. The quest for breakthroughs in the development cycle has made it difficult to finish production and to launch sequentially upgraded satellites.

A related problem has been projecting technical possibilities that are simply unrealistic within current production schedules. Many new systems face formidable maturation barriers. Some have been framed as multifunctional replacements for extant capabilities (Space Based Infrared System High) or as placing terrestrial capabilities in the sky (transformational communications) or moving air-breathing capabilities to space (space-based radar).

Spiral development needs to be replaced by a cookie-cutter production approach with a more realistic view of what is technically possible. Transformation rests on the notion of synergy from deployed capabilities, not the development of silver-bullet space platforms that by themselves create synergy. The network creates the synergy not the breakthrough platform.

Based on this principle, current capabilities would be modernized by a steady approach, not a breakthrough approach. Core capacities for space would be built around modular space platforms, which would be produced to be launched on a regular cycle. A basic electronics package would be prepared for the first module and be iteratively deployed. Development of a new package would occur in parallel

Fixing Space Acquisition: From Spiral Development To Cookie-Cutter Production

◀ ROBBIN LAIRD ▶

but would not be deployed until it was mature enough not to delay the production cycle. The bias of the acquisition system would be towards deployment with as simple a system as possible on a regular deployment schedule, which would make costs predictable. Contractors would be paid largely for deployment, not prolonged development.

Two models might be considered as relevant to the cookie-cutter approach. One approach would be to craft a network of simple satellites, which would be upgraded as needed (Iridium). An additional approach might be that pursued by Lockheed Martin for the single satellite solution used by the A2100 satellite. The company standardized on the bus and developed a modular approach and incremental improvement process. These production models for networks or single satellites would be considered as the norm to be sought, rather than the Space Based Infrared System model.

Extant capabilities would be maintained; multifunctional replacements would be sought via experimental R&D programs. The Defense Advanced Research Projects Agency (DARPA) would be put in charge of funding and developing such programs. When ready, they would be moved to consideration for production.

The Predator model would be followed in space acquisition. Clearly, the small satellite, small launcher programs being pursued by DARPA are part of the solution, but reshaping the process of developing new capabilities is at the core of the challenges

facing the United States.

Requirements creep keeping satellites on the ground has affected U.S. launch requirements as well. Without a clear and consistent satellite manifest for the United States, it is impossible to evaluate the real needs of the U.S. government for dedicated launchers. With the adoption of the cookie-cutter production model, realistic launch demand could be forecasted, budgeted and prepared for.

Much of the pressure on U.S. military space requirements has been reduced by the technical successes of the air-breathing sector of the transformation effort. And these successes can allow more time to develop breakthrough programs like space-based radar and transformational communications. The emergence of unmanned aerial vehicles (UAVs) has become a key challenger to the proliferation of space-based assets. Obviously, space is a crucial domain for C4ISR (command, control, communications, computer, intelligence, surveillance and reconnaissance), but UAVs are emerging as crucial components of the C4ISR "infosphere." Also, the new joint strike fighters will become multimission aircraft strengthening the networks available to the ground forces.

Space as the high ground will become less of a thick network backbone on the Internet model, and more of the top end to the ground-, sea- and air-based networks.

As space becomes the top end, the cookie-cutter model becomes even more possible. By replicating current capabilities with an iterative approach, transformation

emerges from the ability to leverage other elements of the military and commercial networks available to the United States.

In addition to the thickening of the middle level of the network via UAVs and the joint strike fighter, the growth in the capabilities of the global satellite communications networks allows the United States the opportunity to acquire core capabilities from leveraging the commercial marketplace.

The Katrina crisis underscored how important satellite communications are for crisis management and security. Without Iridium and Globalstar systems, connectivity would have been lost in the region during the height of the crisis. Yet the Pentagon's proclivity for nurturing its own protocols and systems has led to its desire to have a transformational communications system whereby data and voice can be managed over secure systems that only it controls. No one would argue against the need for key assets to provide for secure communications; but these systems already exist and work. They could be reinforced by an evolutionary acquisition strategy. The military and the U.S. government could then be in a position to support Globalstar and Iridium type systems for global use as a course of policy, not an accident of policy.

In short, the U.S. government is at a turning point. It can continue to pursue acquisition policies that will reduce deployed capability via a spiral requirements-creep development process. The alternative is to take a network approach. A cookie-cutter modular production approach for space-based elements of the defense and homeland security networks would be pursued. These modules would be part of the defense and commercial networks and be upgraded via a fixed production system. If confidence cannot be restored in current space-based acquisition, there will be little tolerance from the Congress for funding "breakthrough" developments. After all a "breakthrough development" pursued via a broken acquisition system is more of a breakdown than a breakthrough.

Robbin Laird is a Washington- and Paris-based defense and aerospace consultant.

Hardly a week passes without some dire pronouncement about the state of education in the United States — how other nations are surpassing us in developing their work force and their technology base, and what debilitating consequences await our industry and our nation if we do not take action. The Glenn Commission, the Walker Commission, the Moon-to-Mars Commission and the recent Augustine Commission ("The Gathering Storm" report) have all concluded that the future of the republic is in jeopardy. High-tech titans like Bill Gates, Craig Barrett and others have issued similar warnings.

While this sense of urgency is long overdue, the theme is no stranger. Rather, it has echoed throughout virtually every conference and symposium the Space Foundation has hosted over the past half-dozen years. It resonates in our research and analysis work, and we see its very real manifestations in our work with schools, teachers and students.

We understand the problem. It is time for action.

It's Time To Inspire, Enable and Propel Tomorrow's Explorers

◀ ELLIOT G. PULHAM ▶

That is why the Space Foundation is making a serious recommitment to our education mission. Over the past 20 years, we have provided tools and training for nearly 40,000 teachers representing all 50 states. While that might sound impressive, it's really only a drop in the bucket of the nearly four million K-12 teachers and more than 50 million students in the nation. We must do more, and we will need the assistance of everyone we can rally to our cause.

Recently the Foundation received the largest education grant award in our history, a No Child Left Behind grant made to the Foundation and the North Kona, Hawaii, school district by the U.S. Department of Education. This district is one of the most chal-

lenged in the nation, with staggering percentages of disadvantaged students, teen pregnancy, substance abuse problems and students for whom English is a second or third language. We will be training the teachers in this district for the next three years in an attempt to cause a paradigm shift so significant it borders on intervention.

The basis of this work is our prior success in training teachers in the district. This success can, in turn, be attributed to a focused effort launched in 2001 to reinvent our education enterprise. Among other things, the effort has led to an entirely new body of curriculum now accessible to teachers for free via the Internet (www.science-standardslessons.org). This new

body of curriculum was produced by teams of outstanding teacher graduates of our Summer Institute program, and is indexed by federal standards, state standards, grade level and subject area. It is already being accessed by thousands of teachers. Particularly exciting, a new charter school in Colorado Springs, the Star Academy, is being launched with a space theme and 75 percent of its curriculum drawn from the Space Foundation.

Strong, space-inspired curriculum is only part of the solution. Teacher training and support is key. Accordingly we have reinvented our five-week Summer Institute program, and participants now rate it as one of the most effective summer learning experiences for educators in the world. We also

have launched the world's first master's degrees in Curriculum and Instruction-Space Specialist and nearly 100 teachers have already obtained their Space Specialist M.A. Finally, what is working so well in West Hawaii and other areas is a radical new, proprietary teacher training methodology called the Integrated Science and Literacy Model®.

These new tools, and the efforts of our teacher liaisons in 46 states, are making a difference. But our team is small. To truly have national impact, we must scale up.

That is why our board of directors has set a new education strategic vision for the Space Foundation: *To inspire, enable and propel tomorrow's explorers.*

This vision means we — the entire space community — need to inspire all Americans to become excited about our future and to become motivated to prepare themselves through education. It means we must work with teachers and students all across the country to provide the kind of education that will enable them to lead the

SEE PULHAM PAGE 21

September 3, 2007

With the departure of U.S. Air Force Undersecretary Ron Sega from the Pentagon, it is time to start thinking about the best way the nation can proceed to the next phase of military space acquisition.

Sega focused on a "back-to-basics" approach to return military space acquisition from a financial and technological abyss. The system was out of whack with spiral development leading to spiraling costs and non-existent space platforms. His emphasis was on putting platforms into space rather than crafting transformational briefing slides. He focused on more realistic program cost estimates and block upgrades of existing platforms.

With Sega out of the way, the temptation will be to push forward breakthrough programs that are big on promise, but likely to deliver little capability to orbit very quickly. Leveraging current platforms to create capabilities is considerably better than crafting comprehensive systems that are unaffordable and beyond the technological grasp of the current generations of engineers and manufacturers.

While back to basics was putting military space back on more solid financial and technological footing, several strategic developments occurred that should shape a new military space approach. These developments should lead to an emphasis on a systems approach, rather than on advancing a purely proprietary military space sector.

Beyond "Back to Basics"

◀ ROBBIN LAIRD ▶

First, the military deployments in Iraq and Afghanistan have underscored the need for a new approach to the use of command and control (C2) and intelligence, surveillance and reconnaissance (ISR). These operations have relied on air-breathing and ground-based platforms to provide significant C2 and ISR. The U.S. Marine Corps is relying on what it calls "non-traditional" ISR for its operations. By non-traditional, the Marine Corps means "on-demand" ISR for ground- and sea-based decision makers. Air-breathing platforms, whether manned or unmanned, are increasingly central to their ISR and C2 operations. The Marines and U.S. Army have worked closely to share data across ground-based systems as well.

With the dramatically enhanced role of C2 and ISR generated by the ground-air partnership, the role of space has changed. Space becomes a significant layer within the communications and data spheres, not simply the repository of the network. Space systems become relay elements, coordinating nodes and part of a collaborative system, not the dominant layer shaping the network. This means that the U.S. military can shift from building complete military communications and ISR networks in

space to leveraging the evolution of air-breathing and ground systems as well as global commercial systems in shaping its future military space system.

Second, the operations associated with the global war on terrorism have underscored the changing nature of the balance between kinetic and non-kinetic systems. For example, the U.S. Air Force's primary operational missions now are largely non-kinetic. Kinetic strike is a core capability to be exercised as appropriate.

Air Force Secretary Mike Wynne refers to this new state of affairs as the role of the Air Force in the "global security enterprise." The classic role of military space has been to provide C4ISR for kinetic strike against moving or static tactical or strategic targets. With the global war on terrorism, there are fewer targets and significantly more events that need to be shaped on the ground or at sea. Data and communications need to be provided close to the point of decision making, not stored in Washington data vaults. As such, the military and security players in the global security enterprise are relying more on a collaborative and on-demand networks than on the data provided from distant geostationary satellites.

Third, the global security enterprise rests in the words Wynne wrote in a Jan. 16 op-ed for *Aviation Week*: "The thoughtful shaping of coalition capabilities that will provide the authority within which power may be exercised in the turbulent years ahead." This means that a premium is placed from the outset on shared capabilities, not proprietary data provided by U.S. military systems, which then is laundered through a tortured intelligence sharing process with allies. By then events are beyond the point where there is any relevance to the data. Proprietary U.S. military systems are at the core of shaping kinetic capabilities for the joint U.S. forces, but they are not at the heart of the shared data and communications capability that are central to the global security enterprise and needed for an effective global war on terrorism.

This means that relying on shared systems with allies and the commercial sector should be a core consideration for a significant part of the U.S. military space system. On the one hand, data can be purchased from partners and allies. For example, leased communications from the United Kingdom's Skynet system would be part of the U.S. overall capability.

On the other hand, the De-

fense Department needs to rely on commercial networks and systems for capabilities and those needs should be prioritized. This could be done by leasing services directly, by relying on hosted payloads (as the U.S. Federal Aviation Administration does currently), or by leveraging networks like Iridium to support GPS. Rather than viewing the commercial networks as a leper colony, the Pentagon should view the commercial sector as a core element of the overall military space system.

A final key consideration is the impact of the Chinese anti-satellite test. The Chinese have demonstrated the vulnerability of space. By relying on commercial systems that the Chinese would be loath to degrade and by building capabilities that leverage the collaborative capabilities of a redundant data and communications global network deployed locally, the Pentagon would get the redundancy that provides security.

In other words, the Sega pause has allowed the Pentagon to begin thinking realistically about a military space system, not a military space sector. A systems approach recognizes the role of the various contributors to overall capabilities providing for the effects necessary to shape and execute a global security enterprise. It would be a shame if back to basics will now be replaced by back to business as usual with Sega out of the picture.

Robbin Laird is a Washington- and Paris-based defense aerospace consultant.

Dangers of Nitrous Oxide No Surprise

◀ MARK HOLTHAUS ▶

Experimental rocket societies have a more than 60-year history of providing some of the few hands-on hardware development training grounds for the nation's space industry scientists and engineers. Most famous among these organizations is the Pacific Rocket Society (PRS), which was founded in 1946 and has been an incubator for many notable personalities now operating companies in the new commercial space movement.

PRS members have built, tested and flown every type of rocket engine imaginable, including liquids, hybrids and solids. At an amateur rocket launch in the Black Rock Desert, Nev., in 2005, several PRS members witnessed the explosion of their large HTPB/Nitrous-Oxide hybrid rocket.

In terms of design, the nitrous-oxide tank was loaded using a tube that passes through the combustion chamber and plugs into the injector face. At launch, the tube detaches from the injector, allowing the nitrous oxide to flow into the combustion chamber. A burning ignition grain is present to start combustion.

During nitrous loading the tube seal at the injector face was leaking, spraying the nitrous oxide onto the fuel grain. At ignition the fuel grain blew up. Later, it was determined that the detonation was due to the leak that sprayed nitrous oxide onto the HTPB fuel grain, thereby saturating it, and turning it into a volatile, detonable sol-

id. This engine design was later modified to use a polyethylene tube to fill the tank through the combustion chamber; the ignition grain burns through the tube to start the nitrous flow and to start ignition.

Knowing that nitrous oxide sprayed on an HTPB fuel grain can saturate that grain and turn it into a substance as volatile as TNT, I have several concerns with the current SpaceShipTwo design, and have some recommendations to improve its safety based on how the nitrous-oxide hybrid engine disasters that I personally have witnessed could have been avoided.

Venting nitrous oxide through the engine should be avoided at all costs. One possible scenario of high concern is the potential event of an aborted launch requiring the venting of the onboard nitrous-oxide propellant to reduce the vehicle weight for landing. In this type of situation, either the White Knight Two would have to land with a fully loaded SpaceShipTwo, or SpaceShipTwo would have to land with a full nitrous-oxide load thus damaging the landing gear. In both of these cases, the venting of nitrous oxide through the engine to lighten the vehicle weight should be avoided. Venting should be performed through a separate external vent, not through the grain.

In the event of a misfire of the SpaceShipTwo motor, and if nitrous oxide has been vented through the motor without successful ignition, a second attempt at ig-

nition should not be tried. Redundant ignition methods should be used to make sure that ignition occurs when nitrous first flows; otherwise, out of concern for public and passenger safety, the launch should be aborted.

In questioning the ill-fated July 26 ground test, one could ask: Where did ignition occur? When venting a dry gas such as nitrous oxide over a surface, a static charge can build up. If this static discharges, it can ignite the explosive fuel grain, or in the case of nitrous oxide, can ignite the oxidizer itself.

In the Mojave Desert that day, conditions were extremely dry and hot (temperatures hovered around 100 degrees); static build-up was likely to occur. Within a narrow range of temperature and pressure combinations, nitrous oxide in and of itself can undergo rapid, explosive decomposition and can auto-ignite. If, as is claimed, there was no fuel present that day, the nitrous oxide alone could have provided the destructive power that devastated the personnel and equipment at the Scaled Composites test site.

Was this a case of mischaracterizing the nature of the propellant? Were workers led to believe that nitrous oxide should be considered "safe"? After all, didn't the X Prize Cup organization include nitrous oxide on their list of safe propellants? All people with hands-on rocket experience know that there is no such thing as a "safe"

rocket propellant. Unless these substances are treated with respect and scientific precision, they will harm, and in rare and tragic events like the Scaled episode, kill.

Also, as a matter of good practice, it is not safe to flow an oxidizer through a propulsion system with unprotected personnel standing nearby. If the oxidizer is exposed to any organic contamination it can become explosive and detonate during the test. All future flow testing using an oxidizer should be done with the personnel located in a well-fortified blockhouse.

Burt Rutan had commented that they had vented nitrous many times in a similar way, and no explosion had occurred. This type of statement is commonly made in conjunction with accidents. The Apollo 1 fire is a case in point: NASA had performed many high-pressure pure-oxygen cabin leak checks on all the Mercury and Gemini capsules with no resulting fire. But the conditions were right that day for an Apollo 1 fire. Unfortunately for those who died or were injured in the Mojave mishap, the conditions were right again, if just for that one horrible moment.

Mark Holthaus is a safety engineer for The Boeing Co. and so works as a pyrotechnics operator - rockets 1st class with the California State Fire Marshal's Office. He has performed safety analysis on the space shuttle, space station and X37, and has extensive experience with large hybrid rockets through his field work with the Pacific Rocket Society.

FRAMING A MISSION SUPPORT ARCHITECTURE

MLI's Robbin Laird sat down with Admiral Carrier of the United States Coast Guard, head of the Acquisition Directorate, to discuss the Coast Guard's new approach to acquisition.

Admiral Carrier has been a key player in shaping what the USCG calls its new "Blueprint for Acquisition". The new acquisition approach is intended to enhance the ability for the USCG to deploy and support new assets as it performs its role in meeting the challenges of maritime security in the 21st century. Admiral Carrier emphasises that integration of its operations and acquisition is required for the USCG to perform its missions as mandated by the national maritime security strategy.

Adm Carrier underscores that Admiral Thad Allen, USCG Commandant, began his term by issuing several directives to change the acquisition system. Among these initial directives were mandates to consolidate acquisition organisations and to integrate the logistics and support systems within a new Directorate. These directives led to the emergence of the "Blueprint for Acquisition" in February 2007, and this will be the key tool of the new acquisition directorate which will be launched this summer.

In crafting the blueprint, the USCG is guided by four core principles.

First, program managers and integrated project teams (IPTs) must become the core units of action in the formation and execution of the acquisition of USCG assets. Second, both the numbers and capabilities of acquisition personnel, both uniformed and civilian, will be significantly enhanced. Third, acquisition must become a more effective enabler of operations within the service. Requirements generation, definition and execution must become a more effective partnership between acquisition and operations. Fourth,

acquisition is to be reshaped from the perspective of life-cycle support to USCG systems.

Adm Carrier is quick to note that the fourth point should not be seen as coming "last" in importance, but is arguably at the core of the new strategy.

Admiral Carrier emphasises that a "multiple front strategy" will lead to major changes over the next few years, and ultimately to the creation of an acquisition and support architecture, which has been lacking. A three star officer will be in charge of the mission support organisation (within which acquisitions and logistics will be subsumed) which will place it on par with the operations directorate. This is, in itself, a radical move.

TROUBLED BACKGROUND

USCG acquisition is at a critical inflection point. In 1986, the USCG created the Acquisition and related but separate organisations to shape acquisition efforts. But as the USCG confronted the massive challenges of block asset obsolescence of so many vessels, a new approach was launched which saw the USCG working with a commercial partner to shape an overall approach to acquisition. This led to the Deepwater Program Executive Office being created in 1999 to lead this effort.

Now the USCG is combining the efforts of all of the acquisition organisations into a new, consolidated acquisition organisation. But this new merger is being crafted from the perspective of providing life-cycle support to USCG assets. Whereas the Deepwater approach was to contain a new approach to logistics within the Deepwater effort, the USCG now feels that such an approach needs to be subsumed within overall integration of logistics and support within acquisition itself.



SHAPING A SINGLE ACQUISITION DIRECTORATE

A key element of the reform effort is to end the fragmentation of current acquisition structures and to craft common standards, processes and approaches throughout the new acquisition directorate. The current situation results in the suboptimal ability of the USCG to provide proper governance of the acquisition and thus support processes. Within the two primary acquisition entities – Deepwater and Acquisition – staff redundancies exist that independently provide the same or similar functions. These are then repeated elsewhere in the CG structure, leading to further diffusion of resources, and lack of clarity.

A consolidated acquisition directorate will be launched in July 2007. Over the next three years, this new Directorate (CG-9) will go through a series of reforms by which real integration of acquisition and

support will be achieved. Although the organisational change will be profound for USCG culture, it is crucial at the same time to maintain efforts to acquire capacity for a service facing regular operational challenges. Adm Currier says that this is not the time to dump out the baby with the bathwater.

The launch of the new command (CG-9) will carry with it several core changes.

Program management will be the “operational” arm of the acquisition structure. All other elements will exist to support the Program Manager (PM) who will function as the lynchpin for the entire acquisition process. The R&D Centre will be incorporated into an Office of Research, Development, Test and Evaluation. This centre will provide critical acquisition support tasks. This Centre will also contribute to establishment requirements and reviewing those requirements during the pre-acquisition formulation phase. And throughout, there will be a major emphasis on through life support of systems.

THE NEW STRUCTURE AT WORK

A new fully integrated and aligned process will be established which allows the PMs to focus, coordinate and strategically manage projects. The mission support architecture will allow the acquisition process to be able to interact strategically over the life of the acquisition to more efficiently produce the required capability. Requirements will be reviewed on a regular and periodic basis to revalidate or redefine those requirements with regard to realistic judgments about affordability and technical feasibility. Adm Currier underscored that this represents a major change in thinking for the Coast Guard.

A key objective of the new approach will be to provide governance of the acquisition process from the integrated lifecycle management perspective. Staff elements contributing to project execution must do so under the leadership of the designated Project Manager, in a matrix IPT. These IPTs will exist throughout the lifecycle of the system being acquired. Leadership of the matrix IPT can change as the system matures, but the core competencies represented on the IPT will remain in

place throughout the system lifecycle. Although interim steps can be taken to structure the acquisition phase IPTs in advance of full realisation of the Mission Support structure, only through full implementation of this SYSCOM structure can life cycle be governed.

ALL OF OUR EYES ON THE DISTANT HORIZON

The acquisition enterprise that will emerge from a reform effort will focus upon assets and systems acquired and sustained along product lines. This will require an ability to formulate and execute three very different contractual approaches. The first approach is the acquisition of goods and services. Here traditional approaches to acquisition will be modified as sustainment becomes part of the asset acquisition process.

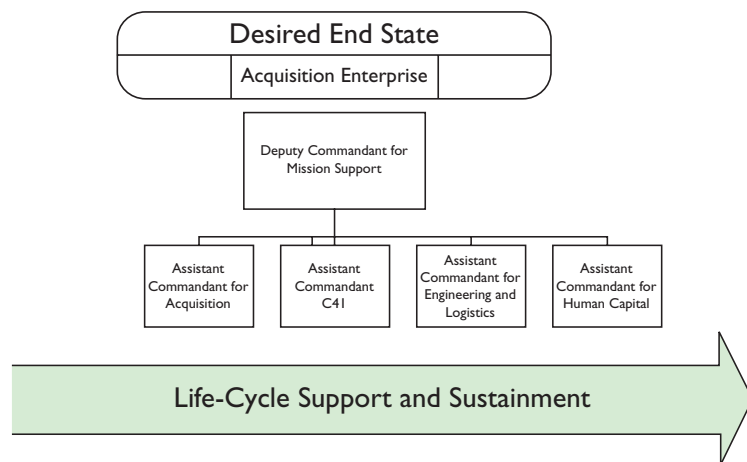
The second approach is that of single asset acquisition, and the formation of strong program managers will be central to the management and governance of the process.

The third is different from the other two. Here the tasks are to govern systems integration tasks and tools. The challenge is less to do it in-house than to ensure that the USCG is fully capable of governing the process of systems integration. As a mid-sized service, the USCG will have limited ability to do systems integration itself. But it needs to be in the position to govern the process and to be able to

work with either government partner or commercial systems integrators.

One way of looking at the reform effort is to see the organisational redesign as a “permanent” revolution, which empowers program managers and contract officers to operate in a common but evolving process to provide timely, and supportable capability to the service.

In short, at the heart of the reform effort will be an enhanced capacity for providing integrated project management within an evolving mission support architecture. In the current situation, the definition of requirements, project management and contracting processes are too disjointed and disconnected. By empowering program managers and rebalancing the relationship between contract managers and program officers, a more effective program management process can emerge. And a key outcome will be better through life management of systems and equipment which should lead both to lower operating costs, and so higher availability of equipment. ■



SHAPING HANDS-ON COALITION CAPABILITY AT SEA

MLI's Robin Laird sees how a US Marine Aviation Group gets on with operating off the Royal Navy's *HMS Illustrious*.



Courtesy of the Royal Navy, Crown Copyright

Marine Air Group deployed 14 AV-8B Harriers, plus 200 support personnel aboard HMS Illustrious for a period of over two weeks. Vital to operating US marine aircraft off a Royal Navy ship is that personnel were not segregated, but were bunked together.

In July of this year, the USMC assigned two Ospreys and fourteen AV-8B Harriers to operate aboard *HMS Illustrious*. The British aircraft carrier was participating in a joint exercise with the U.S. and other allied navies near the Virginia and North Carolina coasts. The exercise was an unprecedented effort by the Marines and the Royal Navy, in which close coordination allowed the Marines to operate fully off of the British ship.

For the Royal Navy, the exercise was the capstone of certification of the carrier as NATO's High Readiness Maritime Strike Carrier. The ship operated alongside the USS *Harry S. Truman* battle group, and worked with the U.S. Navy in developing greater interoperability for future operations of current and new British carriers and other warships. The operation of the US Marine Corps Harriers off the British ship allowed the crew to practice high intensity carrier operations in the absence of their own Harriers, which are currently deployed in Afghanistan.

For the USMC, the exercise provided an opportunity both to certify pilots and, more importantly, to develop coalition operational skill sets. The USMC is a flexible fighting force and sees its range of missions as requiring the ability to work with allies at sea and on land. The preparation for the exercise and the experiences of the exercise itself allowed the Marines to work closely with the Royal Navy. And to thereby further develop coalition collaborative combat skills. It was not a technical exercise in interoperability: rather the Marines saw the exercise as an opportunity to develop an on-the-fly-division of labor skill sets so necessary for coalition operations. British procedures were mixed with Marine Corps procedures in crafting a blended coalition combat capability.

Interviewing Col. Eric Van Camp, the USMC Air Group Commander, on-board *HMS Illustrious*, the colonel underscored the central role of blending the USMC and British crew both before and during the exercise as crucial to the success of the exercise.

"It is an example of two military cultures relatively close to one another simply working through operational differences to create a positive outcome. The mental furniture of the two groups had to be rearranged but the result was a real combat capability" he said.

The idea started with a USMC thought process which emphasized that their vertical lift assets allows them to operate over a much wider variety of platforms than a traditional catapult carrier. By starting with two services with similar strategic cultures, the challenges were perceived to be manageable. In May, a four-person site survey USMC team joined *HMS Illustrious* for a week. Here the two sides worked through the deployment details and what needed to be resolved when the Marines would deploy aboard the British ship. The Marines were to bring parts of two squadrons from the East Coast and one from the West Coast and would then deploy elements of the three units aboard *HMS Illustrious*. They were to follow UK shipboard rules. The plan was to blend the crew aboard the ship so that informal small



US Marine deck crew manoeuvre an AV-8B Harrier around the – for them – tight confines of the deck of HMS Illustrious. Comparing and coordinating support practices was a vital part of the combined force exercise.

group interactions would shape resolutions before there needed to be a formal process put in place.

The methodology followed during the exercise was the “chalk board” approach. As problems were identified, informal teams would form to shape proper outcomes. For example, with regard to flight deck operations there are differences of approach, which are used by the British and American navies. The two sides worked through a division of labor whereby rules would be followed by both sides, but different cultures respected.

The USN provides dedicated personnel for flight operation controls. The RN does not have purple/blue shirts playing this role. The USMC captains refueled their own planes because the UK does not do hot deck refuelling, which is SOP for the USMC. And they created rules to collaborate between the refuelling efforts and the yellow shirts (taxi drivers) to allow for proper flight operations. There are fewer layers of operational flight control elements on the British ship. And the USMC adapted their operations to this reality.

This problem was worked through via “chalk talk” in the actual context, rather than laying down formal paper work.

One key challenge was working through the ordinance issues. The USMC Harriers use different weapons than do the RN/RAF Harriers. The most notable differences are that the USMC AV-8B cannons are a different caliber than the RAF/Fleet Air Arm’s GR7/9 cannons, and the USMC uses JDAM satellite guided bombs, which the UK does not. The ordinance was loaded onto *HMS Illustrious* in Norfolk, Va., along with some special USMC ammunition loading equipment and parts. In actual fact less ammunition storage on the ship was required than the site survey team had anticipated.

Real estate and time are the scarce resources in operations on a combat ship. Via small group collaboration and “chalk talk,” real estate and timing issues were worked through during the actual operations. This would not have happened according to the Colonel without the 200 embarked US Marines and the Royal Navy sailors being berthed together.

The result was that the Marines were able to conduct 315 hours of

flying off of the ship in two weeks with more than 200 sorties. 301 landings were completed whereby 29 pilots were qualified in four days, results greater than the normal experience operating off US Marine ships. *Editor’s Note: Well worth comparing these figures with those revealed in the UK National Audit Office report on the transformation of fast jet support in the UK.*

For the USMC the results of the exercise are very promising. With the number of U.S. ship hulls decreasing over time, the ability of the USMC to operate off of allied ships will be an important contribution to what Admiral Mullen’s refers to as the “1000” ship navy. There is an entire class of allied ships being built by the British, Italians, Spanish, Australians, and French off of which the vertical life USMC assets are ideally suited for coalition operations. What this path breaking exercise demonstrates that working through the practical problems via small group interactions is the core of working the cultural interdependence at the heart of coalition operations. ■

TESTING THE CONCEPTS, REFINING THE APPROACHES

Military Logistics International's Murielle Delaporte and Robbin Laird attended the USMC's LOGMOD-2007-2 War Game held in Quantico.

The LOGMOD 2007-2 War Game was held over five days in September 2007, and *MLI* was able to observe two of those days. Whereas the first game in October 2006 helped develop the overall approach to logistics reform, the second game confronted the approach with a range of real world problems, and identified core challenges which the approach will have to overcome to become viable. The event was not a vague "exercise": eighty-five professionals participated in the war game, most with significant recent combat experience in Iraq and Afghanistan.

The game was a remarkable effort to sort out the tensions in transitioning to a more effective approach to battlefield logistics support. Three core themes came up throughout the games:

- The tension between the approach, which embedded logistics support

on the battlefield, and the nascent IT systems which can empower such an approach.

- The tension between the current operations in Iraq, which are in place logistics for a "second land army," and the real requirements for the USMC of expeditionary logistics for an engaged distributed force.
- The tension between lessons learned from past operations, and the needs for a sea-based force which the USMC sees as core to its expeditionary future.

Overlaying these three themes are some common questions: What logistics reforms fit the future, rather than the past? What realistic capabilities will be deployed with regard to IT? And how much trust can be put in the new system so that hoarding and stockpiling can be overcome as legacy logistics realities?

War gaming and simulation are relatively new tools being used by the

United States Marine Corps as a whole. According to U.S. Marine Corps Sergeant Donald Bohanner, the command has been working on their development since 1995, when the Marine Corps Warfighting Lab (MCWL) was actually established. But Sgt Bohanner explained that the push for Marine Corps simulations occurred in 2001 with a research project initiated by the technology division at Training and Education Command to investigate technologies to create a Deployable Virtual Training Environment for Marines." The advantages over, or complement to, live-fire training are financial, but can be measured in terms of time-saving, risks and preparedness. The Marine Corps Wargaming Division, based in Quantico, is in charge of the program and part of the MCWL.

GAME ONE – GAME ON!

A year ago, from October 30th to November 3rd 2006, USMC

Staff Sgt Jim Goodwin, USMC



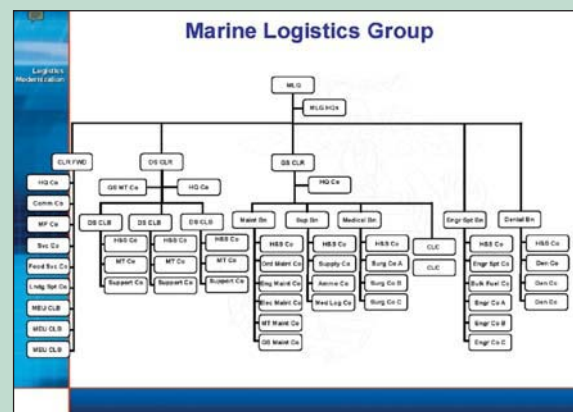
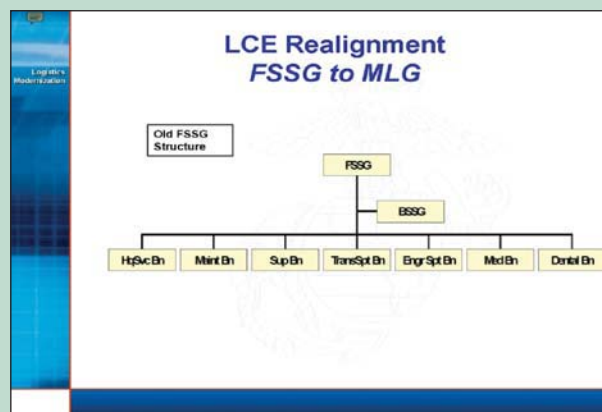
The difficulty has been to shift from a decades-old vertical chain of command to a structure in which all the traditional functional directions – maintenance, transportation, supply, engineering, C2, medical/dental – are integrated within

PLAYING OUT THE GAME

LOGMOD 2007-2 continued the process started during the first LOGMOD game). The goal as described by one of the organizer, Mike Resnick, was to, “make the changes across the Corps”, while fine-tuning the

According to the Maj Applewhite and Mike Resnick, “The purpose of LOGMOD 07-2 is to examine logistics support request procedures and the roles, functions, and activities of the Logistics Combat Element and the supporting establishment while supporting a Ground Combat Element conducting maneuver in the MEF battlespace. LOGMOD 07-2 will examine the feasibility and practicality of changes in capabilities, staffing, process and technology as recommended by: the Field Maintenance Capability Alignment (FMCA) workshops, MARCORLOGCOM [*Marine Corps Logistics Command*] SECREP [*Secondary Reparable*] management concept of operations, Realignment of Supply Spiral I process action teams, and the MAGTF Distribution Conference and policy”.

LOGMOD 2007-2 was designed to test a number of core reform initiatives in terms of their impact on the “affected units”. The basic capabilities matrix used in the game is included below.



An MLG is typically composed of 8,000 Marines and includes, “*for support in Garrison or deployed*”, 116 Refuellers, 300 Medium Lift Vehicles (MTVRs), 28 Rough Terrain Cargo Handlers, 120 Fork Lifts, 60 Mobile Cranes, 75 Maintenance shelters, 34 Bull dozers, 40 Road Graders, 80 Dump Trucks, and 82 Reverse Osmosis Water Purification Units.

LOGMOD INITIATIVE	CAPABILITY	MEP	ASAP	AF	MLC	MDCCC	SECREP	SECDEF	AF / JFAP (AF)	CL (66)	MDCCC	CL (66)	CL (70)	IMPACT
	Alignment of electrical/optical repair special tools for Field LOM units with only 2 nd EOM kits	X	X					X	X	X	X	X		-LCE/Supporting Unit will push optical support forward (increased tool, test equipment, personnel(?) to decrease repair cycle times.
Realignment of Maintenance: SECREP Management	Implementation of recommended LOGMOD Concept of Support for SECREP Management	X	X	X	X	X	X	X	X	X	X	X	X	-MLC: increased requirements for liaison with MDCCC, CLR (GS).
	MLC ability to coordinate and track SECREP asset postures to support cross-living opportunities across the Marine Corps	X	X	X	X	X	X	X	X	X	X	X	X	-MLC: coordination with SEC for asset visibility within MARFORs, migration of operational distribution responsibilities from CLR (66) to MLC (w/MSG)
	MLC ability to coordinate and track configuration of SECREP assets repaired within the Marine Air-Ground Task Force and rebulk at Sustainment level maintenance activities	X	X	X	X	X	X	X	X	X	X	X	X	-MLC will provide personnel to augment GS CLR to assist in sustainment sourcing and realignment from outside of theater.
	MLC ability to coordinate and track evacuation of SECREPs from forward deployed locations	X	X	X	X	X	X	X	X	X	X	X	X	-MLC (Fwd?) migration of operational distribution responsibilities from GS CLR to MLC (w/MSG)
MAGTF Distribution Management	Establish a distribution officer as the single point of contact to integrate, coordinate, and supervise distribution processes	X	X	X	X	X	X	X	X	X	X	X	X	-MDCCC has visibility of asset availability across MAGTF. Assumption is all transportation movement requirements will be regulated with MDCCC.
	MDCCC authorized to oversee and task transportation assets across the MAGTF as the overall Distribution Capacity Manager (DCM)	X	X	X	X	X	X	X	X	X	X	X	X	-GCES/Supported units: MDCCC can retask assets for other missions. -LCE/Supporting Units: MDCCC can retask assets for other missions.
	Configuration of the MDCCC and MMOC tables of organization and equipment per the MDOP	X	X	X	X	X	X	X	X	X	X	X	X	-LCE/GS CLR: effects of realignment of personnel to MMOC structure w/ Supply BN capabilities.
	MMOC conducts throughput operations	X	X	X	X	X	X	X	X	X	X	X	X	-MMOC: Ability to organize/conduct operational/technical level distribution support. AS MEFP PP&P capability resides within MMOC. Maintains ITV nodal network and WOVN deliveries.

shift in responsibilities, as well as assessing the necessary resources to make it effective. Four “capabilities” were explored:

The game tested four key elements of the matrix in terms of the challenges facing the reform process:

- The challenge of Realignment of the Supply Chain (RoS);
- The Realignment of Maintenance (RoM), and where maintenance would be best performed;
- Secondary repairs, a key aspect of the realignment of supply under LOGMOD. There was especially spirited discussion on this point during the game;

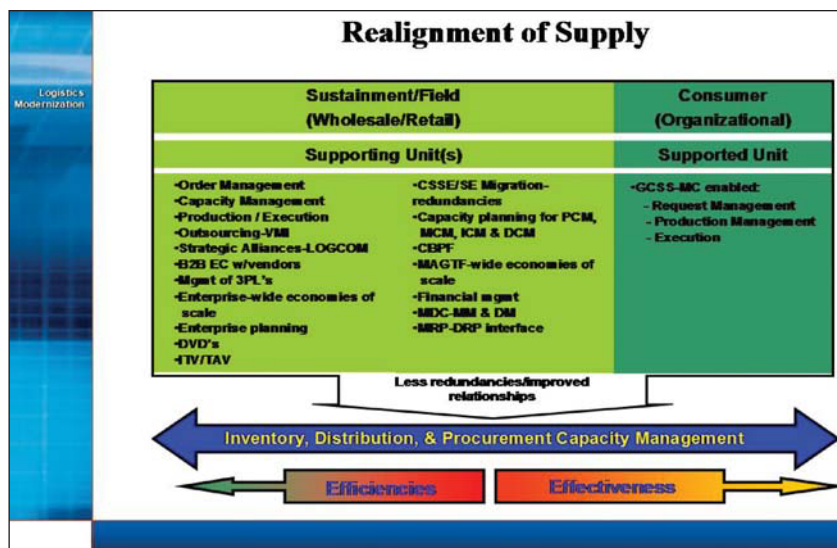
RoS Spiral I, the initial element of the reform process, is the first phase of the Realignment of Supply initiative in the USMC, and the first listed initiative on the matrix. The responsibility for order management is transferred from the supported unit to the supporting unit, while one supporting unit per MAGTF is to be in charge of both inventory and procurement. One focus of the game was to assess the feasibility of such a

- inventory positioning;
- removal of order management functions from supported units;
- centralization of order fulfillment and capacity management (inventory, procurement) responsibilities into one supporting unit for each MAGTF;
- migration of inventory management and inventory warehousing functions for some classes of supplies.

The second element of USMC logistics reform, the RoM (Realignment of Maintenance)/FMCA (Field Maintenance Capability Alignment) process, is the reduction from traditional five echelons of maintenance (EoM) to three levels of maintenance (LoM): operator/crew, field and sustainment.

The three new LoMs would be:

- Operator/Crew LoM, which would be on the battlefield, with a bare minimum of tool, no specialist tools, and no specialist training required to diagnose or perform the tasks.
- Field LoM, which would also be on the battlefield, but not exclusively, some special-to-task equipment,



some specialized training, with inventory close to hand.

- Sustainment LoM, in-theatre, if not on-battlefield support, with specialized teams and tools, and a ready availability of spare parts.

The game players also assessed the impact of the RoM Field Maintenance Capability Alignment (FMCA) on the migration of the ground SECREP (Secondary Repairable) repair capability from the supported unit to the supporting unit or LCE (Logistics Combat Element). To help this assessment, seven capacities were addressed in the war game matrix:

- migration of the capability for repair of ground common electronic SECREPs LRUs from the supported unit to the LCE;
- shared responsibilities for engineer Field LOM tasks between the LCE and the Ground Combat Element (GCE), specifically component repair, evacuation and end item recovery/evacuation missions;
- realignment of all field LOM support repair tasks for AAV, LAV (light armored vehicles) and tank-unique systems within the GCE units;
- migration of all Field LOM component and parts replacement tasks for artillery equipment to GCE units;
- shared responsibilities for component repair, evacuation and end item recovery/evacuation missions between the LCE and GCE units;
- migration of selected maintenance support tasks such as annual small arms gauging tasks, replacement of small arms barrels and replacement of optics components and parts from the LCE to the organic unit;
- alignment of electro/optical repair special tools for Field LOM units with only 2nd EOM kits.

SECREP, the third element under study in the war game, is a process improvement effort under the RoM initiative, and has been another central concept of operations around which the war game was designed. Here too, the idea is to provide a single point of contact to integrate and improve the process of

management of secondary repairables, as well as improving tracking and visibility of the assets. Four capacities were in this case examined carefully, as detailed in the matrix:

- implementation of recommended LOGCOM Concept of Support for SECREP management;
- Marine Corps Logistics Command (MCLC) ability to coordinate and track SECREP asset postures, to support cross-leveling opportunities across the Marine Corps;
- MCLC ability to coordinate and track configuration of SECREP assets repaired within the MAGTF, and rebuilt at sustainment level maintenance activities;
- MCLC ability to coordinate and track evacuation of SECREPs from forward deployed locations.

With the MAGTF Distribution concept, the last element under examination in the war game, a single distribution officer becomes the single point of contact to coordinate the entire distribution process, while having the authority to, “task transportation assets throughout the MAGTF as the overall Distribution Capacity Manager”. In this case, four capacities were also examined by the game:

- establish a distribution officer as the single point of contact to integrate, coordinate, and supervise distribution processes;
- MAGTF Deployment and Distribution Operations Center (MDDOC) authorized to oversee and task transportation assets across the MAGTF as the overall Distribution Capacity Manager (DCM);
- configuration of the MDDOC and MAGTF Materiel Distribution Center (MMDC) tables of organization and equipment per the MDDP;
- MMDC conducts throughput operations.

A SEMINAR-STYLE WAR GAME

The LOGMOD 07-2 War Game Operations Order describes the conduct of the simulation as a, “seminar-style War Game based on a single Marine Logistics

Group (MLG) scenario designed to examine logistics support request procedures ...”, as opposed to a “box game”. The game was to evaluate the, “procedures, roles and functions rather than the players’ performance”. The players communicated via email, and kept track of all their exchanges for further analysis at the end of each day, “outbriefs” as they were known.

The game was divided into five moves and based on a scenario called “Barbary Sword”. The goal of the operation was to free an allied country from a foreign invasion, and in twelve days, the shift was from “MEF in the defense to MEF in the offense”, including a sea-based logistics exercise.

- Stage 1 was “Assembly”;
- Stage 2 was “Movement to Attack Positions”;
- Stage 3 was “Defeat 1st Echelon”;
- Stage 4 was “Defeat 2nd Echelon”;
- and Stage 5 was “Restore the International Boundary”.

The players – divided into four cells – were to review the impact of each move on the major aspects of each initiative and draw conclusions about the feasibility of the reform at the end of the five day-war game. To do so, each organization (and for the final questionnaire, each single player) had in particular to answer the following question:

“What were the impacts of the LOGMOD Concepts on your organization’s ability to execute your mission in this move?”

During each move, the players had to respond to new developments and deal with bottlenecks, or what was referred to as Master Scenario Events List (MESLs). Overall, the game included seventy MSELs, such as, “Who’s got the mission?”, or, “Who’s got the asset?”

Concretely, some of the questions raised and addressed during the game were:

- Where will maintenance be performed on the battlefield?
- Where will inventory be positioned on the battlefield?
- Where will distribution be performed on the battlefield?

- Where will MAGTF go for transportation?
- How to bring resources to the theater in the most efficient way?
- Is more maintenance needed? More equipment? More personnel? More capacity to support it? Who can fix the fastest?

All these challenges were raised very early in the game to make sure that potential gaps in the policies being drafted were to be addressed.

The war game allowed to assess the pros and cons of each LOGMOD initiative, and generated multiple debates and recommendations to address some of the issues at stake. After the full five days of gaming, some of the conclusions concerning the key areas are as follows:

RoM/FMCA

In the case of maintenance, which used to take place at the rear, the question posed during these five days of simulation was to find out at which level it would be best performed. New recommendations were integrated in this war game and one of the conclusions was that “maintenance can be embedded at the Combat Logistics Battalion (CLB) level”.

RoS: centralized order management

The same question was posed as far as supply was concerned: should inventories be spread across the battlefield, or is it better to have an “avenue to go back to”. In this case, the IT enablers allowing the process were not yet fully available. The trend is to, “move away from stockpiling to positioning.” To do so will require decentralization in order management across the board with centralization at the CLB level and in the execution of the orders. Among the conclusions made on the last day, the risk of the CLB becoming a bottleneck was stressed. The physical burden of warehousing and the loss of flexibility it implies was also highlighted.

A recommendation made by one of the cells was that the MLG should be the center of excellence for centralized order management. However, LOGMOD demonstrated the feasibility of reducing the Regimental Combat Team (RCT) logistic footprint, as well as eliminating double orders at the RCT level.

MAGTF Distribution

LOGMOD War Game 07-2 was also an opportunity to examine the distribution pipelines, and to determine better ways to perform this function. The goal is to bring “just the right stuff”, but no more, so the force remains “light, lean and fast”. From this point of view, the Marines have an advantage over the Army in the sense that they never were able to carry a lot with them, just because they would often be sea-based, and the sense among the officials in charge of the war game was that “if the Marines cannot do that, nobody does”.

One of the major changes besides, and parallel to, the integration of various services within the MAGTF, is the existence of liaison officers embedded in units, able to go back and forth the pipeline. This is a major advantage in getting rid of the “iron mountain” mentality. At the end of the war game, there was a consensus that the MAGTF Distribution process did succeed in adapting to a decentralized battlefield and in increasing asset visibility, but that the augmentation in requirements was not matched by an augmentation in personnel. A recommendation was made about the potential use of reserve forces.

SECREP Management

The new SECREP management process was perceived by participants as improving the accountability factor, but that there was an increase in cost and footprint, as well as increased demand. This could however be solved, according to a participant, via a more tailored approach of SECREP allowances. The need for standardization was also stressed. The shift in the control of assets was discussed in terms of pros and cons: the advantages were that there was a “continuity of Ops when the MEF was deployed”, and that it provided a, “stable training platform for Active duty personnel”; on the other hand, the MEF was losing control of assets, budget and process.

Another question raised during some of the final outbriefs was the ability to test a piece of equipment just fixed at the battalion level. The answer was that more than often it is fixed without having to be tested (either it starts again right again or it does not), but that testing can be performed as long as the battalion is not on the move. One of the participants recast this question as follows: would it make sense to develop new equipment which would precisely allow Marines to test a repair on the move?



THE US Marine Corps are rationalising their support/maintenance structures. But whereas some armed forces have slimmed down to two lines of maintenance, the USMC is going from five Echelons of Maintenance (EoM) to three Lines of Maintenance (LoM).

KEY CHALLENGES OF THE FUTURE

A recurrent theme during the five days of war gaming in Quantico was summed up by one of the participants with these two very simple core-questions: “Who’s got the mission? Who’s got the asset?” The most frequent complaint has been to first clarify who was doing what, especially in terms of prioritization of assets, and secondly how reliable the new process was. Indeed, the questions of trust and accountability are at the very basis of the success of logistics reform as a whole.

Past experiences have often been rooted in the fact that whoever owned some assets would tend to hold on to them for fear of not being properly supplied on time. An interesting discussion took place during one of the outbrief sessions about whether or not to institutionalize a practice developed in Iraq, which has been consisting in carrying a small percentage of equipment in excess capacity (about 5%, 10% in the case of trucks). The balance between autonomy, with the extra-weight involved, and trust in the system is obviously a difficult one to achieve and one the Marines have been struggling with. In the case of this exercise, and according to one of the players, “based upon lessons learned during OIF, forward in-store capacity was included during the planning stages of the operation to provide a ready source of combat replacement equipment”. This concept of “forward in-store capacity” resembles mobile pre-positioning and is intended to facilitate force replenishment.

The problem lies however in the fact that it is not so maneuverable, and therefore needs to be calibrated in regard with future sustainment requirements. That is indeed the main change compared to the past, when pre-positioned logistics were in place. Another question raised was the fact that, “if lots of people were to carry SECREPs, how do you get them back to be fixed, and then sent back?” The current situation is that the repair tends to be done on the battlefield and the advantage of a small excess ad hoc capacity is precisely to be able, “to fix on-site as opposed to fill out the pipe of supply”. The consensus is that it is

better to repair as opposed to replace, especially given the problem of transportation likely to occur in wartime (e.g. “no truck to be found in Baghdad”). However, if this may be true for trucks and tanks, the “center for excellence to fix SECREP” is not necessarily at the battalion level. This raises issues not only in terms of transportation, but also as far as how much staff one needs at each level and what kind of qualifications are required.

Marines now involved in expeditionary warfare need to be more flexible, more autonomous and more qualified. The Marines have an advantage over other services as its training traditionally has been less specialized and strived to maintain the same level of quality across the board. As Major Applewhite pointed out, “the Marine Corps’ policy of ‘quality spread’ to assign officers across all occupational fields thus ensuring and equal distribution of high caliber officers in the MAGTF’s Aviation, Ground, and Logistics Combat Elements. Moreover, all Marine Officers are MAGTF Officers trained to understand all elements of the MAGTF, including their employment and support requirements. The resulting synergy combined with our expeditionary culture produces Marine Officers capable excelling across the full logistics spectrum.”

But for the logistics community, the current modernization pushes the process even further – As one participant put it: “training is cross-leveled across the enterprise”. The purpose of the LOGMOD 2007-2 was precisely to identify which additional skills would be necessary to achieve better results, especially at the regiment level, while assessing, “the complexities associated with task organized logistics in direct support of Regimental and Battalion-sized maneuver forces and challenge of developing and maintaining the logistics skill sets needed to manage and lead those logistics organizations”, according to Maj Applewhite. The need to “re-train in a deployed environment” was stressed: one of the major difficulties encountered is indeed for the logisticians to adapt “on the fly” to mission-oriented assignments, hence training needs to emphasize flexibility

and responsiveness. One participant noted that the good news was that the, “training was actually rather easy as long as one can do it at the unit level”.

One of the major future challenges for the US Marine Corps is to remain focused on its primary mission, i.e. expeditionary warfare, as the war in Iraq has been pulling it in the exact opposite direction. The Marine footprint in Iraq has been much heavier and longer-term than initially planned. The risks of drifting towards a “second land army” posture has been stressed by the USMC Commandant himself who recently proposed to deploy the USMC as the lead US force in Afghanistan, leaving Iraq to the Army as the lead force.. The USMC leadership is deeply concerned with losing their expeditionary focus. This is true in terms of training – neglecting some aspects such as sea-based operations for instance – equipment, logistics structure, and organization. What appeared clearly during this war game is that the dilemma for the logistician is to constantly base his/her decision on a “balance between the best solution and the better one”, according to Maj Applewhite.

A key challenge facing logistics reform is the disjoint between new approaches and shifts of authority, and the fielding of the IT technology which empowers the transition. The whole concept underlying LOGMOD relies on a new C2 architecture, which should be available within a two-year framework. As stated by Lieutenant-Colonel Darryl Barnes, “*Marine Logistics ... 2015 Style*” (*Proceedings*, November 2006, p.56), “Technological enhancement, spearheaded by the Global Combat Support System Marine Corps that provides a single program and point of entry to access critical logistics data, will have the most impact on logistics modernization initiatives. Combined with state-of-the-art command and control systems with increased bandwidth, Marines across the battlefield will benefit from real-time logistics status updates”.

During the game, the participants engaged in observing an exercise off site where the new Oracle system was being tested. Reactions were solicited from the game participants concerning what they saw and would like to see in the IT reform effort, notably with regard to metrics.

WAR GAMES AND THE CHALLENGE OF REFORM

If many Marines concluded that they were not “ready for prime time yet”, LOGMOD 2007-2 did help however to identify the potential gaps in the system and “choke points in the Log Order of Battle”, which means that, from this point of view, the goal of the exercise had been attained.

One of the primary advantages of logistics war gaming has been, from the point of view of many of the players involved, to bring together a large group of logistics professionals, who never had a chance till last year to meet in person and work directly together. Some institutional walls are hence starting to vanish, as the structures are being collapsed into more functional entities.

Indeed, in his introductory remarks, the officer in charge of the event, Brigadier General David G. Reist, strongly emphasized the importance of teamwork and how such an exercise contributed to do so by bringing multiple perspectives to the table: “We are all looking at the same Rubik’s cube: we are just looking at different sides of it.”

War gaming is also the only process that puts together not only the elements of the restructuring of the Marine logistic community, but also the lessons learned from the current operations in both Afghanistan and Iraq. The level of combat experience among participants was, indeed, quite impressive, and brought a sense of urgency in the way issues were addressed and solutions proposed. One of the recommendations made at the end of the exercise was to go even further next time by maybe increasing the links with the operational side and by moving from a seminar-style game to a “game with screen”.

If, for some of the participants, the overall conceptual picture is still in flux, LOGMOD 2007-2 was unanimously acknowledged as a step in the right direction and helped identify the difficulties and challenges ahead. By bringing a large group of Marine’s together with recent combat experience, the right focus was evident throughout the game: “where do we bring LOGMOD to support the needs on the battlefield?” ■



USMC

The LOGMOD war games have been called as “a seminar-style war game”. It is hoped that future iterations will see real time input from operational units.

October 22, 2007

Approximately 35 years ago the first generation, near real-time reconnaissance satellite system was authorized and a little more than five years later it launched! While there were birthing pains, it and its successors served the nation well for 30 years and still counting.

Fast forward to the present; the satellite acquisition program landscape is littered in billion dollar plus-overruns, nearly decade-long development schedules and an industrial base and acquisition management system that routinely fails to deliver on commitments. As a former satellite geek with the highest respect for the contract and government personnel and institutions involved in these pursuits I offer the following top 10 observations on why program failures like Future Imagery Architecture (FIA), Space Based Infrared System and some more in the making exist:

No. 1: Competition is a dangerous game.

Where else but space acquisition can a contactor write a slick proposal, commit to give the customer what they want, lack the past experience and

knowledge to deliver and have their costs covered to learn and inefficiently produce the system? And where else can a customer ignore tens of billions of dollars of prior investment in a mission area "believing" that the new kid on the block can overcome these prior investments and deliver even more capability at a lower cost than the legacy team? Competition — you just have to love it!

No. 2: It's the economics, stupid.

The most fiscally efficient programs are those in which you complete development, build several of the design and evolve new capability into periodic block changes staying with the same government/industry team. Examples include the Defense Support Program, Defense Satellite Communication System, the predecessors of the FIA, etc. This leverages the power of amortization lowering unit cost and significantly reduces

learning risk and attendant overruns. This is the exception today rather than the norm.

No. 3: Goldwater-Nichols reform and space acquisition is an oxymoron.

Does anyone really believe we would have today's superb Global Positioning System or an overhead satellite reconnaissance system if the operators were in charge? No way — they wouldn't have been able to articulate the need, and certainly wouldn't have prioritized it or funded it over the day-to-day needs of the operational commands. Finally the operators are ill-equipped to manage the technical requirements process needed to acquire a modern-day satellite system.

No. 4: The program manager function has been seriously wounded.

Time is money in satellite acquisition programs, Murphy's Law does apply, and issue reso-

lution requires timely decisions to keep competing demands of schedule, cost and capability in balance. These are not committee or panel or "Mother, may I" circumstances but the realm of an accountable capable program manager. They don't exist today at any level in the space acquisition chain and it has nothing to do with the capabilities of the involved individuals. It is the assignment of the responsibility without the authority to make the call and have it stick.

No. 5: It's about the quality, not the quantity of system engineering.

Good system engineering is grounded in a repeatable and comprehensive process staffed by competent people. It is a critical and difficult assignment that requires a degree of independence and first among equals relative to the product segments. Few programs being acquired today have or under-

stand the process required — never mind the implementation — and the deficiency has little to do with number of systems personnel available.

No. 6: Congressional interfaces.

Let's face it congressional appropriation and authorization staff have significant leverage over acquisition program efficiency. Too many line items, reprogramming timelines, funding instability, breaks in production schedules, etc., contribute to the situation. Acquisition leadership is challenged to fundamentally change this interface or learn to make the current interface work for them and that will require an up close and personal approach with congressional staff that doesn't exist today

Nos. 7-10.

Go back and read No. 1 through No. 6 again and understand they all work together to create the situation we face today in National Security Space Acquisition.

Al Smith is a retired senior Lockheed Martin executive who also worked at the National Reconnaissance Office.

New Possibilities in Space for U.S., France

< ROBBIN LAIRD >

The Sarkozy administration's clear commitment to working with the United States on global security policy creates new possibilities for trans-Atlantic co-operation. With the United States assured of a new president in 2009 and the new French administration already rethinking its own security, defense and space policies, the next U.S. administration will have an opportunity to build an important new partnership — but that effort could begin even now.

By engaging the Sarkozy government immediately, the Bush administration could set in motion processes that would facilitate positive changes the next administration could build upon. The next administration will inevitably face the challenge of reconciliation with allies and working through new international initiatives to reshape the global security agenda and environment. Rather than writing memoirs justifying their past actions, the country would be far better served if the nation's current executive leadership set in motion a reconciliation that would serve as a real legacy for future generations.

There are three major efforts that ought to be addressed.

First, the United States, France and other European allies need to launch a real collaborative military space effort, one in which the military's digital future is anchored in a collective defense and a new, more effective global security system.

Second, the United States and Europe — led by France, which spends more on space than any of its partners in the European Space Agency — need to

work together to support entrepreneurial space companies.

Third, the United States and Europe need to become full partners in the exploration enterprise.

Bold new initiatives are not required. Ongoing national and other separate efforts in civil space ought to be coordinated to avoid the current duplication of effort all around the globe.

Piaget, the famous Swiss child psychologist, wrote about the play of young children being that of parallel play whereby children have not yet learned to play together in a team effort. As we move into the next 50 years of space exploration, leaving our infancy, it will be necessary to move beyond parallel play to team play, to become realistic about the limitations on resources, energy and efforts shaped on purely an American or European basis.

Intersecting European and American efforts can provide energy that neither side has by itself. The rise of the non-Western space powers provides a realistic challenge requiring the West to pool resources and efforts. By crafting a more effective collaborative trans-Atlantic relationship, a more open architecture would be created for global allies such as Japan and India to participate more fully in a global space enterprise.

Crafting a core, trans-Atlantic exploration architecture would be a central pillar to the global space enterprise. The Bush administration deserves praise for re-energizing the human exploration efforts of the United States. Yet the current plan is too narrowly nationalistic to sur-

vive contact with financial and technological realities.

By re-crafting the exploration enterprise to be a U.S. inspired effort to shape a modular approach to Moon exploration, a full engagement of France and Europe would be much easier. After much hesitation, European space leaders are publicly, but even more privately, interested in the Moon exploration effort. But to gain full commitment of limited resources, decision-making needs to be shared and Europe should be a full partner in crafting a modular approach to the exploration effort.

A good transition element is easily at hand. The Bush administration wishes to end the life of the shuttle to open up the way for the new Ares launch vehicle and Orion crew capsule, but with the shuttle fleet set to retire in 2010 and Ares and Orion not scheduled to come online until at least 2015, there will be a significant capability gap in getting humans and cargo to the station, forcing both Europe and the United States to rely on the Russians.

One opportunity to change that dynamic would be for the United States to make greater use of Europe's Automated Transfer Vehicle (ATV) to transport cargo to the space station in the post-shuttle era. European space transportation also can be part of the overall strategy for returning to the Moon.

Entrepreneurial space efforts must also be an important element of the way ahead for Western space strategies. Europe has been very reluctant to embrace entrepreneurs, but this could be

changed. NASA has focused on its Commercial Orbital Transportation Services program (COTS) to speed the development of commercial services capable of providing transportation to the space station before Ares and Orion are ready in the middle of the next decade. However, it is highly unlikely that the COTS competitors will be available in time to reliably end shuttle flights.

Using ATV in a commercial way in addition to the role it will play as part of the intergovernmental agreement that governs the space station partnership could be a transitional commercial solution, a bridge between the shuttle and a more entrepreneurial approach to space transportation.

Sarkozy's renewed emphasis on entrepreneurship — after all this is a French word — can be extended to space and France should embrace the support of entrepreneurs and perhaps encourage the development of European prizes like the Google Lunar X Prize.

The most immediate focus should be on collaboration in what has historically been called military space. Military space is a digital domain increasingly shaped by the Intelligence Surveillance Reconnaissance (ISR) enterprise that operates from space and airborne assets tied to an increasingly complex ground-based processing domain. As the digital domain becomes the heart of the military and security systems crucial to protecting the West, there are numerous new possibili-

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ties for collaboration.

An initial effort could revolve around what the Secretary of the U.S. Air Force calls shaping the "global security enterprise." By forging ISR and command and control regimes that can share information, core states can shape common actions to provide for enhanced security.

For example, if France and the United States could more fully shape common approaches to maritime domain awareness and sharing of data on maritime security, a key element for using space systems to contribute to common security would be put in place. Shaping common protocols in sharing of digital data is the core effort required to craft the "Link-16" regime for space generated data and processing systems. While "Link-16" has allowed coalition aircraft to work together, a similar effort is required with respect to space systems. The new France under Sarkozy could become a key partner in this effort.

Another logical strategy would be an effort to revisit the Global Positioning System (GPS)-Galileo competition. Galileo has not been effectively funded, in part, because of the correct perception that GPS 2F and, certainly, GPS 3

will be far more capable, and reduce the threat of signal degradation.

The inclusion of Europe in the GPS 3 enterprise if crafted now and crafted to include European capability within the system might provide a new impulse to European-American collaboration. European capabilities can be the provision of satellites to the system, transponders on the system, or, more innovatively, transponders on Globalstar (which is closely associated with Europe) or on Iridium constellations. By engaging Europe fully in GPS 3, the United States could lead an effort to gain much greater robustness and survivability to the GPS system.

In short, the Sarkozy opening provides an opportunity to redirect both U.S. and European space efforts in a direction more likely to meet the objectives of both sides. European collaboration by itself fails to generate the resources and energy necessary to provide for effective space leadership. And U.S. efforts which confuse a national vision with global leadership need to be redirected to shape a collaborative space effort which the West can embrace.

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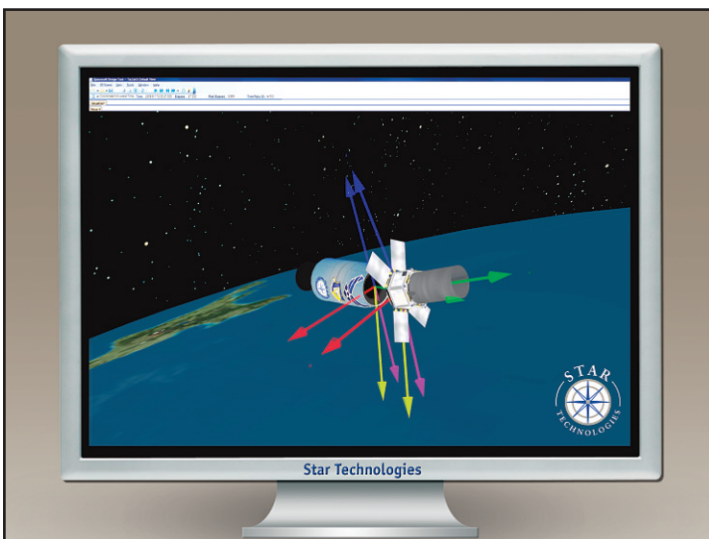
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**21st CENTURY AIR BATTLE MANAGEMENT**

A subject which is widely ignored, but of increasing importance, is air space management – a subject that includes many aspects from 'blue-on-blue' to battle management. We aim to explore many of these in this and subsequent issues. We start with a discussion on the use of new technology and new air platforms to provide an alternative to the relatively vulnerable ground-based combined air operations centre (CAOC) and the effect that this would have on strike options in the Middle East.

Crafting 21st Century Air Battle Management: A Critical Deterrent in the Middle East

by *Dr Robbin Laird*

Robbin Laird is Chief Partner of ICSA LLC, a Paris- and Washington-based aerospace and defence consulting company. Here he considers how an air battle management system shaped by the fifth-generation aircraft and their associated technologies will introduce a whole new meaning to the CAOC as a weapon system, and provide new options for the US in the Middle East.

While there has been much press on the Iranian challenge in the Middle East, there has been considerably less discussion on how Iran might be deterred or dealt with in various Middle East contingencies. Notably, in the United States, the Bush Administration's initiation of actions against the former government of Iraq has shaped the public discussion. This discussion essentially boils down to an all-or-nothing strategy: the US will discuss with the Iranians and tough choices will be obviated or the US will suddenly strike with massive air and naval assets to start 'regime change' in Iran. The difficulty rests on the fact that neither option is very realistic in terms of US options or likely Iranian behaviour.

The barely noticed story of the Gates Pentagon denying three times requests by the US Air Force to deploy the F-22 to the Middle East should have suggested another dimension of how to deal with Iran. But because there is a misperception that the F-22 is part of some 'future war' considerations and not relevant to anything ongoing in this part of the 21st Century, a core dimension of deterrence of Iran was missed. At the heart of the deployment of the F-22 would be the effort to shape a 21st Century battle management system for the Middle East, one which can provide an effective deterrent to Iran or, in the case of the

failure of deterrence, robust military options across the spectrum of conflict.

At the heart of the deployment of the F-22 would be the effort to shape a 21st Century battle management system for the Middle East

Rather than an all-or-nothing option, the President would have a range of capabilities available to work with core allies in the region. A 21st Century air battle management system could provide a core capability for allies to work together to craft a secure second-strike force against Iran, making it clear that any strike against our Arab or Israeli allies would be met with a spectrum of options available to a strike force directed by the F-22.

The CAOC as Weapon System

The USAF considers the Combined Air Operations Center (CAOC) as a weapon system in and of itself. But until the advent of the fifth-generation aircraft, CAOCs are physically located on the ground or dependent on AWACS, which presents a large profile for available air-to-air missiles. With the advent of the fifth-generation aircraft, first by the F-22 and then by the much more numerous and allied-anchored

F-35, the CAOC will become enabled by the flying ISR and C2 systems which constitute the fifth generation. The combination of sensors and stealth allows the new aircraft to operate at altitudes (in the case of the F-22) or over adversary air space (in the case of both aircraft) that allow the aircraft to serve as nodes in a dispersed or distribution air battle management system. In this way, they act as an extension to the CAOC.

F-22 in Battle Management

As Western-Arab allies deploy new generation aircraft (in 2009 with the Typhoon in Saudi and the Block 60 F-16s now in the UAE), there is a real opportunity for the US to craft a new air battle management system which operates at higher altitude and is not subject to Iranian strikes against ground-based installations. The Pentagon talks of building partner capacity, but here is an instance where simply leveraging capacity may turn the tide. The F-22 is evolving into a battle management system able to fly at substantially higher altitude than the F-35. After performing its air dominance missions, the F-22 can transition into a battle management and strike management aircraft. Indeed, with Block 35, the F-22 can be conceived of as the brain of the overall strike force of air and naval strike assets.

The USAF wished to deploy the aircraft to start the process of learning how to shape a new air battle management system, and as the F-35 deploys, lessons learned by the F-22 and allied concept of operations experience can be transferred to the new aircraft.

This connectivity focus has received a new boost from a recent Joint Requirements Oversight Council (JROC) decision. In July, the JROC approved the F-35 data link as the new standard for integrating low-observable airborne assets in denied-access environments. Specifically, the Multifunction Advanced Data Link (MADL) is to be used by both the F-22 and F-35 as the centrepiece for their data transfer and, because the fifth-generation aircraft will be transferring data to robotic airborne radars, the MADL will be important for the next-generation UAVs as well. The JSF MADL system includes six phased Array Antenna Assemblies (AAAs) and three Antenna Interface Units (AIUs). The system allows aircraft to communicate within and between flights in order to share a common view of the battlespace. USAF and senior officials in the JSF programme office view MADL as the centrepiece of elaborating a new relationship between manned and robotic aircraft. Currently, UAVs are built with little regard to their connectivity with manned systems. With the F-35 coming on line as a 'flying combat system', to use the phrase favoured by the USMC, the computer systems of the F-35 will manage new robotic systems. And those robotic systems will become part of the airborne air battle management system. As General Davis has recently underscored, "We will change processing systems twice within the next five years. We will do this by simply taking out the chip and replacing it. The F-35 is a flying computer able to manage the battlespace."



A Significant Evolution

By crafting a new battle management system directed by the fifth-generation aircraft, the Iranians would be facing a distributed strike and strike management asset able to strike against limited targets on their territory or adjacent to their territory. They would be facing as well a core asset able to lead a concerted, comprehensive allied strike against specific or general targets dependent upon Iranian actions. In other words, rather than being a futuristic weapon, the F-22 and then the F-35 would be part of a very significant evolution of air battle management in the Middle East – an evolution crucial to deterrence of Iran and reinforcement of allied capabilities.

The F-22 is evolving into a battle management system able to fly at substantially higher altitude than the F-35

This will be especially significant as Iran procures modern air defences from potential vendors. Countering air defences is increasingly difficult given the evolution of Chinese and Russian mobile systems. For example, the SA-10 can be dismantled, moved and ready for action in a very short period of time. The trend line is towards rapid mobility in the adversary's air defences, and mobility in this domain means that the incoming strike aircraft must be able to do target identification, target acquisition and strike missions simultaneously. A key aspect of the new fifth-generation aircraft is its machine-processing capability onboard, which allows the pilot to simultaneously do operations that historically required several platforms operating sequentially.



An F-22 Raptor is marshalled in preparation for a hot refuelling [US Air Force, Airman 1st Class Jamal D. Sutter]

And discrete targeting options are available as well. If the F-22 had been operational in 1998, the senior terrorist leadership targeted by President Clinton would not likely be alive today. Given the ability of the F-22 to penetrate air space undetected, and the ability to process battle damage information and to re-target ordnance on board, a wave of F-22s can operate to eliminate even hardened targets.

Such a system allows the generation of a much wider range of attack options and an ability to redirect and strike against remaining targets very rapidly

Survivable, Dispersed and Capable

By integrating the F-22 and then the F-35 into an evolving air battle management capability, the US and its allies would have a more survivable, more dispersed and more capable system. Indeed, the whole point of the battle management system directed through the fifth-generation aircraft is that battle management can be generated

throughout the distributed network. Clearly, working through the 'connectivity workspace' to achieve a new air battle management system is a strategic challenge, yet it is one which is inherent in evolving technologies.

Such a system allows the generation of a much wider range of attack options and an ability to redirect and strike against remaining targets very rapidly. The acknowledged capability to communicate and be responsive to tactical battle commanders would greatly leverage any ground forces that may be required for low collateral damage missions. As a result, the new air battle management system will allow a much more flexible set of strategic and tactical options for decision-makers. Flexibility allows decision-makers to shift away from all-or-nothing deterrent options; and peeling away at the onion becomes a very viable effort.

In short, air battle management shaped by the fifth-generation aircraft and their associated technologies will introduce a whole new meaning to the CAOC as a weapon system. In fact, it will allow the CAOC to move more towards the US Marine Corps' understanding of distributed operations, and become more involved in deep operations. And as it does so, decision-makers will have more effective options in dealing with adversaries. The Mullahs of Iran like absolutes; it would be good to give them a range of relative threats that they have no absolute possibility of eliminating. ■

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Evolving Defence Business Models: Challenges of Globalisation, Systems Integration and National Interests

by *Dr Robbin Laird*

Robbin Laird is Chief Partner of ICSA LLC, a Paris- and Washington-based aerospace and defence consulting company. He considers the future for Western defence industries and the challenges that both governments and industry will have to face.

As we face the end of the Bush Administration, the retirement of the father of the UK Defence Industrial Strategy and the processes accompanying the new French White Paper, it is a good time to reflect on how Western defence business models might evolve. Defence business models are explicitly or implicitly based on the partnerships between government and the private sector. Those partnerships are always under stress and subject to change and the next few years will see an intensification of conflict within those partnerships.

Industry faces the overall challenge of adapting to global supply chains

As we face transition, several challenges can be identified which will shape the future course of the defence industry and its partnerships with government and the militaries, which industry serves. Industry faces the overall challenge of adapting to global supply chains, serving militaries involved in global operations, shifting from platforms to systems, the growing salience of services, the political underbelly of globalisation, and the crosscutting advantages of providing lead systems integrator functions to governments. Governments face the challenge of coming to terms with

industry seeking global footprints, lean production and flexibility of operations. Governments want to be prioritised by 'their' industry while industry seeks global capacity to provide customised solutions to 'their' governments. Tensions are inevitable with such crosscutting orientations and approaches.

Which companies will survive the downturn in spending? Which strategic changes will be generated by the new Administration?

The Next Phase

With the end of the Bush Administration and recalibration of the Iraq engagement, the next Administration will pose new challenges to industry. The US defence industry has benefited from being lifted by rising waters and the war in Iraq has revitalised once moribund industries, such as the ground vehicle business.

The end is in sight. Which companies will survive the downturn in spending? Which strategic changes will be generated by the new Administration? Which industrial players will prove best positioned and most agile in making the transition?

It appears that the US is heading into one of its cycles of intense criticisms of contractors – it is not clear what will symbolise the \$600 toilet seat, but surely a symbol will be at hand. Furthermore, the US Congress has now outlawed the use of lead systems integrators for defence

programmes, which means that the US government will be challenged to define its relationship with the large systems integrators it will inevitably continue to rely on to a very significant extent for its military and security capabilities. For allied governments, change is afoot as well. With the retirement of Lord Drayson, the clear commitment of government to a strategic bargain between industry and government on strategic sectors is unclear. The UK relies on foreign contractors more than any allied government, so working through a firm commitment to strategic sectors for UK MoD makes a lot of strategic sense. But will this effort continue? And what role will the private sector play in the evolving defence strategy of the United Kingdom?

With regard to France, the pending release of the White Paper of the Sarkozy Administration will be the beginning of a blood-letting between government and industry over the strategic partnerships between the two sectors. With President Sarkozy's clear commitment to working with allies, French industrial policy will be moved towards more open markets. The surprise decision in the US towards a transatlantic tanker will challenge Sarkozy to open his markets more effectively and deliberately. How will the defence majors, notably EADS and Thales, respond?

Key Industrial Challenges

As always, Western defence companies, being publicly traded, face the challenges of the stock market and the availability of credit. As US spending goes down, the concerns of the 1990s are likely to return. How will defence companies be able to demonstrate to shareholders a stable shareholder value? At the end of the day, aerospace and defence stocks are

of interest to institutional shareholders largely because of their relative stability. Without stability, values deteriorate and governments face the challenge of re-stabilising their defence industrial sectors. The US build-up of the Bush years provided a strong residual support for the UK as its defence companies reached deep into the American heartland to build up capability within the US. Any downturn in the US will put pressure on the UK Government as well.

With President Sarkozy's clear commitment to working with allies, French industrial policy will be moved towards more open markets

A particularly compelling challenge for the large defence and aerospace companies is effectively competing in the presence of global supply chains. On the one hand, defence companies serve 'their' national masters, but on the other hand they draw from transatlantic and global suppliers. This is especially true with the rise of countries like India in providing digital content and software to global industry.

National debates do not effectively take this into account. For example, the recent tanker decision by the USAF has been heavily criticised for relying on the 'French' company EADS to provide the tanker, with the claim that 40,000 jobs will be lost. It is even suggested that US pilots will soon have to speak French to fly American tankers. Besides the patent untruths of all of the above, it has not mattered to the critics of the debate. How 12–15 airframes a year provide 40,000 jobs is a mystery to most analysts. This is in addressable market over the next 20 years of a projected 25,000 airframes. Both the Boeing and Airbus airframes are globally sourced. The core national jobs are customising the aircraft for the USAF customer and these are exclusively US jobs. But the debate reflects the problem and Boeing, notably, has not

minded playing the national champion card while being one of the most effective commercial players in globalisation.

The shift from platforms to systems changes the nature of industrial competition. Historically, platform builders have sought to monopolise the systems, which are put on the platforms in order to build an effective relationship with 'their' national government. But, increasingly, governments want modular platforms with competition for the systems placed on these platforms.

And further competition is provided with regard to the place of particular platforms within the networked capability of national and coalition forces. For example, the F-35 is in many ways the first-generation flying combat system, rather than a fifth-generation aircraft. Nations, which buy the aircraft, will be concerned to leverage the combat systems capability of the aircraft to help integrate ground and maritime forces with air capabilities. Which companies within the procuring nation will be part of the business plan to do this?

The growing salience of logistics support and services both at home and abroad for a nation's armed forces will be crucial to the evolving business models of defence firms. The original equipment manufacturers have a special role in this effort, but not exclusively so. Indeed, governments will seek competition to provide the logistics services and support necessary for their equipment at home, and certainly in support of deployed forces. And cross-national efforts for deployed systems will provide a way to reduce costs as well.

But services do not carry the same profit margin as the manufacture of equipment. How will defence firms manage portfolios of capabilities, ranging from manufacturing to services? And, because these portfolios carry with them very different profit margins, how will companies effectively manage diversity across their companies?

Finally, governments will continue to rely on the large companies to provide systems integration skills and cross-sectoral

capabilities necessary for modern defence at home and abroad. The lead systems integration (LSI) concept was generated as shorthand for the public-private partnership to provide for such capability. Although heavily criticised now in the United States, the function remains important.

But what experiments like Deepwater with the US Coast Guard (USCG) have demonstrated is that you cannot have an LSI without an effective partnership. The USCG is effectively dismantling Deepwater and going back to a platform-by-platform acquisition strategy because that fits its culture. Yet the strategic goal of Deepwater – to provide for a strategic missions context and concept of operations approach within which asset acquisition would occur – remains as significant as ever.

On the one hand, defence companies serve 'their' national masters, but on the other hand they draw from transatlantic and global suppliers

Key Governmental Challenges in Dealing with Industry

A most compelling mismatch between government procurement and global industry has opened up. Governments still tend to think in programme-by-programme acquisition while industry is looking at global markets and partnerships to deliver value to shareholders. The gap is significant and growing as providers become increasingly global.

How does government effectively manage its equities in the defence sector? A bureaucratic control response is characteristic of government seeking to control processes rather than looking at outcomes. Governments face a significant shortage of qualified procurement personnel – a shortage that will likely be chronic – which makes a bureaucratic approach to control of industry significant.



Governments seek to control the proliferation of defence technologies for legitimate reasons – to reduce the threats which they will face in the global environment. But the global supply chains outpace the technology controls. And national approaches that look at widgets rather than supporting strategic capabilities will undercut real technology controls. The problem of technology control will only deepen as the global economic landscape changes in favour of India and China, or to put it a different way, the engagement of Western firms in India and China go up.

The growing salience of logistics support and services both at home and abroad for a nation's armed forces will be crucial to the evolving business models

The problem is exacerbated by the growing digital content of defence systems, growing reliance on telecommunications, the globalisation of software development, and the globalisation of the components that go into defence systems. Nationalistic solutions will simply fail to deal with the challenge, and will leave the nation that decides to isolate itself looking increasingly like the ever-decreasing capability of the Soviet arsenal at the end of the Cold War.

The Way Ahead

Constrained spending will enhance the struggle for survival among the major defence firms. Because of defence consolidation, the struggle will entail seeking to shape the contours of the nation's strategic policy to favour the mix of capabilities, for which the particular company is best positioned. But this can go only so far, as the leaders of a nation are forced to deal with changing strategic realities.

As national leaders reshape forces to meet evolving strategic needs, the large contractors will face the challenge to

adapt. The large defence primes have not fully met the challenge of real integration across their internal sectors or business groups, but with constriction of spending, pressure for creating greater synergy within the large companies will grow. Those companies with more internal agility will be best positioned to take account of strategic realignment.

There will be a smaller number of new platform starts as governments pursue modularity. Competition will shift to the enablement of modular platforms. Control of platform production will clearly provide a leg-up on the competition, but it will not eliminate it. As security challenges grow in importance in relation to military ones, the large defence primes will face increasing competition from the commercial sector. This will be especially true as protection of the global infrastructure grid becomes of increasing salience to global players. Commercial companies in cyberspace, IT, communications and related sectors are better positioned than defence primes to provide global solutions. But the defence primes are the specialists in negotiating with governments and will remain central gatekeepers for those governments.

An additional security challenge facing defence primes and their suppliers is protecting the integrity of the supply chain. Cyber-attacks and cyber-warfare are of enhanced concern in the years ahead. Ensuring that the virtual enterprises which underlie modern research and development (R&D) and manufacturing systems provides multiple attack points for the modern cyber-warrior. Protecting against such challenges will be crucial to both industry and government in tapping into a complex supply chain.

And supply chains are vulnerable to a number of global challenges as well, ranging from currency fluctuations, through transport of core subsystems and core components, to potential political conflict, which can erode support for a robust commitment to building a collaborative product. Effective management, in providing for global alternatives in light of evolving global dynamics, will be a key part of

supply chain policies for both industry and government.

New technologies, notably nano-science and nano-technology, will emerge, pressing for strategic redesign of new defence systems and capabilities. Defence companies will seek to position themselves through commercial and global partnerships to be able to leverage these new technologies. But the overwhelming majority of these technologies will **not** emerge from the defence sector, but rather migrate there. Those defence companies, which can position themselves most effectively to partner with technology and R&D firms, will redefine themselves as capability providers for their governments in defence and security.

Governments will face a significant challenge in restructuring to provide for strategic leadership in providing oversight to 'its' defence industry. As this industry can survive only by living off global technology and supply chains, governments will be challenged to ensure that strategic needs can be met in a cost-effective and timely manner.

New technologies, notably nano-science and nano-technology, will emerge, pressing for strategic redesign of new defence systems and capabilities

In short, the next decade will see spending constraints, new challenges to reshape the public-private partnership in the defence sector, and a very fluid global environment within which industry will both collaborate and compete with governments. To meet global challenges, government needs an industry that speaks 'global'. But nations continue to speak 'local'. Balancing the tensions between 'local' and 'global' will be a central challenge for the defence primes in the decade ahead. ■



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July 28, 2008

The Future of Military Space

< ROBBIN LAIRD >

The recent controversial firings of Secretary of the U.S. Air Force Michael Wynne and Air Force Chief of Staff Michael Mosley provide a strategic inflection point to reflect on the evolution of the U.S. Air Force and the implications of that evolution for military space. The U.S. Air Force is at the center of U.S. military space, both in terms of procurement and demand. Nearly 85 percent of all U.S. military data go through Air Force systems, and the dependence of U.S. military connectivity on the Air Force is crucial enough that Secretary Wynne placed significant emphasis on the challenge of crafting cyber capabilities to defend the network.

After having worked through the "Back to Basics" effort led by former Undersecretary of the Air Force Ron Sega, the service's military space effort has been stabilized, but the future strategic direction remains to be fully determined.

Much like the challenge of replacing the shuttle, the military space sector faces the replacement of an entire generation of satellites. Either the regeneration or replacement of the current military space architecture is required. This is especially important since the next presidential administration's preferences for military strategy and procurement cannot be determined at this point — no matter which candidate wins. Indeed, the twin challenges of replacing the shuttle and determining the strategic direction of military space will determine to what extent the United States is at the center of 21st century space activities.

One path would see air systems function largely in their own domain as shapers of air combat; the F-22 would be seen as the successor of the F-15 and the F-35 as the successor of the F-16. Robotic vehicles would eat away at the numbers of manned aircraft but would largely function either as adjuncts of the air battle or the flying intelligence, surveillance, reconnaissance (ISR) platforms for U.S. ground forces.

Following this latter path, the approach would be to continue to focus on significant space-based ISR and communications systems to support global air operations and U.S. ground forces when they are initially inserted into combat areas. The heritage structure would be replaced by a significant investment in satellites and systems with robust capabilities able to do complex support activities without relying on significant air-breathing intermediaries.

A very different path is suggested by the potential of the fifth generation aircraft and their associated robotic systems. Here the onboard processing capabilities of the F-22 and F-35 would be recognized for what they are — namely, breakthrough capabilities to process data for their own use, for the network of air combat systems and to integrate their capabilities with maritime and ground forces. Wynne refers to this as the air systems providing spherical situa-

tional awareness to the ground and maritime forces. As the manned systems are deployed and their capabilities better understood and exploited, the role of robotic vehicles in the air network will go up dramatically.

A wolfpack concept is likely to emerge in a way that allows the manned systems to direct and be embedded within airborne robotic networks. Those robotic networks, in turn, would work closely with maritime and ground forces. The capability of providing for collaborative decision-making among maritime, ground and air commanders becomes possible as the interactive network shapes options and provides choices to the joint commanders.

The role of space in this world has the potential to become radically redefined. The proprietary U.S. military space network is most significant when the U.S. seeks to establish air superiority and conducts joint and combined maritime and air strikes against adversaries, either nation state or discrete adversary targets located on foreign territory. Here the interaction among U.S. military systems must be carefully protected and highly integrated for a successful insertion of force. In a way, given the key role of the evolution of the F-22, the military space network would be sized to support this initial air superiority and air

dominance effort.

The impact of the fifth generation aircraft on the overall U.S. military enterprise has not been well articulated by the U.S. Air Force. The F-22 has the potential to become the centerpiece of the U.S. strike force. As the connectivity of the aircraft is enhanced to take advantage of its significant situational awareness capability, the F-22 can become the brain of the strike complex.

The F-35 is not an air superiority aircraft, but rather a "flying combat system." Its ISR and command and control (C2) capabilities will make it capable of becoming the centerpiece of the kind of air-ground operations we have experienced in the last few years of warfare in Iraq and Afghanistan. How the U.S. Marine Corps has been articulating its approach to the use of the F-35 at the centerpiece of its Marine Air Ground Task Force is the harbinger of what could be done for the joint forces.

After the establishment of air superiority and support for the joint strike effort has succeeded, and, if the mission requires the insertion of force and its support for initial operations, then the reliance on proprietary military space can go down dramatically. Reliance on inserted air assets — the manned and unmanned network — to provide flying ISR and communications support would

reduce the need for proprietary military space assets as well.

In addition, as ground forces become predominant, more coalition forces are likely to play enhanced roles as well for operations like stability missions. In such a situation, reliance on commercial systems — encrypted — but not based on proprietary U.S. military satellite buses or systems can go up dramatically. Innovative approaches such as the use of hosted payloads can be aggressively pursued if one exploits the advantages of the new generation aircraft and their networked robotic systems.

But if these advantages are not exploited, because of classic military stovepiping and service separatist mentalities, then the need for proprietary military space systems goes up. However, the investment dollars are unlikely to be available to do so. The end result is that the holy grail of ubiquitous bandwidth for the Global Information Grid will not be provided. Indeed, one can question whether the technology or the dollars are available to provide for such a goal.

Rather, the opportunity to exploit the twin promises of the new fifth generation aircraft with new opportunities provided by commercial space is available. But options do not create capabilities without significant effort and clear focus. Will the new administration take advantage of this opportunity?

Robbin Laird, PhD, is an independent consultant who has worked closely with the U.S. Air Force, Marine Corps, Navy and Coast Guard for many years and has focused on the connectivity challenge to craft combined and joint forces.

Building Transparency in Space

< THERESA HITCHENS >

Senior Pentagon and U.S. Air Force leaders have insightfully recognized that international cooperation among governments and the satellite industry will be required to ensure the level of space situational awareness (SSA) needed to protect U.S. and the rest of the world's orbital assets. In recent months, a number of senior U.S. officials — from both the Defense and State Departments — also have been traveling abroad to discuss potential future data-sharing plans with U.S. friends and allies with an eye to creating a so-called "Neighborhood Watch" network.

Today, the majority of space actors receive orbital data from an Air Force-run program known as the Commercial and Foreign Entities (CFE) program. There is broad agreement in the government and commercial space communities that this program needs to be substantially revised. The Air Force, in fact, currently is undertaking a study of SSA needs and is attempting to develop a solid plan for improving its outdated approach to sharing data gathered from its global sensing network. But while nearly everyone agrees on the need for better data sharing to increase transparency in space, avoid collisions and monitor debris, the question of how that will be done is as yet unclear.

Thus, many of the major actors in the

commercial satellite industry recently have banded together to begin examining new ideas for data sharing. One concept, known by the rather bland moniker of the "data center," would seek to create a shared repository of information about satellite positions, using both carefully protected operator data and Air Force space surveillance data. Eventually, this center could provide an automated conjunction warning and assessment service for the geostationary belt. The idea is to establish an economical and trusted voluntary system that exploits current and emergent capabilities, rather than simply adding more operator data into the current decades-old system.

In addition, others in the international satcom community also are informally exploring the possibility of a truly global SSA database that would include inputs from a wide range of spacefaring nations — not just the United States — as well as industry. Indeed, there are a number of potential sensor assets in Europe that could contribute; French President Nicolas Sarkozy has pledged to spearhead the development of a collaborative European space surveillance network. The concept of a global database further is being considered as part of a larger effort to define cooperative measures to sustain the long-term use of space, launched by Gerard Brachet, the

outgoing chairman of the U.N. Committee for the Peaceful Uses of Outer Space in Vienna, Austria. Based on industry experience so far, this is a feasible goal — unless politics get in the way.

And, sadly, politics and bureaucracy seem to be impeding progress already. Despite industry attempts to engage the military space community in the ongoing commercial discussions, the Pentagon and Air Force Space Command so far have failed to fully and constructively engage. This is disturbing, as it is apparent that many of the needed improvements for data sharing, prediction of close approaches — or "conjunctions" — and methods for collision avoidance already could be implemented based on industry know-how. For example, the Center for Space Standards and Innovation, a space research group in Colorado Springs, Colo., actually has launched a process for data sharing and conjunction analysis that is significantly more responsive, both in time and specificity of output data, than current Air Force practice. Further, standards for uniformly reporting data among the owner and operators exist under the auspices of the international Consultative Committee for Space Data Standards.

Yet, those responsible at the Pentagon and within Air Force Space Command

seem to be reluctant to consider using the private sector — despite the fact that the Air Force program is chronically underfunded, understaffed and often underappreciated by service leaders. While it is obvious that there are going to be issues of protecting the security of military and intelligence gathering satellites with any outside system, it is just as obvious that obsessive secrecy will come back to bite all satellite operators, including the military and the intelligence community. Further, it is not at all clear that the government "business as usual" model, which is focused on building new hardware and a new program around it, is likely to be the best answer to the problem at hand.

Instead of blindly forging ahead with plans for the future of the U.S. SSA program, the Air Force and the Pentagon should be paying much closer attention to the industry efforts and move to take advantage of what foundation stones already have been laid. There is too much at stake to allow knee-jerk secrecy and a "not invented here" attitude to delay progress toward improved space transparency.

Theresa Hitchens is the director of the World Security Institute's Center for Defense Information (CDI) and chief of the CDI Space Security Project, which operates in cooperation with the Secure World Foundation.

SPACE NEWS

February 18, 2008

15

Global C4ISR Evolves

< ROBBIN LAIRD >

The more than 40-year history of U.S. military space has entered a new phase. This extraordinary array of spacecraft and related ground equipment was built as a unique overlay to help the U.S. intelligence community and the U.S. military to provide for strategic deterrence of the Soviet Union. It has evolved over time into a global enabler for the transformation of the U.S. military into a truly interconnected global force. It now is the lynchpin for what is emerging as a global C4ISR (command, control, communications, computer, intelligence, surveillance and reconnaissance) enterprise.

What began as a unique military high ground has become one of the four key nodes of the evolving C4ISR system. Space, air, naval and ground platforms are becoming interconnected in a system to provide digital content for the U.S. military. This digital content encompasses communications and sensor systems distributed over space, air, naval and ground platforms. The core platforms historically were built separately and stovepiped. Now the focus is interoperability across the enterprise whereby synergy, leverage and redundancy are the goals.

Synergy comes from the ability

to operate throughout the various domains; leverage is generated by the ability to have a synergistic system that gives each element of the U.S. forces digital tools for their mission sets. Redundancy is increasingly crucial to the survivability and sustainability of U.S. forces. The changing strategic context for U.S. military space (notably, the emergence of China) places a premium on redundancy.

The "crucible of war" has reshaped the role of military space. Rather than advancing a purely proprietary military space sector, the emphasis for space assets today is space's crucial role in enabling a global C4ISR enterprise.

The military deployments in Iraq and Afghanistan have underscored a new approach to the use of C2 and ISR by the military. These operations have relied on air-breathing and ground-based platforms to provide significant C2 and ISR. The U.S. Marine Corps is relying on what they call "non-traditional" ISR for their operations. The Marine Corps means by this "on-demand" ISR by ground- and sea-based decision makers to shape outcomes, which they determine are realistic and close to the operational environment. Air-breathing platforms, whether manned or un-

manned, are increasingly central to these ISR and C2 operations. And the Marines and U.S. Army have worked closely to share data across ground-based systems as well.

With the dramatic enhancement of the role of C2 and ISR generated by the ground-air partnership, the role of space is changed. Space becomes a significant layer within the communications and data spheres, not itself the repository of the network. Space systems become relay elements, coordinating nodes and participants in a collaborative system, not the dominant layer shaping the network. This means that the U.S. military can shift from building complete military communications and ISR networks in space to leveraging the evolution of air-breathing and ground systems as well as global commercial systems in shaping its future military space system.

Also, the operations associated with the global war on terrorism (GWOT) have underscored the changing nature of the balance between kinetic and non-kinetic systems.

For example, now the U.S. Air Force's primary operational missions are largely non-kinetic; kinetic strike is a core capability to

be exercised as appropriate. Air Force Secretary Michael Wynne refers to this new state of affairs as the role of the U.S. Air Force in the "global security enterprise."

The classic role of military space has been to provide C4ISR for kinetic strike against moving or static tactical or strategic targets. With the GWOT, there are fewer targets and significantly more events that need to be shaped on the ground or at sea. Data and communications need to be provided close to the point of decision making, not stored in Washington data vaults. As such, the military and security players in the global security enterprise are relying more on a collaborative and "on demand" networks than on the data provided from distant geostationary satellites.

The global security enterprise rests in Secretary Wynne's words on "the thoughtful shaping of coalition capabilities that will provide the authority within which power may be exercised in the turbulent years ahead." In this context, communications and data need to be capable from the outset to be shared. This means that a premium is placed from the outset on shared capabilities, not proprietary data provided by U.S. military systems,

which then is laundered through a tortured intelligence sharing process with allies. By then events are beyond the relevance of the data provided.

Proprietary U.S. military systems are at the core of shaping kinetic capabilities for the joint U.S. force; they are not at the heart of the shared data and communications capability central to the global security enterprise salient to deal with the GWOT.

This means that relying on shared systems with allies and the commercial sector is becoming more important for the U.S. military space system, not less important as some military analysts contend. On the one hand, data can be purchased from partners and allies. On the other hand, relying on commercial networks and systems to provide for capabilities is increasingly important. Eighty percent of current U.S. space-based communications in Iraq is provided by commercial systems.

By recognizing the reality of military space within the context of a global C4ISR enterprise, several key priorities emerge:

■ First, the job of crafting interdependence among ground stations must receive the attention

SEE LAIRD PAGE 17

Lost in Space

< REP. JANE HARMAN (D-CALIF.) >

A little more than one year ago, on a cold January night, China broadcast its status as a major space power — with a bang.

The successful test of China's anti-satellite (A-Sat) capabilities — in this case, by destroying its own weather satellite with a missile — made very clear that we should be looking over our shoulder.

The immediate consequence is obvious — 20 percent more space debris now litters the sky, threatening all satellites in low Earth orbit (LEO) for decades. But the longer-term impact is more ominous. The A-Sat test revealed our Achilles heel. U.S. space assets are vulnerable.

This isn't a China-specific problem. Other nations also have demonstrated the ability to disrupt or degrade our use of space assets. And it will not be too difficult for these nations to develop more effective A-Sat capabilities in the coming years.

China's test was a very urgent wake-up call. Instead, we pushed the snooze button. In the year-plus since the test, the U.S. government has done almost nothing in response.

I would have expected an administration that warned of a "space Pearl Harbor" in the 2000 elections to have made a greater effort to protect us against this threat — though, to be fair, none of the major presidential candidates has addressed the threat either.

Our new president should come into

office with a strategy in hand. But we need not wait for a new administration.

The current administration's 2006 space policy statement sets general goals rather than a strategic vision. And though the new president may have a different vision, we can surely agree that the paramount policy goal be to maintain our leadership in space for decades to come.

As policymakers, we in Congress don't have the luxury of just throwing stones — though I admit that we often forget this. We have to offer constructive suggestions.

Here are mine.

Any comprehensive strategy to preserve our leadership in space must include five elements:

■ First, better intelligence to understand the motivations of space adversaries. Why did China conduct the A-Sat test? Was China announcing its intent to become a global strategic rival? Or, as many believe, is its focus primarily regional? What are the capabilities and intentions of other spacefaring nations, such as Russia? Congress should consider requesting a National Intelligence Estimate on the test and potential threats to our position in space. We should talk with the Chinese, in much the same way that we spoke to the Soviets during the Cold War. Defense Secretary Robert Gates supports a strategic dialog with China and enhanced military-to-military cooperation, which can help avoid misunderstandings that might otherwise

lead to a confrontation.

■ Second, employ defensive measures in space, and harden our ground assets. We need to search for more tools to protect our satellites from attacks, and to incorporate these technologies into all new government and commercial satellites to the greatest extent possible. We also must secure the ground infrastructure that makes our space assets work. If U.S. space assets are ever attacked, our ground-based space infrastructure will be as well.

■ Third, build in redundancy by maintaining multiple assets available to do the same job. Some systems, particularly those in LEO may be more vulnerable. Using higher orbits — particularly geosynchronous orbits — for more assets that we currently keep in LEO can help protect our capabilities. Some satellites can be stored on the ground if we develop the capability to get them into space quickly and at a reasonable cost.

■ Fourth, mitigate risk by enhancing cooperation with civilian imaging and communications assets.

We should consider relaxing current restrictions on resolution. Many civilian imaging satellites can achieve amazing clarity, and with a few changes can provide imagery close to what our military planners are used to seeing. Enhanced cooperation also would provide security for aerospace engineers. Rocket scientists just do not grow on trees.

■ Fifth, re-examine our approach to export controls. Restrictions on the space technologies that companies can export have had the perverse effect of encouraging other nations — like China and India — to develop their own indigenous technologies. Rather than buying or renting technology built by American companies that are subject to U.S. law, we have given these countries the incentive to figure it out on their own, denying us a lock on cutting-edge technologies.

Multilateral or bilateral agreements, perhaps to preclude the debris-causing sort of test that China conducted last year, may be useful. An informal code of conduct that sets norms of behavior for spacefaring nations could restrain reckless behavior like last year's test. But we should be realistic about what formal agreements can achieve.

Using needlessly provocative language should be minimized. Our current space capabilities are no match for any other nation, even given China's test. Given that advantage, we would have much to lose by provoking others into a space arms race.

It's time to wake up, get focused, and implement a comprehensive strategy to protect our position in space. We snooze at our peril.

Rep. Jane Harman (D-Calif.) is chairman of the House Homeland Security subcommittee on intelligence, information sharing and terrorism risk assessment.

SPACE NEWS

February 18, 2008

ON THE MOVE



■ The Boeing Co. names veteran NASA space shuttle engineer **JOHN P. MULHOLLAND** its new space shuttle vice president and program manager in St. Louis.

Mulholland, with more than 21 years of experience in space shuttle propulsion, systems and subsystem design, assumes responsibility for the overall direction and successful execution of Boeing's space shuttle program.

■ Raytheon Co. names **TIMOTHY S. BURRIS** (above) vice president of communications for its integrated defense systems (IDS) business in Tewksbury, Mass. In this role, Burris assists the IDS communications organization in its external and internal communications activities.

Burris joins Raytheon from Rockwell Collins in Cedar Rapids, Iowa, where he served as senior director of enterprise communication.

■ Arlington, Va.-based Longbottom Communications promotes **PATRICK BOYLE** to managing partner and **JENNIFER HOIL** to account manager.

In this new role, Boyle assumes responsibility for long-term team management and positioning while continuing to provide strategic counsel and support.

Hoil assumes additional account responsibilities spanning research, media planning, event coordination and production management.

Longbottom Communications primarily serves clients in the satellite communications industry.

■ **BRUCE A. WALD**, vice president and director of image information solutions for ITT Space Systems Division, Rochester, N.Y., is elected to a three-year term as a board member for Women in Aerospace in Washington.



■ Northrop Grumman Corp. names **TONY SPEHAR** (above) sector vice president and general manager of its Kinetic Energy Interceptors (KEI) program in Fair Lakes, Va.

In this role, Spehar is responsible for leading the company's effort to develop and test the KEI missile defense program. Spehar most recently served as vice president and deputy general manager for the KEI program.

■ Fourth, leveraging commercial and allied systems would be seen as an enhancer of U.S. security via building redundancy and collaborative tool sets, which would significantly enhance the credibility of the conclusions drawn from national efforts.

In short, U.S. military space assets are no longer unique, sui-generis tools for the intelligence community in assessing a peer competitor. They now are embedded in the overall evolution of U.S. military forces and reconfiguration of how the United States will execute its role in the global system. Transforming from unique to embedded assets now means that space is part of a global digital enterprise, which the U.S. military uses to deploy and sustain force, and in which space and air-breathing systems can alternate depending upon the mission and geo-physical location of operations.

Robbie Laird, PhD, is a senior advisor on security strategy and policy for Gryphon Technologies' National Security Programs.

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VOLUME 3 ISSUE 5

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Feature: Sea Basing
Feature: Logistics Delivery By Air
French Aviation Support

THE US MARINE CORPS AND THE SEA BASE ENTERPRISE: LOGISTICS AT THE HEART OF EXPEDITIONARY FOCUS

The USMC has become more of a land army as a consequence of the Iraq War. Recently, USMC Commandant, General Conway, expressed concerns that the Corps was losing its expeditionary focus. According to Conway, "They have been to Iraq two or three times in most instances but, in some cases, now are leaving us never having stepped aboard a ship." Marine officers who have joined the USMC during the Iraq period are very likely *never* to have been aboard ship, nor getting any amphibious training.

But the essence of the USMC is to be a flexible, expeditionary force. Indeed, in their operations in Afghanistan and Iraq they have conducted flexible operations, but ones primarily built around the Marine aviation capabilities. Indeed, in a famous moment in the initial Afghanistan operation, the USMC operated from ships to move deep inland to operate against the Taliban. Task Force 58 was in essence a seabasing operation as the USMC leadership sees it, and an example of

what the USMC needs to be prepared and supported to do in the years ahead.

Task Force 58's (TF-58) combat operations in Afghanistan during Operation Enduring Freedom (OEF) in 2001 covered 450 nautical miles (nm) to establish Camp "Rhino" and then operated over 750 nm to Kabul. "On 25 November TF 58 opened a second front in the south by commencing the longest ship-to-objective maneuver in history, moving 400 miles inland to seize the desert airstrip south of Kandahar. Renamed 'Forward Operating Base (FOB) Rhino', it supported the introduction of additional joint forces as well as the isolation and the eventual seizure of Kandahar, the last political and military stronghold of the Taliban regime. Supported and sustained from a sea base 450 miles away, FOB Rhino facilitated the projection of combat power several hundred miles further inland", as is listed in the "Naval Operations Concept 2006".

THE STRATEGIC CORPORAL

The flexibility of operations essential to the USMC was underscored by the

release of the USMC's Combat Development Command's evolution of the concept of the "Strategic Corporal". The "Strategic Corporal" was invented by former USMC Commandant General Krulak, and referred to the flexible training and capability of the individual marine operating in variety of organizational settings, notably the "Three Block War." In the October 2007 release of the updated "Strategic Corporal", it became associated with the evolution of the seabase.

Here the concept of the role of the "Strategic Corporal" is that of the USMC unit of operations from battalion on up, able to operate flexibly from the sea many miles inland to influence events. The USMC is seen as able to operate in peacekeeping, stability, and low-to-high intensity operations with integrated equipment packages able to operate from the sea or redeployed on the shore or deep inland. The notable point is the modular seabase approach is seen as integral to the operation of the new USMC equipment, notably the Osprey and the F-35 in the years ahead. Flexibility, expeditionary, integrated operations and sea-basing are seen as closely integrated in evolving USMC doctrine and operations.

To further understand how the USMC is focusing upon the evolution of seabasing, *MLI* sat down with Jim Strock, Director, Seabasing Integration Division of the Capabilities Development Directorate of the USMC Combat Development Command to get further details of the evolution of the USMC's attitude to operations from the sea. Mr. Strock is widely regarded as the USMC's leading expert on seabasing and its evolution.

Communications Specialist 1st Class Mones Model/US DoD



Characteristics of Seabasing Enterprise	Key Attributes of the Seabasing Enterprise
National capability for force projection	No secure beach or host nation required
Exploits sea as maneuver space 365 days a year	No "iron mountain" ashore to protect
Maximizes the effects of forward presence	Assembles troops and equipment at sea
Reduces dependence on vulnerable land bases, "steps lightly" on allies and partners	Selectively offloadable for different missions
Increased options for the President	Sustainment and reconstitution of fighting from the sea
Crafting of an enterprise which can cover the spectrum of political-military missions on a global basis	Deployed and sustained force afloat able to influence events ashore with ground forces engaged ashore
Enabler of joint and coalition operations in area denial and anti-access environments	Sea strike becomes a deployed joint force, not simply an aerospace strike force

The key characteristics of Seabasing for Jim Strock can be summed up by its "modularity, sequencing, flexibility and scalability", allowing for "strategic agility". In fact, the way he describes the rationale for Seabasing is as a response for both the changing strategic environment and the evolving modus operandi of U.S. armed forces as a whole.

Strock says that any seabased task force, "can be assembled in two weeks" and will be sustained as long as a given mission might require it. Seabasing therefore adapts to the variability of the new contingencies and threat environment. "In a Tsunami-type operation, it can be deployed indefinitely," says Strock, or it can be used as a complement to the "indispensable boots on the ground" as part of a broader theater deployment.

It is mostly meant as a way to recover the initiative and as a "substitute to the increasing shore access denial issue": the U.S. presence being less welcome on the ground and U.S. forward deployments being reconfigured, seabasing offers solutions which are already proving very valuable. Strock cites as an example the case of the FARP's (Forward Arming and Refueling Points) as a flexible alternative. He also stresses the importance and strategic value of a "preventive presence" providing "options to influence a situation on the ground"

early on via the deployment at sea of "tailored capabilities".

MODULARITY TO THE FORE

Seabasing does also match the push towards jointness and the evolving doctrines of the Marines and the U.S. Army: it directly "plugs into" the Marines Distributed Operation (D.O.) concept "tactically,

operationally and strategically", and mirrors the same decision-making process decentralization process at sea. Strock also stresses how seabasing better fits "the way the Marines and the Aviation are now working together". He furthermore points out that the Army is not to become a 'seabased force, but rather a seabased-supported force'. Increasingly the Army will indeed not only need more seabased support, but also more amphibious capabilities. Last but not least, Strock believes that seabasing will allow the United States to better work with its allies by lightening its footprint on their territories, as well as by allowing flexibility in the way allied amphibious capabilities can mix and match to build a true "Global Maritime Partnership".

Strock emphasizes that seabasing should be understood in a modular way. A mix of capabilities will be blended to allow the forces operating off of the seabase to influence events ashore. Modular mix and match will allow the seabased force to provide the flexibility necessary to operate in a variety of settings and for a variety of missions. The seabase is flexible and scalable. But without a sufficient robust mix of capabilities and without "sea shield," the seabase will not be effective.



Photographer Mate 3rd Class Aaron Piccola/US DoD

The USMC will look to revert to a sea-based force, able to position itself offshore, before deploying necessary forces and logistic support on shore.



For the Sea base to work as well as is desired, new technologies will be needed to facilitate operations such as trans-shipping of equipment and materiel. Here, the US Navy's Improved Modular Lighterage System is tested.

"Viewing the Sea Base as a capability, it can be formed by one ship, a small group of ships, or a larger, more diverse force. No two seabases will ever be the same," says Strock. "The various potential platforms [conventional amphibious ships, high speed catamarans, US Navy platforms and coalition shipping] are all components that will play a role in the 'system of systems' of the seabase enterprise.

"At the center of the Seabase will be the Maritime Prepositioning Force (Future). The Carrier Strike Group is built around an aircraft carrier, while an Expeditionary Strike Group provides the synergy of surface combatants with a Marine Expeditionary Unit embarked on Amphibious Warfare Ships. Various connectors will provide both intra-theater and inter-theater lift of aircraft, personnel, and equipment. The Combat Logistics Force ships provide sustainment, and Coalition Forces provide unique capabilities to the Sea Base that will be critical to our success."

EMBEDDED LOGISTICS

Seabasing is not about logistics support to forces put ashore. It is about logistics embedded in the sustainment of forces able to deploy

from the seabase deep inland. It is about sustainment and engagement as two arms of deployed capability. Seabased forces maneuver directly to the objective rather than first establishing a presence on shore.

At heart, the seabase by combining its initial logistics support and providing a base for continuing operations with a possibility of sustained replenishment can operate effectively from the moment it arrives on station. By combining sustainment and deployable forces, the seabase embodies a force able to influence events ashore across a wide range of contingencies.

The flexibility of the seabase concept, Strock maintains, will be essential to U.S. and allied strategy in the years ahead, as access denial becomes more telling and the need to insert force rapidly or selectively becomes more important in shaping counter-terrorism or humanitarian missions.

Insertion forces will become strategically important as the U.S. rethinks the desirability of deploying large land armies to do stability operations as a core motif of U.S. operations.

Also important to the USMC is getting the seabase approach in place and operating effectively as it brings

online its new expeditionary equipment. The F-35, the Osprey and the expeditionary fighting vehicle all will provide greater range, lethality, and C4ISR capabilities to a deployed force. And the USMC will be able to operate its evolving doctrine of decentralized and reconfigurable forces (distributed operations) with the new equipment connecting the deployed elements. And with reachback to the seabase, the force can operate with sustainment in place.

Seabasing allows the USMC to focus on operations right away rather than primarily focusing on managing the offloading of equipment to port and shore facilities. Strock underscores that in current operations, it is necessary to offload inventory ashore, then organize the inventory, then marry the supplies to the equipment, then assemble to equipment and *only then* begin operations. This not only takes time, but enhances significantly the vulnerability of an embarked force.

With the growing capabilities of adversaries to target fixed facilities ashore, the need to operate rapidly against those capabilities and to operate from various vectors of operations connected by the seabased forces networks and protected by seabased defenses is growing. The seabase may provide the only viable insertion of ground force option in many future contingencies.

TECHNOLOGY DRIVERS

For operations beyond the initial insertion, the seabase will need to be replenished. And here a new concept, the Vehicle Transfer System (VTS), is being developed to provide offloading capability from replenishment ships, and is capable of transferring assets among elements of the seabase. Indeed, R and D efforts are underway to enhance the capability for replenishment and transfer of assets to provide for greater sustainability and, therefore, operational capability for the seabase. The seabasing concept of the USMC places sustainment on strategic par with the forces able to be deployed. Twinning of sustainment and operational capability is a core aspect of the evolving concept of the seabase.

Some of the key technologies which must be developed to enable the seabased enterprise are:

- Skin to skin transfer of cargo and related operations
- Automated cargo handling systems that will permit selective offload of cargo
- Cranes that can lift more and operate in higher sea states
- The ability to interface and offload rolling stock and cargo with other ships and connectors.

Although seabasing is a core U.S. Navy and U.S. Marine Corps approach, the U.S. Army is becoming an increasingly important partner in the evolution of the seabase. In Iraq and Afghanistan the US Army and USMC have increasingly cooperated in shaping common capabilities, e.g., the procurement of the Shadow UAV by the USMC and sharing of operational approaches with the US Army. The US Army has become a partner with the USMC in shaping joint R&D with regard to vessel requirements and is sharing the acquisition of some elements of the seabase. US Army thinking was underscored in a recent US Army presentation on the seabase at the annual Expeditionary Warfare Conference in October 2007.

In effect, what the Army is advocating is reshaping their logistics ship support from offloading equipment to a mixed fleet which could support operations from the seabase for a period of time before an offloading operation is embarked.

A NUMBERS GAME

Although the USN and USMC both support the seabase concept, there is a difference. Due as much to the shipbuilding challenges as much as anything else, the USMC emphasizes amphibious assault and forceable entry. The USN tends to emphasize replenishment and resupply of forces which have moved ashore. For now, the USMC and USN have compromised on 33 amphibious and large transport ships for forcible entry operations. Their joint agreement provides for 11 big decks, 11 amphibious transport docks and 11 dock landing ships. According to USMC Commandant Conway, the USMC considers this suboptimal because of continuing to deploy older ships rather than adding greater numbers of newer amphibious ships.

Clearly, the USMC would like a significant increase in the commitment in the shipbuilding budget to ships appropriate to the seabasing enterprise. Here additional amphibious vehicles, transfer vehicles, replenishment ships and other assets are required to achieve the promise of seabasing. Strock indicates that about seven percent of the shipbuilding budget goes to the amphibious fleet. He would like to see this increased.

And the USMC has recently adopted a new operational concept that will keep nine infantry battalions forward deployed at all times, with the remaining 18 battalions in training. And for sailors, it will mean a steady reliance on the amphibious fleet. Strock adds that in recent years, with Marines committed to long term presence in Iraq and Afghanistan, the Navy's amphibious ships have at times deployed without Marines on unique missions, such as chasing pirates off Africa or serving as a floating health clinic in Asia. But that may soon be adjusted under the new operational concept known informally as "The Long War Brief", which was signed sometime in late January or early February by Gen. James Conway.

One might observe that the seabasing enterprise could become more significant to future Administrations as

well. The current shipbuilding crisis is shaped by what some call a radical commitment to building many new ships at once for the surface navy. It is a hugely risky venture designed to build a strike fleet. In contrast, the seabase enterprise makes the combined ground, air and naval team (USMC and US Army) the naval strike force. The difference here is significant: is naval strike largely about missile and related strikes from a carrier task force or is it about influencing events ashore from a seabased enterprise? Indeed, one could see the U.S. Navy being recast as a littoral endurance force able to employ a seabased enterprise, provide for maritime security and provide global presence seeking to influence events in the littorals as the core US elements.

If the seabasing enterprise is to be realized, there clearly will have to be a sustained strategic and financial commitment from future Administrations. For Jim Strock, the next Quadrennial Defense Review could indeed hopefully provide such an opportunity. But the promise is intriguing and the impact of thinking about combining sustainment with deployed capability, refreshing for journal dealing with military logistics. ■



New shipping and sea delivery methods will be crucial for Sea Basing. One such – High Speed Support Vessels – has already been trialled. The Austal "Westpac" was used by the USMC in the Pacific to improve sea delivery options.

July 28, 2008

The Future of Military Space

< ROBBIN LAIRD >

The recent controversial firings of Secretary of the U.S. Air Force Michael Wynne and Air Force Chief of Staff Michael Mosley provide a strategic inflection point to reflect on the evolution of the U.S. Air Force and the implications of that evolution for military space. The U.S. Air Force is at the center of U.S. military space, both in terms of procurement and demand. Nearly 85 percent of all U.S. military data go through Air Force systems, and the dependence of U.S. military connectivity on the Air Force is crucial enough that Secretary Wynne placed significant emphasis on the challenge of crafting cyber capabilities to defend the network.

After having worked through the "Back to Basics" effort led by former Undersecretary of the Air Force Ron Sega, the service's military space effort has been stabilized, but the future strategic direction remains to be fully determined.

Much like the challenge of replacing the shuttle, the military space sector faces the replacement of an entire generation of satellites. Either the regeneration or replacement of the current military space architecture is required. This is especially important since the next presidential administration's preferences for military strategy and procurement cannot be determined at this point — no matter which candidate wins. Indeed, the twin challenges of replacing the shuttle and determining the strategic direction of military space will determine to what extent the United States is at the center of 21st century space activities.

One path would see air systems function largely in their own domain as shapers of air combat; the F-22 would be seen as the successor of the F-15 and the F-35 as the successor of the F-16. Robotic vehicles would eat away at the numbers of manned aircraft but would largely function either as adjuncts of the air battle or the flying intelligence, surveillance, reconnaissance (ISR) platforms for U.S. ground forces.

Following this latter path, the approach would be to continue to focus on significant space-based ISR and communications systems to support global air operations and U.S. ground forces when they are initially inserted into combat areas. The heritage structure would be replaced by a significant investment in satellites and systems with robust capabilities able to do complex support activities without relying on significant air-breathing intermediaries.

A very different path is suggested by the potential of the fifth generation aircraft and their associated robotic systems. Here the onboard processing capabilities of the F-22 and F-35 would be recognized for what they are — namely, breakthrough capabilities to process data for their own use, for the network of air combat systems and to integrate their capabilities with maritime and ground forces. Wynne refers to this as the air systems providing spherical situa-

tional awareness to the ground and maritime forces. As the manned systems are deployed and their capabilities better understood and exploited, the role of robotic vehicles in the air network will go up dramatically.

A wolfpack concept is likely to emerge in a way that allows the manned systems to direct and be embedded within airborne robotic networks. Those robotic networks, in turn, would work closely with maritime and ground forces. The capability of providing for collaborative decision-making among maritime, ground and air commanders becomes possible as the interactive network shapes options and provides choices to the joint commanders.

The role of space in this world has the potential to become radically redefined. The proprietary U.S. military space network is most significant when the U.S. seeks to establish air superiority and conducts joint and combined maritime and air strikes against adversaries, either nation state or discrete adversary targets located on foreign territory. Here the interaction among U.S. military systems must be carefully protected and highly integrated for a successful insertion of force. In a way, given the key role of the evolution of the F-22, the military space network would be sized to support this initial air superiority and air

dominance effort.

The impact of the fifth generation aircraft on the overall U.S. military enterprise has not been well articulated by the U.S. Air Force. The F-22 has the potential to become the centerpiece of the U.S. strike force. As the connectivity of the aircraft is enhanced to take advantage of its significant situational awareness capability, the F-22 can become the brain of the strike complex.

The F-35 is not an air superiority aircraft, but rather a "flying combat system." Its ISR and command and control (C2) capabilities will make it capable of becoming the centerpiece of the kind of air-ground operations we have experienced in the last few years of warfare in Iraq and Afghanistan. How the U.S. Marine Corps has been articulating its approach to the use of the F-35 at the centerpiece of its Marine Air Ground Task Force is the harbinger of what could be done for the joint forces.

After the establishment of air superiority and support for the joint strike effort has succeeded, and, if the mission requires the insertion of force and its support for initial operations, then the reliance on proprietary military space can go down dramatically. Reliance on inserted air assets — the manned and unmanned network — to provide flying ISR and communications support would

reduce the need for proprietary military space assets as well.

In addition, as ground forces become predominant, more coalition forces are likely to play enhanced roles as well for operations like stability missions. In such a situation, reliance on commercial systems — encrypted — but not based on proprietary U.S. military satellite buses or systems can go up dramatically. Innovative approaches such as the use of hosted payloads can be aggressively pursued if one exploits the advantages of the new generation aircraft and their networked robotic systems.

But if these advantages are not exploited, because of classic military stovepiping and service separatist mentalities, then the need for proprietary military space systems goes up. However, the investment dollars are unlikely to be available to do so. The end result is that the holy grail of ubiquitous bandwidth for the Global Information Grid will not be provided. Indeed, one can question whether the technology or the dollars are available to provide for such a goal.

Rather, the opportunity to exploit the twin promises of the new fifth generation aircraft with new opportunities provided by commercial space is available. But options do not create capabilities without significant effort and clear focus. Will the new administration take advantage of this opportunity?

Robbin Laird, PhD, is an independent consultant who has worked closely with the U.S. Air Force, Marine Corps, Navy and Coast Guard for many years and has focused on the connectivity challenge to craft combined and joint forces.

Building Transparency in Space

< THERESA HITCHENS >

Senior Pentagon and U.S. Air Force leaders have insightfully recognized that international cooperation among governments and the satellite industry will be required to ensure the level of space situational awareness (SSA) needed to protect U.S. and the rest of the world's orbital assets. In recent months, a number of senior U.S. officials — from both the Defense and State Departments — also have been traveling abroad to discuss potential future data-sharing plans with U.S. friends and allies with an eye to creating a so-called "Neighborhood Watch" network.

Today, the majority of space actors receive orbital data from an Air Force-run program known as the Commercial and Foreign Entities (CFE) program. There is broad agreement in the government and commercial space communities that this program needs to be substantially revised. The Air Force, in fact, currently is undertaking a study of SSA needs and is attempting to develop a solid plan for improving its outdated approach to sharing data gathered from its global sensing network. But while nearly everyone agrees on the need for better data sharing to increase transparency in space, avoid collisions and monitor debris, the question of how that will be done is as yet unclear.

Thus, many of the major actors in the

commercial satellite industry recently have banded together to begin examining new ideas for data sharing. One concept, known by the rather bland moniker of the "data center," would seek to create a shared repository of information about satellite positions, using both carefully protected operator data and Air Force space surveillance data. Eventually, this center could provide an automated conjunction warning and assessment service for the geostationary belt. The idea is to establish an economical and trusted voluntary system that exploits current and emergent capabilities, rather than simply adding more operator data into the current decades-old system.

In addition, others in the international satcom community also are informally exploring the possibility of a truly global SSA database that would include inputs from a wide range of spacefaring nations — not just the United States — as well as industry. Indeed, there are a number of potential sensor assets in Europe that could contribute; French President Nicolas Sarkozy has pledged to spearhead the development of a collaborative European space surveillance network. The concept of a global database further is being considered as part of a larger effort to define cooperative measures to sustain the long-term use of space, launched by Gerard Brachet, the

outgoing chairman of the U.N. Committee for the Peaceful Uses of Outer Space in Vienna, Austria. Based on industry experience so far, this is a feasible goal — unless politics get in the way.

And, sadly, politics and bureaucracy seem to be impeding progress already. Despite industry attempts to engage the military space community in the ongoing commercial discussions, the Pentagon and Air Force Space Command so far have failed to fully and constructively engage. This is disturbing, as it is apparent that many of the needed improvements for data sharing, prediction of close approaches — or "conjunctions" — and methods for collision avoidance already could be implemented based on industry know-how. For example, the Center for Space Standards and Innovation, a space research group in Colorado Springs, Colo., actually has launched a process for data sharing and conjunction analysis that is significantly more responsive, both in time and specificity of output data, than current Air Force practice. Further, standards for uniformly reporting data among the owner and operators exist under the auspices of the international Consultative Committee for Space Data Standards.

Yet, those responsible at the Pentagon and within Air Force Space Command

seem to be reluctant to consider using the private sector — despite the fact that the Air Force program is chronically underfunded, understaffed and often underappreciated by service leaders. While it is obvious that there are going to be issues of protecting the security of military and intelligence gathering satellites with any outside system, it is just as obvious that obsessive secrecy will come back to bite all satellite operators, including the military and the intelligence community. Further, it is not at all clear that the government "business as usual" model, which is focused on building new hardware and a new program around it, is likely to be the best answer to the problem at hand.

Instead of blindly forging ahead with plans for the future of the U.S. SSA program, the Air Force and the Pentagon should be paying much closer attention to the industry efforts and move to take advantage of what foundation stones already have been laid. There is too much at stake to allow knee-jerk secrecy and a "not invented here" attitude to delay progress toward improved space transparency.

Theresa Hitchens is the director of the World Security Institute's Center for Defense Information (CDI) and chief of the CDI Space Security Project, which operates in cooperation with the Secure World Foundation.



COAST GUARD VISIONS

Who is responsible for defence and security in territorial waters? There is a different answer for each nation and, in some, no answer at all. In the US, the US Coast Guard has a major responsibility, but its future role is uncertain – should it have a function in a worldwide maritime security organisation or a much more inward-looking task? The answer to this will dictate not just the design requirements for its ships, but also its future C4ISTAR system. The wide range of coast guard tasks is clear from the various ship designs that Rolls-Royce provides for a significant number of countries.

The Maritime Trade Dynamic: Reshaping the US Coast Guard Role

by Dr Robbin Laird

Robbin Laird is Chief Partner of ICSA LLC, a Paris- and Washington-based aerospace and defence consulting company. In this article he looks at two alternative futures for the US Coast Guard and calls for decisions to be made now.

Global maritime trade is a core element of the dynamics of development in the globalised 21st Century. Historically, finished goods and commodities defined the content of maritime trade. Controlling access to raw materials and providing for freedom of the seas for the exports of major powers was a key element of classic maritime trade, which in turn defined the roles of maritime forces. The 21st Century has dramatically reshaped the nature and role of maritime trade through the globalisation of manufacturing, production and the emergence of worldwide supply chains.

The 21st Century is witnessing a dramatic upsurge in the economic power and significance of Asia and other non-Western regions. And these powers are interconnected with one another and the Western world by the highways of the oceans. Just-in-time manufacturing in Western states depends on the supply of key components in the production cycle through the maritime domain. Maritime commerce is now a lifeline of steady state production worldwide as well as the exchange of finished goods and commodities.

Shipping is at the heart of global trade. Most international trade – about 80% of the total by volume – is carried by sea. About half of the world's trade by value and 90%

of the general cargo is now transported in containers. The containerisation of cargoes and the growth in the size of the cargo ships are important forces for change in the maritime system as well.

"Maritime commerce is now a lifeline of steady state production worldwide as well as the exchange of finished goods and commodities."

Containerisation has been both cause and consequence of a shift in the nature of the global supply chain. Logistic supply chains that feed components and finished products to users on a just-in-time and just-enough basis have become critical to modern manufacturing and service industries. A virtual conveyer belt of goods or a moving warehouse of components at sea have become the tissue of global production. Seaborne trade and its land connections in the global supply chain have become increasingly efficient, large-scale and thus open.

Also part of the containerisation phenomenon has been the rise of the mega-ports. The top 20 container terminals in 2002, led by Hong Kong, Singapore and four other East Asian ports,

accounted for 54% of world sea container throughput in 2002 – 127 million TEUs, out of a total of 237 million TEUs. In 2000, the top 20 terminals handled 109 million TEUs, 47% of the global total of 232 million TEUs.

Disruption of Trade

The conjunction of a dramatic increase in the volume of trade, a shift towards containerisation, the shift in manufacturing and production models and the rise of the mega-ports has created a new maritime trade system. As the system has changed, it has been challenged by forces seeking advantages through disruption of the maritime system. Among the most significant disruptions are the following: disruptions by maritime piracy; disruptions at the mega-ports; significant environmental disasters at sea; and the emergence of terrorists seeking capability to operate on the seas. An additional dynamic has been the melding of criminal and terrorist approaches to disruptions, mimicking one another to learn new approaches to disruption to their advantage. Managing and coping with these disruptions are a key part of the 21st Century safety and security challenges facing global maritime powers and commercial stakeholders.

But who provides for the safety and security of the maritime trade lifeline? And how will nations ensure the collaborative capabilities to work together to ensure lawful transit of the world's production system flowing through maritime channels? How will disruptions to the system be managed? How will appropriate actions be taken with regard

to appropriate safety measures and measured retribution delivered to those consciously seeking to create havoc on the open seas?

The US Coast Guard Role

The core US Coast Guard (USCG) role for the 21st Century is to play a key part in shaping responses to those questions and in participating in the global system to provide for maritime safety and security. But the USCG now stands at a strategic crossroads in dealing with these challenges. It is being pushed between traditional missions, assets and single-asset procurement thinking and a new focus on global mission sets with an integrated approach built on modern C4ISR and an innovative concept of operations. Procurement and policy decisions made since the 7/11 attacks threaten to derail successful efforts to establish the USCG's position as an integrated maritime security force, and return it to the more limited rescue and law enforcement roles of the past.

"But who provides for the safety and security of the maritime trade lifeline?"

The USCG is a unique federal institution. It has belonged to many different agencies throughout its illustrious history — from the Revenue Cutter Service to the Department of Homeland Security, the service has evolved and mutated many times. It works daily with commercial organisations (e.g. shipping lines), law enforcement organisations (in the United States and abroad), and with military authorities (US and foreign).

Indeed, the interoperability requirement for the USCG in its C4ISR is rooted in dealing with the global maritime trade safety and security challenge. It must deal with multiple stakeholders, foreign governments, foreign and domestic ports, commercial shippers, law enforcement officials in the US and abroad, and domestic homeland security and military agencies. As such, the USCG must deploy systems capable of operating with this wide array of agencies. Interoperability with them is the coinage of the realm for

operating as a maritime trade security and safety service.

Beyond Deepwater

Prior to the 9/11 attacks, the USCG had crafted a new approach to acquisition called Deepwater, which was forged upon the requirement to dramatically recapitalise ageing physical assets with limited resources. A new partnership between industry and the service provided for a 'system-of-systems' approach. The acquisition of surface, shore and air assets were to be integrated with common C4ISR tools and approaches to provide for interoperability across the range of stakeholders in maritime safety and security.

The goal was to provide C4ISR systems, largely rooted in the use of commercial and government off-the-shelf procurement, as the backbone for an integrated service. A new central nervous system would allow for fewer, but more capable, physical assets. The events of 9/11 accelerated this approach and demanded new capabilities. Deepwater was redirected by new requirements. The USCG was tasked with handling newly defined maritime security threats. Its evolutionary approach was disrupted by the need for surge requirements to deal with new threats.

Deepwater critics have focused on problems with the acquisition of some assets — largely patrol boats and, to some extent, the new National Security Cutter. The USCG responded by shaping a new acquisition directorate to subsume Deepwater. But lost in the shuffle has been the significant success of several shore and aviation assets as well as the core C4ISR systems and the effort to provide interoperability with its civil, commercial and military partners. The addition of a classified network, the upgrade of Inmarsat communications, the deployment of an automatic identifications system, the upgrade of law enforcement radios and other systems have greatly improved the USCG's capabilities. These successes need to be built upon to extend the effort to provide for an integrated maritime trade and security enterprise.

Too Many Missions

The USCG gained a core maritime security mission in the 2002 Maritime Transportation Law and the Maritime Security Strategy

issued by the Bush administration in 2004. The US Navy (USN) and the USCG have envisioned crafting a national fleet strategy to reinforce this role. But the current shipbuilding crisis affecting the USCG and the USN in deploying a significant frigate-size fleet has threatened the national fleet concept. Also threatening the effort is downplaying the C4ISR effort at the expense of a vast data collection effort associated with traditional US approaches to intelligence data collection.

"The USCG works daily with commercial organisations (e.g. shipping lines), law enforcement organisations (in the United States and abroad), and with military authorities (US and foreign)"

But there is a more serious challenge at the core of the USCG's development. It is pursuing too many missions with too many ageing and fragmented assets. Currently, the USCG has more than 15 mission sets with a wide range of major responsibilities, which pull it in dramatically different directions — one towards the protection and safety of harbour and inland assets and another towards the reach from the ports toward the global security system. Instead of necking down to a priority on the maritime trade safety and security mission and crafting enterprise tools and assets to provide for this mission, the USCG is too dispersed.

In fact, this tension has been important in pulling apart the Service's Deepwater modernisation programme. The Deepwater programme promised an integrated approach to providing capabilities across the many major mission components of the USCG activity but, in fact, it has proven difficult to focus on anything but the



US Coast Guard Mission Sets

Maritime Safety

1. Search and Rescue: www.uscg.mil/hq/g-o/g-opr/g-opr.htm
2. Maritime Safety: www.uscg.mil/hq/g-m/gmhome.htm
3. Recreational Boating Safety: www.uscgboating.org/
4. International Ice Patrol: www.uscg.mil/lantarea/iip/
5. Port Security: www.uscg.mil/hq/g-m/mp/GMPWebpages/index.shtml

Maritime Security

6. Drug Interdiction: www.uscg.mil/hq/g-o/g-opl/Drugs/Drugs.htm
7. Alien Migrant Interdiction: www.uscg.mil/hq/g-o/g-opl/AMIO/AMIO.htm
8. EEZ & Living Marine Resource: www.uscg.mil/hq/g-o/g-opl/LMR/LMR.htm
9. General Maritime Law: www.uscg.mil/hq/g-o/g-opl/Welcome.htm
10. Law/Treaty Enforcement: www.uscg.mil/hq/g-o/g-opl/Welcome.htm

Maritime Mobility

11. Aids to Navigation: www.uscgboating.org/safety/aton/system.htm
12. Icebreaking Services: www.uscg.mil/hq/g-cp/comrel/factfile/Factcards/IceOps.html
13. Vessel Traffic/Waterways Management: www.uscg.mil/hq/g-m/mw/
14. Bridge Administration: www.uscg.mil/hq/g-o/g-opt/g-opt.htm
15. Rules of the Road: www.navcen.uscg.gov/mwv/navrules/navrules.htm

National Defense

16. General Defense Duties: www.uscg.mil/hq/g-cp/comrel/factfile/Factcards/NationalSecurity.html
17. Homeland Security: www.uscg.mil/hq/g-cp/comrel/factfile/Factcards/Homeland.htm
18. Port & Waterway Security: www.uscg.mil/hq/g-cp/comrel/factfile/Factcards/PSUs.html
19. Polar Icebreaking: www.uscg.mil/datasheet/icepolr.asp

Protection of Natural Resources

20. Marine and Environmental Science: www.uscg.mil/vrp/
21. Living Marine Resource Protection: www.uscg.mil/hq/g-m/nmc/standards/index.htm
22. Foreign Vessel Inspections: www.uscg.mil/hq/g-o/g-opl/LMR/LMR.htm
23. Marine Pollution Education, Prevention, Response, and Enforcement: www.uscg.mil/hq/g-m/gmhome.htm

historical core safety and security missions surrounding harbours and inland waterways. The hoped-for breakthrough whereby new cutters and newly deployed C4ISR assets would allow the USCG to operate with greater global reach has been impeded.

A Comprehensive Concept of Operations

The nature of the maritime trade challenge

requires the evolution of a comprehensive concept of operations (CONOPS) for the USCG. The CONOPS would focus on the decision-making tools and approaches necessary to determine priorities with regard to actions which would be most effective in providing for safety and security. The global trade system is simply too large and too expansive to manage with

a large data management system, which has been the thrust of what the USN and the USCG seem to have had in mind in building a maritime domain awareness (MDA) approach. The core data exists in the commercial domain or does not exist at all. Rather than collecting vast data, determining how to decide to intervene (a CONOPS focus empowered by C4ISR) seems a more profitable approach.

"In short, the USCG is facing pressures to move in two very different directions to alternative futures."

And the decision-making focus is further emphasised because of the collective nature of engagement of such a wide range of semi-sovereign stakeholders. How to persuade key stakeholders to provide enhanced responsibility for their role in the global trading system is the key challenge. While adding physical assets is important for the new USCG, developing a new decision-making approach with new C4ISR tools is even more imperative.

Choices

In short, the USCG is facing pressures to move in two very different directions to alternative futures. One direction is to be a key participant in a global maritime trade safety and security system. The core US role in the trading system would provide the USCG with the opportunity to lead in shaping a global C4ISR system and CONOPS approach, which could shape shared decision-making among global stakeholders. The modernisation of USCG assets would be shaped by an integrated approach linking its assets into a maritime security enterprise.

The other direction would circumscribe its role towards a more inward responsibility providing safety and security for ports, inland waterways and related tasks.

Either way, more than missions are not going to be met. A choice needs to be made. ■

Don't let the atmospherics fool you. The inaugural U.S.-Iranian parlay that took place in Geneva on Oct. 1 may have netted a pair of notable diplomatic concessions from the Islamic Republic, namely, a commitment to open its recently disclosed nuclear facility in Qom to international inspectors, and agree-



By **Ilan Berman**, vice president for policy at the American Foreign Policy Council in Washington.

ment in principle to having at least a portion of its nuclear cycle carried out on foreign soil. But Tehran is already giving indications of reverting to type.

In the wake of talks with Washington,

Iranian officials have taken pains to reaffirm that they still view their nuclear program as an "inalienable" right. Not surprisingly, they have nixed the idea of foreign enrichment, demanded nuclear fuel imports from abroad, and announced plans to install a new generation of even faster centrifuges at the previously

Bargaining From Strength

U.S. Must Exploit Iran's Vulnerabilities

clandestine uranium plant in Qom. The message is clear: No matter the diplomatic niceties, Iran's nuclear program is not up for grabs.

By now, this sort of back-and-forth should be old news. Since the start of negotiations over its nuclear program six years ago, Iran's diplomatic strategy has been remarkably consistent. As Hassan Rowhani, Iran's former chief nuclear negotiator, boasted back in 2006, the Islamic Republic successfully used more than two years of negotiations with the European Union "troika" (Great Britain, France and Germany) as a way to add permanence to its atomic effort.

Tehran's current predilection for talks, therefore, is likely a savvy way to exploit the new lingua franca of "engagement" that permeates official Washington.

The American people understand this very well. After years of Iranian intransigence, the center of gravity in the domestic debate over Iran policy now is

steadily shifting in favor of sterner measures. In a recent survey carried out by Fox News and Opinion Dynamics, an overwhelming majority (some 70 percent) of the 900 Americans polled said the White House needs to be "tougher" on Iran. A similar study carried out by the Pew Research Center came up with even more striking results: A clear majority (61 percent) of its 1,500 respondents believe the United States needs to stop the emergence of a nuclear Iran by any means necessary.

The White House, in other words, has a much broader public mandate than ever before to bring Iran's nuclear program to heel.

The Obama administration, however, doesn't seem to have noticed. In keeping with the president's campaign promise to talk to the Iranian regime, his foreign policy team is focused on forging a durable dialogue with Iran's leaders over their nuclear ambitions. In the process, they have

embraced the idea that diplomacy needs to be tried first, tabling economic sanctions and other coercive measures until later.

Action Put On Hold

Thus, despite overwhelming bipartisan support in both houses of Congress, key legislation aimed at exploiting vulnerabilities in Iran's economy and energy sector largely has been stuck in neutral pending the outcome of negotiations with Tehran. So has serious attention to the idea of a military option of any sort, despite the fact that Washington desperately needs — at the very least — to be able to deter and contain Iran's increasingly assertive regime.

Team Obama likewise has quietly walked back support for Iranian democracy, remaining largely silent on Iran's post-electoral unrest and, most recently, withdrawing support from non-governmental organizations involved in tracking regime human rights abuses. In the process, the

administration has stripped itself of precisely the type of strategic leverage that would be useful at the nuclear negotiating table.

It's no wonder that Iran's leaders believe they are negotiating from a position of strength. As Maj. Gen. Hammad Ali Jafari, the commander of Iran's feared clerical army, the Islamic Revolution Guard Corps, put it recently, the very public military war games carried out by the regime in late September "led the enemies to an understanding of the fact that military threats against Iran would prove useless and that they should even give up their sanctions."

In other words, Washington's willingness to talk is being touted in Tehran as evidence of strategic surrender.

It's up to the White House to disabuse the Iranian government of that notion. In order to do that, though, Team Obama will need to abandon its current, sequential approach in favor of a strategy that simultaneously harnesses economic, diplomatic and military measures to create real leverage over Tehran's decision-making. Only in that way can our diplomacy with the Islamic Republic have a prayer of having any real bite. ■

As it faces the challenge of a significant shortfall in spending for new power-projection platforms, the U.S. military has an opportunity to shape a joint concept of operations (con-ops) for the U.S. Air Force and Navy, ensure more effective

networking among Air Force and naval systems, and build improved collaborative C4ISR systems with allies.

At the heart of this opportunity is leveraging new programs to ensure that they

work effectively together. The cancellation of portions of the Army's Future Combat Systems (FCS) program means that the original concept surrounding the program, whereby the network would enable the platforms, will shift to ensuring that the ground network works effectively with air systems.

The air-ground revolution, which was launched by the Iraq invasion, has continued with the surge and with the transfer of forces to Afghanistan. The use of

UAVs to shape ground-force options and decisions, and links like the Rover video system, which has connected manned aircraft to ground decision-makers, has rapidly expanded in the Iraq and Afghan operations.

Now the question is, why not take the termination of FCS to create an opportunity for greater collaboration between the air and ground systems? This will be especially significant as the F-35 Lightning II fighter jet enters service.

The F-35 is a "flying combat system" that can greatly enhance the capabilities of the air and ground forces to work together and shape collaborative con-ops.

Marine Corps Linkage

The U.S. Marine Corps can serve as an important catalyst to develop a new relationship between Navy and Air Force assets and the Army. The Marines adopted Shadow as its common UAV with the Army; in so doing, the Marines and Army have worked through a number of common solutions to the use of data coming from the UAV to support ground operations.

This relationship can be expanded to help link the Marine Corps F-35 and the Army. And because the systems on the

Marines' F-35 are virtually identical to those of the Navy and Air Force, this would establish an important template to reshape air-ground connectivity as the Army modernizes and the F-35 is introduced as the common air element across three services.

There are already some elements in place to improve joint operations. For example, the U.S. Defense Advanced Research Projects Agency has sponsored a Rockwell Collins program called Tactical Targeting Network Technology (TTNT), which can be used to more effectively integrate air and ground operations. TTNT is a capable waveform built upon an open system approach. The technology enables networking among airborne platforms, weapons and ground forces, and as an Internet Protocol system, it operates in ways similar to what is available commercially with systems like Blackberry or iPhone.

But unlike such commercial systems, TTNT provides a highly secure structure and can function up to 300 miles for line-of-sight operations and connections to beyond line of sight. In addition, the system is scalable and survivable, complementing legacy communications systems.

Navy program officials associ-

ated with the Unmanned Combat Air System have recently underscored the cost savings and advantages associated with an open architecture, scalable system such as TTNT.

As reported by *Defense Daily*, Glenn Colby, the integrated project team leader for the system, commented, "If you design for scalability ... then you pull the old one out, put the new one in, and it doesn't really matter if it's the same exact model or not, because the design for scalability ensures that you can plug the new one in and you get better capability at less cost. If you don't design for scalability and you are asking this vendor to give you the exact same model, it's very costly, because in the commercial world, nobody builds [that part] any more."

Connecting some of the new air assets will bolster strategic capability. Notably, the Osprey, with a range and speed that allow ground forces to operate over an entire theater such as Iraq, can provide a key piece of the puzzle in making UAVs a much more effective instrument.

Currently, if a UAV discovers a target that requires prosecution by ground forces and is not appropriate for an airstrike, by the time rotorcraft reach that

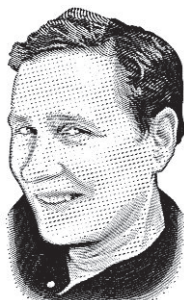
target, it is almost certainly gone. With systems that connect the Osprey effectively with UAVs, the ability of the Marines, Special Forces and the Army to quickly strike such targets discovered by the UAV would be significantly improved.

Another important connectivity intersection revolves around the Navy's Aegis radar system and the F-35. Efforts to strengthen their integration are a natural path to improve U.S. global coalitions. Many U.S. allies that operate Aegis-equipped ships are current or prospective F-35 participants. For example, given Norwegian concerns about northern European energy security, including the Arctic, there is interest in bolstering Link 16 connectivity between Aegis systems and the F-35.

The extent to which allies can integrate F-35 with Aegis creates extended "littoral bubbles" into which the Navy and Air Force can plug their systems, which, in turn, extends the capabilities of allies.

In an environment of financial scarcity, directly confronting the connectivity challenge is central to maintaining U.S. and allied capability. Otherwise, as the platform-shredding process generated by financial stringencies unfolds, we will simply have fewer and fewer tools to deal with our global military and security challenges. ■

The Connectivity Opportunity



Robbin Laird is co-founder of the new defense analytical Web site, www.sldinfo.com.

A 21st-century Concept of Air and Military Operations

by Robbin F. Laird

Overview

The evolution of 21st-century air operations is unfolding under the impact of a new generation of fighter aircraft and a significant shift in the role of air operations in support of ground and maritime forces. So-called fifth-generation aircraft often are mistakenly viewed as simply the next iteration of airframes: fast, stealthy replacements of obsolescent legacy platforms. In fact, the capabilities of fifth-generation aircraft, and their integration into a network-centric joint force, will change the roles of manned fighter aircraft in air, ground, and maritime operations. These changes are so far-reaching that the Services face the challenge of crafting a new concept of 21st-century air operations, indeed, of all combat operations.

Historically, fighter aircraft have operated mainly within the classic domain of air operations in the distinct roles of air superiority, air dominance, air defense, strike, and support. Numerous models and modifications of the first three generations of fighters were assigned separable tasks to be performed in sequence. (See box on the next page for a discussion of the five generations.) As the capabilities of fighters increased, the old distinctions blurred, particularly with the introduction of fourth-generation, multirole fighters. Fifth-generation aircraft coming online now will transform the roles of all air elements, including legacy aircraft, and lead to a new concept of operations. Designed (or redesigned) and built in the information age, these aircraft take full advantage of and contribute to the networking of U.S. Armed Forces. The result is a fully capable distributed approach to air operations that enables the United States and its allies to support the full gamut of military missions. Multimission aircraft enable global multimission operations for U.S. joint forces.

Toward a New Concept

Air operations are a significant component of 21st-century U.S. and allied joint and coalition operations. As fifth-generation aircraft enter service in larger numbers, they will generate not only greater firepower, but also significantly greater integrated capability for the nonkinetic use of aircraft¹ and an expanded use of connectivity, intelligence, surveillance, and reconnaissance (ISR), communications, and computational capabilities built around a man-machine interface that will, in turn, shape the robotics and precision revolutions already under way. The capability of air assets to connect air, ground, and maritime forces throughout the battlespace can support the decisionmaking of ground and maritime command elements. Indeed, the command, control, communications, computers (C⁴) and ISR envisaged in networked operations is becoming reshaped into C⁴ and ISR/D, whereby decisionmaking (D) is shared across the battlespace. Distributed information and decisionmaking will be enhanced as air operations become much more capable of providing information in support of the deployed decisionmaker, and kinetic and nonkinetic support elements can be cued in support of air, ground, and maritime combat requirements.

A RAND Corporation brief on air combat issued in August 2008 generated debate about U.S. air capabilities in difficult future combat scenarios.² In particular, the F-35 came under scrutiny in much of the political and analytical coverage. The RAND brief and the reactions to it are a good starting point for discussion of the changing nature of air operations induced by the introduction of the new manned aircraft.

The RAND analysts focused on a core challenge facing the Air Force in the 21st century, namely, the evolving capabilities of competitors' air systems and counterair capabilities. In particular, the RAND study focused on a 2020 scenario over the Taiwan Strait in which Chinese forces sought to deny air superiority to the United

Defining Fifth-generation Aircraft

Jet fighters can be classified in five generations. The first consisted of subsonic aircraft developed early in World War II through the Korean War (German ME-262 Schwalbe, American F-86 Sabre). The second generation incorporated lessons from air combat and ground support during the Korean War and exploited technological advances, especially in materials and electronics (F-8 Crusader, F-104 Starfighter) and was capable of supersonic flight. Third-generation fighters were largely shaped by Cold War competition with the Soviet Union and combat experience in the Vietnam War; these included increasing use of air-to-air missiles and defense against surface-to-air missiles, both of which put a premium on advanced avionics (F-4 Phantom, F-111).

The first three generations of jet fighters lasted about a decade each. The fourth generation began around 1970 and continues to constitute most fighters in service, although recent versions of some fighters are so improved that they sometimes are called generation 4.5 (F-15 Eagle, F-16 Falcon). Fifth-generation fighters are air superiority and multimission aircraft that achieve increased performance through numerous advances in airframe and propulsion and increasingly sophisticated avionics, including flight control systems.

Fifth-generation fighters are distinguished from generations 4 and 4.5 mainly by their inherent stealth and compatibility with a network-centric or distributed concept of operations, although they are much more capable in many respects. Computing capacity, sensors, and communications systems enable them to gather, exploit, and disseminate information to an extent that can multiply the effectiveness of military forces throughout a theater of operations. To date, only the Air Force F-22 and F-35 qualify as fifth-generation fighters, although several nations are developing comparable fighters.

Non-experts tend to think the shift from legacy aircraft to fifth-generation aircraft is largely about the airframe or stealthiness. Stealth is important, but it is the conjunction of stealth and other capabilities that creates a different capability for a flying force:

- Stealth allows the aircraft to operate over enemy positions, and onboard sensors enable it to target mobile as well as fixed weapons systems. Indeed, the increasing capability of mobile air defenses is a major threat to air superiority in the 21st century. Legacy aircraft rely on target data from other platforms to launch strikes and may not be able to identify and target mobile systems. Incorporation of stealth and sensors in one aircraft puts mobile targets within the scope of effective strike actions.

- Command, control, communications, computers, and intelligence, surveillance, and reconnaissance capabilities are built into the aircraft itself. Integration allows the aircraft to process data and to make informed decisions much more rapidly than fourth-generation aircraft, which need Airborne Warning and Control Systems, electronic attack aircraft, and a variety of accompanying specialized assets to operate effectively in a 21st-century threat environment.

- An easily upgradeable, distributed computer system provides processing power that facilitates a greatly improved man-machine relationship. The aircraft can process data and assist pilot decision-making. Indeed, many decisions can be made without intervention by the pilot, which makes the aircraft particularly useful in 21st-century air operations. The man-machine relationship of fifth-generation aircraft enables integration of airborne robotic systems in 21st-century air operations as well. Indeed, as the new aircraft are deployed, a new generation of unmanned systems will develop as well.

States. The study addressed three key elements of U.S. air superiority—the use of nearby bases or seas, exploitation of stealth advantages, and employment of beyond-visual-range (BVR) missiles—applied against Chinese forces. The study argued that all three U.S. advantages could be countered by a Chinese strategy that combined a significant numerical advantage, antiaccess denial strategies, counterstealth innovations, and countermeasures and operations to defeat BVR missiles. In the RAND scenario, the Chinese innovated, but the United States did not.

The study underscored reasonable concerns. Numbers do matter, antiaccess technologies and strategies are evolving rapidly, and defensive measures against stealth and BVR missiles are improving—and Chinese defenses are proliferating. Simply building a small number of highly capable platforms will not enable the Air Force or the U.S. military to prevail in combat.

That is the bad news. The good news is that by leveraging the capabilities of new systems, crafting a 21st-century approach to air operations, more effectively integrating legacy and new air and naval forces, and evolving combined and allied operations, the United States

can counter the evolution of a competitor like China. The proliferation of capabilities being developed by China and Russia globally to U.S. and allied competitors is enhancing the need for a rapidly evolving concept of operations (CONOPS) for U.S. and allied forces shaped by the forcing function³ of fifth-generation aircraft and associated air and naval systems.

Before returning to the analysis of the RAND brief, I want to develop an understanding of 21st-century air operations and the role of fifth-generation aircraft and unmanned systems within the CONOPS. I will then apply the 21st-century CONOPS to the RAND analysis and suggest how the outcome might look quite different.

Connectivity and Battle Management

Air operations in the 21st century are characterized by an increasing ability to connect air, ground, and maritime forces, whereby air assets can support the decisionmaking of ground and maritime command elements. In 20th-century CONOPS, air assets are a largely self-contained force that needs to bring its own assets—notably Airborne Warning and Control System (AWACS) and electronic warfare aircraft—to support air operations. In the new CONOPS driven by fifth-generation aircraft, the combat and strike power of a single aircraft within the operation will not be defined by what it carries, but by its ability to direct and rely on deployed network partners.

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Fifth-generation aircraft will be able to direct strikes by any assets within range of an identified target, whether the weapons are carried by air, ground, or maritime platforms.

In traditional CONOPS, credit for combat power could only be given for internally stored weapons. For the fifth-generation aircraft, a core ability to direct strikes from outside is a core competence for the aircraft and a key element enabling 21st-century air operations. Air battle management becomes networked as well, and not reliant on AWACS, which presents a large profile for air-to-air missiles and thus will be attacked early in an air battle. The Air Force considers the combined air operations center (CAOC) a weapons system in and of itself. To date, CAOCs have been physically located on the ground or dependent on AWACS. With the deployment of fifth-generation aircraft, first the F-22 and then the much more numerous and allied anchored F-35, the CAOC will be enabled by additional flying ISR and command and control (C²) systems. The combination of sensors and stealth enables the new aircraft to operate at altitudes (in the case of the F-22) or over adversary air space (in the case of both aircraft) to serve as nodes in a dispersed or distributed air battle management system. In this role, they become extensions of the CAOC.

The primary forcing function of fifth-generation Air Force aircraft is to enable distributed air operations across the air, maritime, and ground platforms within which unmanned assets and networked information and strike assets become central to the overall capability of the Service. The F-22 is evolving into a battle management system able to fly at a substantially higher altitude than the F-35. After performing its air dominance missions, the F-22 can transition into a battle management and strike management aircraft.

A key dimension of shaping distributed air concepts of operations is shaping the “connectivity workspace” within which the fifth-generation aircraft are linked and the evolution of capabilities to link the new aircraft with other air, ground, and maritime military assets.

With regard to connecting stealth assets, a vital aspect is to communicate without detection within “denied” air space or, as the Air Force refers to it, enabling “antiaccess denial” strike forces. Here, the concern is to connect the F-22 with the F-35 with the B-2 and with new unmanned stealth assets. Connectivity for this effort was the focus of a Joint Requirements Oversight Council decision in July 2008, which approved the F-35 data link as the new standard for integrating airborne assets. Specifically, the Multifunction Advanced Data Link (MADL) is to be used by both the F-22 and F-35 as the centerpiece for data transfer in the antiaccess denial strike mission.

But linking these assets with legacy aircraft, ground forces, maritime forces, and the evolving robotic fleet is a dynamic task. The current data standard Link-16 is considered not robust enough by many analysts to provide for full connectivity for the evolution of U.S. military capability. A new approach such as the new Tactical Targeting Network Technology (TTNT) being developed by the Defense Advanced Research Projects Agency and Rockwell Collins could provide for such a possibility.⁴

Connecting manned and unmanned systems is a central aspect in the evolution of distributed air CONOPS.⁵ Currently, unmanned aircraft systems (UAS) are built with little regard to

connectivity with manned systems. The computer systems of the F-35 will manage new robotic systems that will become part of the airborne air battle management system.⁶ In turn, a 21st-century CONOPS enables the operating characteristics of the fifth-generation aircraft to be optimized.

The RAND authors assumed the fifth-generation aircraft were going to operate as if they were combat aircraft in a 1991 air CONOPS. They concluded that the Chinese air capability circa 2020 would prevail, in part, because of superior numbers of aircraft and weapons. As Douglas Barrie of *Aviation Week & Space Technology* observed, “in the Rand study’s combat scenario, while the exchange ratio is hugely in favor of the F-22, weight of numbers (of a capable combat platform) coupled with weapons load-out still mean key ‘Blue’ assets—tankers, airborne warning and control, maritime patrol, and surveillance unmanned aerial vehicles—would be lost.”⁷

The RAND study evaluated F-22s and F-35s only in their stealth mode; only missiles contained in internal bays were counted when calculating exchange ratios. But fifth-generation aircraft will not operate only in stealth mode. Indeed, their advantage is that they can be loaded heavily with external stores, operate outside the “stealth operational”

range, and launch missiles that are then guided by other fifth-generation aircraft or stealthy unmanned systems (such as the proposed Naval Unmanned Combat Air System) operating within the stealth operational range. After firing external weapons or dropping fuel tanks, the fifth-generation aircraft

can refuel and return to the fight and, operating in stealth mode, enter the combat zone and function as forward air controllers, ISR, or C² assets—with the internal bay still loaded with missiles.

Working through enhanced collaboration is an evolving effort as fifth-generation aircraft are introduced and a “collaborative workspace” is shaped with other aircraft and between air and surface elements. The potential is significant because of the core capabilities of the new aircraft. Fully realizing the potential will require shaping collaborative tools and CONOPS that leverage the elements of a national or allied force structure. Military platforms and systems are significant, but working through effective concepts of operations for using them is central. This is why one should speak of the “forcing function of fifth-generation aircraft,” rather than assuming that simply introducing these aircraft into the inventory is a “silver bullet.”

The F-22

The first Air Force fifth-generation aircraft (the F-22)⁸ has evolved over nearly 30 years. Originally conceived of as the replacement for the F-15 to maintain air dominance against Soviet aircraft, the focus was largely on shaping F-22 capabilities to generate multiple kills of enemy aircraft. While air dominance remains the sine qua non of successful air operations and power projection into denied territory, the still-evolving F-22 can contribute much more to a joint force. Some of the key lessons learned from years of F-22 deployments are being transferred to the F-35 fleet. More importantly, the air dominance capabilities of the F-22 relieve the F-35 from being designed for this mission set and allow it to focus on its synergistic role working with air, ground, and maritime platforms.

connecting manned and unmanned systems is a central aspect in the evolution of distributed air CONOPS

The primary task of the F-22 is air-to-air dominance, followed by core competence in counterair defense missions. The latter task is increasingly difficult, given the evolution of mobile air defense systems. The trend line in adversary air defenses is toward rapid mobility. For example, SA-10s and SA-20s can be dismantled and moved and be ready for action in a short period of time. Mobile air defenses mean that strike aircraft must be able to do target identification, target acquisition, and strike missions virtually simultaneously. A key aspect of the fifth-generation fighter is its onboard processing capability, which allows the pilot to perform operations simultaneously that historically required several platforms operating sequentially.

But the most significant evolution of the F-22 is in its ISR and C² capabilities, both associated with its unique Active Electronically Scanned Array radars.⁹ The F-22 is evolving into a battle management system able to fly at substantially higher altitude than the F-35. After performing its air dominance missions, the F-22 can transition into a battle management and strike management aircraft, a role further enhanced by the deployment of the to-be-much-more-numerous F-35.¹⁰

F-22 and F-35 Dynamics

The limited numbers of the F-22 will ensure that the F-35 will be the dominant fifth-generation aircraft in terms of both numbers and availability in a coalition environment.¹¹ From the standpoint of thinking through 21st-century air operations, the ability of the F-22 and F-35 to work together and lead a strike force will be central to U.S. core capabilities for projecting power. And it is to be remembered that the F-35 is coming off Air Force airfields, allied airfields, Navy carriers, and, in the case of the F-35B (the vertical lift version of the F-35), virtually anywhere close to the action.

The F-22 and F-35 will work together in supporting air dominance, kicking in the door, and supporting insertion of a joint power projection force. Here, the F-22 largely provides the initial strike and guides the initial air dominance operations; the F-35 and fourth-generation aircraft support the effort. The F-35, because of its stealth and sensor capabilities, will be able to operate in a distributed network to provide strike, ISR, and air defense suppression, as well attack shore defenses against maritime projection forces.

The F-35 is more than a fifth-generation fighter; it is a first-generation flying combat system.¹² The effects that the F-35 can deliver within the battlespace are flexible, synergistic, and multidimensional (air, ground, maritime).¹³ The F-35's open architecture allows this flying combat system to become the focal point of three core activities: air-to-air, air-to-ground, and air-to-maritime roles and missions. The F-35 will be defined by how its open architecture is customized by national militaries in meeting their perceived priority needs and mix of air, ground, and maritime mission sets. Its combat capabilities will be defined in part by "CONOPS customization."

One example of an opportunity for CONOPS customization derives from the F-35's multimodal/multimission capability, which

includes the ability to deliver nonkinetic as well as kinetic effects, offering decisionmakers many options. The F-35 is central to operationalizing the networked battle management environment. It can provide services (communications, intelligence, and electronic support) to others in the battlespace in ways that are transparent to its pilot. Large platforms that used to provide battle management will be supplanted by a force mix of the F-35 and unmanned vehicles, shaping a 21st-century approach to air operations.

CONOPS customization is the reason that the F-35B is of special interest to the Marine Corps, Royal Air Force, Italian navy, and other forces. The F-35B's short takeoff and vertical landing (STOVL) capability will make possible a different approach to ground-air integration and CONOPS than with that of the F-35 conventional takeoff version. Almost certainly, weaponization and ISR requirements will be modified to work with the STOVL-enabled CONOPS.

An additional aspect in developing joint or coalition CONOPS for the F-35 will revolve around its interaction with other manned and unmanned assets. With regard to manned assets, a key challenge will be to work an effective connectivity battlespace with other manned aircraft, such as the Eurofighter Typhoon and legacy U.S. aircraft. Here, the advantages of each platform in contributing to the air battle and to the type of flexible military force packages that 21st-century air capabilities provide will be the focus of a joint concept of operations.

In addition to the core dynamic of working with a variety of manned aircraft across the joint and coalition battlespace, the F-35

will be highly interactive with the evolution of robotic elements. UAS are not well designed for self-defense. For early entry UAS to stay alive, they need to be part of a wolf pack built around the protective functions of the manned aircraft. As air dominance and air superiority operations succeed, their significance can recede during an operation, allowing the role of

unmanned aircraft to increase significantly and, over the course of the operation, supplant manned aircraft in ISR and C² roles.

The man-machine attributes and computational capabilities of the F-35 provide a significant opportunity to evolve the robotic elements within airspace to provide for data storage, transmission, collection, weapon emplacement, and loitering strike elements, all of which can be directed by the manned aircraft as the centerpiece of a manned-robotic strike or situational awareness wolf pack. Rather than focusing on robotic vehicles as self-contained units with proprietary interfaces and ground stations, the F-35 can be useful in generating common linkages and solutions to combine into a core wolf pack capability.

Overlaying Concepts

Unlike the authors of the RAND study, I am assuming that the United States is innovating, too, and applying a 21st-century approach to a CONOPS that will complicate Chinese planning and effectiveness. The Chinese will attack U.S. airpower with counterair assets, including fighters in number and in force, and with significant missile strike assets. Like the RAND authors, the Chinese will assume that the Air Force will fight alone, following 20th-century air battle management

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and attack CONOPS. This assumption will be an important contribution to the Chinese defeat.

First, the Air Force and Navy can operate as an integrated strike and defense force. Fifth-generation aircraft will be used as forward air assets to support coordinated strike and defense operations. As the Chinese reach out to strike U.S. air assets, the distributed operations of the Air Force and Navy will use UAS, fifth-generation fighters, legacy aircraft, integration with Aegis systems, and reliance on Navy strike missiles to provide a comprehensive offensive and defensive capability. Allies will contribute land-, sea-, and air-based systems to the fight. Fifth-generation aircraft functioning as forward air controllers will provide a complicated set of vectors of attack and defense, and Chinese strike assets will be exposed to counterstrikes as they seek to reach out to assets they think they can see in the forward area.

Second, the fifth-generation fighters will draw on lethal assets outside the forward area to attack approaching Chinese forces. Distributed over the battlespace, and operating as nodes in the strike determination network, fifth-generation aircraft will guide strikes and determine core targets for a counteroffensive.

Third, the STOVL capability of the F-35B¹⁴ will allow its distribution throughout the battlespace on dispersed launch points to contribute to the diversity of vectors of attack and defense against the Chinese. The ability of the F-35B to penetrate the battlespace in a stealth mode, land in a remote area, and then wait to deploy against a primary target is an additional capability, which this fifth-generation aircraft contributes to the new CONOPS.

Fourth, allies will be available to contribute ISR and other nodes in the attack and defense network, which can contribute to a further enhancement of the distributed network. Australian F-35s can participate in the fight or their Wedgetail and Global Hawk assets deployed to provide further battle management capabilities.¹⁵

Fifth, the introduction of the Navy's new unmanned combat air systems (UCAS) and other unmanned aerial vehicles can provide important strike assets that can be directed by the F-22s and F-35s functioning as forward air controllers.

Sixth, the movement away from AWACS to the use of the fifth-generation fighters as air battle management assets will significantly reduce the ability of the Chinese to shut down the force multiplier aspects of air battle management. Indeed, the RAND study provides an important warning for why the United States needs fifth-generation aircraft. AWACS is an increasingly easy target for a force such as China.

Seventh, the tanker vulnerability identified in the study is a good argument for the next-generation tanker. The tanker selected by the Air Force in 2008 (the NG A330) would deploy farther from the strike area and be able to remain aloft indefinitely (with crew rest areas) and be refueled while deployed. Because fifth-generation fighters operate as a combined strike, ISR, and communications asset, they need to be able to stay on deployment for a period based on the pilot's endurance, not on the fuel capacity or weapons load of the aircraft.

In short, by confronting the Chinese with a distributed 21st-century air CONOPS, the United States and its allies can prevail. If the Air Force operates alone and follows 20th-century air CONOPS and relies on

the limitations of legacy aircraft, the United States loses. That is why it is imperative to focus on a 21st-century CONOPS and to build, buy, and deploy joint and combined assets that enable such a CONOPS.

Moving Forward

Acquiring fifth-generation aircraft in sufficient numbers to enable 21st-century air operations is crucial. Doing so could allow elimination of several legacy systems, such as AWACS, and dedicated electronic warfare assets, which would save money in terms of acquisition and logistics, as well as enhance the capability of U.S. operations. Leveraging legacy fleets is equally important. Here, the F-35, which will become the centerpiece of the 21st-century air operations fleet, with MADL and other post-Link-16 (such as TTNT) connectors for strike and defense fleets, is the clear centerpiece.

The F-35 has the further advantage of being a joint and coalition aircraft.¹⁶ This means that the integration of a significant part of U.S. power projection forces—Air Force, Navy, and Marine Corps—is built into acquisition of the aircraft. And as coalition partners acquire the aircraft worldwide, working joint concepts of operations with those allies will enable both allies and the United States to operate in a 21st-century CONOPS.

Indeed, integration of the Navy and Air Force within an overall power projection force is suggested by such an approach. The Navy's first 21st-century carrier will carry F-35s and probably UCAS, which will allow the Navy to configure the carrier as a significant contributor to joint CONOPS. And the UCAS will precede any new bomber for the Air Force and will make an important technological and operational step toward defining how a new bomber can contribute to the joint battlespace.

By becoming much more closely integrated with the Air Force, the Navy can make intelligent decisions about the future of its surface fleet. The F-22 will play a key role as the lead element of a Navy or Air Force strike force, but the RAND analysis underscores the need for the United States to significantly increase the number of "bullets" that it can bring to the fight. The Navy can provide those bullets in terms of missiles deliverable from the surface fleet.

Unmanned contributors to the joint fight should be developed according to their ability to work with fifth-generation aircraft. Some will operate as decoys whereby the Chinese, for example, fire against what they think are deployed U.S. strike assets and so open themselves to a powerful counterstrike from distributed assets. Some will function as airborne routers operating in the battlespace to receive data from fifth-generation fighters machine systems and then distribute that data to the relevant assets in the battlespace. Airborne routers and other assets will also dump data to ships for further processing and distribution in determining strike and defense positions, which will then be provided to the shooters available to strike key targets. And some will function as weapons caddies carrying weapons to be targeted by manned aircraft or forward deployed UCAS.

In short, a 21st-century concept of air operations opens the way to an overall 21st-century concept of power projection. And shaping such an approach is crucial to defeating an adversary such as the one

acquiring fifth-generation aircraft in sufficient numbers to enable 21st-century air operations is crucial

posed in the RAND report and to the general ability to link U.S. and allied capabilities into a collaborative force able to provide for a global security enterprise.

Notes

¹ Examples of nonkinetic effects are information and cyber warfare, electronic attack, intelligence, surveillance, and reconnaissance (ISR) and command and control contributions to ground forces, management of robotic ISR elements, and processing of information to support shared decisionmaking between air and ground forces.

² John Stillion and Scott Perdue, "Air Combat, Past, Present and Future" (RAND Project Air Force, August 2008). The report was not released officially, but an unauthorized version has been available on the Internet since shortly after it was presented. One source is available at <www.flightglobal.com/cgi-bin/mt/mt-search.cgi?search=baby+seals+brief&IncludeBlogs=108>. Among the articles that discuss the report are Wendell Minnick, "RAND Study Suggest U.S. Loses War With China," *Defense News*, October 16, 2008; Stephen Trimble, "Under Attack," *Flight International*, October 14–20, 2008; and "The F-35's Air-to-Air Capability Controversy," *Defense Industry Daily*, October 12, 2008.

³ In the terminology of systems engineering, a forcing function is a parameter that controls the behavior of a system and makes its behavior regular and predictable. It is also known as a driver function or, in common parlance, a driver.

⁴ A brief description of Tactical Targeting Network Technology is available at <www.darpa.mil/ipto/Programs/tnt/tnt.asp>.

⁵ As Major General Charles Davis, USAF, the Program Executive Officer for the F-35, recently commented, "We know that we want to share targeting, data, threat or electronic warfare information with or from a UAV. The issue is not if we can do it. We've got the software. But it is a pretty big gorilla in terms of the number of aircraft that will have the capability. You've got to find the message and determine what it says. How do I want it to go from node to node? They haven't solved it, but it has highlighted the problems with a future networking system."

⁶ As General Davis observed, "We will change processing systems twice within the next four years. We will do this by simply taking out the chip and replacing it. The F-35 is a flying computer able to manage the battlespace." See David Fulghum, "JSF Honchos Talk Program Future," *Aerospace Daily and Defense Report*, February 13, 2009.

⁷ Douglas Barrie, "Quantity and Quality," *Aviation Week & Space Technology*, November 3, 2008, 66.

⁸ Michael Sirak, "F-22A: The Next Stage-Raptor Rapture," *Jane's Defence Weekly*, January 18, 2006.

⁹ "F-22 Demonstrates Sensor Data Transfer," *Defence Systems Daily* (May 6, 2008); "F22s May Deploy to Middle East," *Aviation Week & Space Technology*, March 31, 2008, 21; "Not Just Fighters," *Aviation Week & Space Technology*, June 25, 2007, 27.

¹⁰ David Fulghum, "F-35 EW System Redefines Combat," *Aviation Week & Space Technology*, January 21, 2008, 50; David Fulghum and Graham Warwick, "New Missions for the F-35," *Aviation Week & Space Technology*, July 23, 2008, 13.

¹¹ Graham Warwick, "USAF Plots Path from F-22 to F-35," *Aviation Week & Space Technology*, September 29, 2008, 36.

¹² The Marine Corps argues for the F-35B as a "flying combat system." The Service's aviation command focuses on the F-35B as a "key enabler for distributed operations lethality" with "unprecedented situational awareness and connectivity with ground forces providing organic high-end ISR and electronic warfare capabilities." Also see Gareth Jennings, "Above and Beyond: F-35 technology offers a new vision of future combat," *International Defence Review*, June 2008.

¹³ See General Davis' comments in Douglas Barrie et al., "Industrial Dogfight," *Aviation Week & Space Technology*, July 21, 2008, 24.

¹⁴ "Though nearly identical in appearance to the F-35A, the F-35B incorporates a counter-rotating shaft-driven lift fan positioned directly behind the cockpit. The lift fan, produced by Rolls-Royce, is turned by a drive shaft from the F-35's massively powerful single engine, which features a swiveling rear exhaust nozzle that vectors thrust downward during vertical flight. The lift fan, engine, and stabilizing roll ducts beneath the F-35B's wings combine to produce 40,000 pounds of lifting force. Converting the F-35B from STOVL to conventional flight and vice-versa requires only the push of a button by the pilot. The system otherwise operates automatically." See "Lockheed Martin F-35B STOVL stealth fighter achieves successful first flight," available at <www.lockheedmartin.com/news/press_releases/2008/061108ae_f35B_firstflight.html>.

¹⁵ David Fulghum, "Australia's Need for UAVs becomes Critical," *Aviation Week & Space Technology*, May 31, 2006.

¹⁶ A key aspect of the F-35 not discussed here is the new manufacturing system, similar to the Boeing Dreamliner or Airbus 350, in providing automated production capabilities, subsystem integration, and global sourcing. For a discussion, see Robbin F. Laird, "The F-35 as a Manufacturing and Export Model," *Manufacturing News*, March 9, 2009, available at <www.manufacturingnews.com/news/09/0309/laird.html>.

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The Metrics Of National Decline

BY PATRICK BUCHANAN

"Bush Boom Continues" trilled the headline over CNBC's Lawrence Kudlow column, as George W. Bush closed out his seventh year in office. "You can call it Goldilocks 2.0," purred Kudlow.

Yes, you could. But what a difference 12 months can make.

Final returns are now in on the eight years of George Bush. Charles McMillon of MBG Information Services has crunched the numbers. And, pace Kudlow, the only relevant comparison is to Herbert Hoover.

From January 2008, right after Kudlow's column ran, through January 2009, the U.S. economy lost 3.5 million jobs. The private sector loss of 3.65 million jobs was slightly offset by 148,000 jobs created by federal, state and local governments. Say what you will, the Bush years were boom times for Big Government.

And the private sector? Beginning and ending in recession, the Bush presidency added a net of 407,000 private sector jobs over eight years, less than 51,000 a year, the worst eight-year record since 1927-35, which includes the first six years of the Great Depression.

By January 2009, the average workweek had fallen to 33.3 hours, the lowest since record keeping began in 1964.

From Jan. 31, 2001, through Jan. 31, 2009, 4.4 million manufacturing jobs, 26 percent of all of the manufacturing jobs in the United States, disappeared.

Semiconductors and electronic component producers lost 42 percent of their jobs. Communications equipment producers lost 48 percent of their jobs. Textile and apparel producers lost, respectively, 63 percent and 61 percent of their jobs.

As a source of American jobs, manufacturing, for the

(Continued on page 12)

Obama's Top Economic Aide Praises The 'Wal-Mart Economy'

A top new economic policy advisor to President Obama believes that Wal-Mart and "the Wal-Mart economy" have been very good for American workers, low-income Americans who can't afford to buy more expensive products made in America, and American taxpayers who pay part of the health care costs of thousands of Wal-Mart employees and their children.

Jason Furman, 38, who was hired to work as deputy director of Obama's National Economic Council, wrote a paper in Nov. 2005 entitled "Wal-Mart: A Progressive Success Story," in which he states that "there is little dispute that Wal-Mart's price reductions have

benefited the 120 million American workers employed outside of the retail sector."

But there is such a "dispute," especially among executives and owners of domestic manufacturing companies who have long argued that the "Wal-Mart economy" has

destroyed the American manufacturing sector — the wealth creation part of the United States economy — and has contributed to the demise of the American middle class.

Not in Furman's eyes. The Harvard Ph.D. notes that Wal-Mart saved American consumers \$236 billion in 2004, or \$2,239 for the average American household, though, like most Wal-Mart proponents, Furman does not mention the trade deficit in goods for the same year, which totaled \$670 billion (or \$8,800 for the average American household).

The fact that thousands of Wal-Mart workers have to be subsidized by the federal government does not

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Aide Embraces The 'Wal-Mart Economy'... (From page one)

phase Furman. In fact, "that is where a second progressive success story comes in," he writes in a paper published November 28, 2005, when he was a visiting scholar at New York University.

The Clinton administration successfully expanded the "social safety net" to American workers not paid enough to afford health care coverage, he explains. Expanding government assistance programs to support Wal-Mart workers who can't make it on their own is something that should be cheered by "progressives," he claims. The bulk of the benefits of government social programs go to "workers that receive them, not to the corporations that employ them," Furman states.

Progressives who have fought the growth of Wal-Mart in the United States have been on the wrong side of the battle, claims the Obama appointee who worked for Treasury Secretary Robert Rubin during the Clinton administration. By blocking the expansion of Wal-Mart into new communities, progressives are not only limiting the benefits of low-priced products to low- and moderate-income customers but they "also limit the job opportunities that Wal-Mart and other retailers provide," writes Furman. "More puzzling is that some progressives have described Medicaid, food stamps, the Earned Income Tax Credit and public housing assistance as 'corporate welfare.' The right response to Wal-Mart is not to scale back these programs but to expand them in order to fulfill the goal of making work pay." Without these government worker assistance programs, Furman notes later in his paper, more people, especially women, would be on welfare.

In keeping with the Obama administration's unwillingness to address domestic production as a means of helping the United States escape the current downturn, Furman argues for an expansion of policies that encourage "Everyday Low Prices." He cites studies describing how much money Americans save by shopping at Wal-Mart over "unionized chains like Kroger and Safeway." He explains: "Because moderate-income families spend a higher percentage of their

incomes on food than upper-income families, these benefits are distributed very progressively." He notes that the company Global Insight was hired by Wal-Mart to quantify the national benefits of Wal-Mart's low prices, and highlights the study's results: a decrease in commodity prices of 4.2 percent between 1985 and 2004 and a 3.1 percent decline in overall consumer prices. A further increase of \$118 billion in purchasing power for Americans "is primarily the result of Wal-Mart's contribution to total factor productivity, but is also due to its ability to bargain for lower prices for imported goods," he writes, noting in the paper's first footnote that "the author has never received payment from Wal-Mart of any kind."

Wal-Mart is also great at creating jobs. "In the spring of 2004, a new Wal-Mart opened up in Glendale, Ariz.," Furman explains. "The store received 8,000 applications for 525 jobs with wages starting as low as \$6.75 per hour. A Harvard applicant has a higher chance of being accepted than a person applying for a job at that Wal-Mart. These anecdotes strongly suggest that jobs at Wal-Mart are better than opportunities these workers would have in the absence of Wal-Mart, either other jobs or unemployment."

Furman describes the average wage of a Wal-Mart employee compared to others in the retail sector. He says that unionized retail workers make 20 percent to 40 percent more than Wal-Mart workers "a fact that is reflected in a similar magnitude mark-up of prices at unionized grocery stores." Wal-Mart pays about 70 percent of the cost of health benefits for its workers, though only 48 percent of Wal-Mart's employees have health insurance — compared to 46 percent in the retail industry. Five percent of Wal-Mart workers are on Medicaid; 27 percent of Wal-Mart workers' children are on S-CHIP, the federal health insurance for children. "The fraction of children is relatively large, reflecting the expansion of public health coverage for children in low- and moderate-income families," Furman writes. "The fact that Wal-Mart employees

top the Medicaid rolls in a number of states is simply a reflection of Wal-Mart's enormous size, not the higher likelihood that its employees will be on Medicaid."

Why would a Wal-Mart worker go on Medicaid rather than the Wal-Mart-provided health care plan, Furman asks. "Because a family policy costs \$1,800 annually for a Wal-Mart worker. A Medicaid-eligible worker has the choice of taking home an additional \$1,800 in take-home pay and being insured through Medicaid or taking home less pay and instead getting Wal-Mart's insurance. The beneficiary of choosing Medicaid is the worker — who gets to keep an additional \$1,800 — not Wal-Mart. Wal-Mart — like every other business — is interested in paying the lowest possible total compensation (wages and benefits) consistent with recruiting, motivating and retaining a qualified workforce. As a corporation, it does not fundamentally care about whether this cost is in the form of wages or benefit."

None of this should be held against Wal-Mart because President Bill Clinton (from Wal-Mart's home state of Arkansas) changed the economic dynamic in the United States in the 1990s by expanding the Earned Income Tax Credit. He did this based on the idea, described in the Furman paper by Clinton himself, that "people who work shouldn't be poor. We need to make work pay by expanding the EITC for the working poor...At the same time, we need to assure all Americans that they'll have access to health care when they go to work."

Clinton "radically" shifted social assistance programs in America away from non-working Americans to those who are working, leading to "large increases in the incentives to work," writes Furman. "The intention of these expansions was two-fold: to get more low-income people, especially mothers, into work and to ensure that even low-paid, unskilled jobs come with a decent wage and benefits. Wal-Mart employees would seem like perfect candidates on both scores. Critics of

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THE F-35 AS A MANUFACTURING & EXPORT MODEL

The Nation Ignores The Defense Industry In Its Quest For An 'Economic Stimulus'

BY ROBBIN LAIRD

Last year, *Manufacturing & Technology News* editor Richard McCormack in a commentary on the defense sector [MTN, Oct. 18, 2008] underscored the importance of manufacturing in this sector for the U.S. economy. He wrote: "Few talking heads have said anything about the importance of reviving the U.S. high-tech manufacturing base and of rebuilding U.S. industrial capacity for the 'environmental' era that will demand a new generation of radical innovation and efficiency in product design, production and use. Without a viable industry, how is the United States going to pay off even more debt? By selling lollipops to the world's suckers who continue buying America's financial 'paper'?"

This plea for consideration of the role of manufacturing and exports for the future of the American economy is of growing significance as the economic crisis deepens. Notably, President Obama has orchestrated an economic stimulus package that does little to support manufacturing. Even more stunning, the stimulus is focused on domestic revival with little consideration for generating the exports that will be needed to pay off foreign bankers buying U.S. Treasuries.

There is plenty of press coverage of problems of cost over-runs for defense programs and a new desire for procurement reform that will somehow help solve the nation's economic woes. But there is virtually no media coverage addressing the essential role that the U.S. defense manufacturing sector plays in developing new technologies, deploying advanced manufacturing processes, generating jobs and driving global exports. For example, the media is fixated on the decline of the auto sector, yet there has not been a single story about how BAE Systems is building a new ground vehicles manufacturing facility in Detroit, employing engineers from the auto sector.

Notably absent from the numerous recent stories about redundancy of military aircraft is the role of a key program that will define the tactical aircraft industry for the next 30 years: the F-35 program, which will become the "foundational" platform for U.S. and allied air forces. This program is fundamentally reshaping manufacturing and will lead to an era of sustained global exports. Whatever the final number aircraft to be

produced (from 3,000-5,000), the F-35 will define air and ground combat for years to come. It is built on a unique globally sourced program with 20 percent of the aircraft being produced through the contributions of foreign partners, a first in military aircraft manufacturing. Because of its great potential and immediate economic benefit, the F-35 technology and production program is worth a close look.

For the novice, the shift from "legacy" aircraft to the F-35 is largely about a stealthy airframe. The first stealth aircraft — the F-117 and the B-2 — demonstrated the utility of stealth to support strike operations and dominate air defenses. Stealth combined with a new generation of integrated sensors make the F-35 especially important by creating a different capability for a flying force. Stealth allows the aircraft to operate over enemy positions, and a new generation of sensors on board will allow the aircraft to strike mobile as well as fixed targets. Indeed, a major threat to air superiority in the 21st century is the growing capabilities of mobile air defenses, because "legacy" aircraft rely on target data obtained outside of the aircraft itself to launch strikes. With stealth and sensors integrated within the F-35, mobile targets — an increasingly important element of adversarial systems — are within the scope of effective strike actions.

Second, all of the previous add-on C⁴ISR (command, control, communications, computers, intelligence, surveillance and reconnaissance) capabilities that led to

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The F-35 Joint Strike Fighter is being produced in Fort Worth, Texas, with an estimated 3,000 people projected to be involved in assembly.

(Source of photo: Lockheed Martin)

F-35 As A Manufacturing Stimulus... (Continued from page three)

substantial price escalations in previous aircraft are built into the F-35 itself. The integration allows the aircraft to process data and to make informed decisions much more rapidly than a fleet of older aircraft that need AWACS, electronic attack aircraft and a variety of specialized assets to accompany them to work effectively.

Third, the computational capabilities of the new aircraft are significantly greater than legacy aircraft. The F-35 has an advanced distributed computer system on board that can be upgraded simply by changing the chips empowering the system.

Finally, the processing power and integration of the aircraft facilitate a new man-machine relationship with the use of airborne robotic systems that process data and assist pilot decision-making.

What is interesting for the readers of *Manufacturing & Technology News* is that a new manufacturing process generates this capability. The design of the production system is essential to the emergence of the new aircraft. The manufacturing system is one of the key attractions to the foreign partners participating in the program. The F-35 is a 21st century manufactured product that embodies capabilities similar to the new manufacturing systems used by Boeing and Airbus in producing their next generation commercial aircraft.

The F-35 is not a traditionally produced combat aircraft assembled from a myriad of components provided by suppliers. It is a moving-line, high-tolerance manufactured product in which key partners manufacture assemblies and sub-systems. Stealth is a product of the high-tolerance manufacturing process, and is not "crafted in" through hand-built efforts.

As a program, the F-35 has been built around new manufacturing processes that are an essential part of the systems development phase. Machine tools and all elements of production are being pre-tested through the actual manufacturing of test aircraft. Based on feedback from this process, production systems are being altered so that full-scale production will be as efficient and effective as possible.

The F-35 prime contractor (Lockheed Martin) has adopted a "Fighter Production System" in which the final assembly facility is the outcome of a closely networked system of global suppliers. A collaborative engineering approach links the core stakeholders in the production process for a high-tolerance aircraft from the start. It will not use a traditional supply chain where the flow comes from the periphery to the final assembly center.

F-35 production will utilize a hub-and-spoke system. Collaborative information sharing and engineering processes are co-located in the hub and are closely connected to the stakeholders. A "digital thread" manufacturing capability enables CATIA design models to feed directly into computer numerically controlled machining centers and coordinate measurement machines. Other CATIA designs are processed in a composite programming system before being sent to fiber placement machines. In both cases, the finished product can be traced back to the original computer model through a "digital thread," thereby ensuring

greater precision and accuracy in manufacturing. Global suppliers are collaborative participants in a networked engineering approach to the development and production of the aircraft. They are integrated into the "digital thread" manufacturing process.

The cost of aircraft produced by this manufacturing system will be driven down by the automated nature of the production facility. Life cycle costs will be further reduced by logistics and sustainment capabilities built directly into the F-35 as a manufactured product. Several of the tools being used to build the aircraft will be the same tools used to maintain the aircraft. The high degree of automation built into the integrated sensor systems on the aircraft will allow real-time monitoring of the health of the aircraft. This data will be delivered to logistics workers and will drive down maintenance costs.

Although it is central to the F-35 enterprise, the new manufacturing approach is not widely appreciated. For the next three years, the number of aircraft to be produced is more significant as a generator of revenue to prepare for the *launch* of production. Much of the program money over the next three years will be pushed into the manufacturing base to build the machine tools and carbon-fiber thread machines.

In short, the F-35 is an example — and not the only one — of a significant advance in manufacturing technology. The new engineering and production processes will allow the United States to demonstrate global manufacturing leadership. Unfortunately, the economic media in the United States continues to ignore the importance of the defense sector for hundreds of thousands of skilled workers, their communities and the nation. Instead, the media's focus is on sideshows like the presidential helicopter — as if it were something like a Wall Street corporate jet "scandal." Although amusing, the fate of the nation and its industrial base is at stake.

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Letter To The Editor

One of my long time largest customers, Brake Parts Mfg. in Litchfield, Ill., is closing its doors. They are relocating manufacturing operations to China. After 28 years of my doing business with them things tend to get personal. You come to know the families involved who have made their livings for generations in the company. The town of Litchfield grew up around Brake Parts as there isn't much else out there. These are difficult times and I wanted to make sure that people understand this crisis. We are losing businesses that are 100+ years old. The United States is in a depression not a recession. This is what happens when lawyers dictate trade policies.

— Barry McKenna
McKenna Service Company
Mundelein, Ill.

Research Community Perplexed By Buy American

The American Association for the Advancement of Science isn't quite sure how various "Buy American" statutes contained in the \$787-billion Stimulus Bill will impact the research community. These "less-noticed" Buy American provisions "are raising questions for researchers," notes AAAS in an e-mail to its members. There has been no guidance issued by the various R&D agencies such as the National Science Foundation, NIH or the Department of Energy

on how recipients of R&D grants must deal with the requirement that all manufactured goods used in construction or renovation of public buildings be produced in the United States. Research organizations are not sure yet how the requirement will impact the purchase of scientific measurement equipment and instrumentation. Moreover, Section 1611 of the bill "incorporates the 'Employ American Workers Act,' which in theory could exclude foreign graduate

students and postdocs from stimulus projects," notes AAAS in its February 25 "Policy Alert" to members. "While agency heads may be able to waive these provisions, how they will play out in practice is not at all clear."

Meanwhile, the head of the World Trade Organization says the Buy American clause in the Stimulus Bill is legal. "The final compromise is that this provision will be implemented in a way that is consistent with U.S. WTO obligations," said WTO Director-

General Pascal Lamy on February 24 in Seoul, Korea. "Unfortunately, Lamy's quote has not received much coverage," says Steven Capozola, communications director for the Alliance for American Manufacturing. "But the truth is that Buy America provisions are consistent with U.S. obligations under the WTO's General Procurement Agreement. And so, all the fuss about 'Smoot Hawley' and 'protectionism' was overblown and inaccurate."

Major Purchasers

Machine Tool Consumption, \$-millions

		<u>2008 (est.)</u>	<u>2007 (rev.)</u>
1.	China	\$19,365.0	\$16,171.0
2.	Germany	9,950.1	7,454.6
3.	Japan	8,030.5	7,637.0
4.	United States	6,755.8	5,863.6
5.	Italy	5,809.1	5,150.5
6.	South Korea	4,150.0	4,150.0
7.	Taiwan	2,800.0	3,563.0
8.	Brazil	2,547.2	1,822.6
9.	India	1,870.4	1,808.9
10.	France	1,773.5	1,573.6

Source: Gardner Publications, Inc.

Top Producers

Machine Tool Shipments, \$-millions

		<u>2008 (est.)</u>	<u>2007 (rev.)</u>
1.	Japan	\$15,846.9	\$14,323.2
2.	Germany	15,656.8	12,922.5
3.	China	13,965.0	10,750.0
4.	Italy	8,208.8	7,293.4
5.	Taiwan	5,000.0	4,492.0
6.	South Korea	4,550.0	4,550.0
7.	United States	3,787.5	3,246.9
8.	Switzerland	3,742.9	3,514.7
9.	Spain	1,540.2	1,433.3
10.	Brazil	1,288.7	1,157.8

Source: Gardner Publications, Inc.

U.S. Is Far Behind In Machine Tool Use And Production

China's consumption of machine tools jumped by 20 percent in 2008, to \$19.4 billion, almost three times the amount of machine tools purchased in the United States (at \$6.7 billion), according to Gardner Publications. Germany was the world's second largest purchaser of machine tools in 2008, at \$10 billion, followed by Japan at \$8 billion, and then the United States in fourth place.

However, consumption of machine tools in the United States increased at a healthy clip of 15 percent in 2008 to \$6.7 billion. Machine tool consumption is one of the most important measures of the health of a country's manufacturing sector because machine tools form the basic building block of manufacturing. The United States accounts for only 10.7 percent of all machine tool purchases among the top 10 countries globally.

On the production side, the United States was in seventh place globally in 2008 (with production of \$3.8 billion), well behind Japan in first place (at \$15.8 billion), Germany (\$15.6 billion), China (\$14 billion) and Italy (\$8 billion). The United States accounted for only 5 percent of production of machine tools in 2008 among the top 10 producers.

Trends Analyst Suggests The Economic End Is Near

The “Greatest Depression” is under way and it is going to get strange really soon, according to the Trends Research Institute, which has been predicting economic Armageddon for years. “Global financial markets are collapsing,” says Trends Research Institute director Gerald Celente. Soon there will be massive bank failures, runs on banks, and bank holidays. “Even if deposits are FDIC insured, quick access to money is by no means assured,” says Celente. “At a minimum, have reserves on hand for emergencies.”

There is no economic turnaround in sight because the global financial system was built upon greed, fraud, speculation and cheap money. No amount of government stimulus packages, buyouts and bailouts can avert the coming tragedy.

“Undeterred economists, analysts and pundits continue to speculate on buying opportunities and market bottoms, but there is no market bottom in sight,” says Celente. “Each new day produces a new record low. The only figure that can be forecast with confidence is that the Dow won’t reach zero!”

Governments will soon be taking drastic measures to prevent a total economic collapse and public panic. “We have cautioned the likelihood of such measures before, but the rapidity and severity of the economic unraveling now demands immediate attention,” says Celente. “When the ship is sinking there are very few options: life boats, life rafts, life preservers and, for the late to act, possibly a few pieces of floating debris to cling to.”

Celente says that gold is about the only safe financial haven. It has already surged above \$900 an ounce and Celente has long predicted that it will reach \$2,000 per ounce, “and beyond.”

MAPI Expects Economic Upturn By End Of Year

It’s going to be a rough year for manufacturing production in the United States, according to the Manufacturers Alliance/MAPI. As the recession intensifies, MAPI projects manufacturing production in 27 major American industries will decline by 9 percent in 2009, rebounding by 3 percent in 2010. “A severe recession among our global partners has caused exports to decline, thereby removing a previously positive support to the economy,” says Daniel Meckstroth, chief economist at MAPI.

Industrial production fell by 16 percent at an annual rate in the fourth quarter of 2008, after falling at a 9 percent annual rate in the third quarter. “High-tech industrial production fell at a 29 percent annual rate in the fourth quarter of 2008,” says MAPI. Steel production declined by 41 percent, material handling equipment production dropped by 25 percent, industrial machinery production fell by 23 percent and housing starts were down by 43 percent.

But the recession should ease by the end of the year, as the federal government’s stimulus spending starts to penetrate the economy, as pent-up demand begins to spill over into spending, as lower commodity prices begin to free up resources, as lower mortgage and borrowing rates improve the housing market, and as declining imports help keep money in America. Let’s all pray that this happens.

‘Some Of Us Are Looking At The Stars’

Amidst a nerve-wracking crash of the stock market (and the article contiguous to this one), here is a worthy diversion: wit and levity from the play that made the Irishman Oscar Wilde famous, “Lady Windermere’s Fan.”

- I can resist everything except temptation.
- Don’t lose your temper; you have only got one.
- Now-a-days we are all of us so hard up that the only pleasant things to pay are compliments.
- Who are the people the world takes seriously? All the dull people one can think of.
- Men become old, but they never become good.
- I am the only person in the world I should like to know thoroughly; but I don’t see any chance of it at present.
- When men give up saying what is charming, they give up thinking what is charming.
- A moment may ruin a life.
- If a woman wants to hold a man, she has merely to appeal to what is worst in him. We make gods of men, and they leave us. Others make brutes of them and they fawn and are faithful.
- My own business always bores me to death. I prefer other people’s.
- Whenever people agree with me, I always feel I must be wrong.
- In this world, there are two tragedies. One is not getting what one wants, and the other is getting it. The last is much the worst, the last is a real tragedy.
- A man who knows the price of everything and the value of nothing.
- Experience is the name everyone gives to their mistakes.
- I like talking to a brick wall – it’s the only thing that never contradicts me.
- What a pity that in life we only get our lessons when they are of no use to us.
- Actions are the first tragedy in life, words are the second. Words are perhaps the worst. Words are merciless.
- If I lost my ideals, I should lose everything.
- We are all in the gutter, but some of us are looking at the stars.

Far More Plants Are Closing Than Opening In The U.S.

ArcelorMittal plans to indefinitely close its Cleveland, Ohio, steel plant, and lay off 960 workers, due to the downturn in the automobile industry. ArcelorMittal's Cleveland plant "is the company's most efficient facility and perhaps the most efficient in the world," says Rep. Dennis Kucinich (D-Ohio). "The idling of a mill with such great productive capacity and such a well-trained workforce is disconcerting not just for Cleveland, but for the steel industry throughout the country."

Integrity Manufacturing of Shepherdsville, Ky., a metal fabricator, has shut down, and laid off as many as 400 workers, according to the *Business First* newspaper in Louisville. "An employee who answered the door at the company's factory and who asked not to be identified, said that the decision was made [March 3] for the company to cease production," says the publication. "There were only a handful of cars in the company parking lot when a *Business First* reporter visited the plant."

Spartan Corp. has announced plans to close its Jackson, Mich., electronics manufacturing plant and lay off 210 workers. The company will shift production from the factory to plants in Florida and Vietnam.

Jabil, the St. Petersburg, Fla.-based electronics contract manufacturing firm, has announced plans to lay off 3,000 of its 85,000 workers. It will close 10 of its manufacturing plants throughout the world.

Burgess Norton Manufacturing has announced plans to close its automotive and truck piston plant in Claremore, Okla., and lay off 105 employees. "It's with great regret that we take this step," said company president Brett Vasseur. "Business conditions in the automotive and commercial truck industry have deteriorated significantly over the past several months."

International Game Technology, a maker of slot machines, has announced plans to lay off 660 workers, about 200 of which will be at the company's manufacturing plant in Reno, Nev. The company last year had 5,600 employees.

Cabot Corp., a maker of carbon black, has announced plans to close four of its manufacturing plants, mothball two others and delay opening a factory in China. The Boston-based company did not say which of its 39 manufacturing facilities would be closed. Production of its rubber blacks declined by 29 percent globally in the fourth quarter 2008, due to a steep decline in demand for tires. The price for rubber blacks has also fallen from \$1.40 per pound in September to \$0.94 in January. "We continue to be

concerned about the automotive and construction sectors," says CEO Patrick Prevost.

Cesna has announced plans to lay off an additional 2,000 workers on top of the 2,600 announced in December. About 4,000 workers in Wichita, Kansas, will be leaving the company, along with 200 people from its plant in Independence, Kansas. "These numbers are profound," says Cesna CEO Jack Pelton. "It is extremely painful to lose so many of our colleagues and friends." Cesna is owned by Textron, which says slowing sales will force it to make more reductions later in 2009.

Dow Chemical has announced plans to lay off 5,000 employees and start closing plants throughout the world. The company in December said it will close 20 plants worldwide, and cut output in another 180 plants. Dow will cut production at its largest manufacturing facility in Freeport, Texas. It will close its production of vinyl resins at its Texas City Plant, along with styrene plants in Oyster Creek, Texas.

BASF has announced plans to temporarily close 80 manufacturing plants throughout the world and reduce production at 100 other plants, impacting 20,000 workers.

Advanced Micro Devices announced plans in January to cut 1,100 jobs and spin off its manufacturing operations into a separate company in partnership with the Abu Dhabi sovereign wealth fund. The company cut 600 workers in December after firing 1,600 earlier in 2008. "As a result of the continuing global economic downturn, we have determined that we need to take difficult but prudent actions designed to reduce our costs," the company said in a statement. CEO Dirk Meyer and chairman Hector Ruiz will reduce their salaries by 20 percent; senior executives will have their pay cut by 15 percent; those not eligible for overtime will see salaries decrease by 10 percent; and those eligible for overtime will see their pay decrease by 5 percent. The company has stopped making contributions to employees' 401(k) plans.

Milliken has announced plans to close its 50-year-old textile plant in Barnwell, S.C., and lay off 120 people.

OptiSolar Inc. of Los Angeles is laying off 300 workers — half of its workforce — and has halted construction of a manufacturing plant because it cannot secure funding needed to expand. The 550-megawatt solar plant would have been built in Sacramento, Calif. The company will lay off 105 workers in Sacramento and another 185 in Hayward

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Plants Closing... (From page seven)

The windpower industry is experiencing layoffs. Clipper Windpower of Carpinteria, Calif., will lay off 90 of its 390 workers at its plant in Cedar Rapids, Iowa, according to the Associated Press. LM Glasfiber will lay off 150 workers and stop production at its factory in Little Rock, Ark. DMI Industries of North Dakota will cut its workforce by 20 percent, including 90 jobs at its wind-turbine tower plant in Fort Erie, Ontario. Aerisyn of Chattanooga, Tenn., will lay off 54 workers at its Chattanooga, Tenn., wind tower manufacturing plant. And Trinity Structural Towers of Fort Worth, Texas will lay off 131 workers in Tulsa, Okla.

Sunoco has announced plans to close a polypropylene manufacturing facility in Bayport, Texas, and take a charge of \$35 million. The company says the plant, which produced 400 million pounds per year of polypropylene, was no longer financially viable.

Multi-Color Corp., a maker of labels, has announced plans to close its heat-transfer label plant in Framingham, Mass.

Bardon Homes of Syracuse, N.Y., has closed its manufacturing plant in Preble, N.Y., and will lay off 20 workers. The company will move all of its manufacturing of precut floors, interior and exterior walls and roof trusses to a factory in Middleport, N.Y.

Ethan Allen Interiors has announced plans to close its Eldred, Penn., upholstery manufacturing facility and lay off 350 workers.

Dubuque Stamping & Manufacturing in Dubuque, Iowa, has laid off about 25 percent of its workforce, or 40 workers, due to the recession. The company makes stampings, tools and dies for the automotive, appliance, agriculture and heavy truck industries.

Cianbro Corp. in Brewer, Maine, has announced plans to cut 110 workers from its new manufacturing plant making equipment for the oil refinery industry. The drop in oil prices has impacted its business,

Bridgestone has announced plans to stop making passenger and light truck tires at its manufacturing plant in LaVergne, Tenn., and lay off 534 workers. In all, the company will have laid off 802 workers at the facility since it started downsizing last year. The company will continue making tires for large commercial trucks at the plant and continue to employ 700 workers. Bridgestone, a Japanese company and the world's largest tire and rubber company, has been producing tires at the LaVergne plant since 1982.

Dott Manufacturing Co., in Deckerville, Mich., is expected to close up shop and lay off 160 people, according to Rhonda Heilig, president of the United Steelworkers local. The plant makes molded and decorated surface acrylics and car emblems.

Intel Corp. is closing its last manufacturing plant in Santa Clara, Calif., bringing an end to an era of manufacturing in Silicon Valley. Intel also plans to close a plant in Oregon and assembly and test facilities in Malaysia and the Philippines. It will lay off 6,000 workers due to slowing demand for microprocessors.

Herff Jones Inc. has announced plans to close its manufacturing plant and photography lab in Lewiston, Minn., a facility that employs 275 workers. The company will shift its operations to its site in Charlotte, N.C. The company is based in Indianapolis and produces recognition awards and graduation-related items.

Dell has announced plans to close its manufacturing plant in Ireland and move production to Poland and outsource to third-party manufacturing partners. The company says it will lay off 1,900 employees at the Limerick, Ireland, facility, which has a total head count of 3,000. Poland has much lower labor costs — \$406 per month compared to \$2,000 per month in Ireland.

Danaher will close 13 factories and lay off 1,700 employees. "Global economic conditions have continued to deteriorate over the last several weeks impacting many of our customers as well as a number of our businesses," said Danaher CEO Lawrence Culp. "In addition, the strengthening of the dollar against other global currencies has created additional headwinds that will negatively impact our financial results." The company has also initiated a wage and salary freeze across most of its businesses.

Boeing has announced plans to reduce employment at its Commercial Airplanes business by 4,500 in 2009 "as part of an effort to ensure competitiveness and control costs in the face of a weakening global economy," says the company. The reduction will bring the division's employment to approximately 63,500, "similar to the level it was at the start of 2008," says the company. Most of the jobs that will be eliminated are in "overhead" areas located mostly in the state of Washington. Layoffs will not impact aircraft production workers.

Interface Inc., an Atlanta, Ga.-based maker of flexible floor coverings for offices, has announced plans to close its manufacturing plant in Belleville, Canada, and reduce its worldwide employee base by a

(Continued on page nine)

Plants Closing... (From page eight)

total of 530, or 14 percent of its workforce. "We sincerely regret the impact it will have on many of our hard working associates," says company president and CEO Daniel Hendrix.

Affinia Group Inc. has announced plans to close automotive brake component manufacturing facilities in Dallas, Texas, Litchfield, Ill., and Milton, Ontario. The facilities employ about 400 and will close within the next four months. The impacted employees "are extremely talented and dedicated and these closings in no way reflect upon their performance," said John Washbish, president of Affinia's Under Vehicle Group. "Our decision to phase out manufacturing in Dallas, Litchfield and Milton was unavoidable, reflecting fundamental changes that are taking place in the markets we serve around the world. We deeply regret the impact on the lives of our people and their families and will provide assistance where possible during these challenging times."

Deluxe Corp. has announced plans to close its Greensboro, N.C. manufacturing facility and lay off 117 people. The company, which makes custom printed items such as business cards, stationary labels and retail packaging supplies, will also close a manufacturing facility in North Wales, Pa., and a manufacturing facility and call center in Thorofare, N.J., laying off a total of 570 people.

Companies that have announced layoffs in 2009:

- Circuit City: 34,000
- New York City: up to 23,000
- Caterpillar: 20,000
- Pfizer: 19,000
- Alcoa: 13,500
- Boeing: 10,000
- Home Depot: 8,000
- Sprint Nortel: 8,000
- Home Depot: 7,000
- Starbucks: up to 6,000
- Microsoft: 5,000
- Kodak: 4,500
- Cummins: 4,500
- Hertz Global Holdings: 4,000
- Avery Dennison: 3,600
- Corning: 3,500
- SAP: 3,000
- General Motors: 2,000
- MeadWestvaco: 2,000
- Huntsman Corp.: 1,175
- WellPoint Inc.: 1,500
- Baker Hughes: 1,500
- Target: 1,500
- General Dynamics (Gulfstream): 1,200
- Bon Ton: 1,150
- Harley-Davidson: 1,100
- Northrop Grumman: 750

- Autodesk: 750
- Navistar International: 700
- Volvo Trucks North America: 650
- Freightliner: 500
- Teradyne: 500
- City of Sacramento: 500
- Deere: 325
- Readers Digest: 280
- Weyerhaeuser: 220
- Greenheck Fan Corp.: 155
- Pella: 150
- M.J. Soffe: 107
- Square D: 67

NEW PLANTS IN THE UNITED STATES:

ProTech Systems, a maker of venting systems for residential and commercial heating equipment, has opened a new 24,000-square-foot manufacturing facility in the City of Albany, N.Y.

ProSeal America, a division of ProSeal Holdings in Manchester, England, has announced plans to locate a new facility in Richmond, Va., to import and manufacture heat-sealing machinery and tools for the food processing industry.

NEW PLANTS OVERSEAS:

Toshiba Corp. has announced plans to construct a new factory for the production of its rapid rechargeable lithium ion battery intended for use in the automotive industry. The company started shipping the batteries in April 2008 and has generated "considerable interest from potential customers," says the company. Total worldwide sales of lithium-ion batteries are expected to reach \$19 billion by 2015. The new facility will be constructed in the city of Kashiwazaki, which has created incentives to be the center of a "low-carbon society by promoting electric vehicles and to attract electric-vehicle related businesses." The city has applied for recognition as a "model area for the EV and plug-in hybrid vehicle (PHV) town concept," which is promoted by Japan's Ministry of Economy, Trade and Industry, according to Toshiba. Lithium-ion batteries suffer from less than a 10 percent charge and discharge loss after 3,000 cycles and are able to repeat the charge-discharge cycle over 6,000 times, "which means that they can be continuously used for more than 10 years with a once-a-day recharge-discharge cycle," says Toshiba.

Toshiba has announced plans to open a manufacturing facility in Vietnam for its Industrial Products Division. The company will manufacture high-efficiency industrial motors rated under 100 horsepower, plus parts. The \$77-million factory will be built in the Amata Industrial Park in Dong Nai Province. The facility will have production capacity of

(Continued on page 10)

New Plants Overseas...*(From page nine)*

1.2-million motors per year and will export to North America, China and Japan. It hopes to sell \$210 million worth of motors by 2015.

Kyocera Corp. has announced plans to build a new large-scale solar cell manufacturing facility in Yasu City, Japan. It will be the company's largest manufacturing facility in Japan. Construction is starting early this year with production scheduled to begin in the spring of 2010. The facility will allow Kyocera to more than double its annual production of solar cells from an output of 300 megawatts in 2008 to 650 megawatts by 2012. The plant will manufacture Kyocera's new "back-contact cell," which has an energy conversion efficiency rating of 18.5 percent. The company will continue its strategy as a fully integrated manufacturer of solar modules, managing the entire production process from procuring and casting raw silicon to producing solar cells and assembling ready-to-install solar modules." Kyocera has been in the solar business for 33 years.

Finisar Corp. of Sunnyvale, Calif., has opened a new manufacturing and R&D facility in Shanghai, China. The company has hired 650 local workers to man its new state-of-the-art factory making fiber optics, lasers and passive devices, and man its new R&D shop.

Sanofi-Aventis SA, the third largest pharmaceutical company in the world, announced that it will increase its investment in research and development in China. The French company will work with the Shanghai Institute for Biological Sciences (SIBS) to jointly research and develop drugs for neurological disease, diabetes and cancer. Sanofi-Aventis has also created a biometrics center in Beijing to support testing and analysis of local trials in pharmaceuticals and vaccines.

Hong Kong Highpower Technology, a manufacturer of nickel-metal hydride and lithium-ion batteries, has started building a new battery manufacturing facility in Huizhou, Guangdong Province, China. It is the company's second battery plant in China, and its output will triple the company's current production capacity. The

company, with 2,174 employees, expects to increase production from approximately 600,000 batteries per day to 1.6 million per day. Almost all of the output from the plant will be sold to the United States, Europe, China, Hong Kong and Southeast Asia.

DuPont's Liquid Packaging Systems division has opened a new manufacturing facility in Manchester, England, making pre-made bags for bag-in-box applications. The company will sell its output throughout Europe, the Middle East and Africa. The company makes wine, beverage and food packages.

Laird Technologies, a maker of wireless and electronics products, has opened its first manufacturing plant in India in Sriperumbudur near Chennai. The factory will employ more than 1,200 people and will produce antennas, battery packs and other components used in Nokia's cell phone manufacturing facility in Chennai. UK-based Laird has more than 14,000 employees across 40 facilities in 14 countries.

H.B. Fuller Co. of St. Paul, Minn., has announced plans to build a new factory in China to produce specialty adhesive for textiles and wood applications including insulating glass, textile lamination and footwear. The company will also build a new research and technology center at the site. H.B. Fuller had sales in 2007 of \$1.4 billion.

Wipro Infotech has opened a new manufacturing plant at Kotdwar in Uttarakhand, India, to manufacture computer servers, storage devices, notebooks and desktops. The factory produces more than 1,000 computers a day and supplies India's northern region.

Powers Fasteners, a Brewster, N.Y.-based maker of concrete anchoring systems, has expanded into China with offices that will act as a quality checkpoint for products manufactured in China and shipped to the United States. "We see this as an important step to accelerate the launching and development of products tailored towards the North American and European" markets, said company president Jeffrey Reid Powers.

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The Lesson From Toyota: Respect Science, Especially In A Crisis

BY JAMES WOMACK

The current recession is the fifth in my working career. And it is beginning to feel like the worst. I can't imagine that any manager or improvement team member in any industry in any country isn't feeling a bit queasy at this point, as the world economy keeps recessing toward an unknown bottom. Where should we go to calibrate our North Star in times like these, to reassure ourselves that we are on the most promising path? Recently I've found one answer.

In carefully reviewing a new publication from the Lean Enterprise Institute, I've had the opportunity to spend a lot of time with the "fathers of lean." By this I mean the small band of Japanese line managers who made the original breakthrough to create a lean enterprise and who were interviewed at length much later about what they did and why. The relevant point for this moment is that a small group of managers achieved a lean leap in a time of severe stress, making some of their boldest moves during the financial crisis of 1950.

As the Japanese economy entered a steep recession in that year, the Toyota Motor Company ran out of cash, which was tied up in inventory for products customers no longer wanted. The company fell under the control of bankers who chopped the company in two, creating separate firms to divide the marketing and sale functions from the product development and production functions. (These firms were only recombined in 1982 to create the current Toyota Motor Corporation.) Founding president Kiichiro Toyoda (new president Akio Toyoda's grandfather) was driven out in the process. The pursuit of what became the Toyota Production System, along with the product development, supplier management, and customer support systems, was the creative response to this crisis.

As I started to read these interviews I expected to discover that Toyota's managers had a clear plan all along. Surely leaders like Taiichi Ohno, Kikuo Suzumura, and Eiji Toyoda knew exactly where they were going and how to get there. I also expected to find a clearly chartered improvement team and a formal program to go with it. (Perhaps "The Way Forward," Toyota's recent tag line in its advertising?)

What I found instead was that a few line managers had some very simple ideas and an extreme sense of urgency: Minimize lead time from order to delivery (to free up scarce cash). Remove waste from every step in every process (to reduce costs and enhance quality). Take action now (because there wasn't much time). But what they also had — and this was critical — was a tight scientific discipline. While they did act quickly, they also took the necessary time to document the current state, to state their hypothesis very clearly, to conduct a rigorous experiment, to measure the results, and to reflect on what they had actually achieved, sharing their findings widely.

What they didn't have was a "program" or even a name for the system of scientific discovery they were creating. Indeed, the label "Toyota Production System" was only introduced in 1970, after the system had been fully

invented, to explain it to suppliers. What they also didn't have was a program office or a dedicated improvement team. The fabled Operations Management Consulting Division was introduced at about the same time as the label TPS and only after TPS was deployed across the enterprise. Toyota's remarkable act of creation — based on a scientific process of systematic discovery — was conducted by line managers as the most important part of their daily work. And here's the really inspiring part: they did most of their research in midst of a fierce battle for survival.

In learning more about Toyota's achievements in the 1950s as the company struggled to survive, I've gained a new appreciation for the fact that we have no excuses in our current period of chaotic markets and falling demand. Systematic science works wherever it is applied to any process. And it is more and not less useful in the depths of a crisis. The only ingredient that may be lacking today is our determination to respect rigorous science in the current crisis. And that you can quickly rectify!

— James Womack is the founder and chairman of the Lean Enterprise Institute: jwomack@lean.org. This article was reprinted with permission from LEI, copyright 2009.

U.S. Long Way From Being The World's Most Competitive Country

The United States is no longer the world's leader in innovation and competitiveness, and, in fact, is not even close to being the world's most competitive nation, according to a new analysis from the Information Technology & Innovation Foundation. In a ranking using 16 indicators such as IT infrastructure, economic performance, entrepreneurship, innovation capacity and economic policy, ITIF found that the United States ranks sixth in the world among nations, with Singapore being the world competitive leader.

But the trend line is not up for the United States. In a measure of the progress nations are making in the 16 indicators since the turn of the century, the United States ranks dead last — 40th of the 40 nations and regions examined, according to ITIF. The United States has made the least amount of progress in improvement in international competitiveness and innovation capacity over the last decade. Adds ITIF president Robert Atkinson: "This is not a very encouraging picture of the U.S. competitiveness position."

"The prevailing view among many Washington policymakers is that the United States has been number one for so long it will continue to be number one," according to the ITIF report. "Given this situation, the thinking goes, there is no real need for the United States to develop and implement a national economic development or competitiveness strategy."

The United States doesn't have time to dither. Its position "is slipping rapidly and with it, relative U.S. living standards," says ITIF.

The report "The Atlantic Century: Benchmarking EU and U.S. Innovation and Competitiveness," is located at <http://www.itif.org/files/2009-atlantic-century.pdf>.

Metrics of Decline... (From page one)

first time in our history, fell below health care and education in 2001, below retail sales in 2002, below local government in 2006, below leisure and hospitality, i.e., restaurants and bars, in 2008.

Between this unprecedented loss in manufacturing capacity and jobs, and the \$3.5 trillion in trade deficits in manufactured goods alone, run up by George W. Bush, the correlation is absolute.

In February, final trade figures for 2008 came in. They make for riveting reading for Americans who yet believe that manufacturing is an indispensable element of national power.

With China exporting five times the dollar volume in goods to us as she imports from us, Beijing's trade surplus with the United States set yet another world record: \$266 billion.

In those critical items the Commerce Department defines as advanced technology products (ATP), our trade deficit with China in 2008 reached an astonishing \$72 billion. Since Bush took office, our total trade deficit with China in ATP exceeds \$300 billion.

Which of us, China or America, has the trade profile of a mature industrial and technological power?

Americans deplore our deepening dependence on foreign regimes for the vital necessity of oil. Are they unaware that the U.S. trade deficit in manufactured goods, \$440 billion, is \$89 billion greater than our all-time record trade deficit of \$351 billion in crude oil?

Why is a dependence on Canada, Mexico, Venezuela or Saudi Arabia for oil a greater peril than a reliance on China and Asia for vital necessities upon which our prosperity and military depend?

A week ago, the *Washington Times* ("Volcker Blames Recession on Trade Imbalances") reported that ex-Fed Chair Paul Volcker told Congress the "massive trade-related imbalances in the United States economy were the source of the financial crisis."

Pressed by Sen. Chris Dodd, Volcker said, "Go back to the imbalances in the economy. The United States has been consuming more than it has been producing for many years."

What "imbalances" was Volcker referring to? Perhaps these.

Since 1982, the United States has run \$5.7 trillion in trade deficits in manufactured goods, and \$2.1 trillion in trade deficits in auto parts, trucks and automobiles. In the Bush years alone, the United States ran more than \$1 trillion in trade deficits in auto parts, trucks and cars.

These statistics, these realities — factories closing in the United States, manufacturing jobs being outsourced in the millions to China and Asia, enormous, endless trade deficits in goods — testify to a painful truth: America is a receding and declining world power.

And in dealing with this systemic crisis, Obama's stimulus package is as irrelevant as were the Bush tax cuts.

How do we correct those "trade-related imbalances" of which Volcker spoke? We must export more and import less, save more and spend less, produce more and consume less. We need to emulate the ants and behave less like the grasshoppers of summer.

But how do you tell that to two generations of Americans who have been raised in an era of entitlement?

America needs an Industrial Policy.

But how do you tell that to Americans indoctrinated in the hoary myth that Reed Smoot and Willis Hawley caused the Great Depression and anything that sounds like America First risks a rerun of the 1930s?

— Patrick Buchanan has been a senior advisor to three Presidents, a two-time candidate for the Republican presidential nomination, and was the presidential nominee of the Reform Party in 2000. His Web site, "Right from the Beginning," is located at <http://www.buchanan.org>.

Wal-Mart... (From page two)

Wal-Mart, however, have harshly criticized the fact that Wal-Mart employees receive benefits through these programs."

But taxes paid by both Wal-Mart and by its employees far outweigh the costs to American taxpayers of government spending on Wal-Mart workers. "Together with indirect effects like driving up real estate values, their total tax bill is much larger than the claimed \$1.5 billion in federal subsidies for its low-income employees," states Furman. "Implicit in much of the criticism of Wal-Mart is the belief that the company has enormous resources and could easily pay higher wages or more benefits without making a major sacrifice. After all, Wal-Mart's mind-boggling \$10 billion in profits last year make it appear as if the company could wave a wand and do anything it wants. But Wal-Mart also has a staggering 1.3 million American employees, multiplying the costs of even a modest change in compensation. Overall, it is no easier for Wal-Mart to change compensation than many other companies. This year, Wal-Mart will earn about \$6,000 per employee. This is virtually identical to the average for the retail sector and somewhat below the national average of \$9,000 in profits per employee in the corporate sector. If Microsoft paid each of its employees an additional \$5,000 or expanded its health benefits, its profits would be largely unchanged. If Wal-Mart took the same step — and did not pass the cost on to consumers — it would be virtually wiped out....The image of Wal-Mart as all powerful is at least six years out of date."

Those who are anti-Wal-Mart are doing the country a economic disservice, argues Furman. Higher prices will hurt low-income people. Instead, "a much better strategy would be to recognize that Wal-Mart is a progressive success story," he writes. "...The Wal-Mart economy is not about an economy in which corporations are squeezing workers. It's about an economy in which the return to skills is rapidly growing and technological change...is leading to increased inequality. The most fundamental solution to these challenges is to invest in education and training necessary to ensure that all Americans have the skills to be successful in a technologically sophisticated global economy."

Shaping Future Strategic Capability: The F-35 Manufacturing Approach

by **Dr Robbin Laird**

Robbin Laird is Chief Partner of ICSA LLC, a Paris- and Washington-based aerospace and defence consulting company. The author visited Lockheed Martin production facilities at Fort Worth in December 2008 and July 2009 as well as Northrop Grumman's Baltimore manufacturing facility in July 2009. He describes the new approach to manufacturing the F-35 and says that this significant advance has yet to be appreciated by the US authorities.

Amongst much that has been lost in the US scurrying for dollars in dealing with 'overseas contingency operations' and paying for the Obama 'stimulus package' and 'health care reform' is the significant question of the role of manufacturing in the evolution of the US economy and its global competitiveness. Notably, when President Obama delivered his major address on science to the National Academy of Sciences, defence and aerospace were relevant only as

historical examples, rather than as critical elements of shaping future capabilities.

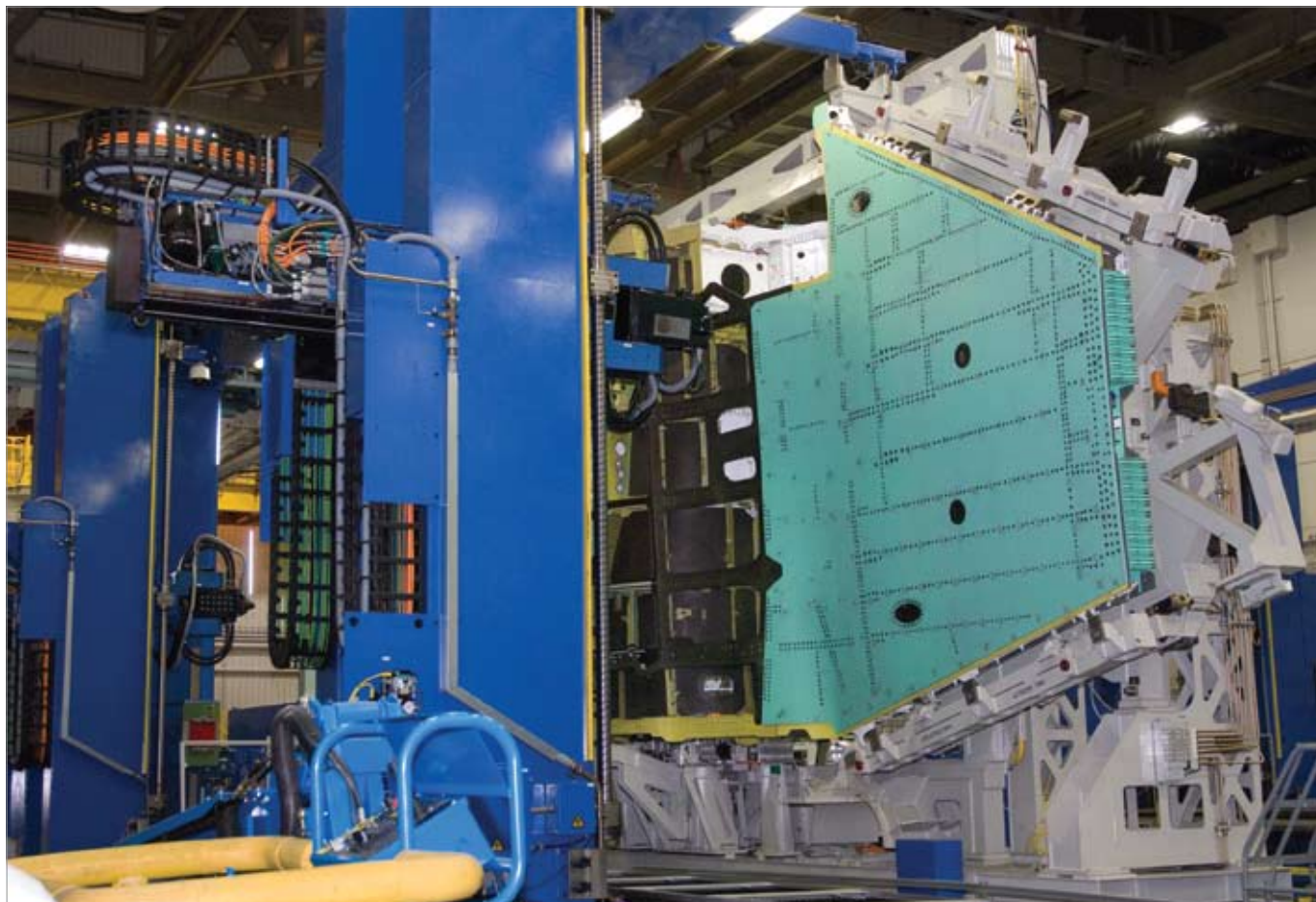
Manufacturability

Yet for modern military forces, the question of the 'manufacturability' of defence goods and capabilities is crucial for the operation and deployment of a global force. Indeed, one could argue that those failures of acquisition that have happened since the early 1990s in the US have largely been rooted in pursuit of well-designed briefing slides rather than well-designed manufactured products. The difference between the debacle of the Future Image Architecture (FIA) and the F-35 could not be more stark. Whereas the failure of FIA has left the United States with a significant intelligence gap, the core focus on the F-35 programme has been on manufacturability, and this includes how the systems on the aircraft will allow the aircraft to operate as a flying combat system.

The Obama Administration Faces the Future

Core Defining Military Missions





This machine is holding one of the F-35 wings. The high-tolerance manufacturing process is a large part of why the aircraft is stealthy [Robbin Laird]

The F-35 is a 21st Century manufactured product which embodies capabilities similar to the new manufacturing systems used by Boeing and Airbus in producing their next-generation commercial aircraft. The F-35 is not a traditionally produced combat aircraft, which is assembled from a myriad of components provided by suppliers; it is a moving-line, high-tolerance manufactured product in which system providers operate as key partners in manufacturing assemblies and sub-systems. Stealth is a product of the high-tolerance manufacturing process, and not crafted in by essentially hand-built efforts.

The F-35 Manufacturing Programme

As a programme, F-35 has been built around new manufacturing processes, which are an essential part of the systems development phase or SDP. In this process, the machine tools and various elements of the production process are being pre-tested through the actual production of test aircraft. Based on feedback from this process, the machine tools and various elements of the production process are being altered, so that when full-scale production comes it will be as efficient and effective as possible.

The F-35 approach is embodied in the concept of an advanced Fighter Production System (FPS) – a 21st Century

manufacturing approach in which the final assembly facility is the outcome of a closely networked system of global suppliers. The engineering approach underlying the manufacturing system has closely linked the core stakeholders in the production process from the start. The collaborative process has been designed to ensure that a high-tolerance manufactured product will emerge, rather than having a traditional supply chain whereby the flow comes from the periphery to the final assembly centre.

The F-35 Process

The F-35 process is a hub-and-spoke system whereby the collaborative information-sharing and engineering processes are co-located in the hub, but closely connected to the stakeholders. A digital thread manufacturing capability enables the collaborative system.

In Digital Thread manufacturing, the CATIA computer model feeds directly into the processing or manufacturing production effort. The CATIA computer model is fed into a Computer Numerically Controlled (CNC) machining centre, and Coordinate Measurement Machines (CMM), and is then processed in a Composite Programming System (CPS). The CPS then sends the data to a Fiber Placement Machine for the production process. In both cases the finished

product can be traced back to the original computer model through a 'digital thread', which ensures greater precision and accuracy in manufacturing.

The F-35 is a globally sourced product, based on the basic manufacturing model for the F-35. Global suppliers are stakeholders in the digital thread manufacturing process and collaborative participants in a networked engineering approach to the development and production of the aircraft.

The cost of aircraft produced by a 21st Century manufacturing system will be driven down by the automated nature of the production facility. At the height of building the F-16, 18,000 persons were necessary to produce the F-16 on the final assembly line. For the F-35, 3000 persons will play a similar role. The cost of a 21st Century combat aircraft of the new generation is driven down and maintained by a new-generation approach to manufacturing.

An example of the different quality of the man-machine relationship in the F-35 programme compared to other aircraft is in the process of making the F-35 a stealth aircraft. Stealth is a result of a high-tolerance manufacturing process, and not a handcrafting effort. The final coat placed on the aircraft is by a robotic coating process. The tolerance for the final coat on an

F-35 is the size of a human hair, which would not be possible except through a robotic process.

Repair and Logistics

Repair for the F-35 in the field will be provided by a common set of tools and systems, which all the partners in the programme acquire along with the aircraft. At the Fort Worth facility of Lockheed Martin, a low-observable repair facility is in operation, which involves shaping the proper tools for doing stealth repair in the field. Partners in the programme visit the facility regularly and are part of the test programme to determine how best to maintain low-observable aircraft in the field.

Costs are further reduced by the logistics and sustainment capabilities built into the F-35 as a manufactured product. The aircraft has been designed with manufacturing and sustainment considerations built in. Several of the tools being used to build the aircraft will be the same tools used to maintain the aircraft. The high degree of automation built into the integrated sensor systems on the aircraft will allow real-time monitoring of the state of health of the aircraft, and this data will be delivered to the logisticians in real time. Such data will be useful for more effective operational and combat considerations, but will drive down maintenance costs on the aircraft. The cost of weapons support to the aircraft is driven down as well by



The forward fuselage auto drill [Robbin Laird]

the reduction in staff necessary to weaponise the aircraft on operational assignments.

Also, the way the supply chain has been set up will allow the sustainment system to operate more effectively. The manufacturing team for F-35 works on an aggregated demand model whereby one set of priorities is established between the prime and the suppliers. This set of priorities encompasses requirements for sustainment and production, rather than treating these as separate processes.

Integrated Sensor Systems

Another central aspect of the manufacturing process is the AESA radar and integrated sensor systems on the aircraft. The nature of these integrated systems shapes the concept of operations of the aircraft and the ability of the aircraft to operate as a flying combat system, able to shape air combat as well as air-surface operations.

The manufacturing process underlying this capability comes from Northrop Grumman's Electronic Systems' production facility in Baltimore, Maryland. Here, the core reality of this system is the production of small radar chips that function as radars in and of themselves, which are then combined in a variety of platform products. These chips are produced by a highly automated production process, which reflects

several years of manufacturing experience, so that the F-35 systems, which are built around these chips, are inheriting the experience of several legacy platforms.

The New Manufacturing Approach

Although central to the F-35 enterprise, the new manufacturing approach is not widely appreciated. The next three years of funding for the programme are essential for ramping up the capability to launch production. Although the programme is expressed in numbers of aircraft, for the next three years the numbers of aircraft are more significant as generators of revenue to prepare for **launch** of production. Much of the programme money for the next three years will be pushed into the stakeholder manufacturing base to build the appropriate machine tools, carbon-fibre thread machines and related manufacturing systems and assets.

In short, the F-35 is an example, and certainly not the only one, of a significant advance in manufacturing technology and production approaches and processes. Recognising the significance of these capabilities to the United States and its allies is an important strategic requirement for the decades ahead. Although 'cash for clunkers' might appear to be a useful addition to the US defence supplemental, it would be more credible if US leaders would recognise the risk to the nation and to its allies of losing the edge in the manufacturing base. ■

RUSI Land Warfare Conference

8-9 June 2010
RUSI, Whitehall, London

We are delighted to announce 8-9 June 2010 as the dates for the RUSI Land Warfare conference. Working in close partnership with the British Army, RUSI are developing a programme that will bring together the foremost thinkers, military practitioners, captains of industry and government officials to analyse, discuss and debate the critical challenges facing land forces in the context of the UK's announced Defence Review.

The conference will be the UK's largest and most significant gathering of the land forces community and their key partners from the Royal Navy and Royal Air Force, as well as senior figures from the US, France and other Allied nations. As well as setting the intellectual agenda, the event will provide unparalleled networking opportunities with an audience of over 500 and a dedicated land forces equipment exhibition.

For further details regarding sponsorship, speaking and attendance opportunities, please contact Olivier Grouille on +44 (0) 207 747 4960 or ogrouille@rusi.org

www.rusi.org/landwarfareRDS

March 23, 2009

The financial crisis and the responses to the crisis will reshape the strategic landscape for years to come. The globalization of the world economy enforces the need for multiple-sum solutions among countries, but each of the major players will position themselves within those solutions and will be either strengthened or weakened for the next phase of global competition.

For the nations, the question becomes what role will space play in the global collaborative or competitive environment? Will space return to its central role as a symbol of national power or play a role in reinforcing multiple sum collaboration? Will zero-sum competition be reinforced or new global sharing arrangements forged? Space is a key part of answering this question.

The twin roles of China and Russia will be definitional. For the Chinese, with their significant global currency reserves, there will be an opportunity to invest in strategic industries to gain global advantage. Will space emerge as a strategic industry in this regard? The expansion of their launch business — rooted in \$58 million launches — could be suggestive of their intent and capabilities. For the Russians, the desire to reassert their role in the near-abroad — meaning former territories of the Soviet Union — and to use what remains of their aerospace, defense and space capabilities to strengthen relations with India and Third World states can allow them to recover lost ground. The hoped for breakthroughs be-

The Strategic Impact of the Financial Crisis on Space

< ROBBIN LAIRD >

tween the United States and India may not occur because of the return of Russia as a significant aerospace and defense actor.

For the United States, the role of the state is being reasserted by U.S. President Barack Obama's administration at the expense of the private sector. There is virtually no support in the financial stimulus package for the aerospace and defense sector. The administration could have robustly supported the next generation air traffic control system — there is some support tellingly only in the aviation part of NASA — which, in turn, could shape a new transport landscape in the United States. And this landscape could well help the demographic deconcentration, which, in turn, helps the "green agenda" of the administration. There could have been support for satellite broadband to shape a new distribution of capability in the commercial market, to provide for gaps in homeland security and to support the worldwide activities of either the soft or hard power of the U.S. military. And this, in turn, would have helped reduce demographic con-

centrations and augment sustainable development.

And more generally, the collapse of the credit market calls into question the approach adopted in President Bill Clinton's administration and continued under President George W. Bush to rely on the private sector to generate significant space capabilities. Will the Commercial Orbital Transportation Services (COTS) program remain even remotely a viable alternative for NASA? Will private launch companies be available to provide capabilities for the Pentagon? Will the commercial sector provide enough American satellite capability to provide reliable bandwidth in a cybersecurity age? And most notably, can the Obama administration shape a new multiple-sum strategy in civil space to save the international space station and guide a new exploration strategy? Without a radical re-look at its relationship with Europe, this is not likely. With the challenges from China and Russia, and the pressures on NASA and military space, it will be increasingly imperative to overcome barriers between the United States and Europe for col-

laboration in civil and military space.

Of course, the financial crisis does not only augment the role of the state, it reshapes the private sector as well. The space business is really a residual business for the aerospace and defense sectors. The macro-changes in these businesses play a shaping function for the space business.

And these businesses will be in trouble, as pension funds have to be supported, new programs start to simply be eschewed by Office of Management and Budget, and the inability to put in place new staff to shape a vigorous relook at sustainable space programs. The absence of real commitment to support for manufacturing — civilian or military — in the stimulus package is a core problem as well, for it is through manufacturing that exports are generated. Space businesses can be part of the solution, not simply considered as an overhead cost to be reduced.

Opportunities abound for a strategic relaunch. Combating piracy in Somalia with a multinational task force requires shared intelligence, surveillance and re-

connaissance (ISR) and communications. Obviously, space assets are crucial. How can we shape a solution and by so doing forge multiple-sum solutions? The multinational engagement in Afghanistan requires shared ISR and communications, which again call for multiple-sum sharing of a sort in which the private sector and new systems supporting the "soft" power solutions favored by Obama could be generated. The need to replace the shuttle and to provide cargo transportation to the space station provide clear opportunities to recast the U.S.-European working relationship. Finding a way to use Europe's Automated Transfer Vehicle (ATV) for U.S. and allied use is one obvious way; re-engaging the Europeans in exploration or robotic missions is another.

Crises are reshaping moments; they are flashpoints for the re-making of global power landscapes. This one is no different. It is an opportunity to launch new programs and new approaches, not to simply expand state spending for building bridges and tunnels. The famous bridge to nowhere of former Sen. Ted Stevens (R-Alaska) could become a metaphor for the new administration. It need not be so. Engaging the energy of the high-technology industries in a new approach to Europe and to multiple-sum programs for space can be part of the change we all want to believe in.

Robbin Laird is a Washington- and Paris-based defense and aerospace analyst.

What Is Wrong with Spirit and Opportunity?

< DONALD F. ROBERTSON >

The U.S. Mars Science Laboratory sits in its assembly hall on Earth, awaiting the late delivery of complex actuators with undiagnosed problems. This giant Mars rover is consuming a great deal of money while conducting no science and making no discoveries. Meanwhile, the Spirit and Opportunity Mars Exploration Rovers (MER) have been operating on Mars for 10 machine years, and counting.

Why are we not reusing the extraordinarily successful MER design? An ongoing characteristic of the U.S. space program is that, the flawed space shuttle aside, we almost never reuse a successful spacecraft. We threw away the expensive but tremendously capable Apollo infrastructure just as it was beginning to mature. We build our Mars probes in ones or twos. What used to be open-ended series of military satellites, like those for infrared missile warning, are now replaced with "better" three- or five-of-a-kind spacecraft that routinely cost many times their planned budgets.

If it succeeds, the Mars Science Laboratory could certainly be "better" than Spirit and Opportunity. Its Sky Crane landing system is designed to execute a precision landing within a 20 kilometer by 25 kilometer ellipse in relatively chal-

lenging terrain. If that works, the vehicle should range farther and faster than the earlier rovers, letting it drive to one of the four small sites identified from orbit as exceptionally interesting. These include a river delta or the sediments in an ancient crater lake.

The nuclear-powered vehicle will be independent of solar power, which means it can operate at high latitudes. It should not have to wait for fortuitous winds to clear accumulated dust off solar panels. Sophisticated instruments should advance geological studies, biochemistry and the understanding of Mars' surface radiation environment with an eye toward future human missions.

Mars Science Laboratory's current estimated costs are approaching \$1 billion over the originally approved budget. Some of the needed funds are being raided from elsewhere, and will probably cause significant delays to unrelated projects. The science laboratory also has slipped to a later launch window, causing additional budgetary stress and a potential conflict with the Juno Jupiter orbiter.

Spirit and Opportunity's landing systems are known to work reliably. These rovers have what turned out to be an outstandingly rugged design and are now undergoing the most realistic flight testing

possible in the environment in which they were designed to function.

By my rough calculation, not taking into account economies of scale, manufacturing lessons or launch costs, at least four copies of the Mars Exploration Rovers could have been built and operated for what one Mars Science Laboratory will cost, even before the latest delay. The science laboratory's slipped launch alone would have paid for most of a fifth exploration rover.

Consider the large number of serendipitous discoveries achieved by Spirit and Opportunity. What might five new duplicates of Spirit and Opportunity stumble into at five new sites on Mars? If there is one thing we have learned about Mars it is that, on a global scale, the planet's surface is tremendously diverse. Would five nonprecision but carefully selected landings at five widely separated sites on Mars — even with legacy scientific instruments — really be less scientifically rewarding than one landing in one region, however superior the instrumentation and however great the distance traveled within that region? Meanwhile, Europe has learned nothing from all of this. Their ExoMars rover has been deliberately rescoped for "better" science, doubling its size and cost, and forcing Europe to go to the United

States or Russia for contributions. Presumably, two or more rovers of the earlier design could have been sent to two different sites on Mars for what Europe now plans to spend on ExoMars. Worse, Europe is trying to go directly to a "laboratory-class" rover, without first building and flying simpler designs — almost guaranteeing additional development difficulties and cost overruns.

It is time for the space industry to relearn some basic manufacturing lessons: Perfection is often the enemy of good.

Economies of scale and learning curves inherent in mass production result in cheaper, more reliable machines.

If you have several rovers, the likely loss of one or two would have a lower impact since they could be replaced by one of the other vehicles. Alternatively, a new vehicle could be added to the end of the production run at relatively low cost.

When repeatedly building the same basic machine, incremental improvements and better payloads can be introduced at lower risk and cost than starting each time from scratch.

In the long term, this kind of evolutionary improvement may lead to more radical change at less total cost than trying to leap

SEE ROBERTSON PAGE 37

July 27, 2009

Leveraging Austerity: Recrafting Military Space

< ROBBIN LAIRD >

The military budget under U.S. President Barack Obama and Defense Secretary Robert Gates is dominated by the twin themes of Afghanistan and austerity. The focus on Afghanistan is shaping the strategic perspective for the administration's military strategy, and austerity is reshaping the defense portfolios. The power projection forces so dependent upon proprietary military space assets are being significantly redrawn, less by strategic design than by strategic refocus.

The impact of the administration's decisions and approaches are significant for military space, and is leading to either outright termination of programs, reshaping programs or putting programs on budgetary diets. The impact is to reshape military space significantly. This reshaping is further accelerated by the continued priority placed on the intelligence community's "black" assets, which may or may not serve well as operational deployed power projection forces.

The challenge is how to leverage austerity and the new priorities to recraft military space. The "strategic pause" being enforced by such actions can provide an opportunity to look at gapfillers and near-term fixes as key elements for shaping a new space approach which, in turn, can lay the foundation for the launch of new programs on the other side of the Afghan operation. Indeed, the impact of the current strategic review process owes the country more than simply justifications for canceling programs and supporting counter-insurgency operations. It owes the country some foundational principles for launching a new architecture and new programs to support U.S. and allied power projection forces providing for security and military needs.

Leveraging austerity would start by reconsidering the role of the commercial space sector and the changing nature of national security missions. The commercial space sector is viewed by the military space acquisition process as largely a gapfiller or final resort to

provide the data unable to be provided by the preferred proprietary U.S. military systems. Nonetheless, commercial systems will be used more in the next few years due to program terminations and shortfalls in the military space sector.

But a reverse in logic is required. U.S. military space programs should be built with significant commercial space assumed as a core acquisition priority for the U.S. security and military services. The U.S. military space architecture should now be built with a commercial space foundation in place from which unique capabilities would then be defined and prioritized in U.S. military-unique acquisitions. A complete reversal in logic is required: rather than gapfilling with commercial systems, U.S. military systems would become the unique providers of capabilities unable to be provided by the commercial sector.

Commercial developments make this possible. Notably, hosted payloads provide a significant infrastructure opportunity for the U.S. military to put on commercial

satellite buses, communications and other assets, which can be launched on a regular commercial launch rhythm. Hosted payloads can provide both test beds for new technologies and augmented capabilities for communications, missile warning and space situational awareness. Commercial operators can field these systems faster (less than three years) and cheaper than dedicated military systems. And such systems can be launched from secure NATO launch ranges on more than 12 commercial satellites going to geostationary orbit each year (from Cape Canaveral, Fla., and French Guiana).

And the change in the focus of U.S. strategy calls for increased use of commercial systems, which can be shared with allies and partners. The purchase of shared assets to support security and law enforcement operations is of increasing significance to the types of operations, which Obama espouses. Whether performing counterpiracy operations, working in joint counternarcotics operations,

whether dealing with environmental threats or challenges, or sharing arms control data, all of this can only happen with the sharing of timely communications and data provided by satellites or other C4ISR (command, control, communications, computer, intelligence, surveillance and reconnaissance) systems.

By relying on commercial systems, the ability to share is built in as common decisions can be made about encryption standards for the shared data. If this is not done, the United States is left with the very unsatisfactory situation of making case-by-case decisions to share unique proprietary data provided by U.S. military and intelligence satellites. One does not build effective military space architecture on an ad-hoc basis of sharing with allies and partners when you have asserted that working with allies and partners is now the core reality of your strategy.

The new military space architecture would then start by two

SEE LAIRD PAGE 17

Changing to Renewable Space Transportation

< WILLIAM A. GAUBATZ >

Why, in this era of change and emphasis on renewable and reusable resources, is NASA investing its future space transportation development on ancient and wasteful concepts — throwaway rocket systems. While other parts of NASA are developing and applying the fruits of modern technology to enhance their science and exploration programs, the NASA 21st century space transportation concepts remain firmly rooted in the mid-20th century, indeed some would say 14th century technology first introduced by China.

The Ares program will modernize the Apollo concepts and upgrade an enormous infrastructure that supports and propagates continued reliance on expendable, man-rated rocket systems. Dedicated government and industry teams are accomplishing significant and challenging engineering tasks fielding this new/old rocket system. But when finished, the United States will be left with a modernized relic that still will not resolve the key problems inhibiting space growth — lack of safe, routine flights that can lower the cost of traveling to and from space and increase the commercial use of space for business and pleasure.

What is regrettable is the large sum of precious research and development (R&D) resources — time, money and talent — being spent on re-engineering old concepts, that otherwise could be focused on moving the U.S. commercial and civil space activities forward. This forward focus should be on developing 21st century technology for reusable space transporta-

tion systems. NASA and the United States would greatly benefit by expending our scarce R&D resources on advancing space transportation technology, while transitioning existing commercially available and developing rocket systems, such as the Delta, Atlas, Space Exploration Technologies Corp.'s Falcon or foreign boosters, to satisfy near-term needs. Advancing space transportation means moving beyond expendable systems and advancing to space planes that can be used over and over and over again — renewable space transportation. This change starts with concepts of operation and continues with vehicle design, test, manufacture, training and operations. This change requires leaving behind old terms of man-rating, vehicle reliability and escape systems and embracing design for safety, maintainability and certification. This is the approach that has evolved and been proven by the aircraft industry to achieve both low costs and the lowest accident and fatality rate of all transportation systems. This change leads to a global spaceport infrastructure supporting hundreds of flights to and from space as well as rapid point-to-point travel here on Earth. This new spaceport infrastructure will involve hundreds of new communities that will contribute to and benefit from an expanding space economy.

What NASA can do to lead the space transportation change is to refocus its development of expendable systems to support maturing the technology for next-generation, privately developed and operated, reusable vehicles and supporting infrastructure. These new, privately de-

veloped reusable capabilities will be available for NASA to use in expanding space exploration (both human and robotic) and science programs.

In this way NASA will return to its NACA roots and devote its resources to help build a new space industry not another shuttle program. The National Advisory Committee for Aeronautics (NACA) did not try to build and operate a DC-1 or a Boeing 307 Stratoliner. NACA did develop fundamental technologies and national facilities that supported these and other commercial as well as military developments.

Rather than continuing with a point design for a second shuttle development, NASA and the United States will be better served by NASA developing commercially relevant technologies and demonstrating these technologies through a series of X-Plane projects. These projects should be narrowly focused to demonstrate specific technologies and concepts of operation enabling technology solutions that private industry can draw upon to build and operate a 21st century space transportation infrastructure. X-Plane projects should encompass technology demonstrations using existing commercially available equipment for both suborbital and orbital flights. These will lead to periodically flying specifically designed X-vehicles to demonstrate the integration of these technologies, including operations.

NASA also should help in the development of commercially relevant infrastructure such as on-orbit propellant depots that would support future NASA missions

as well as commercial ventures such as space-based solar power stations and provide a competitive market for the new space transportation systems. NASA in conjunction with the Federal Aviation Administration Office of Commercial Space Transportation should help in developing the standards, processes and procedures as well as the relevant technologies and databases required for the flight worthiness certification of the equipment and personnel for the design, manufacture and operation of the new space transportation systems.

As the United States considers its next steps in space science and exploration, a top priority should be given to developing the commercial benefits of space, specifically using X-Planes to mature critical technologies and operations to enable reusable, 21st century space transportation systems. With safe, routine and affordable transportation the United States will lead the world in opening the new space frontier and a 21st century of high-tech jobs, education and economic bounty.

William A. Gaubatz, Ph.D., is the former director of the Delta Clipper programs and the DC-X/XA flight demonstrations. He was a co-founder of Universal Space Lines where he was president of SpaceAvailable LLC and presently is a consultant for "new-space" activities. Dr. Gaubatz is an associate fellow of the American Institute of Aeronautics and Astronautics, a member of the International Academy of Astronautics, an honorary member of the Japanese Rocket Society, chairman of the Space Tourism Society, co-founder of the annual International Symposium for Personal and Commercial Spaceflight, and member of the Space Frontier Foundation.

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principles. First, robust acquisition of commercial satellite services would define what the military needs to acquire uniquely. Second, commercial systems would be used widely to allow the kind of sharing required for security and law enforcement operations in which the United States will engage in the 21st century.

Additional principles could be added to shaping the new architecture.

The third principle would be to determine what the air-breathing assets already acquired and being acquired provide to the C4ISR architecture of which military space is a key component. The commitment to the F-35 means that a significant ISR capability will be fielded over the next 10-15 years, which when joined by unmanned vehicle systems will revolutionize operational ISR. With the addition of stratospheric air vehicles, a significant change in what is required from space can be anticipated.

The fourth principle would be to determine the nature of collaborative space operations with friends and allies. How will U.S. unique systems complement and contribute to the ability to do coalition operations and shape effective global security operations? This means that the United States needs to build into the core of its own activities an ability to shape and work with allies in crafting shared and joint collaboration. Notably, the emergence of the European Galileo system at precisely a time when the United States is worried about GPS shortfalls suggests that a joint effort would make sense. Collaboration is not the last act of desperation; rather it should become a foundational principle of procurement and operations.

The fifth principle would be to determine the unique systems that military space would need to provide in light of the first three principles. With a clear definition of what functionalities are unique, rather than what platforms are unique, commitments could be made for the unique assets, which the U.S. military must own and operate. This would be especially true for a combined naval and air power projection force. The long-range strike and reconnaissance missions that the naval and air forces perform clearly need to be supported by unique U.S. military assets. But rather than defining the architecture largely on the basis of this principle it needs to be the crowing definer of requirements.

Cybersecurity challenges and the threats from some powers who are developing abilities to disrupt U.S.-specific military systems simply reinforce the advantages of a multilayered architecture encompassing commercial, air-breathing, allied and U.S. military systems. The United States cannot afford to build a proprietary Pentagon-funded layered and diverse architecture that deals with cybersecurity threats all by itself. A diversified architecture in which commercial and allied elements are part of the foundation makes the task of disruption much harder and certainly for states not terribly desirable politically.

In short, a new military space architecture could be built by leveraging austerity. An opportunity exists for the United States to move beyond a primary proprietary military procurement to a new approach in which unique military systems are defined as necessary in a new layered architecture.

Robbin Laird is a Washington- and Paris-based defense and aerospace analyst.

ON THE MOVE

■ **MARY LASSITER SNITCH** of Lockheed Martin Corp. in Crystal City, Va., is inducted as the national president of the Achievement Rewards for College Scientists (ARCS) Foundation Inc.

In this role, Snitch spearheads the foundation's national efforts in providing scholarships to outstanding U.S. scholars pursuing undergraduate and advanced degrees in science, technology, engineering and mathematics related fields at 44 leading universities.

■ Griffon Aerospace, Madison, Ala., is recognized by Northrop Grumman Corp.'s Aerospace Sector as a 2008 Supplier of the Year. Griffon Aerospace joins 10 other suppliers from around the country to receive the 2008 award.

Griffon Aerospace is selected based on their support of the

NASA Max Launch Abort System (MLAS) program. According to the award certificate, "Griffon Aerospace worked together with Northrop engineers to perfect Northrop's 'out-of-autoclave' cure bond assembly technique used to design, build, test and deliver eight large composite fins within a compressed schedule."

■ The Science and Technology Facilities Council in the United Kingdom, appoints **MARC BALCELLS** director of the Isaac Newton Group of Telescopes in the Canary Islands.

Balcells' scientific interests include galaxy formation and assembly, deep surveys, galaxy structure, dynamics and evolution, numerical modeling of interactions and mergers of galaxies and the development of near-infrared instrumentation.

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The Case for New Programmes in a Period of Defence Transition: The Naval Unmanned Combat Air System Case

by *Dr Robbin F. Laird*

Robbin Laird is Chief Partner of ICSA, LLC, a Washington DC and Paris-based aerospace and defence consultancy. Against the background of President Obama's April statement on defence funding and acquisition, he looks at the case for funding new equipment such as the Navy Unmanned Combat Air System (UCAS).

The United States and its allies are in the midst of a significant financial downturn with serious consequences for defence acquisition. The 'contingency operation' in Afghanistan and the 'withdrawal' from Iraq both generate severe budgetary pressures and emphasise force acquisition priorities most

appropriate to those operations. And the 'withdrawal' from Iraq will cost billions of dollars in moving kit, training and equipping Iraqis, destroying kit and depoting kit used in Iraq. The Iraq 'withdrawal business' will come at the expense of new kit in production or development.

Secretary Gates announced in early April his intention to turn this budgetary dilemma into a strategic reset in favour of counter-insurgency forces and equipment. Most notably, the Department plans to add civilian and military personnel with the attendant costs of such personnel and their clearly negative impact on funds available for procurement. He argued against

The Obama Administration Faces the Future

Core Defining Military Missions





The new US carrier will carry a new Hawkeye system and F-35, and can become the mother ship for a new unmanned combat air vehicle (UCAS) system [Northrop Grumman]

the acquisition of 'exquisite' equipment (such as the F-22 and some missile defence systems) in favour of 80% solutions. In such an environment, it will be extremely difficult to launch new programmes or to promote programmes in development, which have not entered full production. Indeed, Washington is awash with 'defence reformers' who want stable prices and cost-effective solutions for defence problems, no matter how complex the challenge. Such a stance will inevitably lead to a bias against new or developmental programmes. By definition, one can know the cost of a tank in production; one cannot fully price its replacement.

The Obama Administration will require power projection forces to be reinforced, not weakened, during its tenure

The Power Projection Transition

The United States faces a special dilemma in this regard because its power projection forces are unique in the West;

and, indeed, US allies have grown accustomed to US naval and air superiority. This assumption may no longer be warranted both because defences are becoming strengthened against offensive air operations (with mobile systems being put in place by states such as Iran, which although not 'peer competitors' will have access to peer weapons), and because the US Navy increasingly operates away from Blue Water in more dangerous proximity to land in 'enduring littoral operations', which expose the fleet to a growing multiplicity of threats.

Indeed, one can argue that the Obama Administration will require power projection forces to be reinforced, not weakened, during its tenure. Power projection forces are crucial to the Iraq withdrawal mission (in deterring Iran, and in protecting forces leaving, moving or staying in Iraq); to the Afghanistan mission (which requires distributed military forces connected by air assets including increased demand for tanking and lift for both missions); and, of course, all the other global missions which require US power projection forces.

Indeed, one can also argue that the most significant element of US force structure which needs to be renewed and acquired over time is multi-mission power projection forces. These forces have been used continuously and flexibly throughout

the post-Cold War period and in a variety of contingencies and situations, where shaping new capability on the fly has proven central to success.

Enhanced US Air Force and US Naval Synergy

An effective approach to a strategic reset for the United States does not start where Gates has focused the effort – namely, on the priority of stability operations or counter-insurgency forces. Rather, it starts by a more effective integration of US power projection forces and continued commitment to multi-mission forces. This means seeking where possible synergies in the concepts of operations between the US Air Force (USAF) and the US Navy (USN), and promoting programmes which allow such synergy to be enhanced.

An effective approach to a strategic reset for the United States does not start where Gates has focused the effort

In other words, there is a strategic requirement and opportunity to provide for much better integration between the USAF and the USN in promoting connectivity, synergy and capability to leverage its forces. Both face significant shortfalls; working more effectively they can enhance the nation's capability to project power, provide presence and work with friends and allies.

This can be done in a number of immediate ways. The Joint acquisition of Global Hawk and the Joint deployments on Guam provide opportunities to develop more effective Joint ISR concepts of operations and data sharing. The Joint acquisition of the F-35 provides a further opportunity to develop a 21st Century concept of air operations which draws on the strengths of the fifth-generation aircraft to provide for a new approach to maritime and air integration. The integration of Aegis systems with the F-35 provides another opportunity to link the USAF and USN into more effective littoral presence and strike missions.

The USN will launch a new carrier and it would be an excellent idea to link this new carrier with new Concept of Operations for the USN as an anchor for global security. The point of an aviation carrier is that it carries air assets, and by working closely with other US air elements and promoting capability to work with allies, a carrier becomes part of a global security solution, not just dedicated to blue water operations.

The new carrier will carry a new Hawkeye system and F-35, and can become the mother ship for a new unmanned combat air vehicle (UCAS) system. As General Davis, the former PEO for F-35, noted in a recent interview for this article:

"What becomes important is to understand how our new systems are working much more effectively with regard to interoperability and leveraging one another. We need to focus on the emergence of battle management networks encompassing carriers, F/A-18s, Hawkeyes, UAVs, F-35s and marines on the beach."

With these systems interoperable with other air and strike elements, broader recognition of the value of the continued carrier efforts might be generated.

The Naval UCAS as Significant Enhancer of Power Projection

The new UCAS system is an example of the type of new programme, which ought to be supported in the period of defence transition in front of the United States. It is currently in a vulnerable funding state. The demonstration programme has been funded, but in the current environment can a new programme such as UCAS survive?

The programme brings a number of key enhancements to the table, and these contributions suggest a template for the types of new programmes that should be supported even in a constrained fiscal environment.

First, it extends the strike range of an already funded core capability, namely, the carrier task force. Tactical aircraft have limited range; the UCAS has much greater range and reach. This makes it valuable in and of itself, but extending the reach of the new tactical aviation asset to be deployed to the fleet, namely the F-35, enhances its value. The sensor and communication capabilities of the F-35 are significant, but the reach of the aircraft remains within tactical ranges; the UCAS has forward strategic strike reach as well as ISR and communications reach-back to the tactical assets. The UCAS can spearhead the entire sensor and strike grid put up by the carrier task force.

UCAS has forward strategic strike reach as well as ISR and communications reach-back to the tactical assets

Second, the UCAS will be the first unmanned system developed in the wake of the deployment of the new F-35. The F-35 as a 'flying combat system' should be a generator of change in the unmanned fleet. The development and then deployment of the UCAS will be integrally interconnected with the F-35, and as such can take advantage of commonality in sensors and communications with the new manned aircraft. Shaping a common concept of operations between the F-35 and the UCAS can provide an important stimulus for change for the USAF as well.



The UCAS with its distinctive stealth capabilities will become an important node in the new air operations network [Northrop Grumman]

Third, it is highly likely that the USAF's new bomber programme will be shifted to the right in funding priorities. This provides a significant opportunity for the USAF to learn from the USN's experience in deploying the UCAS with the F-35 to shape a possible unmanned successor for the manned bomber. A template could be shaped by the Navy, which could provide important lessons learned in shaping the USAF's strategy to work the future of its unmanned programmes with manned aircraft.

Fourth, the company building the UCAS demonstrator, Northrop Grumman, can draw on significant lessons learned in their other unmanned programmes, such as Global Hawk, and on their core contributions in sensors and communications to the F-35 to provide a realistic development-to-production programme for the new UCAS aircraft.

In other words, the programme evidences a number of key qualities, which makes it worthy of funding even in a stringent environment. It leverages significant capabilities already paid for and deployed. It leverages new capabilities coming into the fleet. It provides a way to enhance synergy between both power projection forces. It provides a learning curve, which the USAF can use in shaping its future development and acquisition approach.

A Significant Enhancer of Multi-Mission Capability

Another discriminator for the UCAS is that it provides a core multi-mission capability for the Joint and coalition force structure. It should not be understood as a stand-alone platform, which is of value only in the most extreme warfighting conditions. It is **not** a specialised asset, rather it is a multi-mission asset useful across the spectrum of conflict, and in the diverse concepts of operations that the USN and the Joint and coalition forces are likely to engage in against the most likely threats of the next two decades.

The UCAS with its distinctive stealth capabilities will become an important node in the new air operations network

The UCAS will be a significant asset in the formation of the new concepts of operations for distribution aerospace forces. Among the forward deployed stealth assets, ISR, C2 and strike functions will be shared and communicated to other assets

in supporting roles. The UCAS with its distinctive stealth capabilities will become an important node in the new air operations network which can be used in command and control functions, as a forward air controller identifying targets for either stealth or legacy aircraft, and as strike platforms leading an attack or supporting an attack by providing more weapons on targets needed by the manned stealth aircraft.

You do not want to bring a knife to a gunfight, especially when you are not certain of who is defining the nature of the conflict

The UCAS will be an important contributor to fighting the hybrid wars facing America and its allies. With the diffusion of advanced technologies, both commercial and military, US and allied militaries cannot count on a clearly defined spectrum of conflict from low to high intensity of operations: low intensity can become mid-intensity rapidly. You do not want to bring a knife to a gunfight, especially when you are not certain of who is defining the nature of the conflict or its tactical or strategic reach.

This is especially true in the era of cyber warfare, whereby the length and breadth of the battlespace is unknown until engagement. A modular UCAS brings a diversity of capabilities to the battlespace, ranging from command and control support, situational awareness, providing crucial links in a distributed electronic or cyber war attack, initial strike weapons, and additional support strike weapons. In addition, these capabilities are launched from an alternative airfield at sea, with a different set of trajectories than land-based facilities, which further enhance the capability of the Joint or coalition force.

The UCAS can also provide an important tool in support of insertion forces. The US Marine Corps (USMC) focuses on the need for a new approach to sea basing. As the US Army, the USAF and the USMC augment their Special Forces capabilities – and in the case of the USAF and USMC the Osprey is seen as a key tool for rapid force insertion – the UCAS can provide a crucial support element for rapidly inserted ground-air forces. The introduction of a stealthy UAV provides the top cover for the insertion of Special Forces for raiding or counter-terrorism operations. Insertion forces by definition can be rapidly withdrawn as well. The US, after long wars in Iraq and Afghanistan, might well consider the advantage of rapidly inserted forces to deal with the suppression of local threats creating global consequences.

The USMC for certain, and several allies as well, will deploy the F-35B. And perhaps the USAF, as it reconsiders its position within the reset of power projection forces, might acquire this

aircraft as well. The STOVL aircraft has many advantages for concepts of operations, including deploying ashore on rugged 'airfields', and operating from support structures at sea or in the air. Dependent upon the amount of time ashore and where operating, the USMC has developed an effective plan for support of the dispersed force ashore. The advantage of 'airfields' not known ahead of actual deployment is significant; a UCAS providing early and continuing ISR or defensive support for forward-deployed STOVL airfields is compelling.

And finally, the UCAS can provide a significant contribution to an enduring littoral presence mission for the US. The Navy has struggled to define its littoral mission. When the service operated 'from the sea', the littoral were simply spaces through which strike and sea control were exercised. In the world of today and the next decades, engagement in the littorals for relatively long duration is a crucial mission. As the USN considers acquisition of the littoral combat ship (LCS), the question of how to sustain the operation of these ships or how to combine them with other littoral assets, such as an engaged USMC, will become significant. The UCAS will provide a significant airborne asset to support the LCS in its initial engagement and provide sustained support as desired.

The UCAS should be seen as a multi-mission asset, not a specialised asset

Conclusion

The UCAS should be seen as a multi-mission asset, not a specialised asset. The threats facing the US and its allies are hybrid in character. As such, multi-mission capabilities need to be deployed for **any** tailored mission. Indeed, the experience since the end of the Cold War has demonstrated how little predictability either strategists or policymakers have provided in their forecasts for the future. What has happened is that the US military has used virtually every weapon or capability in its kit to craft unique responses to every situation that policymakers have demanded of the US military. As a result, it would be prudent for US policymakers to ensure that a multi-mission power projection force be supported and developed in the years ahead. ■

Recent articles in *RUSI Defence Systems* on unmanned systems include:

October 2008: Grounds for Discrimination by Professor Noel Sharkey
 UAVs or Cruise Missiles by Duncan Brewer
 Future Weapons for UAVs by Michael Franklin

February 2008: Loitering Munitions by Dr Akram Ghulam

June 2007: Unmanned Air Vehicles and Active Imaging by
 Commodore Jack Green

'On a 40-person ship, you cannot expect that crew to maintain it the same way we have previously.'

SHAPING THE SUSTAINMENT ENTERPRISE

Robin Laird quizzes **Rear Admiral James McManamon**, Deputy Commander for Surface Warfare, SEA 21, Naval Systems Command, about how the US Navy's newest class of ships will be supported in service.

The Littoral Combat Ship (LCS) is starting to see active service after a troubled procurement phase. Arguably, a key difference between the class and all the navy combat ships that have gone before it is supportability.

'[Maintenance/support] is a core part of LCS because obviously we designed the ship to be optimally manned,' R Adm James McManamon says. 'As an optimally manned ship, we wanted to minimise the manpower requirements. Again, when you start talking total ownership cost, personnel is a huge piece of that as you go forward.'

'On a 40-person ship, you cannot expect that crew to maintain it the same way we have previously for other ships, because it is literally a 2,800 ton ship, 350 plus feet depending on which one we're looking at. Quite honestly, it had to have the ability to do distance support, given the crew size.'

He said that in the design definition phase for the supportability piece, the US Navy (USN) had to start to think differently about how it maintains and supports surface ships.

'We have designed this ship somewhat along the lines of an aircraft, as regards the support doctrine,' McManamon explained. 'With regard to an aircraft, when the pilots have problems, they land it, they turn that punch list over, and then the squadron maintainers come on board,

they prep it, and they make sure it's all good to go. But the maintenance team is not aboard the aeroplane, so this is similar to what we are doing with regard to the LCS.'

SUPPORT FROM AFAR

Next, he said that a key aspect of maintenance and support for LCS is based around off-board teams, enabled by what he called 'distance support'.

'We've designed a lot of pieces into LCS with a lot more ability to do distance support – we've taken the workload off the ships,' he outlined. 'For example, the supply officer on the ship has the ability to email his request to get the order in. He'll make sure that the order gets off the ship, but all the mechanics and backroom people who would on many ships be physically there, will actually be ashore at the support squad.'

But the distance support piece is still at a stage where the concept is being tested, trialled and refined almost constantly.

'We've learned that when some folks talk distance support, they want information to go off the ship automatically. But others will come back and tell me: "But what happens when you lose connectivity? Does that mean the ship is not blind to what the system is doing?"'



Photo: US DoD

'So we made sure that we designed in the fact that, on normal operations, some of this data and lots of the data on my engineering systems goes off the ship automatically. But we also made sure that you can always look at that information on board if you need to. I normally don't need to because I don't want to – in a sense outsourcing others to do that. However, if I have a challenge in connectivity or weather or whatever, and something isn't working the right way, we do have the ability to look at that aboard the ship.'

RICHES OF DATA

As is always advisable with new ships, early models should be used to establish the mechanical reliability of the overall platform, as well as important subsystems, and McManamon said that this was what is happening with the

LCS is stretching the envelope, both for maintenance and supplies. The aim is to have a lean-manned vessel, meaning new thinking is needed to tackle the support question.

(Photo: US Navy)



first LCS, USS *Freedom*, as the navy works out how it will support the class over the long term.

'Part of the exploration is shaping the build as we get new information from the maintenance efforts,' he said. 'For the initial deployment for USS *Freedom*, much of what we are doing is wringing out the basic mechanics, the engineers, being able to put the ship in the water, being able to communicate with other ships.'

Adding that trials from February to April 2010 went very successfully in this respect, he moved on to the broader data-gathering exercise for LCS to inform the support plan.

'I can access the availability of about 2,200 systems onboard – right now we monitor about 800 of those as part of the interim support plan,' McManamon explained. 'It's collecting that data, analysing what it's taking, what is it telling us, how much does it cost to me to have that kind of support? We do have reliability engineers that are associated with the LCS that are watching the data flow.'

'We have eight specific systems that generate a report every six hours, and we then try to see what this depth of information actually means to

us, and how much had it cost me to keep that kind of level of support. That's exactly what we're doing during this test period.'

He continued: 'I didn't have a lot of hard data – I had estimates for everything. And I don't have a lot of hard data on how these systems are put together on LCS, operating the way LCS is, how much that really costs and what drives their performance and reliability.' He thought that it will take two or three of the first-of-class LCS vessels to fully inform the support plan with the data that it needs.

CLASS SUPPORT, GLOBALLY

Support/maintenance testing is not just a home port activity, but is also being conducted around the world, as McManamon explained.

'There's a lot of discussion and study depending on how far forward we want to deploy some of these ships. Obviously we have deployed ships in a lot of areas – Bahrain, Japan – so as we start looking at LCS, we need to look at the kind of networking we could take advantage of, the connectivity to do that kind of support. And because we expect other allied navies to become customers for LCS, we

anticipate that there will be an enhanced global support network as well.'

LCS will be supported on a class basis, as has started to become the norm for many vessels in the USN, as it has been shown to deliver efficiencies and cost-effectiveness.

'The fact that we've set up a CLASSRON [class squadron] framework for LCS is in part recognition of the need to shape approaches for a new class of ships,' McManamon said. 'We recognised that with LCS we needed to have a much more robust support structure. If I'm going to take what would be notionally a 200-person ship based on tonnage and size, and I'm going to man her with a 40-man blue-gold type of team, and I'm going to try to remove workload from her because of the manpower shift, then I have to have a stronger support element that understands what is going on in the ship. We needed a common approach to manage and support the ship.'

'So we actually have gotten smart enough to understand that these are unique ships, and that the CLASSRON itself is the centre of the maintainability, supportability of that ship, rather than the ship – this is a change of thinking.' **MIL**

AMERICA IN SPACE: THE NEXT 10 YEARS

Will This Be the Decade of NewSpace?

< JEFF KRUKIN >

U.S. President Barack Obama's proposed 2011 budget for NASA has set the stage for a NewSpace industry renaissance, but the outcome is by no means assured. The budget faces congressional resistance and ill-informed negative press commentary, and NASA may not be able to support entrepreneurial human spaceflight as anticipated. So what is a young industry to do? As one of my college buddies used to say during card-playing marathons, "Go big or stay home."

This is a pivot point in history, the perfect moment for taking a stand and making a bold declaration that this will be the "Decade of NewSpace." As transformational leadership consultant Tracy Goss writes in *The Last Word on Power*, "Taking a stand is a declaration of possibility that allows something to move forward from existing as a possibility only because you said so to existing as a reality where it is so in the world." But do not make such a declaration lightly, for it will be meaningless without publicly stated achievable goals, and without the business professionalism and strategic planning re-

quired to accomplish these goals. Put in a context we can all appreciate, this is the NewSpace industry's opportunity to make a commitment that is as daring as President John F. Kennedy's lunar landing declaration of 1961.

Some may feel that such a bold move is premature since the NewSpace elements of NASA's budget may be weakened by Congress. However, NewSpace will grow even if this happens, and the declaration must describe how this will be accomplished. This is no time for timidity, and getting out in front of the issues is how you frame the conversation to your advantage and engage, educate and enroll your detractors.

So how should we proceed? Here are some suggestions:

- Use a "Decade of NewSpace" declaration to reframe the conversation about manned space activity. It is no longer enough to only talk about exploration, national pride and scientific accomplishments. This is about extending commercial aviation to a higher altitude, expanding the human economy to the Moon (for starters) and settling and developing the solar

system. Declare short-term goals that both fire the imagination and address our more bread-and-butter problems (economic growth, energy, resources, etc.), and describe how these are a foundation for the decades after this one.

- Establish a public outreach strategy that aggressively and professionally targets respected journalists and publications whose views are locked in the past. Examples include *Time* magazine's announcement that the Ares 1 was the best invention of 2009, and columnist Charles Krauthammer's recent derision of Obama's new direction for NASA: "It would be swell for private companies to take over launching astronauts. But they cannot do it. It's too expensive."

- Engage state-based economic development organizations and help them understand the job-creation potential for their existing aviation, aerospace and technology manufacturing industries, and how support for entrepreneurs can create new space-related industries. If all politics is local, then state-based commercial spaceport development should make

it abundantly clear that NewSpace is local.

There is too much of an "us vs. them" mentality within the NewSpace industry, too strong a belief that companies have no choice but to battle over a finite pie. This must change, and it would help to define the various sectors of the NewSpace industry, their interrelatedness and their connection to the broader economy. For example, when I work with state and local politicians and economic development leaders, I describe six sectors: atmospheric flight; suborbital transportation; orbital transportation; commercial destinations; service and support; and commercial spaceports. Perhaps it would be useful to create something like NAICS (North American Industry Classification Systems) codes for NewSpace.

Traditional large aerospace firms such as Boeing, Lockheed Martin and Northrop Grumman will become crucial providers of skills, experience and resources that are needed by NewSpace companies, and at the same time they will benefit from working with NewSpace entrepreneurs. Cultural differ-

ences and lack of trust must be addressed.

A "Decade of NewSpace" declaration would generate multiple benefits: It would attract the public and bring much-needed change to the traditional and outdated space exploration conversation. It would provide the NewSpace industry with a strategic road map for all stakeholders. And it would inform other industries and help them understand how they may participate in and benefit from an expanding Earth-space economy.

If we do this right, "NewSpace" no longer will have any meaning by the end of the decade. Large traditional aerospace firms will buy small entrepreneurial space firms, so how will we define a NewSpace company? Neither the industry nor the accomplishments will be new anymore. And most important, space business will be more widely understood as being tightly integrated with and fundamental to Earth's economy and our daily lives.

Jeff Krukin is a NewSpace economic development consultant and may be contacted at www.JeffKrukin.com

U.S. Strategy 2020: Facing a Multipolar Future

< ROBBIN F. LAIRD AND ALAIN DUPAS >

As the administration of U.S. President Barack Obama launches its space policy — both civil and military — the space context within which the policy will be affected is changing rapidly. By 2020, several nations will have new capabilities in space, along with civil capabilities, rivaling today's sensing and communications capabilities possessed by the U.S. military. And with the barriers to entry for space operations going down, multipolar space — or several global players shaping core space capabilities — will be a fundamental reality by 2020.

No matter what the United States does, multipolar space will create new policy realities. There will be alternatives to working with the United States for human and robotic space explorations. There will be alternative constellations to U.S. global positioning systems. And Europe, India, China and Japan will all have significant space assets, which can operate as magnets attracting the iron filings of space activities. Space will become a multiple Venn diagram of activity.

Yet the U.S. space debate is caught on dead center and seems to assume hegemony or a U.S.-centric "multinationalism." The reality by 2020 will leave such

assumptions in the dustbin of history.

The United States needs to craft a space policy now that takes into account the strategic realities coming into view. Without significant investments and redirection of efforts to embrace an engagement policy on the international domain, one that accepts the legitimacy of the leadership of others, the United States will neither dominate nor lead in space by 2020.

Although the Obama administration has decided not to return to the Moon via a new human space exploration program, other key players in U.S. space policy — in Congress and the space industrial community — do not agree, and see this much like former NASA Administrator Mike Griffin sees it: as a rallying effort to shape new capabilities.

Another challenge facing the United States is the strategic inertia driven by the intelligence community construct still largely shaping U.S. national security space. This construct drives the technology toward larger satellites, ever-greater resolution for satellites and a continued lockhold on exchange of data from those satellites.

The alternatives being proposed under the rubric of operational responsive

space — new launcher and satellite options — are where commercial and other national players are often starting their efforts to generate space capabilities. The historical legacy of success for the United States is turning into a conceptual chokehold on executable innovation and a further barrier to collaborating in the emerging multipolar space era.

The long list of capabilities that are likely to be operational by 2020 includes:

- Chinese twin capabilities for GPS and missiles for the global marketplace that draw upon their GPS system.

- Commercial sensor and communications satellites that deliver capabilities now considered strategic in character.

- Small satellites launched and available for coordination into constellations for the use of various clusters of states, including Africa, the Mediterranean, the Middle East, Europe and Asia.

- Europe playing a key role in driving the evolution of applications for GPS.

- Significant global capabilities for reconnaissance for intelligence and support of operations with separate and coordinated European capabilities, in India with dual-use systems, and by the Chinese.

- Global telecommunications services

for military and security operations outside of U.S. control (Europe).

- Responsive access to space (with, for instance, an air-launched project in France not yet decided but technologically feasible).

- Responsive small satellites (in Europe).

- Hypersonic demonstrators (Russia, India and Japan).

- Space situational awareness (Europe and China).

- Anti-ballistic exoatmospheric missiles with anti-satellite capabilities (Europe, China and India).

- Human access to space (Russia, China and India).

- Docking in space and an alternative to the international space station (China).

- Robotic Moon missions (Europe, Japan, China and India).

- Robotic Mars missions (Europe, Russia and India).

Such capabilities allow for alternative poles for leadership in space:

India already is launching programs with European and American equipment on board; it could easily become a multinational powerhouse.

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limits, so new booster engine technology advances will be marginal and in areas such as production cost. Nonchemical types of propulsion are low thrust, require a vacuum or pose a severe hazard in a launch failure. The use of an air-breathing first stage provides only a slight benefit. Realistic launch systems, either expendable or reusable, are limited to delivering about one ton in orbit for every 16 tons of vehicle on the launch pad at costs not greatly less than current systems.

Because of the limited benefit of funding technology for launch systems, my presentation to the Stafford committee focused on the great benefit of drastically reducing the required mass in orbit. A large proportion of the required mass relates to the propulsion system for near-term technologies such as chemical propulsion or nuclear propulsion. Another significant proportion for long-duration missions is life support, including radiation shielding. Once in space, propulsion systems having lower mass requirements that are not usable for launch from Earth become feasible, especially those requiring a vacuum or having highly toxic products. By reducing transit times, life support can be reduced.

The results of detailed mission models that I presented to Stafford and his committee showed that the use of continuous low, 0.1 gravity or less, acceleration and deceleration provided reasonable transit times and initial mass in Earth orbit compared with using impulsive thrust with long drift periods, as in Apollo. Achieving a continuous thrust capability required breakthrough advancement of in-space propulsion — specifically, a performance increase of at least 20 times the best chemical rockets like the space shuttle main engine, 10 times Apollo-era nuclear rocket technol-

ogy, and two to 10 times current electrical propulsion in terms of thrust to mass flow rate is needed.

We identified propulsion concepts to the Stafford committee that had potential for approaching this performance level. The most promising, in order of increasing performance, were: gas core nuclear fission; magnetic confinement fusion; magneto-plasmatronic, of which VaSIMR is an example; laser initiated fusion; anti-matter initiated fusion; and anti-matter annihilation. Less-advanced propulsion technologies, such as nuclear thermal, have trouble surpassing space shuttle main engine technology chemical propulsion when the mass of the reactor and shielding is considered.

I fully agree with Zubrin that we must avoid playing technology forever or building the pieces before we know the mission, either of which could paralyze the U.S. human spaceflight program. However, an in-space propulsion breakthrough would be enabling for many destinations, particularly Mars. At Rocketdyne, we considered this area so important to the long-term future of humanity in space that even though the Space Exploration Initiative wasn't funded, we funded joint work with universities such as Penn State and other researchers on company resources for many years after our Stafford briefing. Marshall Space Flight Center and other NASA centers also maintained ongoing investigations of these high-payoff approaches.

The inventor of VaSIMR is certainly an advocate of his specific concept, but his advocacy of the need for advanced in-space propulsion is shared by many. Whatever destination is selected for future human spaceflight, extremely high performance in-space propulsion is a critical enabling element.

Stephen A. Evans
Foothill Ranch, Calif.

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China wishes to be a multinational leader, but its nationalistic ambitions may get in the way; its approach may be more to use space for asserting national technological power rather than crafting an effective multinational approach. But it will create exportable opportunities, notably for its missile business.

Russia will be back and more assertive in terms of core launchers and satellite capabilities.

Japan remains an uncertain player, but core capabilities exist if the national will is there to operate in various domains of launch and satellite capabilities.

New players such as Brazil are likely to arise as the cost to entry is reduced either by a glut of launcher capacity driving down prices or by the emergence of globally responsive space options.

As satellite constellations become assembled from either the top down or the bottom up, serv-

ices will be globally available for communications or situational awareness.

And as states such as Iran add access to or engagement in multipolar space capabilities, one gets the sense of how the world will be different a decade out.

Although the technology and capabilities advance, policy thinking remains stuck in neutral. The core question facing the Obama administration and its successor is simple: How will the United States operate in the world of multipolar space powers? What will it contribute and how will it remain a global space leader in the decades ahead?

Robbin F. Laird is head of ICSA LLC, a consulting firm based in the United States and France, and co-founder of the Web site Second Line of Defense (www.SLDinfo.com), which deals with evolving global military capabilities. Alain Dupas is a European space expert and the author of many books on science, technology and space issues.

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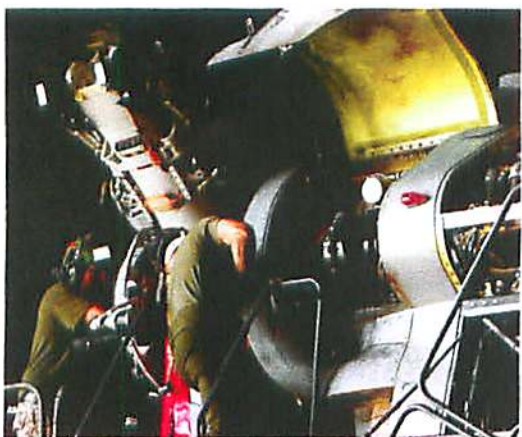
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OSPREY MAINTENANCE MOVES FORWARD



A USMC maintainer overhauls a V-22 at MCAS New River. Here, he has covered space and all the tools he needs to hand – the deployed support picture is dramatically different. (All photos: author)

The Osprey is a revolutionary aircraft. As a plane which can perform like a helicopter, the US Marine Corps (USMC) has used the aircraft in Iraq to cover the entire theatre of operations for support in a single day. In Afghanistan, they have flown it to supplement traditional systems when carrying out envelopment operations against the Taliban, and generally they have used the aircraft to shrink the battlespace.

But the strategic advantages of a new-build platform require robust sustainment regimes to keep the capability flying. Here, the Osprey faces some challenges.

The aircraft has a significant digital reporting capability, which allows the plane to shape

Robin Laird looks at how operational experience is crafting how the US Marine Corps supports the V-22.

enhanced maintenance regimes, but such innovations require technicians used to managing the CH-46 with 30 years of experience to adapt to a new regime. This is not unusual for the Osprey, but reflects a cultural shift for maintainers as they transition from mechanical to digital systems driving the protocols for maintenance.

BECOMING MATURE

The Osprey community is starting to mature its maintenance approach in the middle of an ideological battle over Performance Based Logistics (PBL). These are not popular with the Obama administration, and more traditional approaches have been highlighted.

The difficulty is simply that the current regime, whereby Naval Air Systems Command buys parts on an annual schedule, is challenged by operational realities. And there is a clear need to relate operational realities to supply chains and ensure that changes to parts are made in a timely fashion for both the production and maintenance of aircraft.

Ironically, there is a PBL for the engines on the Osprey which works fine. As Matthew 'Digger' Howard, who works on the V-22 team within the USMC Department of Aviation, commented: 'By way of background for PBL, it has a bad name or a good name depending on whom you talk to. I believe, and we believe collectively as an institution, that if you build it

right with accurate metrics to capture accurately what you're paying for, it works.

'So what's good about it? In the case of the V-22 propulsion system, what do the marine corps have to do to support the engine? The answer is basically very, very little. Under this arrangement, essentially what we do is when the aeroplane tells us, using its diagnostics, that the engine needs to be replaced or repairs need to be made, at the organisational level, that is the marines who maintain the aircraft on a daily basis, they remove the engine and remove the components as required and perform certain O-level repairs. Beyond that, they take that engine, they put it in a can, close it up and they send it for processing and it's appropriately catalogued and it goes to the shipping dock and it goes to Rolls-Royce.'

LEARNING CURVE

Several aspects of the maintenance challenge facing the Osprey were highlighted by crews at MCAS New River. The 'learning curve' required was repeatedly emphasised – marines expressed frustration with critics who seemed to assume that a new product will reach maintenance optimum right out of the box. 'It takes time,' was a frequent comment.

According to Lt Col Garcia, an Osprey maintainer with experience in both Iraq and Afghanistan, the maintenance approach is work in progress. It takes time to get it right, but



The V-22 sees the USMC transitioning from a fleet of largely analogue aircraft to one which is entirely digital – this requires a new approach to support.

the regime and supply chain is being reworked to reflect actual operational and combat experience. This is normal in the deployment of new systems. But ensuring that the deployed warfighter has the right parts at the right time is the challenge facing the supply system.

According to Garcia: 'Improving the performance of the components is central. We have components that are supposed to last in excess of 5,000 hours, which we're routinely replacing at less than a thousand hours, and it's not just the fact that we have to pull something off and replace it with something else. It's all the other things that you have to pull off to do that, all the maintenance – it's added maintenance on top of that.'

According to Sgt Jeremy Kirk, who has come to the Osprey with significant CH-46 experience, the marine corps had decades of experience maintaining the older rotorcraft. The V-22 is new, and has the normal shake-down challenges on operational deployments. Maintainers are shaping a regime to understand the new aircraft and how to maintain it on operations. He underscored that there are challenges but, 'it takes time to learn how to maintain a new aircraft'.

Kirk stressed that: 'I can see significant improvements from 2005 to now from just the experience levels of maintainers learning their tasks and learning the tricks of the trade on the new aircraft. And I think you have seen

it on the pilot side also. We just needed to have the aircraft actually deployed to learn how we were going to use it, and how we're going to maintain it.'

DEPLOYED SUPPORT

Maintainers emphasised the challenge of supporting deployed forces in Afghanistan and Iraq. It is one thing to maintain the aircraft in a facility such as New River, with machinery to lift parts of the airframe and a building to protect it from the elements. In Afghanistan, the USMC operates the Osprey in very tough conditions, and does maintenance out of tents. This is certainly a challenge when considering readiness for operations. So, it is different when talking about deployment in extreme environments.

As Cpl Washek, an Osprey maintainer, commented: 'I deployed with VMM-261 when they went out to Iraq. Occasionally, we'd run into something like we'd be in a situation where the service representative wasn't available or we'd be on our own and the publications we were relying on were a little unclear, or none of us had seen the problem before quite in the same way. So we would draw upon the "Osprey Nation" or the maintainers operating through the global Osprey enterprise.'

When asked how challenging the Afghan maintenance situation was, Washek commented: 'It definitely was interesting. The space

issue was probably our major focus. If a rotor head were to go down, we didn't really have the space at I-level to fix that rotor head. We were working out of the vans.

'And for the I-level, we were working out of tents, so we didn't have the space to actually put a rotor head in the tents, take it apart or anything like that so we would have to rely on the squadrons – that they may possibly give us a spot in their hangar, to work out there and use all their tools. We're taking our tools down the flightline and basically we had to move our shop down there. This took a couple of hours just to move our shop.

'For example, we would have a rotor head stand and a rotor head we'd fit on and we'd have to move that from where they were located on the compound down to the flightline. This took a joint effort of supply using a forklift, maybe a flatbed truck. Somebody would have to have a licence to drive a truck and some way to get it off the truck when we have to support the flightline.'

In short, the maintenance regime is a work in progress. But being marines, the corps inserts its kit on support operations and works the maintenance regime to support the deployed warfighter. When one watches Congressional hearings and hears complaints about readiness rates, one wonders how the congressman would cope with working in a tent on the Osprey. **MLI**

THREE- DIMENSIONAL WARRIORS



A PUBLICATION OF SLD.INFO.

FOREWORD

The interviews and essays in this booklet have appeared in earlier versions on the web site Second Line of Defense (<http://www.sldinfo.com/>). SLDinfo.com focuses on the creation and sustainment of military and security capability and the crucial role of the support community (military logistics community, industrial players, civilian contractors, etc.) along with evolving public-private partnerships among democracies in crafting real military strength. SLDinfo.com is updated every Tuesday; articles, photos and videos are posted on a weekly basis.

Some of the interviews and articles in *Three-Dimensional Warriors* are excerpted from the longer pieces on SLDinfo.com as indicated at the beginning of the article. The original pieces on the web site often include photos and graphics which are not included in this publication.



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INTRODUCTION: THE F-35B IN THE PERSPECTIVE OF AVIATION HISTORY

Ed Timperlake

FORMER COMMANDING OFFICER, VMFA-321 "HELLS ANGELS"

In the opening days of U.S. combat in World War II, extremely courageous Navy and Marine pilots went up against the Imperial Japanese Navy in inferior aircraft. For the Marines, the Brewster F2-A *Buffalo* was woefully inadequate at the Battle of Midway. An entire Navy torpedo squadron, Torpedo-8, except for a single pilot, was killed in combat.

With the entire world in combat and nations fighting for their very existence, aircraft design teams pressed ahead with all the resources and intellectual vision they could bring to the design table. The U.S. air forces introduced a steady stream of type, model, and series (T/M/S) of always improving airborne killing machines.

From the Brewster F2-A *Buffalo* to the F-4F and F-4U to the F-6 and, at war's end, the F-8 *Bearcat*, the Navy had a series of prop-driven fighters that mastered the Japanese Zero. The Army Air Corps went from P-39 to P-38 *Lightning*, P-47 *Thunderbolt* to the P-51 *Mustang*, with its wonderful bubble canopy, to carry the fight to the heart of Germany.

Along the way, emphasis was placed on pilot survivability by putting armor plates in the cockpit and installing self-sealing fuel tanks. Since the entire objective was to get first "tally" and then out-maneuver and kill the enemy, the design focus was on an improved blend of speed, range, and maneuverability—in essence, better engines and smarter airframe designs.

While the main effort was producing enough "motors and gun sights," industry and research labs were working on the technology of the air fight.

The P-61 *Black Widow* was an early attempt to put radar on a night fighter, and the Germans tried a rocket plane against B-17 formations. The Italians, Germans, Brits and, ultimately, Americans

experimented with early jet engines. But it was the German ME-262 that changed the dynamics of combat, although the Germans employed it in an inefficient manner by following Hitler's call for it to be committed to an air to ground role.

After WWII, the jet engines saw improved airframe system performance by improving speed, range, and maneuverability. But two new dynamics were added—both related to payload.

For a fighter in WWII, the payload was simple—what caliber and how many machine guns or cannons fit the design to give the pilot enough "deadly bursts" to kill several of his opponents?



In the jet age, the complexities of adding airborne systems and improving the weapons on board changed the technology vectors of design considerations and introduced two more synergistic, but relatively independent, research and development paths.

Airborne radar and sensors were added to fighters. Those systems helped the payload—guns and early infrared (IR) "fire and forget" missiles became more efficient with the AIM 9 sidewinder series. But then, concurrently, independent performance was put into the payload by improving missiles and linking long-range (BVR) missile shots to radar technology. At first, radar guided missiles needed continuous guidance from the fighter but eventually even radar guided missiles became BVR self-contained "fire and forget."

Unlike WWII research and development, where research on airframes and engines was the mantra, the jet age involved two other major design factors. The first was always a continuous quest for

improved radar systems and, second, as technology allowed, improved weapons. Yet again, the art of aeronautical design had to work in partnership with the science of military R&D.

Along the way, survivability concerns shifted from armor, speed, and a good canopy to electronic warfare and the incorporation of stealth characteristics through design, composite materials, and paint chemistry.

Stealth is a survivability factor and multiplies the effectiveness of the fighter. Stealth isn't just *added*, it is *incorporated* into the fighter. Being a multiplying factor means it is sensitive and can drive the entire performance of the airframe and combat system.

At the end of the 20th-century the complexities of fielding the best fighter were a much bigger challenge because of three synergistic but independent factors—basic airframe performance improvements, internal system R&D, and constantly improving weapons.

However, with the computer revolution moving at light speed, a fourth design dynamic is now at work—the man-machine interface.

With the capability of three-dimensional sensing and the ability to distribute information to other warfighters—airborne, on the ground, or at sea—the relationship of the individual pilot to the entire air battle offers a truly revolutionary shift that will continue to evolve.

For example, one of the most important capabilities of the F-35B, not yet exploited, is the distributed information capability. All pilots, regardless of experience, will fly into the air battle with the same knowledge and situational awareness.

Consequently, in the formation, if one pilot gets inside the opponent's OODA loop (observe orient decide act) all are capable of having that same joint knowledge. The revolutionary aspect is that the enemy can "splash" an individual F-35B but they can't kill the knowledge gained by all—a truly unique 21st-century technology brought to an air battle.

Conversely, on the offensive, if one F-35B picks up an enemy's airborne vulnerability, such as an aircraft system, weapon frequency emission, or stealth breakdown—it can be sent to all. Every *Lightning II* is a real time intelligence collection

system. The entire engagement is also captured electronically for immediate and direct refinements to tactics and analysis at the Marine Air Weapons Training Squadron during the air battle. Fleet-wide information sharing among services and allies will be a huge factor in winning an air campaign.

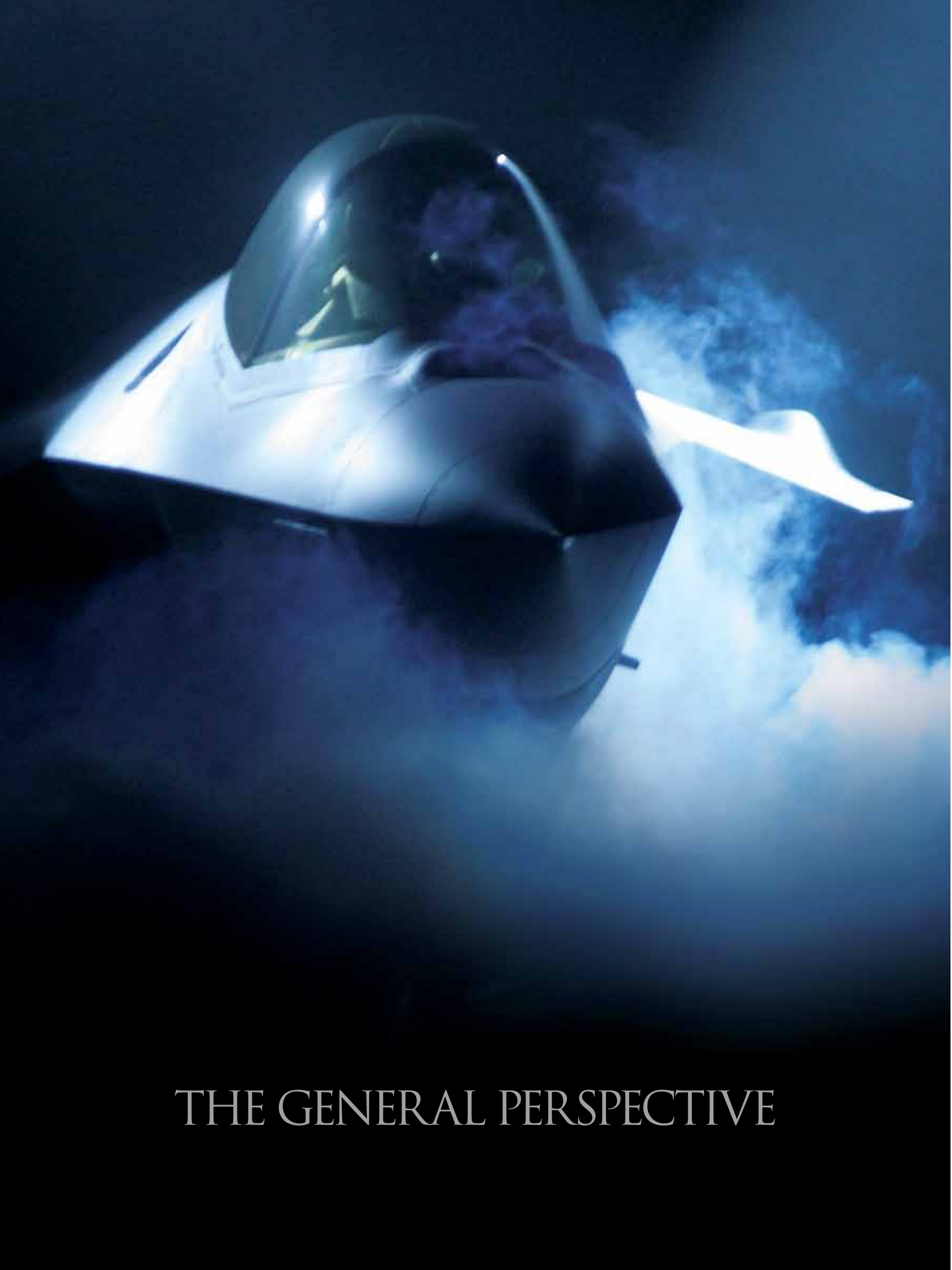
In WWII the *Buffalo* was a "grape" and the design teams worked with wartime efficiency to follow a single path to improve airframe performance. After WWII the technology vectors of improving internal systems and weapons carried were added to the mix. In this new century, the concept of each pilot being a three-dimensional warrior with superior knowledge is being pioneered by the USMC aviation community.

The F-35 is not designed for the early century's concept of the knife fight, and it has the growth potential for internal changes to its systems to always incorporate the best weapons while expanding empowerment of combat pilots to have three-dimensional knowledge and elevate the fight to a new level.

In other words, the F-35 may actually be its own follow-on. Instead of the old paradigm of needing to completely build another fighter to move from the F-2A "Grape" to F-4U "Whistling Death," the Marines can just change and update the F-35B system, sensors, and weapons. The Marines flying the F-35B with a pre-planned product improvement design philosophy to pull and replace or add system capabilities will in the future have total flexibility to add new sensors and the improved AA missiles currently being designed.

Exploiting man-machine, three-dimensional knowledge is truly a brave new world. Consequently, the F-35B is capable of constantly updating the next generation of U.S. fighters, but not by building a new airframe, by staying inside the F-35B basic airframe and adding the next generation of systems and weapons. The American arsenal of democracy is shifting from an industrial production line to a "clean room" and a computer lab as key shapers of our competitive advantage.

It is a bold concept and only history will tell us if this is indeed the best way ahead. In addition, the USMC combat flexibility of basing mode enabled by V/STOL adds a revolutionary capability for the integrated air-ground battle. ★



THE GENERAL PERSPECTIVE

AN INTERVIEW WITH BRIGADIER GENERAL GEORGE J. TRAUTMAN, III, USMC, DEPUTY COMMANDANT FOR USMC AVIATION ON THE IMPACT OF USMC AVIATION ON THE EVOLVING CAPABILITIES FOR THE U.S. WARFIGHTER

SLD: The Commandant has referred to the F-35 as the centerpiece for the future of the MAGTF. Why is that so?

LGEN Trautman: The Marine Corps is by nature a light force. We don't have the luxury of traveling with a lot of heavily mechanized forces. Because of our naval character, we often go by sea and because of our expeditionary nature we often find ourselves in austere locations early in a campaign. In order to get there early in a campaign, we need to deal with an increasingly inaccessible world.

At the forefront of the ability to operate in this environment is the very low observable capability that the F-35 brings to the fight, as well as the capabilities that STOVL will bring to the fight with regard to close proximity to our expeditionary forces.



The Marine Corps depends on TacAir probably more than some of the other services because of the light nature of our force and the dependency that we have on TacAir to ensure that we can take risk in maneuver. You can only take risk in maneuver if you have adequate intelligence surveillance and reconnaissance, dissemination of information and the firepower that comes with it that will enable you to move about the battlespace without the heavy firepower that, for example, an Army heavy corps would bring to the fight.

So TacAir is essential to our ability to maneuver in the battlespace. F-35 is going to be an incredible contributor because of the sensing and computing power that this machine is going to bring to us. We are going to find ways to better disseminate that information across the entire battlespace and all the way down to our platoon and fire team leaders at the right time and in the right way.

And so in many ways, F-35 will lead us to the next generation of warfighting, if you will, in which information exchange is going to become more and more important, and the F-35 is ideally suited for that kind of operation.

SLD: The F-35 is going to replace several aircraft for the Marine Corps. What contributions does simplification of your fleet bring to the fight?

LGEN Trautman: The tangible benefit of replacing our *Hornets*, our AV-8s, and our EA-6B *Prowlers* with a single type model series is going to be huge. From the perspective of the logistics footprint, from the training perspective, from things like peculiar support equipment, ground support equipment, the training of individual Marines and aviators, we're going to take more than a threefold increase in effectiveness, efficiency and resource savings by transitioning to this single type model series.

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We learned this when we, for example, transitioned our H-1 helicopters to two airplanes, the AH-1 *Zulu* and UH-1 *Yankee*, which have 84 percent commonality. We're already reaping the benefits. We anticipate the same result with the F-35.

It's absolutely essential that a machine that is going to do everything that our STOVL AV-8s, F/A-18 fighter attack airplanes, and EA-6B electronic

warfare airplanes do for us today be a “pilot-friendly” machine. If it’s not a pilot-friendly machine, built from the ground up with fused systems, we’re not going to be able to perform all of those functions.

We’re actually quite optimistic in what we’ve seen in the simulator and what we’ve seen through various studies of the systems that are already being built by the contractor that we’re going to be able to train to this range of mission sets. We may have to have specialization of some of our aircrew. It remains to be seen as we build our concepts of operation and our tactics, whether we have to evolve into a specialized approach or not. At this juncture, we’re actually fairly confident that the enhanced capabilities of the F-35 are going to enable us to avoid building specialized aircrews.

SLD: The USMC has introduced the Osprey, which is certainly a transformational product, and the F-35B is coming online. Those two together should give you more integrated capability to certainly provide a leapfrogging capability for your amphib fleets for example.



LGEN Trautman: The range and speed that the Osprey brings to the fight is very much transformational, and the ability to connect Osprey to F-35 and then to the rest of the joint force is going to open up potentialities that just have not existed in warfighting to date.

I think by the time F-35 comes to the forefront here in the next four to five years and by the time we figure out how to connect the two in the battlespace, we’re going to bring to the fight something that is going to be very much a game changer. It’s going to be a game changer from the perspective of the kinds of things that commanders can choose to do should they choose to do them.

Combined with the improved intelligence surveillance and reconnaissance capabilities that our nation already has, we’re going to be able to exploit our asymmetrical advantage which will be in the combination of the F-35B in the STOVL mode and the V-22 with the range and speed that it contributes to the fight.

SLD: The combined capabilities that you are crafting will be an essential contributor to dealing with hybrid threats. How do you view the multi-mission capability of the F-35 in dealing with hybrid threats?

LGEN Trautman: Some people like to paint the fifth-generation strike fighter, the F-35, as only essential in a state versus state endeavor where a near peer competitor has decided to build a sophisticated integrated air defense system or has decided to spend a lot of money on sophisticated aircraft that can conduct a near peer aerial warfare fight.

I think that’s flawed thinking because even in a low end fight, it’s possible that you can encounter very sophisticated enemy scenarios with radar guided air defense systems and even double-digit surface-to-air missiles in localized areas that preclude your ability to operate freely. In other words, you can encounter an integrated air defense system on a local level right in the midst of another kind of fight.

So in a single day—much like the Three Block War that General Krulak talked about; much like the hybrid war that we saw the Israelis and Hezbollah involved in—you can find yourself in a COIN fight in one part of the battlespace quickly evolving into a very different threat scenario in another part of the battlespace. This might happen all within the range of maybe 100 miles or 200 miles. You have to be ready and prepared to evolve from one type of threat scenario to another, even at the lower scale, on a daily basis.

Consider, for example, if someone had introduced sophisticated double-digit SAMs into Iraq at some point in the recent past or in the near future; it would change the whole nature of the fight. You have to be prepared to swing across the range of military operations, not just in the broadest strategic sense, but at the tactical level in the context of something like the current fight that we find ourselves in in Afghanistan or previously in Iraq. ★

EVOLVING MANNED AND UNMANNED CONOPS: AN INTERVIEW WITH LIEUTENANT GENERAL DAVID A. DEPTULA, USAF

[IN APRIL 2010, SLD INTERVIEWED LIEUTENANT GENERAL DAVID A. DEPTULA, USAF TO DISCUSS THE EVOLVING INTERACTIONS BETWEEN THE NEW MANNED AIRCRAFT AND NEXT-GENERATION UNMANNED AIR VEHICLES.]

General David A. Deptula is Deputy Chief of Staff for Intelligence, Surveillance, and Reconnaissance at Headquarters, U.S. Air Force in Washington, D.C. He is currently responsible to the Secretary and Chief of Staff of the Air Force for policy formulation, planning, evaluation, oversight, and leadership of Air Force intelligence, surveillance, and reconnaissance.

SLD: UAVs and the ISR provided by UAVs have become prominent in public discussions about the future of airpower. What are your thoughts about their future contributions?



LGEN Deptula: Well, it’s an interesting question because it takes us down a deeper train of thought where we are focusing beyond remotely piloted aircraft vs. piloted aircraft. It takes us beyond the notion of aircraft as individual systems and moves us into the realm of a future that is dominated not by things but by concepts of how you tie all of these things together and how they can all provide military capability, whether they operate from the ground, on the sea, or in the air.

And that Information Age is being perpetrated by advances in technology that allows us to do many more things on individual aircraft than we’ve ever been able to do before. This advancement in technology enables different concepts of operation for employing remotely piloted aircraft and joining them together with modern manned aircraft like the F-35 and F-22. These capabilities can help produce concepts of distributed air operations that we simply have not had the advantage of executing in the past.

Modern fifth-generation aircraft like the F-22 and F-35 are not simply fighters. We’re trapped by an old historical nomenclature system here. They are in fact flying sensor platforms that have inherent force application capability associated with them. So we need to think about new and innovative ways that they can contribute to a system of individual elements that create a force that can achieve outcomes that are not just sequential in nature.

SLD: So we should begin to think of the correlation between ISR and OPS rather than looking at them as separate entities?

LGEN Deptula: Absolutely. The evolution of technology and information is allowing us to change our culture, a culture that in the past tended to segregate intelligence from operations. That historic segregation of “ops” and “intel” is really dysfunctional and slows our ability to accomplish desired outcomes. Let me give you an example.

In the 21st-century I would tell you that ISR is operations, it’s not simply support to operations. A good example is when we took out al-Zarqawi, the Al Qaeda leader in Iraq in 2006. That outcome took about 600 hours of Predator time, thousands of hours of analyst time to evaluate that observation activity from those remotely piloted aircraft, and about

I like to characterize the point of history we’re in today as a transition point between Industrial Age warfare and Information Age warfare.

six minutes of F-16 time to send al-Zarqawi to the nether regions. So the question is which one was the operation?

The fact of the matter is each one of those activities was required to achieve the desired outcome. As we move into the future—enabled by the variety of different fifth-generation systems that we’re going to acquire—we have to think about incorporating all the elements that they can bring to the table, not just the force application pieces. The old approach is sequential thinking as opposed to parallel application of mission capability, which is the fused con-ops approach of 21st-century air operations.

As we move to the future, we need to think about not manned or unmanned aircraft as separate entities but how we can join them together in an integrated fashion to accomplish desired outcomes of a particular joint force commander.

SLD: In a way we shouldn’t refer to this as fifth-generation fighters, we should talk about this as integrated sensor strike platforms?

LGEN Deptula: Absolutely. We have to get rid of last-century designators. If you look at either the F-22 or F-35, they conduct a panoply of missions. ISR strike is perhaps a better way to describe them because they perform all of those roles simultaneously.

SLD: The F-35 brings with it significant computational power, several sensors, 360-degree awareness with the distributed aperture system, a different kind of helmet, all of which leads to a different kind of capability. How will that shape the next generation of UAVs?

LGEN Deptula: Because of the powerful nature of the sensor suite resident on the F-35 we’re only

scratching the surface; we don’t know yet. It has a fascinating degree of capability when you look to the future because of the modularity of the avionics packages that were built into it.

At the same time, we have some inkling because you can conceive of a next-generation remotely piloted aircraft that is built to supplement and enhance the capabilities that an integrated ISR on the F-35 can bring to the fight. For example, by acting as out-riggers in the context of providing information beyond the immediate range of the sensors of a particular F-35, the RPA can act as a weapons mule, if you will, by providing additional weapons at a much lower cost, in terms of both the remotely piloted aircraft themselves and in the context of not exposing a human to the threat.

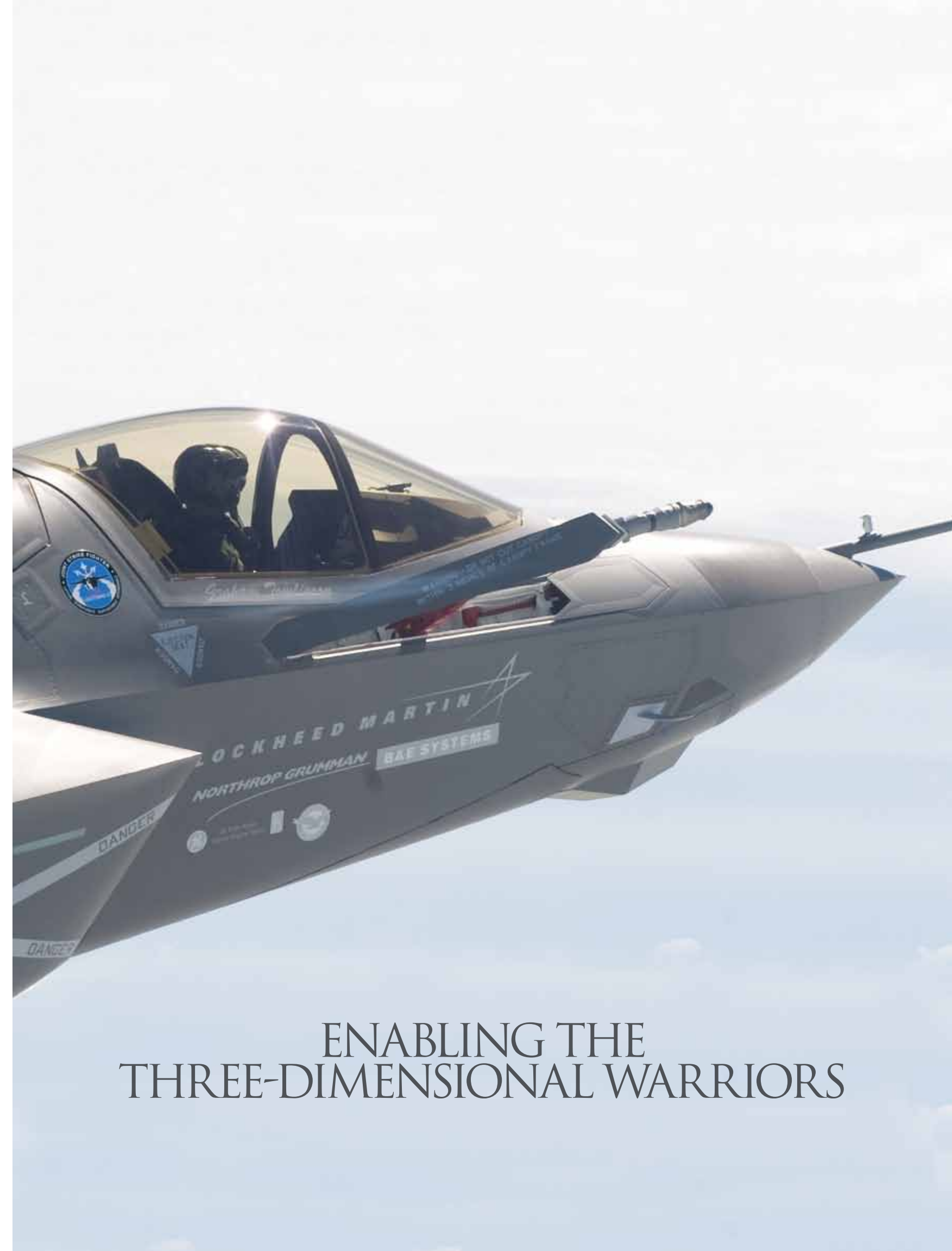
So it can be used in higher threat situations than you would want the F-35 actually to penetrate, and as a part of robust distributed air operation that the F-35 and F-22 in conjunction with remotely piloted aircraft can bring to the fight.

So there’s a variety of different ways, but we need to think about using remotely piloted aircraft—not just as separate aircraft to be used in traditional ways, but as elements of a distributed air operation where they can contribute to the entire panoply of missions that an air operation might encompass.

SLD: Can you discuss how the notion of “fractionation” plays off the distributed air operations you just mentioned?

LGEN Deptula: The notion of a fractionated system is separate and distinct from what has been discussed over the past couple of years as network systems. A network traditionally involves different nodes, different systems performing different missions. The notion of a fractionated system is that you have multiple entities operating to provide a particular effect; you can afford to lose some yet not lose the effectiveness of the overall system.

So again, that should lead us toward a concept of operations where we can marry-up remotely piloted aircraft with fifth-generation aircraft in a way to amplify the entire force package in ways we never conceived of in the past. This package is much more survivable than the way we’ve operated in the past or by using a traditional network approach to the problem. 🌟



ENABLING THE
THREE-DIMENSIONAL WARRIORS

THE DISTRIBUTED APERTURE SYSTEM AND 360-DEGREE SITUATIONAL AWARENESS

[AN INTERVIEW WITH MARK ROSSI, NORTHROP GRUMMAN ELECTRONIC SYSTEMS.]

SLD talked with Northrop Grumman Electronic Systems' Mark Rossi about the Distributed Aperture System (DAS) on the F-35, which together with the helmet provides 360-degree situational awareness for the F-35 pilot.

Mark has served as the Director of the AN/AAQ-37 Electro-Optical Distributed Aperture System (EO DAS) for the F-35 platform, having management responsibility for the product development and production of the EO DAS hardware and software. He joined Northrop Grumman in 1984 and has held numerous positions of increasing responsibility in Technical Subcontract Management, Business Development and Program Management.

SLD: The Distributed Aperture System (DAS) is one of the reasons why the development of the F-35 is about the next 30 years of military aviation, not the past 30 years. Yet folks have not really wrapped their heads around what DAS is or can and will do for the warfighter.

Rossi: The biggest problem with DAS is that it's completely unknown to most people. We think of it as revolutionary. If you consider radars, it's evolutionary. Everything since WWII has been equipped with a radar, they just keep getting better. We keep building on it. People are used to what it brings to the fight. They've never had the capability provided by DAS. So we wow them with imagery, we wow them with performance data, and so forth. But I think everybody who listens to our story, especially at a classified level, can imagine what they might do with this thing. But they have no idea what they're getting.

The number one thing that DAS brings to JSF is 360-degree spherical situational awareness. We create this bubble around the airplane where we're just seeing everywhere all the time, we're always on, we never stop. We don't interleave. We do it 100 percent, all the time.

SLD: Is this a man-machine interface we're talking about?

Rossi: From a situational awareness point of view, the pilot does absolutely nothing. We are monitoring the world around us all the time and then differentiating things that occur that are important to that pilot—classifying them for him. It's only when we determine there's something important that he'll even know anything's going on.

SLD: DAS provides 360-degree situational awareness for the individual pilot on the F-35, but is there any reason that we couldn't take that fused data and share it?

Rossi: There's no reason we couldn't do it short of limitations of those sharing channels.

SLD: But the point is that you're standing up a basic capability on the first production aircraft and there's the opportunity to take this capability, which is unprecedented, and figure out new ways to share data and new ways to battle manage. In other words, you're investing in the future by buying this capability.

Rossi: Absolutely, absolutely, absolutely. All of it's there. What you do with it beyond ownership is all in the realm of possibility.

SLD: So the point—focusing on the individual aircraft now and the pilot managing the aircraft—this allows him to have capabilities to see 360 degrees and understand the threat envelope around him.

Rossi: The pilot gets this situational awareness, and obviously we're providing an IR situational awareness of the world. It's not individual. It's in the IR band and it is completely passive so it's on all the time and it doesn't hurt the LO capability of the aircraft.

Within that situational awareness, another mode that we were asked to develop was a missile targeted at the plane. So we have to know what all those manmade airborne objects are and classify them, and then if we believe that one of those happens to be a missile that's targeted at the plane, we have to actually tell them that.



SLD: So this is a key tool to de-clutter the battlespace so that the pilot can focus on the most important priorities.

Rossi: Absolutely. So the pilot keeps track of the world, but we classify the world into things that the pilot would care about that are manmade. Obviously, this includes missiles and airplanes, both air-to-air and air-to-ground, so if there happens to

be something coming from the ground, not only do we need to know that it's something coming from the ground, we need to know that it's coming from the ground and it's targeted at you and we have to tell you where it came from too.

SLD: Why is the DAS so misunderstood or underestimated?

Rossi: I think number one, they don't really understand what it's going to do for them. And number two, the few systems out there that try to do this, never try to this degree. The missile warning systems that exist out there are just fraught with error. The reliability of the DAS ensures a whole new level of trust and confidence for the pilot in operating the aircraft.

The reliability of the DAS ensures a whole new level of trust and confidence for the pilot in operating the aircraft.

SLD: How does the new helmet for the F-35 interact with the DAS?

Rossi: The DAS provides 360-degree NAFLIR (Navigation Forward Looking Infrared) capability. So if you think about it we're out there staring at the world. We have all this information. We can then take and post-process where the pilot is looking on his helmet. We also have an auxiliary channel where he can dial in any particular sector that he wants to keep track of and we can give him near 20/20 IR imagery of the world about him.

So now night landings on carriers are fully enabled. We show this stuff to Navy pilots and they're just awestruck that they can even see the horizon, let alone the boat out there and the wake.

It's going to revolutionize night landings on aircraft carriers.

FLIR is an archaic term because FLIR stands for forward looking infrared. We're not *forward* looking; we're *everywhere* looking. But it's a term that people have created so we stick with it. But anywhere the pilot can turn his head—through his legs, through the floor of the airplane—he can look because we're looking everywhere.

SLD: You mentioned fusion. The fact that this data is fused... can you tell me a little bit about what advantage that brings?

Rossi: We take and collect all that information and we, for lack of a better term, we fuse that data and create a global theme within our processor. From that we produce the NAFLIR imagery. We're watching everything and then we're classifying everything by order of importance. So we do all of that, that fusion, ourselves and then the output is per the Lockheed defined interface control drawing as to what messages we send and the streaming video that we also send.

Then that information is fused with other weapon systems on the aircraft and then presented to the pilot. We actually don't determine what gets presented to the pilot, they do. So if we see something and they want to put another weapon system on it to verify it, they might do that. We don't know exactly what they intend to do with all the information we send them. That's a Lockheed fusion job. You don't directly interface with the pilot, other than our imagery on their helmet and the declaration of a plane-targeted missile.

We do a lot of fusion at our level because we have to integrate six sensors into a singular unit that does not lose track of things across sector boundaries and camera boundaries. A lot of systems in the past, even with multiple sensors, were challenged by fusing those into a singular global seam that is impervious to the boundaries relative to tracking things of interest across them. Being able to seam to the point that we don't have a loss of track across

the camera or the sector boundaries in inertial space is critical.

SLD: Lockheed is addressing the broader air integration issues, but there's a significant difference between an F-18 or F-16—where you're doing iterative additions to the aircraft—versus what you're doing with the F-35—where you're coming on with an integrated sensor capability—and the DAS—where it can work on a man-machine basis. That is very, very different than just incrementally adding capabilities.

Rossi: That's the whole fifth-generation concept. The F-22 is a fused airplane and so is the F-35, and they can use these other weapon systems to enhance their overall integrative capability. The beauty about DAS is that we're seeing everything all the time in places on a 360-degree basis. Radar's a phenomenal system but it has a cone, right? It's never looking behind you and most of the time it's not looking to the side of you unless you have side arrays.

So we look everywhere and we can let the pilot know that there may be a problem. The pilot may need to turn around and look to see if there is a need for other weapon systems, where in the past you would have nothing in those coverage areas.

And then we have to work in all clutter environments. Think about it, we're looking everywhere. In the daytime, at all times in the daytime, one of our cameras, at least, is looking at the sun. So think of the challenges associated with an IR system that's staring at the sun. We obviously can't bloom on it; we can't bleed over.

Think about those challenges. There are all kinds of things associated with looking everywhere. We're looking at cold sky at the same time as we're looking at a very highly cluttered mountainous range, and we're looking off to the side at backlit clouds all at the exact same time in this 360-degree world. So we can't be tuned to one or the other, we have to be tuned to all of them in order to provide this performance. When you get into the details you realize the challenge associated with doing this because we're looking everywhere all the time in all conditions day and night, and we have to address all those conditions or else we're not a capable system.

SLD: You're providing technologies, tools that really allow the pilot to act very differently, function very differently.

Rossi: Absolutely. We provide a whole lot more situational awareness around the pilot. We project imagery into the helmet to a defined field of view based on where the pilot is looking. All that's mapped, and we predict where the pilot's going to move his head. We have post-processed that region of imagery to provide the near 20/20 quality. We could do it everywhere, but it would just be a processor hog so we post-process the spot where he's looking and the region around where he's looking so to minimize latency as he moves, and then present him that near 20/20 quality visual wherever he moves his head.

And again, he can go pick an area and if he wants to just watch that area all the time, he can just dial that in and he'll stare at that thing. But remember, we're not slewing anything. We're not moving anything. It's all just picking a spot in a virtual global sea. We're doing this in the processor.

SLD: How do you think they'll experience this because it's going to be a very different experience and will drive new battle tactics and operational foci?

The young kids who are going to be flying these airplanes will have grown up playing video games.

Rossi: This will not be foreign to them. We're providing that technology now so that when the next generation of fighters get in that cockpit, it's not going to be unlike what they're used to back

home playing they're videogames. If you consider the mentality of the kids that are going to be sitting in those seats, they would be very disappointed if they didn't have that kind of capability. That's just my take on the world. I'm 50 and I didn't grow up that way, but my 13-year-old knows a lot more about it than I do.

The next generation of pilots is going to expect that speed. They're going to expect that image quality to be given to them, and I think that they'll already know how to use it because they will have been trained all their life by playing video games. With this kind of capability, the F-35's mission can be increased.

The missions JSF can do can expand the operational envelope. You don't want to make JSF a drone, but if he's up there anyway and they're everywhere and they're linked, your mind starts to think of the possibilities of what they could do with this kind of 360-degree, fused information.

Also, think about the additional information that we could provide. We're seeing everything so we're seeing ground activity, all of which, right now, we completely suppress. We throw it away because—guess what—it's not an airborne object and right now we don't care about it. But what if with a simple algorithm change you could direct other weapon systems to, say, “Hey, something's moving right there!” Then you point your “soda straws” and, wow, you're not scanning and searching like you do today with your traditional “soda straw” systems.

Even radar is in volume search a lot. DAS is looking everywhere, seeing everything, maybe not with the clarity of a targeting system, but if I see something here, all I have to do is tell my radar or my EOIS to go look, and bingo. There are capabilities limited only by our imaginations! 🚀

RESHAPING TACTICAL CAPABILITIES: THE DISTRIBUTED APERTURE SYSTEM (DAS) AND THE NEW HELMET

[SLD INTERVIEWED LIEUTENANT COLONEL “DINO” MICHAEL DEHNER, USMC, HEADQUARTERS, MARINE CORPS AVIATION ABOUT HOW THE NEW HELMET WILL ENHANCE THE WARFIGHTING CAPABILITIES OF THE F-35B.]



The new helmet and the interactions between the pilot and the systems on the F-35B provide the hub for new operational capabilities. Lieutenant Colonel Dehner is part of the JSF cell at HQMC. He is currently the USMC test coordinator for F-35 and has flown with prototype test helmets in the F-35 concept of operations simulators.

SLD: Could you describe how the systems on the F-35B shape a new environment within which the helmet functions?

LCOL Dehner: One of the new operational capabilities of the F-35B is its ability to sense the IR energy—the heat coming off of the environment—a full 360 degrees around the aircraft. It’s as if you are in the middle of a soccer ball looking out through the facets. There are IR sensors all around. The aircraft also detects more of the electromagnetic spectrum, similar to a Prowler. There is a lot more information available that needs to be understood.

So the next question is, “How does one put information in a way that a human being can understand and act upon it?” The information is displayed to enable the pilot to be a tactical decision-maker. So, instead of being very mechanically-driven, like we are in our current aircraft in which you have to help move the radar around to make it do its thing, with the F-35B the systems on the aircraft do that.

Now, that’s only part of the answer. The next piece is the Distributed Aperture Systems (DAS) that is sensing the IR world 360 degrees around. Camera eyes

are staring at all times all around. So then we have to ask, “How do we get that information across to a person that, obviously, can only look in one direction at any given time?”

The system’s interface, the DAS imagery, gets projected on a patch on the new helmet, which is an improvement from the current helmet. Then you have a window into this other world and can look at information in the IR. When you turn your helmet, you see the world surrounding you through the DAS information that is being transmitted.

SLD: You alluded to the relationship between the classic tactical fighter and a specialized war battle manager, who’s on electronic warfare aircraft. Will this change?

LCOL Dehner: Absolutely. The classic tactical fighter was defined by the strike package where there are aircraft that deliver weapons and fighters either clear the way or protect. Then there are electronic attack aircraft to provide another level of support. In contrast, the F-35, by design, will be able to do all three of those things with the same aircraft or the same small family of aircraft. So, you can prioritize different roles; two on the front are the fighters today; the third is going to pick up electronic attack; and the fourth is going to do the strike. But depending on how you’re configured, you can flex that in real time.

But with all that increased capability, you still have the same human beings flying aircraft in a similar way that was done 50 years ago. So now there is a need to train those pilots in a different way. You take all the very classic training techniques—teach them

how to actually fly the aircraft, teach them how to use the aircraft as a weapon—and then you train them to be an information manager because this aircraft really is an information sponge.

This aircraft is a little information hub in the sky. The job of the pilots is to be effective for their primary mission, but then also to decide how to get information to other people.

This aircraft is a little information hub in the sky. The job of the pilots is to be effective for their primary mission, but then also to decide how to get information to other people—not just other pilots but also to the ground—because they may be in a better spot to be more effective.

SLD: What is the role of the helmet in facilitating what you just described?

LCOL Dehner: The helmet in the F-35 will display fused data, and creates a picture so that, literally, when you look down through what would be the skin of the aircraft, you get the projection of the ground underneath. So, if I am trying to locate a target, the current helmet will give you a little box or a symbol to highlight that target. But as soon as the wing of the aircraft gets in the way then I have to move the airplane. With the new system I can see through the wing.

An immediate benefit is that I wouldn’t have to move my aircraft into a place where I might not want to go. For example, when we orbit for an intelligence, surveillance, reconnaissance (ISR) mission there are better paths in the sky for us to stay within. I want to get a really good picture, so I’m going to set up an orbit. But that instantly can change if my wing gets in the way. So then I’m going to have to move the wing out of the way to get a better look, and then get back on profile. That’s a lot of the work for the pilot. With the DAS, this problem goes away.

SLD: Can you predict the changes in pilot behavior as a result of this synergy of the DAS and the helmet?

LCOL Dehner: One of the other significant changes will be the way we fly our formations and get more out of the aircraft. With traditional tactics, we’re tied relatively close to each other because we’re covering each other for anybody shooting from the ground. You’re checking me. I’m checking you. So, we tend to fly together. We don’t have to, but otherwise it’s risky.

In order to get more aircraft over a larger area, we separate. Now you can only do that when you have very fixed-wing tolerant conditions. Then I’m not going to be shot at a lot because I’m either at a higher altitude or the threat is just not there.

With the DAS, the computer is working all the time, looking all around, making sure that no one’s taking a shot at me.

With the DAS, the computer is working all the time, looking all around, making sure that no one’s taking a shot at me. So that instantly frees up the pilot and the squadron to spread out. We’re not taking on risk or adopting a different procedure—which is how we’d mitigate the risk today—because of the DAS system on board.

SLD: By having a closer relationship between the ground and the air element will the confidence level of using weapons in close support go up, resulting in reduced collateral damage?

LCOL Dehner: Technology enhancements in the last 10 years have already improved that quite a bit. This will be the next huge step. More information is getting to the pilots so that’s going to make that pilot feel more confident. We’ve already started sending information down on our legacy aircraft. In the F-35, there will be a lot more information to push down to those ground commanders for shared decision-making. 🚀

THE F-35 PILOT

[AN INTERVIEW WITH LIEUTENANT COLONEL M.G. “SQUIRT” KELLY,
F-35 FLIGHT OPERATIONS LEAD, VX-23, PATUXENT RIVER, MARYLAND.]



The pilot on the F-35B is really a centerpiece of what we are calling the three-dimensional warrior. The new helmet and the interactions between the pilot and the systems on the new aircraft provide the hub

for new operational capabilities.

SLD went to Patuxent River in April 2010 to interview several members of the Patuxent River test team and spoke with test pilot “Squirt” Kelly about his thoughts on the F-35 experience.

SLD: You’ve been testing the helmet and the plane. What’s the synergy between the helmet and the plane?

LCOL Kelly: Well, it is quite a nice synergy, actually. The helmet becomes very natural to the pilot, because it mimics what we have in legacy systems, but it presents it in a way that’s clean and easy to understand, and is the building block for the DAS system, for the night camera, and all of the situational awareness that can be provided to the pilot.

SLD: And you don’t need night vision goggles?

LCOL Kelly: You don’t need night vision goggles; it’s all built into the helmet. So, depending on the conditions—the light levels, environmental factors, and cultural lighting—you may choose to use the night camera or your DAS system, depending on what gives you the best situational awareness.

SLD: Do you have better peripheral vision as a result?

LCOL Kelly: Yes. The night vision goggle—the Legacy Night Vision Goggle—is just a sensor. It

doesn’t provide you with an integrated picture. The F-35 night camera as it’s projected in the helmet is really more like using your own vision, rather than looking through a narrow sensor, or soda straw, so to speak.

SLD: Do you foresee a significant adjustment when you start using this in the airplane?

LCOL Kelly: We think there will be a building block approach as we integrate more of the capabilities into the aircraft and the helmet. We saw the same jump in tactics development in the simulator when we first added the helmet capability. We had to take a step back and rethink some of the ways we were performing the mission, because now we had more information, better information, more situational awareness. We could be even more efficient and effective at performing the mission with this helmet.

SLD: Can you give me an example of the difference this makes?

LCOL Kelly: With the F-35, if my wingman finds a target on the ground, he can data-link that information to me and now my helmet will tell me where to look on the ground to find that target and I know we are looking at the exact same target.

SLD: So, in other words, it’s shared information?

LCOL Kelly: Yes. It’s shared information and the helmet will tell the pilot where to employ sensors and weapons while providing threat information. You get more awareness, throughout your flight, on friendly and enemy positions. So you have shared situational awareness across the board to understand who the “friendlies” are, who the “hostiles” are, what the order of battle is, and what the current situation on the ground is in real time.

You have shared situational awareness across the board to understand who the “friendlies” are, who the “hostiles” are, what the order of battle is, and what the current situation on the ground is in real time.

SLD: Are you also building a consensus between you and your mate on what you think you’re seeing?

LCOL Kelly: Absolutely.

SLD: So you have confidence that you’re looking at the same thing?

LCOL Kelly: Absolutely. Between you, your wingmen, and the ground. That consensus allows for a safer, more rapid employment of weapons with less potential for collateral damage.

SLD: So situational awareness offers a higher sense of confidence in the decision you’re about to make. Is one of the advantages going to be your ability to share this information rapidly with a ground decision-maker?

LCOL Kelly: Yes, based on the information you and your wingmen obtain, you can make timely decisions more effectively as a team, and rapidly pass that information to the ground without relying on other assets.

As you add the F-35, you are going to reshape other capabilities on the battlefield as well, and provide the foundation for managing battlefield assets, UAVs, intelligence, and other tactical information. The F-35 will change the way we think about the role of tactical aviation.

SLD: Is there a cultural challenge to learn how to maximize the impact of the F-35 and to adjust CONOPS?

LCOL Kelly: Yes, but one of the things we made sure of with the F-35 was that it is and will be compatible with legacy systems, like Link 16. Legacy platforms of the United States and various nations are going to be around for quite a number of years. The F-35 will have the ability to interact with those platforms in a large force coalition CAOC environment where there are multiple platforms and multiple services. And then also provide the ability to have a separate communication system that’s designed for low observable aircraft, which provides the flexibility to operate differently and more independently.

SLD: I assume that the F-35 will be able to operate more effectively in airspace from the pilot’s point of view?



LCOL Kelly: One of the other great things about the F-35 is that it is a first day of the war airplane, but not just a first day of the war airplane. So in those situations where we are supporting Marines on the ground in a rapidly changing environment, the F-35 will be able to safely operate in that environment because of its sensors and the threat information that is presented to the pilot.

In a high-threat, close air support environment, the F-35, through the helmet, will enable the pilot to focus on employing weapons on time, on target, while providing the information to avoid threats where that's possible, or defeat those threats where that's necessary to perform the mission. And the helmet is the key to getting the pilot looking in the right direction. We all know a picture is worth a thousand words, so, hearing something is nice, but being able to see it on the ground in relation to the battlefield really builds the pilot's knowledge and awareness.

SLD: So you are enhancing the probability of looking at the right thing?

LCOL Kelly: Yes, whether it's friendly or hostile, and then having the aircraft, through the helmet, alert the pilot to what action he needs to take in a particular scenario, to either avoid or defeat that threat, and then perform the mission. In a legacy aircraft, depending on what that threat is, you may have to abort your mission. You wouldn't have the real time situational awareness of all the threats, so there could be confusion about whether you can still perform the mission ... how safe is it to continue.



I would have to abort missions in a legacy aircraft that I will now be able to continue in an F-35.

SLD: Tactically, the big deal used to be to get your opponent to jettison his ordnance. To react to you, he punches everything off, and you're fighting and you want to kill him if you can't get the silver star, but at least you've stopped your opponent from doing something ugly to your guys. And they're telling you, basically, you're not going to throw anything over the side, you're going to press on with the fight, with enough confidence that you survive a fight and get the mission done.

LCOL Kelly: With this aircraft, I could take off, and after employing weapons on my primary target, my wingmen or someone on the ground can say okay, I've got another threat over here, can you provide me some information. Instantly, you can become a flying ISR platform, and adjust to provide the context for that ground commander. So even after employing your weapons, which was your initial goal, you can continue maximizing your capabilities. ✖

PAX RIVER INTERVIEW:
GUNNERY SERGEANT LARONE THOMAS IN
CHARGE OF F-35B MAINTENANCE

[IN APRIL 2010, SLD INTERVIEWED GUNNERY SERGEANT LARONE THOMAS ON F-35 MAINTENANCE.]

Sergeant Thomas is in charge of maintenance for the F-35Bs that are undergoing tests at Patuxent River. He recently received the Maintenance Officer of the Year Award from the Marine Corps Aviation Association. Thomas has significant experience as an F-18 aviation electrician.

SLD: How is maintaining the F-35 different from traditional aircraft?

Sergeant Thomas: The aircraft is the aircraft. Any good maintainer is going to be ready to walk in and be able to do maintenance on this aircraft. There is going to be a learning curve for some, but it's not going to be much of a learning curve. If the aircraft does half the things that it is projected to do, it is going to be sweet. It's going to be ten times better than any aircraft that we have right off the bat.

The capabilities I've seen on a hover pad—how much thrust and force I have seen—will be a major increase in capability. It's very promising, and as we work on shaping protocols and routines we can help make decisions for the fleet to make it easier to maintain in the field.

SLD: So during the test process you are shaping a protocol process for the maintainers in the fleet?

Sergeant Thomas: Correct. For example, we had some difficulties but they were based on past practices. Unlike other aircraft, you can access many things from panels. This takes getting used to. One day one of the maintainers was having some

difficulties, but we found that he was not following a procedure appropriate to the aircraft.

This aircraft is tighter and a lot more reliable. Its chips are pretty hard to damage. The maintainability package is smaller and focused because the F-35 is more maintainable and more solid state.

SLD: Tell us about your approach to shaping the metrics and protocols for maintenance on the F-35B?

Sergeant Thomas: One big change is how we do our maintenance day. On traditional aircraft we have a maintenance checklist and we do a set of tasks each day. Now the day is defined by what the aircraft "tells us" it needs to have repaired. And we are trying to match our work approach to how the aircraft operates.

We're working towards the goal of having an aircraft tell us—"Hey, I'm low on oil." We have to get used to working with this kind of capability. In the long run we will waste less as we won't change things that don't need changing.

SLD: Tell us about your handheld laptops or Personal Maintenance Aids (PMAs).

Sergeant Thomas: These tools allow the maintainer to connect to the aircraft and run up certain systems to verify if the aircraft is in working order and running properly. Right now, the software is not at that state, but that's what we're working towards.



SLD: So the goal is to have the software and the computer to dialogue with the aircraft?

Sergeant Thomas: Correct. The goal is to have my maintenance day determined by what I’m seeing on my screen.

SLD: As opposed to being defined by a checklist?

Sergeant Thomas: We’ll have two separate entities. The PMA is able to access CMMS, the Computerized Maintenance Management Tool System. CMMS is where we document our maintenance. We use it to document ordered parts and more, but the other function, the other PMA, will run up systems on aircraft—pull up Joint Technical Data (JTD), things of that nature.

The impact will be shortened maintenance time and the ability to repair the aircraft and generate more sorties in support of the Marine in the field. That is the whole point.

SLD: Unlike the F-18, the F-35 has internal weapons bays. How hard is this to work with?

Sergeant Thomas: I’ve loaded this aircraft, I’ve been part of the team here, and I am certified. It’s not hard at all. It’s not going to be a steep learning curve that will require extra schooling.

SLD: This is the test regime for maintenance, so presumably it will take longer to do maintenance here than when you have necked down the procedures and do it in the fleet?

Sergeant Thomas: Doing pre-flight inspections and post-flight inspections on aircraft is cumbersome here because everything has to be documented. We are shaping a process to make sure that there’s not going to be an issue in the fleet. Our inspections are way more involved than what they’re going to be once the F-35 is in operation. 🇺🇸



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Reshape U.S. Force Structure for Agility

A key challenge facing the U.S. Department of Defense is shaping the transition and withdrawal from Afghanistan while shaping an effective modernization strategy within a fiscally constrained environment. Defense Secretary Leon Panetta has started the process with a key statement about the current situation and the way ahead: "We're within reach of strategically defeating al-Qaida. And I'm hoping to be able to focus on that, working obviously with my prior agency as well." Because he was previously CIA director, his words have tremendous authority. Consequently, since his view is that intelligence and deadly force have driven al-Qaida to strategic defeat, it is now time to chart a way out of Afghanistan and deal with the growing threats as he sees them.

Panetta highlighted the role of Iran in arming forces attacking allies in Afghanistan, as well.

This sets the stage for the drawdown of Big Army in Afghanistan and guiding the transition of U.S.

forces as they modernize for threats such as Iran and China.

For these challenges, rebuilding U.S. power-projection forces is central. And the U.S. Army is part of the solution to a reconfigured power-projection force.

Shaping a force that can finish off al-Qaida on a worldwide basis and contain outside threats to Afghanistan and Iraq becomes highlighted. And this force structure is not a big occupation Army. It seems clear that Panetta understands the opportunity to use Afghan withdrawal as a key element in shaping a new modernization strategy.

It is time to leave Iraq and Afghanistan with full honor, not like Vietnam in 1975. America can leave a residual force at a strategic airfield: If you do not leave, you do not lose.

Just like the drawdown in Iraq, it is time for what is known as Big Army to disengage sooner than later from Afghanistan. In the Iraq War, Big Army has done all and more than America has asked. From their Thunder Run into Baghdad to the surge, the across-the-board Army/Navy/Marine/Air Force victory in Iraq can be an exceptionally proud battle streamer for all Big Army units.

Panetta can now size the force necessary in Afghanistan to checkmate any residual al-Qaida.

However, it is long past time that the Taliban become an Afghan Army/police problem as they are no strategic threat to America.

This brutal point is made because the U.S. does not have the resources to build for our future and also squander resources to build for an Afghan future. It is a rapidly evolving sideshow, and we have done enough.

It has often been argued that Afghanistan is the key to a stable Pakistan. That is definitely not working out, and any threat from Pakistan can be addressed with one word: India. In going out of our way to engage with Pakistan, India has been reduced in strategic value to America, and this is not good.

So it is time to refocus, especially with the unrelenting military rise of China and the emerging strategic defeat of al-Qaida.

Tactically, like a few poisonous snakes in the grass, al-Qaida can always strike, but not a strategic blow unless they get a nuke — the Iranian issue.

This bold statement by Panetta gives America the strategic opportunity to build the forces necessary to deter China until they crumble from within or to play a key role in reinforcing allies and friends in a time of turbulence in the Middle East.

Detering Iran or China revolves around strengthened U.S.

power-projection forces. Building for the future is now. We have all the pieces in development or fielded. No platform fights alone, so we need the political will —

known as budget dollars — to integrate everything into a total force package.

From F-22s and B-2s to F-35s, and new Navy ships, cyber capabilities, robots and space, the components of a Pacific air/sea battle force is upon us now. And this force structure serves as a template for reshaping a nonland-based force, which can alter perceptions and realities in the evolving Middle East, as well.

The U.S. Army needs to become lighter and more agile. Its more agile and lethal components can be elevated in importance to shape the force remaining in Afghanistan throughout the transition and to become a key element of the power-projection reset.

Panetta has set in motion a way to think about this reset by focusing on the wrap-up of the al-Qaida mission and the significant drawdown of force in Afghanistan. This effort can be conjoined with the effort to rebuild the U.S. force structure as heavy forces, which rely on large land infrastructure, give way to more expeditionary forces. It would be tragic if the force structure of the past decade was considered the template for the future. It isn't. With new Pentagon leadership, a page can be turned. ■



By **Robbin Laird**, co-founder of the defense analytical website www.sldinfo.com, and **Ed Timperlake**, editor of the SLD Forum, www.sldforum.com, and former Defense Department representative to the National Counterintelligence Executive Committee.

Embrace the Air-Power Revolution

U.S. air power has reached a turning point. As budget cuts increase and the U.S. Air Force's percentage of the defense budget falls, the crucial requirement is to invest in the future.



By **Robbin Laird**, editor of a book on the evolution of air operations, "Re-Norming Air Operations," and co-founder of the defense analytical website www.sldinfo.com.

After canceling the F-22 without ever understanding what the Raptor brings to the joint war fighter, the administration is slowing its investment in the F-35, instead put-

ting money into legacy aircraft.

The new aircraft represent a sea change with significant savings in terms of fleet costs and overall capability. But this will not happen unless policymakers understand that the transition is not simply from fourth-generation to fifth-generation aircraft, but a transition from yesterday's approach to war fighting to distributed operations.

The shift is from linear to sequential operations; it is a shift away from fighter pilots who need to reach back for support from large aircraft command-and-control and ISR platforms, to 360-degree dominance by deployed decision-makers operating not in a network but a honeycomb.

The F-35 is a flying combat system able to operate across the spectrum of warfare. It is the first plane that has the combat system to manage 360-degree space. Deployed as a force, it enables distributed air operations, an approach crucial to the survival of our pilots in the period ahead.

U.S. Can't Approach 5th-Gen Aircraft the 'Old Way'

The fifth-generation aircraft are a benchmark for a new approach to airpower. The traditional aircraft adds systems that provide capabilities, and the pilot has to manage each new system. The F-35 has five major combat systems that interact with each other to provide capabilities.

Functional capabilities emerge from the interaction of the systems done by the machine and are not simply correlated with a single system. For example, jamming can be done by several systems aboard the aircraft; the machine determines which one through interaction among the systems. The entire system rests on a common architecture with broadband capabilities.

But if airpower leaders simply mimic the operations of older aircraft with fifth-generation planes, the promise of new air operations will not be realized. The result would be a repeat of the failures of the French facing the Germans in World War II, where the French

had superior tanks but outmoded tactics and command structures, and achieved predictable results. The new aircraft simply do not function as do the old. Considerable cultural change will be required in moving to distributed air operations and decision-makers.

And the shift will require developers of weapons and remotely piloted aircraft to think differently about how to leverage the new stealth-enabled distributed air operational capabilities.

F-22 pilots have already called for the change. They don't want to be tethered to the Airborne Warning and Control System; they don't want to be directed by the classic operations of a centralized combat air operations center.

Another key part of the airpower cultural revolution is the approach to maintainability. To hear some Air Force officials, they sound like the union members in the 1970s objecting to changes in the work force associated with digital production of the newspaper. To re-

call the days of the controversy, union members wanted to keep their typesetting functions in spite of the elimination of the jobs necessary to produce a newspaper digitally. They lost and Rupert Murdoch won.

The same is true of the shift from mechanical to digital maintenance regimes. Many jobs will be eliminated — the U.S. Marine Corps estimates one-third — and the tooth-to-tail ratio much improved.

The administration's ideological opposition to performance-based logistics (PBL) systems is part of the problem of "union style" resistance to change. The last administration signed a PBL with the partners; the current administration should honor it. The benefits are clear; less cost for sustainment for a more capable aircraft.

In short, the U.S. and its partners are on the cusp of an air-power revolution if our leaders have the courage to embrace cultural change. And there is a clear need to direct investments toward the future, not the past. After all, this is change you can believe in. □

August 8, 2011

Building Blocks for a New U.S. Military Space Policy

◀ ROBBIN F. LAIRD ▶

Earlier this year the administration of U.S. President Barack Obama issued a thoughtful new military space policy. At the heart of the new national security strategy is the stated objective of improving U.S. space capabilities. Although it is articulate and well intentioned, specifics regarding how the administration plans to implement its new strategy have been a bit hard to find.

Innovation is the key to improving America's capabilities in space. But innovating in a constricted financial environment is especially challenging. Yet it can be done — should hard decisions be made to terminate what we can no longer afford, to make room for necessary spending on new technologies and approaches.

Straightforward ways for the Pentagon to achieve this needed elbow room include: leveraging other military platforms in a comprehensive strategy for command, control, communications, computers, intelligence, surveillance and reconnaissance for decision-making, or C4ISR D; partnering with commercial and allied service offerings; and pursuing a distributed architecture whereby capabilities emerge from the elements of a deployed capability.

Taking this approach means

the administration must avoid the temptation to adopt a traditional costly, albeit comprehensive, space architecture that requires proprietary funding to support end-to-end capabilities. The key to saving money is leveraging other people's investments, whether they are commercial or those of like-minded allied nations.

NATO systems and infrastructure, for example, include C4ISR D platforms that are essential for implementing an affordable and capable military space strategy. This mix of commercial and allied capabilities not only will drive innovation, it will achieve stated national security objectives by shaping a de facto distributed space architecture.

Overcoming stove-piped space programs and challenging the Air Force as well as the intelligence community to operate outside the box are crucial. Merely contemplating change is no longer adequate given the budget crisis we face today. Engaging in organizational innovation is at the heart of today's technological innovation. Money can be freed up to support organizational innovation and core needs that emerge at the edge of overlapping capabilities.

First, we need to make difficult decisions of terminating long-favored programs and sys-

tems that provide redundant capabilities. The Evolved Expendable Launch Vehicle (EELV) program is unaffordable, and the notion of two launch families being supported in a diminishing-demand-driven environment makes no sense. United Launch Alliance needs to become the "Un-united" Launch Alliance with one system emerging as the launcher of choice for the Department of Defense and intelligence community. The backup launcher for national security space is clearly at hand as well, namely the Ariane 5, operated from secure facilities in NATO allied territory. With 44 consecutive successes, Ariane 5 can provide a reliable backup service for U.S. national security payloads after one of the two launch families is eliminated from the EELV program. The EELV program would then enjoy reduced infrastructure and overhead savings as well as increased launch rates for the remaining launch system, increasing reliability while reducing unit costs through higher volume production and launch rates with a single team.

Second, the Space Exploration Technologies (SpaceX) revolution needs to be put into context. Although the Defense Department seems willing to use undeveloped and untested SpaceX products, the reality is

that when the department takes its unique satellites to a launch customer, it spends a great deal of time overseeing the relationship to ensure reliability. This requirement will make it hard for SpaceX to easily become the next EELV launcher. You simply don't launch a multibillion-dollar satellite that took a decade to build on the Falcon 9 until it is fully understood, proven and has a demonstrated reliability.

But if this can happen, there is no reason Ariane 5 couldn't provide a backup capability while the administration engages in innovation with SpaceX or other vendors able to deliver lower launch costs while ensuring reliability for exquisite and expensive national security payloads.

Third, money needs to be saved in part to continue support for a core robotic vehicle, which can provide top-end capability for the C4ISR D enterprise. The X-34B promises to deliver core breakthrough capabilities for the deployed warfighter and the insertion of force. The X-34B as an operating robotic vehicle provides capabilities not available with fixed-orbit satellites. But if savings are not found from the fixed launcher programs, it will be difficult to fund this breakthrough capability.

Fourth, space provides a significant contribution to C4ISR D. Yet

the unmanned revolution as well as the fifth-generation aircraft are game-changers in providing data for deployed decision makers. And the role of hosted payloads in supporting unmanned aircraft has become evident in the Afghanistan operation. The new capabilities can provide a rethink about how to leverage commercial space, notably hosted payloads, in supporting air-breathing C4ISR D assets.

The role of proprietary military space becomes a default capability: What *cannot* be provided by the powerful conjunction of air-breathing assets and commercial satellite capabilities? The relatively un-agile Defense Department structure would then be put on notice to identify necessary programs that can interact with such a conjunctive capability, but provide unique and core capabilities unable to be generated by either air-breathing military assets or commercial space, notably the hosted payloads structure.

Savings would come from both sources.

First, the Defense Department would have to be creative in leveraging its investments in unmanned and manned aerospace assets. The deployment of the F-35 will provide game-

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A Shuttle Orbiter Curatorial Policy Recommendation

◀ DANIEL R. ADAMO ▶

In a recent National Public Radio interview, former NASA space shuttle program director Wayne Hale was asked what the shuttle program's most important lesson had been. Without hesitation, he replied "safety." Certainly among the most important safety lessons taught during space shuttle operations is the vulnerability of the orbiter's thermal protection system (TPS) to debris impacts. Damage from such an impact was determined to be the root cause of orbiter Columbia's destruction, and the loss of its seven-person crew, during hypersonic atmospheric entry Feb. 1, 2003.

During a typical mission, orbiter TPS is continually at risk of potentially fatal impacts. Immediately following launch, debris threats arise from spray-on foam insulation liberated at high dynamic pressures from the space shuttle's external tank immediately adjacent to an orbiter's TPS. The demise of Columbia was traced to a specific foam insulation debris impact on the left wing's leading edge. Other hazardous TPS impacts are possible throughout orbit operations. These arise from untracked orbiting debris moving at speeds often exceeding 10 kilometers per second with respect to an orbiter. Finally, landing

operations are subject to TPS impacts from runway debris that may be from the ambient environment or from the orbiter's tires.

Debris impacts to orbiter TPS pose relatively little safety risk when incurred on the runway as a mission ends. But damage from these and all other impacts accumulated during that mission requires expensive and time-consuming repair before the orbiter launches again. If the orbiter lands in California and is to be ferried piggyback atop a Boeing 747 to Florida, TPS damage must first be treated with a clear sealant to prevent additional damage from airflow erosion.

Particularly after Columbia's loss, heroic in-flight measures were implemented to detect and mitigate orbiter TPS impact damage. These measures included impact sensors installed in the orbiter's wings whose data were recorded during launch and orbit operations, many crew member hours dedicated to close-up inspection using on-board robotic systems, and imagery of the orbiter during terminal approach obtained by the international space station crew. All data relating to TPS integrity were transmitted to the ground for painstaking expert analysis

before an orbiter was cleared for entry. These transmissions often monopolized significant air-to-ground communications bandwidth.

With this history in mind, arguably the most compelling story a decommissioned orbiter can relate when displayed to the public is told by TPS damage incurred during its final flight. This damage should be rendered safe for public viewing, likely by a sealant akin to that used for ferry flights, but it should be otherwise faithfully preserved. The only TPS damage subject to repair after a final flight should be any arising from deservicing and other postflight activity required by NASA as part of an orbiter's decommissioning.

Three institutions have been granted an orbiter with flown space mission history for display: Discovery to the National Air and Space Museum's exhibit near Washington, Atlantis to the Kennedy Space Center Visitor Complex, and Endeavour to the California Science Center in Los Angeles. These institutions are urged to adopt in-flight TPS damage preservation as a curatorial policy. From the heroic operational measures outlined here, such preservation is the only responsible course to take from the stand-

point of exhibiting aerospace history to our progeny with minimal distortion. The message conveyed is that humanity's first attempts to operate with a reusable TPS to and from low Earth orbit typically incurred this degree of damage during just one flight. Future aerospace technologists will be far better informed by viewing such damage firsthand than by reading secondhand reports.

In addition to avoiding the cost of most TPS repairs, which NASA is not obligated to fund, exhibiting institutions will be wise to preserve in-flight TPS damage because this policy also preserves each orbiter's monetary value. There is a huge body of anecdotal precedent for this in valuations associated with all manner of human artifacts, from furniture to automobiles, damaged by meteorite impacts. As experts appearing on "Antiques Roadshow" often attest, a damaged historic artifact's value drops dramatically after repair.

Dan Adamo is an independent astrodynamics consultant with research interests in space mission design throughout our solar system. From 1990 until 2008, he supported 60 space shuttle missions from NASA Mission Control's Flight Dynamics Officer Console. He welcomes feedback at adamod@earthlink.net.

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SHUTTLE FROM PAGE 9

about 300 people July 31, spokeswoman Carri Karuhn told *Space News*. Not all of those worked on the shuttle program. Pratt & Whitney Rocketdyne now employs about 2,500 people, Karuhn said.

Pratt & Whitney Rocketdyne of Canoga Park, Calif., manufactured the reusable space shuttle main engines. The company also holds a NASA contract for the development of the J-2X, an upper-stage engine derived from Apollo-era technology. The next NASA-owned rocket, the congressionally mandated Space Launch System, would use a cluster of three to five space shuttle main engines for its core stage and a J-2X for the upper stage.

Pratt & Whitney Rocketdyne has 15 fully assembled space shuttle main engines remaining in its inventory. Another two engines could be certified for flight, Karuhn said.

Alliant Techsystems (ATK) laid off 100 workers the week of Aug. 1 in its latest round of shuttle program layoffs, spokesman

George Torres said.

ATK made the space shuttle's four-segment solid rocket boosters and is working on a five-segment version of those motors for the Space Launch System.

Torres said ATK has lost about 1,600 jobs as a result of the shuttle program ending.

Meanwhile, just before Congress began its August recess, Rep. Sandy Adams (R-Fla.) introduced legislation that aims to attract new employers to Florida's Space Coast.

Her proposal, known as the "Shuttle Workforce Revitalization Act of 2011" (H.R. 2712), would, in certain situations, give preferential treatment to small businesses in Brevard County, Fla., that are seeking federal contracts.

The Kennedy Space Center, the U.S. government's main civil spaceport, is located in Brevard County.

Adams' bill was referred to the House Small Business Committee. No consideration of the legislation is possible until early September, when U.S. lawmakers return from their traditional summer recess.

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space and power to accommodate it, Gricius said. The Air Force Research Laboratory has spent about \$1 million on the project to date and has asked Raytheon and Aerophysics to quote a price to fully qualify the system for an operational mission, he said. The first mission would cost about \$50 million, with subsequent systems costing less than \$5 million, he said.

Meanwhile, Raytheon recently started work on a small radar satellite mission that is being developed for the Pentagon's Op-

erationally Responsive Space Office. Raytheon will assemble, integrate and test the spacecraft for the Modular Space Vehicle program under a subcontract from Millennium Engineering and Integration of Arlington, Va.

The 400-kilogram satellite is expected to complete its preliminary design review in November and launch in early 2014, Gricius said. Northrop Grumman Aerospace Systems of Los Angeles is building the satellite platform, and the payload is being developed by Harris Corp. of Melbourne, Fla., and Sierra Nevada Corp. of Sparks, Nev.

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changing capabilities that can be harvested to reshape the C4ISR D structure.

Second, the evolution of satellite capabilities in the commercial sector provides significant cost investments, which the Defense Department does not need to make. By shaping long-term contractual service relationships, the Pentagon can save scarce investment capital. But this requires it to think and contract long term — not one of its core competencies.

Such an approach facilitates a strategic reconsideration, which parallels what we are doing with fifth generation aircraft. The focus is upon distributed operations and shaping a honeycomb of decision-making supporting the deployed warfighter. This allows one to tap into the emergent thinking about shaping a disaggregated strategy whereby space policymakers look to focus on overall capabilities from the enterprise rather than a concen-

tration of capabilities on single-point-of-failure platforms.

Disaggregation and distributed operations further highlight the opportunity to build smaller payloads and to operate across a variety of launch platforms. By reducing the cost of a launch failure and its impact on expensive and complicated satellites, innovation is enhanced as well. With the distribution of a diversity of assets across the space enterprise, and leveraging of commercial space and air-breathing assets, innovation and cost effectiveness are enabled.

Without such an entrepreneurial quality to managing the space enterprise, the Defense Department will remain stuck in the last century with diminishing assets and capabilities. Such an outcome cannot be in the national interest.

Robbin F. Laird is co-founder of the website Second Line of Defense (www.SLDinfo.com), which deals with evolving global security and military capabilities.

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Leveraging New Platforms During the Strategic Transition: Avoiding “Penny Wise and Pound Foolish” Acquisition Approaches

By Dr. Robbin Laird

The United States is facing twin pressures of fiscal constraints and a drawdown and withdrawal from Afghanistan. The first highlights the need to reduce budgets; the second focuses upon the re-configuration of US forces.

The need to reduce budgets in the context of a significant drawdown can be met in significant part by removing the two billion dollar a week cost to operate in Afghanistan. The logistics costs in Afghanistan alone have diverted money from investment accounts and have frozen US forces into a force in being to manage territory. Cost savings from withdrawal need to be conjoined with a significant re-configuration of forces as withdrawal unfolds. Indeed, one could argue that the withdrawal and the re-configuration of Big Army are closely connected. Indeed if Secretary Panetta can manage it, the withdrawal, downsizing and reconfiguration of Big Army is really at the heart of structural redesign of US forces.



US forces need to become more agile, flexible, and global in order to work with allies and partners to deal with evolving global realities. Protecting access points, the global conveyer of goods and services, ensuring an ability to work with global partners in having access to commodities, shaping insertion forces which can pursue terrorist elements wherever necessary, and partnering support with global players all require a re-enforced maritime and air capability. This means a priority for the US Coast Guard (USCG), US Navy (USN), US Marine Corps (USMC) and the US Air Force (USAF) in the re-configuring effort. Balanced force structure reduction makes no sense because the force structure was re-designed for land wars that the US will not engage in the decade ahead. The US Army can be recast by the overall effort to shape new power projection capabilities and competencies in the decade ahead.

Retiring older USN, USMC, and USAF systems, which are logistical money hogs and high maintenance, can shape affordability. Core

new systems can be leveraged to shape a pull rather than a push transition strategy. Fortunately, the country is already building these new systems and is in a position to shape an effective transition to a more affordable power projection capability.

At the heart of the approach is to move from the platform-centric focus where the cost of a new product is considered the debate point; rather the value of new systems and their ability to be conjoined is the focal point. No platform fights alone is the mantra; and core recognition of how the new platforms work with one another to shape collaborative con-ops and capabilities is central to a strategic re-design of US forces.

A good illustration of this approach can be seen with regard to crafting 21st century air capabilities. 21st century air capabilities are built around the three “M”s. The aircraft need to be multi-mission and manufactured to be significantly more maintainable than 20th century aircraft.

In today’s world, the acquisition of aircraft in financially stringent environments favors multi-mission platforms. The U.S. and allied air forces are buying less aircraft and a smaller variety of aircraft. The expectation is that the aircraft purchased will do more than their core specialty.

There is an expectation that if I buy an airlifter it will do more than airlift. It will be able to refuel, it will be able to deliver in the air lethal and non-lethal weapons out of the back of the aircraft, it will be able to become a C2 aircraft if needed, etc.

The second M is maintainability. New platforms are built with a significant amount of attention to how to enhance their ability to be maintained over time. When platforms were built thirty years ago, logistics support was an afterthought. Now it is a core element of determining successful outcomes to the manufacturing process.

Sustainability is a core requirement for 21st century air forces and air operations. Sustainability is a combination of logistics and maintainability considerations combined. Designing a more sustainable product, which can operate fleet wide, should be one of the very core procurement principles.

But it does not even exist on the playing field. The questionable notion of life-cycle costs is used but has little or real meaning as key drivers of life cycle costs are often outside of the domain of a platform considered by itself or fleet wide.

Additionally, one needs to buy Fleetwide. Savings will come from pooling resources, something that cannot happen if you buy a gaggle of aircraft, rather than operating a common fleet. Just ask Fed Ex what commonality for their fleet delivers in terms of performance and savings.

The final M is manufacturability. Briefing slides and simulations are not the same thing as a finished good of high quality and of high reliability. Here you need a trained workforce, good engineering practices and an ability to deliver a product of high

quality and standards. It is challenging to build new systems and not every manufacturer is created equal.

A core element of today's manufacturing systems is the challenge of managing extended supply chains. And these supply chains are subject to disruptions and the need to manage those disruptions.

(For a further look at the 3 Ms see 21st Century Air Capabilities <http://www.sldinfo.com/?p=20246>)

An excellent example of how to leverage what you are buying for the evolution of overall maritime security and defense capabilities are the intersections between the USCG's National Security Cutter, the USMC's F-35B and Osprey, and the USN's LCS.

Shaping a collaborative approach for these three systems via the aviation assets and C4ISR systems is suggestive of a leveraging strategy.

The National Security Cutter is already deployed in the Pacific and provides a significant enduring presence in the Pacific. Any US strategy for the Pacific - which is clearly one of the key definitional areas for the next decades for US strategy - needs to operate from the Arctic to Australia. And here the USCG's core endurance asset is a key player. The ship is currently being bought on a fixed priced contract, but the Congress is certainly not rewarding the Service for good behavior, but in any case the USCG needs more than 8 NSCs with 3-4 available in the Pacific.

As Admiral Currier, the Deputy Commandant (Mission Support) of the USCG, recently noted:

The National Security Cutter, in addition to being able to operate at high sea states, can launch and recover aircraft under those conditions. You have to understand the cutter's utility as a weapon system.

It's a platform for multiple, fast, small interceptor boats, surface craft, and also air assets, whether it be a helicopter, or unmanned aerial vehicle, which really extends the reach of the cutter significantly. We have a larger capacity for the small, fast boats, the interceptor boats. We can carry three vice one or two on a 378. The NSC is a sea base for fast response small boats and helicopters or virtually any specialized force for dealing with a wide spectrum of threats.

We've proven this concept repeatedly with interdiction of narcotic go-fasts in the Caribbean and Eastern Pacific. With a Maritime Patrol Aircraft (MPA), or with the use of non-USCG national assets, the ship is able to detect, monitor, and be in position to launch its helicopters, which will stop the suspect vessel, followed by the small boat boarding team.

It is a complete package. It capitalizes on external cues, intelligence, and airborne maritime patrols to develop a picture of the area. With the available maritime domain awareness, it can prosecute threats using its fast, armed, small boats, and its armed helicopters.

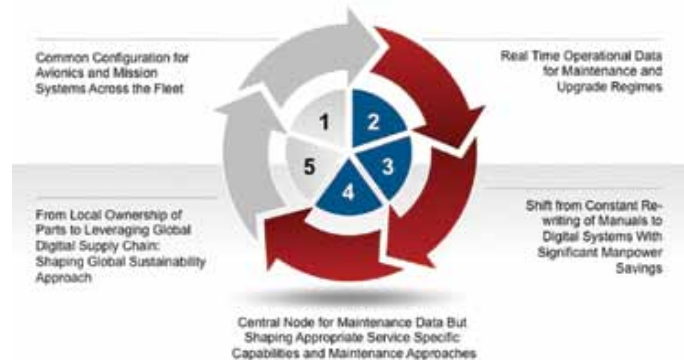
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This asset provides an enduring presence asset globally, which can work with other USN, USMC or USAF assets in delivering global security solutions essential to 21st century operations.

And the NSC can fit into the puzzle of managing security and defense threats along with the other new assets being shaped by the USMC and the USN. The USMC intends to deploy the F-35B and the Osprey on its Amphibious Ready Group (ARG) and these new assets significantly change the capabilities of the ARG and the ability of the ARG to work with other USN and USCG and USAF assets.

F-35 Building Blocks for Cost Effective Performance

Significant Reduction in Touch Labor Time and Enhanced Ops Tempo



Yet the F-35B "debate" focuses on the IOC cost of the plane, not the value it brings to maritime transformation and the enablement of the joint force. The F-35B brings electronic warfare and cyber operations capability to the ARG; it provides C4ISR to command aviation and maritime assets; and it can redeploy to austere airfields to support ground operations across the spectrum of security and defense operations. And oh by the way can get places fast with its supersonic capabilities.

And coupled with the Osprey, which has only barely begun to be fully connected to a networked force, a newly enabled ARG is emerging. As General "Dog" Davis, currently the Commander of the 2nd Marine Aircraft Wing at Cherry Point, North Carolina, has argued:

Our MEUs have never been used as effectively as they are today. These new capabilities are going to make them exponentially more potent and useful to our nation's leadership.

The F-35Bs give the new ARG a very high-end air superiority fighter, that's low observable if I want it to be. I can roll from Air to Air to Air to Ground quickly and be superior to all comers in both missions. That's bad news for our adversaries. I can use the F-35s to escort the V-22s deep into enemy territory. With those V-22s we can range out to a 400-500-mile radius from the ship without air refueling. I can go deliver Marines deep in the enemy territory or wherever and do it at 250 miles an hour, so my speed of action, my agility is exponentially increased, and I think if you're a bad guy, that would probably give you a reason to pause. It's a very different animal that's out there. We are good now, but will be even more so (by more than a factor of two in the future).

I also have significant mix and match capability. And this capability can change the impact of the ARG on the evolving situation. It is a forcing function enabled by variant mixes of capability. If I wanted to strip some V-22s off the deck, to accommodate more

F-35s - I could do so easily. Their long legs allow them to lily pad for a limited period of time – off a much large array of shore FOBs - while still supporting the MEU. It's much easier to do that in a V-22 than it is a traditional helicopter.

I open up that flight deck, or I can TRANSLANT or PAC additional F-35s. If I had six on the deck and I want to fly over another six or another four, we could do it rather quickly. Now the MEU has ten strike platforms. So if I need to have a TACAIR surge for a period of time, that deck provides a great platform for us. We've got the maintenance onboard that ship, so we can actually turn that Amphib very quickly from being a heliocentric Amphib to a fast jet Amphib. Conversely, I could also take the F-35s off, send them to a FOB and load it up with V-22s, 53Ks, or AH-1Zs and UH-1Ys. Flexible machines and flexible ships. The combination is exceptional.

We will have a very configurable, agile ship to reconfigure almost on a dime based on the situation at hand. I think the enemy would look at the ARG as something completely different from what we have now. I think we have to change the way we do things a bit in order to allow for that, but I think we will once we get the new air assets. The newly enabled ARG, or newly whichever the term you're using, will force our opponents to look at things very differently. We will use it differently, and our opponents are going to look at it differently.

<http://www.sldinfo.com/?p=17319>

And of course, the USMC helos can land on the NSCs and support the higher end operations and needs for the NSCs as DoD assets. And narco and terrorist elements are using higher end capabilities such as mini-sub and fast planes, for which an overlap in ARG and NSC operations can provide a potent mix.

Now let us add the new Littoral Combat Ship to the mix. Again, no platform fights alone and in the new fiscally constrained environment driving maximum values from any new platform purchase is a sound idea. And as one builds collaborative con-ops across the joint force, a more effective power projection force can be shaped.

These two forces - the LCS and the newly configured ARG - can be conjoined and forged into an enlarged littoral combat capability. But without the newly configured ARG, and the core asset, the F-35B, such potential is undercut.

This is a good example of how buying the right platform - the F-35B - is part of a leveraging strategy whereby greater value is provided for the fleet through the acquisition of that platform.

In a time of fiscal stringency, good value acquisitions need to be prioritized. Such acquisitions are able to leverage already acquired or in the process of being acquired capabilities and provide significant enhancement of capabilities.

They are high value assets, both in terms of warfighting and best value from an overall fleet perspective.

The USN-USMC amphibious team can provide for a wide-range of options for the President simply by being offshore, with 5th generation aircraft capability on board which provides 360 situational awareness, deep visibility over the air and ground space, and carrying significant capability on board to empower a full spectrum force as needed.

Now add the LCS. The LCS provides a tip of the spear, presence mission capability. The speed of the ship allows it to provide forward presence more rapidly than any other ship in the USN-USMC inventory.

It was said in fighter aviation "speed is life" and in certain situations the LCS can be paid the same complement. The key is not only the ship's agility and speed but it can carry helicopters and arrive on station with state-of-the-art C4ISR capabilities to meld into the F-35B combat umbrella. Visualize a 40+ knot Iron Dome asset linking to Aegis ships and the ARG air assets.

Inserting an LCS into the Maersk Alabama incident can see an example of the impact of speed. As one naval analyst put it, the impact would have been as follows:

- LCS at 45kts would have been on scene in less than 7 hours (6.7), or 37% sooner than a ship transiting at 28 kts.
- LCS fuel consumption for such a sprint 40% less than the 28 kt sprint.
- LCS would consume less than 23% of her fuel capacity in such a sprint.
- A helo launch within 150 nautical miles from Maersk Alabama puts helo overhead within four hours (4.3) from the time of the initial tasking.
- Two H-60's permits LCS to maintain a helo overhead Maersk Alabama for a sustained period of time.

With a response time of four hours the probability of thwarting a piracy attack is increased—especially if the naval ship is called upon the first realization of the targeted ship's entry into piracy infested waters.

If an LCS was tasked to respond when Maersk Alabama encountered the first group of pirates craft on 7 April 2009, it would have arrived on scene well in advance of the attack on 8 April and may well have prevented it.

And if you add the LCS to the USN-USMC amphibious team you have even more capability and more options. As a senior USMC MEU commander has put it:

You're sitting off the coast, pick your country, doesn't matter, you're told okay, we've got to do some shaping operations, we want to take and put some assets into shore, their going to do



The littoral combat ship Independence (LCS 2) underway during Acceptance trials

some shaping work over here. LCS comes in, very low profile platform. Operating off the shore, inserts these guys in small boats that night. They infill, they go in, their doing their mission.

The LCS now sets up – it's a gun platform. It's a resupply, refuel point for my Hueys and Cobras. Now, these guys get in here, okay. High value targets been picked out, there is an F-35 that's doing some other operations. These guys only came with him and said hey, we have got a high value target, but if we take him out, we will compromise our position. The F-35 goes roger, got it painted, got it seen. This is what you're seeing, this is what I'm seeing. Okay. Kill the target. The guys on the ground never even know what hit them.

<http://www.sldinfo.com/?p=21129>

By shaping a pull rather than push transition strategy, these new platforms WHICH ARE ALREADY BEING bought can provide for new capabilities by shaping collaborative con-ops. Significant savings come after having made the transition for older less fuel efficient and environmentally unfriendly 40-50 platforms, which suck up sustainment dollars.

To provide simply one example would be the impact of the F-35 on logs bills. Shifting from the legacy air fleet to the F-35 fleet will save trillions of dollars in operational support. Although the headlines were generated on the more than 1 trillion support costs of the F-35 fleet in 2065 dollars, what was missed that the legacy fleet in those very 2065 dollars would cost more than 4 trillion dollars.

The plane has been designed to optimize maintainability and to reduce the amount of touch labor on the plane by at least 30%. And the fleet commonality will lead to significant ability to operate, deploy and sustain fleets of aircraft.

Recently, retired head of Marine Corps Aviation General Trautman hammered the first point home.

Affordability is the balance of cost and capabilities required to accomplish assigned missions. For over a decade the Marine Corps has avoided the cost of new procurement during a time when the service lives of our legacy aircraft were sufficient to meet the missions assigned. However, in the near future, our investment in the capabilities of the F-35B will outweigh the unavoidable legacy aircraft operations and sustainment (O&S) cost increases we will incur with the F/A-18, AV-8B, and EA-6B.

The O&S costs of legacy aircraft across DoD have been increasing at an average rate of 7.8% per year since 2000. The operational lifetimes of legacy aircraft are being extended well beyond their original design limits. As a result, we have been continually engaged in a struggle to maintain operational readiness of our legacy aircraft due largely to the increasing age of the aircraft fleet. Early in an aircraft's life cycle, the principal challenge is primarily attributed to the aging proprietary avionics systems upon which the user depends for warfighting relevance; later it is maintenance of the airframe and hardware components that are become the O&S cost drivers.

The Marine Corps strategy for the last eleven years has been to forego the procurement of new variants of legacy aircraft and continuing a process of trying to sustain old designs that inherit the obsolescence and fatigue life issues of their predecessors. Instead, we opted to transition to a new 5th generation aircraft that takes advantage of technology improvements, which generate

substantial savings in ownership cost. The capabilities of the F-35B enable the Marine Corps to replace three legacy aircraft types and retain the capability of executing all our missions.

This results in tangible O&S cost savings.

A common platform produces a common support and sustainment base. By necking down to one type of aircraft we eliminate a threefold redundancy in manpower, operating materiel, support services, training, maintenance competencies, technical systems management, tools, and aircraft upgrades. For example: Direct military manpower will be reduced by 30%; approximately 340 officers and 2600 enlisted.

- *Within the Naval Aviation Enterprise we will reduce the technical management requirements the systems requiring support by 60%.*
- *Peculiar Support Equipment will be reduced by 60%; down from 1,400 to 400 line items.*
- *Simulators and training support systems will be reduced by 80%; five different training systems will neck down to one.*
- *Electronic Attack WRA's will be reduced by 40% and replaced with easier to support state of the art digital electronics.*
- *The Performance Based Logistics construct will nearly eliminate macro and micro avionics repair, and intermediate propulsion support functions.*
- *Airborne Armament Equipment (AAE) will be reduced by over 80% with the incorporation of a multi-use bomb rack.*

Compared to historical parametrics we expect our overall O&S costs to decrease by 30%.

The key to enabling these reductions is to evolve our supportability concepts, processes and procedures instead of shackling ourselves to a support infrastructure built for legacy aircraft. We need to be innovative and ensure our sustainment posture keeps pace with technology advancements and global partnering synergies. Working together with industry, the Marine Corps is intently focused on the future as we seek innovative cost effective sustainment strategies that match the game changing operational capabilities resident in the F-35 Lightning II.

<http://www.sldinfo.com/?p=10063>

The impact of fleet operations was highlighted by retired General Cameron, now working on the F-35 program with Lockheed Martin. Cameron as a retired USAF general in charge of maintenance highlighted the fleet consequences of shifting from F-16s to F-35As for the USAF.

The real beauty of the F-35 program is the fact that you can look out across the entire fleet, all the international partners, all the domestic partners, and tell immediately if there are systemic fleet wide issues. The program can share assets to ensure a surge capability to wherever it's needed and can share the robust supply chain that's already established on the F-35 production line. Our experiences with the F-16 highlight another major advantage of the F-35 approach. The F-16 has been a highly successful program. However, configuration management has been a challenge because it has been handled at the individual service level. Therefore, there are roughly 130 configurations of the F-16. The operators, when prosecuting the air battle, have to know the precise configuration of each F-16 in order to

know what capabilities it brings to the fight. The sustainment of the F-16 is even more challenging with spares not being interchangeable among F-16 variants. The F-35 is a common configuration so interoperability is the key in both operations and sustainment.

<http://www.sldinfo.com/?p=12899>

One could simply note that the views of such warfighters are simply bypassed in making wild assumptions about future life-cycle costs. An alternative approach would be to examine how the F-35 as manufactured leads to significant REDUCTIONS in touch labor time and to ENHANCED operational tempo, which in turn lead to COMBINED reduction in maintenance costs with enhanced, combat efficiencies.

In conclusion, the combining of the withdrawal from Afghanistan and Iraq, the sizing down of Big Army, and leveraging the new

platforms already being built, the retirement of older platforms and systems can together form an acquisition strategy to shape the new US power projection capabilities for the 21st century. If one simply downsizes a skewed force structure of the last 10 years, an historic opportunity would be missed.

Dr. Laird is an analyst of European, US and Asian strategic affairs. He has published more than 20 books, and published regularly for over 30 years in journals, newspapers and has appeared regularly on TV and Radio. He is the co-founder of Second Line of Defense (<http://www.sldinfo.com>) (<http://www.sldforum.com>) and has published several books leveraging the interviews and analysis on the website. The most recent are Re-Norming Air Operations, The Challenges of Maritime Security and 21st Century Air Capabilities.



MEETING THE CHALLENGE OF
**MARITIME
SECURITY**



A Publication Of Second Line Of Defense

FOREWORD

The interviews and essays in this booklet have appeared in earlier versions on the web site *Second Line of Defense* (<http://www.sldinfo.com>). SLDinfo.com focuses on the creation and sustainment of military and security capability and the crucial role of the support community (logistics community, industrial players, civilian contractors, etc.) along with evolving public-private partnerships among democracies and partners in crafting real military and security capabilities. On SLDinfo.com, articles, videos and photo slideshows on military and security issues are posted on a weekly basis.

Some of the articles and interviews in *Meeting the Challenge of Maritime Security* are excerpted from the longer pieces on SLDinfo.com, as indicated at the beginning of the article. The original pieces on the web site often include photos and graphics which are not included in this publication.

The cover photo is of a CASA C-212 for the Mexican Navy. The CASA C-212 is a platform for developing and integrating a wide variety of versions such as the Maritime Patrol Electronic Warfare (ESM/ECM and ELINT/COMINT), Aerial Survey, Pollution Control, etc.

MEETING THE CHALLENGE OF MARITIME SECURITY

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THE CHALLENGES

THE CHALLENGE OF RISK MANAGEMENT

Dr. Robbin F. Laird

The world may be flat because of globalization, but has anyone considered that we may not want it to be flattened? The trouble with analyses like Thomas Friedman's in his book *The World is Flat: A Brief History of the 21st Century* is that if there is "globalization" with automatic effects and benefits for the "global economy" then nations disappear—and somehow the system magically works for the greater good.

The difficulty with such a presumption is that it ignores the critical role that key states play in guaranteeing global economic, military and political security. Virtually all globalization models ignore the security element. Without security for air, ground, and maritime transit, there is no globalization. Without secure cyberspace, there is no effective transfer of information and data in the worldwide web. The internet was built to secure communications, not to make the world flat.

There simply is no guarantee of freedom of commerce, information, currency and security of persons, data and goods and services. In particular, future guaranteed security will be provided by new stakeholders in this evolution of the global commons. The core challenge is to find ways to provide global security without shutting down the very openness which makes globalization work.

Inevitability of the Security Challenge

Macro-economists tend to view defense and security as drains on productive resources. Yet productivity in a nascent global system rests on security and defense. The line between defense and security capabilities is being blurred by modern states as

their interests reach beyond traditional national boundaries and traditional measures of national power.

A global system in which data, currency, goods and services flow worldwide through mechanisms like just-in-time production is increasingly vulnerable to disruptions. Strategic disruptions are to be assumed in the global system. The need to manage such disruptions is a growing need in order to service the public good. Yet significant strategic thinking or investment in ways to cope with strategic disruption is lacking.

The decentralization of the global economy and global information grid is enhancing the ability of small groups and even individuals to engage in activities which disrupt the global system. The growing capability of small groups bent on disrupting the world system and seeking to divert it to their advantage is a real threat.

Meeting the Challenge

Risks need to be dealt with and managed as a normal task in coping with globalization. Clearly, it is impossible to build a completely risk-free global infrastructure. What is troubling is the lack of investment in systems to deal with crisis contingencies or "surge" capabilities to provide for short-term amelioration for the shutdown of ports, airports, train lines, or protect against what the Gartner Group calls the danger of a "digital" Pearl Harbor.

The first priority is to build a capability to plan for and expect strategic disruption into our national decision-making systems. Herman Kahn, the famous nuclear strategist, called for "thinking the unthinkable." Kahn was one of the first nuclear strategists and crafted the study of how to conduct nuclear war if such a horrific problem emerged.

Iranian sailors stand on a British boat, captured by the Iranian navy in 2004, during a 2008 ceremony to mark the anniversary of Iran's 1979 Revolution in Tehran.

Photo credit: photographer Raheb Homavandi / Reuters / Corbis

If Kahn were still alive today he would write a new book about strategic disruption as “thinking the unthinkable.”

The second priority — assuming we can craft decision-making systems which could plan for strategic disruption — is to encourage today’s fractious societies to consider the pain of the “unthinkable”. Pain avoidance is the goal of modern democratic society, unless it is self-inflicted in seeking higher metaphysical states. Before we reach this state we might find our way of life significantly threatened by small groups possessing weapons of mass destruction seeking to send us via an alternative pathway to reaching the next life!

How will we implement decisions in a timely and effective manner? What tool sets do we need for effective implementation? How can we train and prepare the public for the unexpected?

Building an Effective Tool Kit

Modern decision-making systems need to include effective tool kits for dealing with risk management. We need security and military tools that are robust and flexible enough to aid in the prevention and response to strategic disruption. Among the tools necessary are redundant and hardened communications systems and interoperable communications and information systems that enable public and private institutions to share data and to train for crisis and effectively communicate in crises.

We have to learn to be at least as effective as terrorist groups in using decentralized structures. Decentralized structures maximize survivability and the ability to be flexible — rather than presenting rich target sets associated with vulnerable networks.

Crisis leadership rooted in decentralized structures is effective for dealing with strategic disruption and deters groups from random strategic disruption attempts.

Conclusion: Crafting a Risk Management Posture

In preparing for strategic disruption, we need the right mix of response capabilities. We need to combine proactive, active and reactive elements in our decision-making and implementation capabilities.

We need to blend three core elements: robust and redundant communication and information systems; resilient organizations capable of absorbing shocks, and alternatives, particularly in crisis periods, to single-source dependencies.

The strategic challenge is to craft, forge and reinforce decision-making systems with:

- The right mix of centralization and decentralization in execution
- Fail-safe procedures
- An extensive cadre of well-trained first responders
- Significant exercises and simulations to guarantee effective procedures for the unexpected

Strategic disruption is not a surprise in a globalized environment; it is a given. Effective risk management will be the result of extensive investment in formal policies and procedures, not chance.

It is better to plan for the unexpected... because it isn’t.

<http://www.sldinfo.com/?p=80>



Illustration credit: Bigstock™



In May 2010, sailors from the French frigate *Tonnerre* boarded two pirate ships 450 nautical miles east of Somalia. The boarding party secured evidence and took the suspected pirates on board the frigate. The mother ship, a “whaler” was destroyed and two skiffs were taken aboard *Tonnerre*.

Photo credit:
U.S. Navy Visual Service

PROTECTING THE GLOBAL CONVEYER BELT

Excerpt from *Shaping a Collaborative Maritime Strategy for the Pacific*

Shipping is at the heart of global trade. Most international trade – about 80 percent of the total by volume – is carried by sea. About half of the world's trade by value and 90 percent of the general cargo is now transported in containers. The containerization of cargos and the growth in the size of the cargo ships are important forces for change in the maritime system as well.

Containerization has been both cause and consequence of a shift in the nature of the global supply chain. Logistic supply chains that feed components and finished products to users on a just-in-time and just-enough basis have become critical to modern manufacturing and service industries.

A virtual conveyer belt of goods or a moving warehouse of components at sea have become the tissue of global production. Seaborne trade and its land connections in the global supply chain have become increasingly efficient, large-scale and thus open.

Also part of the containerization phenomenon has been the rise of the megaports. The top 20 container terminals account for more than 50 percent of world sea container trade.

The conjunction of a dramatic increase in the volume of trade, a shift towards containerization, the shift in manufacturing and production models and the rise of the mega-ports has created a new maritime trade system.



This large container ship in the Panama Canal illustrates that larger cargo ships, along with expanded Panama and Suez Canals, will increase the challenge of managing maritime traffic and security ports. Photo credit: Bigstock™



Managing port logistics is a key part of the risk management for maritime security. Photo credit: Bigstock™

Forces seeking advantages through disruption of the maritime system have challenged the evolving trade system.

Managing and coping with these disruptions are a key part of the 21st century safety and security challenges facing global maritime powers and commercial stakeholders.

Among the most significant disruptions are the following:

- Disruptions by maritime piracy,
- Disruptions at the megaports,
- Significant environmental disasters at sea,
- And the emergence of terrorists seeking capability to operate on the seas.

An additional dynamic has been the melding of criminal and terrorists approaches to disruptions, mimicking one another to learn new approaches to shaping disruption to their advantage. Managing and coping with these disruptions defines the maritime safety and security context for the 21st century global economy.

Naturally, with the rise of commerce comes the need for increasing law enforcement operations. Interdiction of illicit drugs and illegal migrants will continue to be a major priority. Additionally, it is essential that standards of operation that affect

the ecology and therefore the commercial viability of the seas and waterways be controlled and enforced....

Persistent presence is key but only a part of shaping an effective Maritime Security Regime. Persistent knowledge regarding the potential threats to the “conveyor belt” is necessary across the entire range of the “conveyor belt”.

<http://www.sldinfo.com/wp-content/uploads/2009/10/Shaping-a-Collaborative-Maritime-Security-Strategy-SLD-special-report-sept-09-pdf2.pdf>



Security inside the port is crucial in securing the transit supply chain. Photo credit: Bigstock™

EUROPEAN NAVAL FORCE: A PROMISING “FIRST”

Harry Syringas

One of the European common defense policy’s main goals is to consolidate the European Union (EU) impact and role in the international scene. Apart from controlling what goes on within its borders, it also conducts operations in order to monitor and intervene, within its capacities, in a situation taking place beyond them.

One of those operations is EU Naval Force Somalia’s Operation Atalanta, which is part of a vast EU action to deal with the crisis in the Horn of Africa region.

Below is a mid-course glance at the four-year mission undertaken in 2008.

Twenty years of escalating chaos in Somalia piracy around the Horn of Africa is the result of two factors: the motive of profit and political instability, the latter being the origin of escalating chaos.

Somalia is a country that has not had a functioning government since 1991. Today it is in a state of total anarchy, facilitating riots between opposite illicit groups and banditry. [1] Somalia has had no functioning government since the United Somali Congress (USC) ousted the regime of Maj. Gen. Mohamed Said “Barre” on January 27, 1991.

The present political situation is one of widespread anarchy marked by inter-clan fighting and random banditry, with some areas of peace and stability. In the wake of the collapse of the Somali government, factions organized around military leaders and took control of Somalia.

However, banditry is not confined to local clans. Pirate attacks initiated from Somali ships have increased so much over the past few years that Somalia has become the number one security challenge in the area.

The International Maritime Bureau recorded 111 attacks in the waters off the Horn of Africa in 2008, nearly double the number in 2007. Between January and April of 2009, the International Maritime Bureau counted 84 attacks, with approximately 300 non-U.S. crew members on 18 hijacked vessels remaining in Somali captivity. [2]

The absence of coastal security authorities led to unlawful fishing, waste dumping, and attacks against foreign commercial vessels and humanitarian aid missions.



In September 2008, Somali pirates in small boats hijacked the Belize-flagged cargo ship, the MV Faina, that was carrying Ukrainian tanks. The ship had no security on board and was forced to an anchorage off the Somalia coast.

Photo credit: U.S. Naval Forces Central Command

The European Security and Defense Policy (ESDP) First Maritime Operation

In response to this scourge, the UN Security Council issued four resolutions: 1816, 1838, and 1846 adopted in 2008, and 1897 adopted in 2009. Resolution 1851 allowed international naval forces to arbitrate in the open sea around the Somali coasts. The EU launched the operation in

December 2008 – the first maritime operation of the ESDP – and reached full capability in February 2009. According to the decision of the Council of the EU last June, the mandate will continue until December 2012. [3]

Its main objectives are to escort vulnerable shipping crossing the area, including vessels from the World Food Program and the African Union Military Mission in Somalia (AMISOM), repress piracy, and monitor fishing activities off the coast of Somalia.



The French Navy arrested nine suspected Somali pirates, foiling their attempt to hijack a cargo ship in the Gulf of Aden. Photo credit: European Union

At present, the strength of EU NAVFOR – Atalanta is formed by:

- One fast frigate and one maritime patrol and reconnaissance aircraft – MP and RA – (CISNE CN235) from Spain
- One frigate from Greece
- One frigate and one MP and RA (JESTER P3C) from Germany
- One ocean patrol vessel and a MP and RA (Blue Bird Dash 8) from Sweden
- One MP and RA (Seagull Merlin III) from Luxembourg
- One landing platform Dock/Amphibious Ship from Holland
- One MP and RA (Lobo P3P) from Portugal
- One Frigate and helicopters from France

Belgium and a number of third countries, such as Norway and Croatia, are also participating, and the Ukraine and Montenegro are expected to participate.

Moreover, there is a military staff from Cyprus, Ireland, Finland, Malta, and Sweden providing aid to the team at the Northwood Operation Headquarters. The European Naval Force (EU NAVFOR) operates in a zone comprising the south of the Red Sea, the Gulf of Aden, and part of the Indian Ocean, which now includes the Seychelles. This represents an area comparable to that of the Mediterranean.

As key coordinator since November 2009, EU NAVFOR-Atalanta led the coordination of the multinational, national, and regional naval forces operating in the area. This was an important step to strengthening the EU's pivotal role, as it was the liaison for the CTF-151, the NATO Maritime Group and the Russian, Indian, Japanese, and Chinese vessels taking part in monitoring the zone.

Since the operation was initiated in late 2008, vessels of the World Food Program have stopped being attacked, making it possible for nearly 400,000 metric tons of food to be delivered into Somalia through the ports of Mogadishu, Merka, Bossaso, and Berbera.

The operation and, more importantly, the coordination of international forces brought fruit and showed that when there is will there is a way.

However, the fact that the presence of European and international naval forces in the Somali coasts and the Gulf of Aden is prolonged means that the primary goal is yet to be achieved.

The EU NAVFOR is a synergistic police/monitoring mission; it's part of the global EU initiative and action in the Horn of Africa to resolve the ongoing Somalia political crisis. While this successful operation is a positive example of European coordinated, defence policy action, the root of the problem — the absence of an actual state in Somalia — is still there. Extirpating it will demonstrate that the EU is positioned for the resolution of this kind of crisis in that region.

[1] www.globalsecurity.org

[2] Congressional Research Service, Piracy off the Horn of Africa, <http://africacenter.org>

[3] www.eunavfor.eu

<http://www.sldinfo.com/?p=11584>

SHAPING AN EFFECTIVE TOOL SET



BUILDING MARITIME SECURITY TOOLS FOR THE GLOBAL CUSTOMER

EADS is shaping several tool sets to deal with Maritime Security and to deal with the risk management challenge discussed in the lead piece.

This selection is taken from the EADS special web site posted for the Fall 2010 Euronaval Exposition where the company explains their approach and role in shaping global maritime security tools for protecting the global commons.

<http://www.eads.com/eads/int/en/Maritime/EADS-and-Maritime-Security.html>

As a baseline approach, and as a Lead Systems Integrator (LSI) the company can provide an overall management perspective to shape approaches to maritime security and to help clients manage risk.

This approach is further underscored in the next two chapters, first with an interview with SIGNALIS' (formerly Sofrelog's) CEO that was conducted by *Second Line of Defense* at the Euronaval Exposition. It is further underscored by the partnership with the Tanger Med authorities in building a 21st century port complex.

Counter Piracy

The act of piracy creates ripples that can be felt beyond the oceans themselves. If food is hijacked at sea, for example, prices for everyday commodities could rise if the total cost of transporting these commodities rises because of increased risks, growing insurance rates and time-consuming detours.

The International Maritime Bureau recorded as many as 239 attacks in 2006, equaling the number of attacks in just the first half of 2009. Somalia, the Gulf of Aden and the Straits of Malacca have become the most dangerous waters in the world today. A solution needs to be found through greater international regulations and preventive humanitarian actions.

To protect ships and international trade, EADS offers system solutions that safeguard both surveillance and reconnaissance and help to enforce international regulations.

EADS can design, deliver and maintain system solutions tailored to the needs of its customers. All elements of such a network solution are interconnected to allow quick communication and decision-making on launching the appropriate type of action.

EADS offers space-based, airborne and sea-based surveillance capabilities along with communications solutions for authorities and coastal surveillance with radars. Rapid action can be taken with the help of radars such as the TRS-3D.

The border security applications developed by Cassidian merge information derived from airborne sensors and sensors in space or on the ground-- alerting authorities in cases of illegal immigration,



The multimode radar system TRS-3D – pictured here on a Danish Stanflex 300-class ship — is specially suited for deployment in littoral waters and has been deployed successfully on several types of naval ships worldwide. Photo credit: Cassidian

smuggling or pollution and providing efficient tools to coordinate responses to such threats.

As for coastal surveillance systems, Cassidian has taken a decisive step towards the protection of coastal sovereignty by improving the ability to respond rapidly against smugglers, illegal coastal activities and piracy...

Economies

The standardized container is a symbol for a globalized economy. Ships transport roughly 98 percent of all commodities that are conveyed around the globe, more than two thirds of them are in containers. But such a success story relies on safe transport and the management of threats from pirates or accidents at sea.

A growing world economy calls for safe waters on the open sea, in harbors and in narrow straits. System solutions are required to ensure that a maximum number of container ships can reach their destination and pick up their shipment for the next journey.

EADS offers system solutions for naval and coastal security, comprising airborne solutions as well as coastal systems or surveillance from space.

SIGNALIS and Cassidian have supplied Vessel Traffic Systems (VTS), coastal surveillance systems and port security systems to 50 countries, installing more than 100 control centers that are connected to more than 500 radars.

Additionally, Cassidian acts as prime contractor for mission-critical systems that have been developed for its customers. Cassidian assumes all risks incumbent on a lead systems integrator, providing interoperability between deployed systems and subsystems as well as the necessary integration for decision-making chains that involve many parties.

Airbus Military has supplied several Coast Guards with CN-235 and C-295 maritime patrol aircraft versions. Eurocopter helicopters have saved many sailors lives after their ships have capsized.

Territories

Natural resources are limited. Every state has the right to protect them, not only on their own



Unmanned vehicles are becoming a critical capability for use in maintaining port surveillance and security. Photo credit: Cassidian

territory and the territorial waters off their own coasts, but also in their exclusive economic zones. This 200 nautical mile-wide sea zone grants every coastal state unique rights to explore and exploit marine resources.

These constitute huge areas that call for constant surveillance missions in order to prevent illegal fishing or the exploitation of resources such as oil from the sea shelf or monitor oil spills from tankers. These tasks and the protection of boundaries and territorial waters from illegal intrusion require network solutions that offer surveillance, communications between all security forces as well as authorities and support for law enforcement units.

EADS designs, delivers and maintains complete system solutions that establish interconnections between surveillance capabilities, provide protected communications between all involved parties and enable authorities to decide and launch necessary actions.

They include airborne or space-based surveillance using remote sensing satellites such as TerraSAR-X or maritime patrol aircraft such as CN-235 or C295.

In the long term, UAVs will also support national and international authorities.

Communication between all necessary authorities can be facilitated with Professional Mobile Radio communication systems. Cassidian has set up coastal surveillance solutions for several countries including radar systems for permanent surveillance.

Environment

Shipwrecks may be a new underwater home for plant and fish species, but not every piece of waste is a welcome addition to the marine ecosystem. Illegal dumping is a severe hazard to the environment. Effective surveillance can detect who is responsible for what damage to an ecological system.

Solutions are needed to ensure that international treaties against waste dumping, for example, in the North Atlantic are upheld. Satellites can detect pollution from space while maritime patrol aircraft can conduct close-up surveillance of vessels that are suspected of spilling used oil. UAVs will be used in the future for long-range airborne surveillance to support mission control centers, offering the ability to keep an eye on huge sea zones. Illegal fishing is a threat for any country that tries to protect endangered species.



Nearly 70 percent of the Super Puma fleet is operated in offshore transport. Large sliding doors allow for the transportation of bulky freight and rear access enables large loads. It is widely used by firefighters, police and emergency services. Photo credit: EADS

MARITIME SAFETY AND SECURITY: GOING THE EXTRA MILE

An Interview with Rémi Julien, President and CEO of SIGNALIS

At Euronaval in October 2010, *Second Line of Defense's* Murielle Delaporte interviewed Rémi Julien while he was still the CEO of Sofrelog. Julien is now the CEO of SIGNALIS which was officially launched on January 10, 2011. SIGNALIS is co-owned by Cassidian and Atlas Elektronik, which have merged their subsidiaries Sofrelog and Atlas MS.

SIGNALIS has a workforce of more than 190 maritime surveillance specialists in Germany and France, as well as on its large customer base with more than 210 VTS (Vessel Traffic Service) and CSS (Coastal Surveillance Solutions) systems in use in some 50 countries. The new company provides small-scale vessel traffic service systems and coastal surveillance solutions in addition to solutions for harbor security, port management and information systems and other related radar processing applications.

In this article, the key themes which were discussed are summarized with the complete interview in French to appear later on the *Second Line of Defense* website.

At the crossroads between domestic security and naval defense, maritime safety and security is a growing global market. Until recently, maritime border control had been largely defined as an element of anti-terror policy, which has called for a specific military approach especially since the attacks on the U.S. on 9/11.

This market has emerged through the involvement of small and medium sized companies that are providing traffic control services for strategic areas, such as maritime straits. Traffic safety systems have been relying on the four following tools:

- Radars allowing target detection
- Communication
- Control centers
- Accident monitoring system

Since 2000, mass terrorism, piracy, illegal immigration, smuggling and environmental hazards have been rampant. Such rising threats demand higher levels of protection for citizens and the environment but also for economic assets such as strategic offshore oil and gas. Through integrated and interoperable safety and security systems, stakeholders can demonstrate their ability to react rapidly and prevent a major crisis. Maritime security is a three-dimensional business as it relies on space assets, sea-based platforms as well as land-based systems to provide for security monitoring and control.

Born Out of a Fragmented Market

Besides the new threat requirements, the evolution of technology has revolutionized a market which, before the 1990's, was fragmented. Except for Panama Canal-like customers, the cost barrier was too high for the broader use of maritime security

controls. This changed with the emergence of digital technologies. These technologies drove down the cost of acquisition of maritime security devices, which provide for live traffic control via VTS systems (Vessel Traffic Services). Many harbors, such as Calais, France, started to invest in such technologies with SOFRELOG in the early 1990s.



The SYTAR technology developed by SIGNALIS is based on sophisticated real-time software and an advanced networking architecture. SYTAR systems are being used by port authorities, navies and coast guards in Benin Republic, Canada, China, Denmark, France, Malaysia, Mexico, Morocco, Qatar, Spain, Taiwan and the United Kingdom.

Monitoring the straight of Malacca was one of the first endeavors that Sofrelog initiated in 2000. The system of controls provided capabilities to meet two demands, the domestic military police's requirements and global traffic monitoring. Implementing such a system over the last decade has been a major factor behind the reduction of piracy in this part of the world.

The beginning of the 21st century witnessed the growth of terrorism and piracy, and it became necessary to merge civilian domestic aspects with security and defense considerations. The need for a new organization and a common operating picture based on the synergy of available assets has been more apparent in order to manage the variety and fragmentation of the players involved in maritime safety and security. The same technologies and capabilities are required, whether detecting a benign sailboat or a potential threat, even if the actual response to the latter, once identified, is significantly different.

CROSSing Over

Another factor, which has revolutionized the maritime security market has been the upgrade of Spationav (Système naval de surveillance des approches maritimes et des zones sous juridiction nationale) in 2005.

Spationav is a system aimed at federating all of the means of the French Ministry of Transportation as well as of the maritime centers called CROSS (Centres Régionaux Opérationnels de Surveillance et de Sauvetage). The system enhances surveillance of maritime straits and coastal regions along France's thousands of miles of sea borders.

The system was developed in order to deal with the variety of challenges encountered along the coast, whether it be illegal immigration, drug trafficking or environmental issues such as maritime pollution.

Spationav is a multi-phased system whereby radars of two ministries are networked to provide integrated capabilities. Currently, the data collected by 70 radars from the two ministries – Transportation and Customs – as well as data from Automatic Identification Systems is collected into a common operational picture for four Centers of the French Navy, including the Paris base of the French Navy, as well as five CROSS and three Customs centers.

What Spationav has been pioneering is the notion that maritime security, as well as land border security, can be managed over a vast amount of territory and able to cover significant distances. The success of Spationav has led to other contracts to manage territorial security such as with Saudi Arabia.

The demand for comprehensive security has provided a growing marketplace. As a result, SIGNALIS has been involved in various major international projects driven by a confluence of economic, political and security considerations, such as oil platform security in the Middle East and Schengen immigration control requirements in Europe.

Some of these projects are as follows:

- Qatar's National Security Shield offers coastal and EEZ (exclusive economic zone) monitoring, as well as monitoring of offshore oil platforms

and storage facilities, which need full protection from air, sea and land-based threats;

- A similar project is underway to protect Saudi Arabia's 2,000 kilometers of coastline;
- Private oil companies are also requesting help in this area. Aramco's main oil facility has, for instance, been protected for years via a system of four naval radars capable of identifying low-altitude threats, such as helicopters, and securing a vast zone;
- Enhancing the security in the straight of Ormuz for Oman, where Oman's and Iran's territorial waters meet, is being addressed by SIGNALIS;
- In Spain, assistance to the Guardia Civil to combat illegal immigration and trafficking has been underway for five years, especially in the Canaries and Balears Islands and the Gibraltar straight;
- SIGNALIS is also assisting the Danish Navy with maritime safety and security programs in the North and Baltic seas;
- The security of Mayotte Island is another challenge being addressed;
- The Schengen treaty and the necessity for EU entry candidates to comply with immigration control minimum requirements has resulted in Bulgaria requiring border control that was actually funded by the European Union itself.

The Ikea of Maritime Security: Shaping a Effective Total Cost of Ownership Approach

According to Rémi Julien, "We are in a way the 'Ikea of maritime security' in the sense that we build the 'kitchen' at the factory as well as the missing parts if need be; we assemble it and then deliver it ready to go. It would indeed be much more expensive to do so on site."

"A simple project, the installation of a few radars aimed at monitoring a hundred kilometer zone, can be implemented over a twelve to eighteen month period from the signing of the contract till the delivery of the system per se," explains Rémi Julien .

A customized maritime security contract will also typically include the training of future operators in accordance to existing international standards (AIALA; IMO). The training can be accomplished in one week.

Even though a 100 percent readiness is required — missing the deadline for one container delivery translates into the loss of hundreds of thousands of dollars for the Port of Tangiers for instance — maintenance per se is rather light since the systems are mostly computer and radar-based.

No specific norms exist for maintenance and all options are possible as far as maintenance is concerned. Basically, readiness is ensured via a redundancy and automatic shift system.

"We have machines which in the past five years have never stopped once and have demonstrated a high level of reliability, even long after they were no longer covered under guarantees. However, we are extremely concerned to keep it that way and, given our high pace of development, maintenance teams have tripled over the past two years," the SIGNALIS CEO underscored.

As far as Spationav is concerned, the acquisition cost is significant, but the total ownership cost is competitive, since maintenance mainly consists of preventive visits.

Every five years an upgrade is required for sensors and software, but the emergence of new technologies or new missions can also trigger upgrades. Enhanced ergonomic and algorithmic development, data management and decision-making assistance are the usual areas of improvement requested by customers.

From the outset, SIGNALIS has been at the cutting edge with the development and application of open source software since 2001. Radar integration and signal digitalization are also areas of expertise. The level of sophistication of radars — usually civilian radars — varies ranging from simple radars for port security to extremely sophisticated systems that are adapted to coastal monitoring requirements , such as small target detection

"It is SIGNALIS' mission to fit and anticipate each customer's specific need and to provide an overall approach whenever customers task us to do so," concludes Rémi Julien.

BUILDING A 21ST CENTURY GLOBAL PORT: THE CORE ROLE OF SECURITY

Tanger Med is the evolving port complex in Morocco which is providing a new capability for global trade.

As *The Economist* put it in a 2008 article on the Mediterranean economies, “Look southward from the southern tip of Spain, across the strait of Gibraltar. There, only 14km (nine miles) away through the slight sea haze arises the vast construction works of a new seaport to the east of Tanger in northern Morocco.”

Tanger Med opened its first docks last July (2007). Handling 3.5m containers a year, it is already as big as Felixstowe, Britain's biggest port. A second terminal opens this summer, and within seven years its annual capacity will rise to 8.5m. It will be the largest container port in the Mediterranean, not far behind Europe's biggest, Rotterdam (although merely one-third the size of the Asian giants of Singapore, Shanghai and Hong Kong). Similar ports are being finished in Algeria, Egypt, Malta and Tunisia.

One-third of the world's container traffic already passes through the Mediterranean, bringing manufactured goods from China and South-East Asia to Europe and the east coast of America. The Moroccans, spending some € 3.5 billion (\$5.5 billion) on Tanger Med, and others along the coast hope that if they build, a big slice of global commerce will come to their shores. Goods will arrive to be broken down into smaller loads and sent around Europe. Manufacturers will set up factories in tax-free zones planned around the docks, bring in components for assembly and serve the huge market across the water.

The Economist (July 10, 2008)

Building a new port facility in such a strategic location requires considerable attention to the security dimension. The entire infrastructure of the port and its maritime traffic situation requires an extremely sound security system. The Tanger Med complex is managed by the Tanger

Mediterranean Special Agency (TMSA) on behalf of the Moroccan Government. Cassidian has built a trusted partnership with the TMSA since an initial contract was signed in early 2008 to work on security with the TMSA.

The partnership has entailed *three* core efforts.

The *first* was crafting architecture for the Tanger Med security system as a lead systems integrator working with the TMSA. Such an approach allowed the port authorities to determine the most effective way to proceed with the security approach, rather than simply adding ad hoc systems to provide for security in a jury-rigged manner.

The *second* was to shape an approach to container security for the port. Given that a core *raison d'être* of the port was to manage container ships, and especially the new giant container ships, this is a key element for secure operations of the port. Cassidian worked with the TMSA to determine which systems needed to be put in place for the authorities to successfully establish a command post with capabilities to provide for container security.

The *third* was to shape other security tools and capabilities to ensure efficient protection of the port.

In December 2010, *Second Line of Defense* spoke with Cassidian's maritime security expert, Emmanuel Villers, to discuss the Tanger Med port project and the role of Cassidian in crafting a 21st century port security solution set.

SLD: Could you describe the importance of the Tanger Med port project?

Villers: The project reflects the intent of the King of Morocco to develop the North of Morocco. It is located in a key strategic location in the Gibraltar



The Tanger Med project will shape a major hub in global maritime traffic and will become a major part of the global conveyor belt.

Straits. More than 30 percent of global container shipping passes through the Straits. Shipping from Asia goes through the Suez Canal and passes through the Mediterranean en route to North and South America. The port is also at the crossroads of north-south shipping, and has great growth potential as 21st century trade increases.

SLD: Is security a high priority for the TMSA?

Villiers: Security of the port is one of highest priorities for the TMSA, which has decided to entrust its security system to one integrator instead of several companies. In part, it is because of the magnitude of the investment – more than three billion euros to date. The shipping companies require a high level of security, thus the port's economic viability will depend on reliable security.

SLD: I understand that you started with a comprehensive assessment for the customer. Could you describe the approach?



Shaping a comprehensive security regime is viewed by the TMSA as a bedrock of effective operation of the port and their ability to create a core hub in the global conveyor belt.

Villiers: The first thing we did was provide a threat assessment. The key contribution of a lead systems integrator is not just to provide tools, but first of all to provide a security solution. And this solution needs to be efficient. The key difference here is between a system integrator and a product manufacturer. The customer wanted at the outset to look at an integrated solution, rather than just

buy separate products. TMSA understood that they have a significant range of threats and wanted a specialist for security to shape a comprehensive and integrated solution. This was our initial and baseline role.

SLD: It sounds like the project started with shaping a trusted partnership with the customer.

Villers: Yes. We worked with the customer to shape an operational concept (con-ops) — to design the approach to comprehensive port security. A key challenge is to draw an approach that provides comprehensive security for the various stakeholders. There are many actors ranging from port authority, port facilities, shipping companies, industries, maritime police, and more. We needed to shape an operational concept that could bring together a threat assessment plus clearly define the stakeholder roles in the overall concept.

SLD: When was this done?

Villers: The baseline assessment was done in 2008. Based on this, we recommended a range of solutions to implement the con-ops. We determined that there were two types of threats that needed to be addressed. First is the safety of the shipping based on the fact that the Strait of Gibraltar is relatively narrow with various dynamic wind and sea conditions. A good traffic surveillance system is essential. The Cassidian VTS system is used to provide for this basic capability.

Second is the security for the port, which is challenged by various potential threats such as theft, illegal immigration, drug trafficking, smuggling, and terrorist organizations. Tanger Med is a major trans-shipment port for shipments coming from east to west and north to south. As such, it is an attractive location for illegal and terrorist activities.

SLD: What are the major tools you are shaping for the port?

Villers: First we are providing the Vehicle Traffic Services (VTS) system. The customer operates a control room within which VTS operates. The main mission is to follow big vessels or container ships to provide for vessel safety — against collision, for example. We have built the infrastructure for the VTS and have put Sofrelog (now SIGNALIS) tools in the control room, which the customer then uses to provide for the safety for the large ships. The customer runs the VTS, but we provide training for the staff as part of the global contract.

SLD: Do you have a security plan beyond VTS?

Villers: We have a second pillar to provide for security which focuses on the malevolent threats, notably those associated with small targets. We are focused on following small boats, swimmers and individuals trying to penetrate the port. This is a complex challenge. We have to manage threats from the water side using radars, cameras and other tools – day and night — to detect persons seeking to penetrate the port. We have to manage the land side as well. We have to take care of the perimeter of the port with various integrated systems such as intelligent video, access control, biometric controls, truck traffic controls including cargo and driver, and verification. There are other systems, as well, such as scanners and secured communications.

This complex and diverse effort is centralized in a security control room that is tasked to monitor security activity based on the flow of data from the various security systems. This security control room is focused on managing the data and alarms from the diverse systems to ensure that we are making the best decisions in dealing with the various threats. All of these subsystems are integrated in the security control room, which increases efficiency while reducing the number of operators and patrol teams, and enables the port security forces to focus their attention on threats in real time.

THE ROLE OF C4ISR IN THE U.S. COAST GUARD

An Interview with Rear Admiral Robert E. Day, Jr. USCG

In the fall of 2010, *Second Line of Defense* interviewed Rear Admiral Robert E. Day, Jr., USCG and discussed the challenges of building effective C4ISR for the U.S. Coast Guard (USCG). The discussion underscored how important it is for the USCG to have capabilities to network the force, and the challenges of getting folks to understand the importance of investing in the connectors.

The USCG puts personnel on target via its ISR systems. Thus, without effective ISR, the effectiveness of the personnel and resources are undercut. With C2, the deployed force, after getting to the assignment, can effectively organize the most appropriate response. The use of efficient C4ISR systems is essential to mission success. Because C4ISR is less visible than physical assets, it tends to receive less support than it should.

SLD: How does C4ISR work in the USCG?

RADM Day: Drastic changes in how C4ISR is used in support of Coast Guard missions have occurred in the last 10 years, and drastic changes are going to be needed even in the next five years.

SLD: C4ISR is essential for a modern Coast Guard to function. Although ethereal to many, the glue, which holds the platforms together, is clearly C4ISR. Could you provide a sense of the shift in performance enabled by the new C4ISR systems?

RADM Day: Consider the Eastern Pacific drug mission. In the old days, we literally went down there and bored holes in the water, and if we came across a drug vessel, it was by sheer luck. It might be on a lookout list, and we might just happen to see it. Fast forward to the 2000s. We are now able to fuse actionable intelligence and communicate that intelligence at light speed. So now we can

order a Cutter to go to point A and pick up smuggler B with load C. And we're doing that in real time with delivery of a common operational picture, which has been fused with intelligence. That was unheard of 10 years ago.

SLD: So now you have the information you need to actually target a problem.

RADM Day: Not only that, we are taking information from a wide range of intelligence sources and agencies and fusing it. We are leveraging these tools and processing the information to figure out anomalies and initiate these interdictions.

SLD: Could you contrast your experiences as a young sailor and a sailor doing the mission now?

RADM Day: It's a whole different framework. The framework is shaped by the fusion of the information, which is not being done on the Cutter.



The Cutter is merely a delivery mechanism for the capability, in essence, the point of the spear. This has enabled the networks and all the systems ashore at our Command Centers and our Intelligence Coordination Centers, whether it's from the Joint Inter-Agency Task Force (JIATF) South or our own centers. This ability to communicate in real time allows us to transmit a common operational picture; the X is already on the cutter's radar screen they are simply told to go to that target.

SLD: So the difference here is that in the first case, you're just throwing a spear out to the ocean.

RADM Day: And hope you hit something.

SLD: So now there is a virtual grid over an area, and your platforms are the enforcers.

RADM Day: Absolutely. They execute the mission that results from the information we are producing.

SLD: Are the C4ISR systems essential to the USCG in its joint role as well?

RADM Day: Yes. For example, in the eastern Pacific, that's done in JIATF South, which is an interagency taskforce, they're doing the lay-down based on the information that they've got. They're getting the intelligence feeds as well we're getting intelligence feed and feeding into it.

<http://www.sldinfo.com/?p=13429>

SHAPING A 21ST CENTURY U.S. COAST GUARD: THE KEY ROLE FOR MARITIME PATROL AIRCRAFT

Dr. Robbin F. Laird

The U.S. Coast Guard (USCG) is at the vortex of commercial, law enforcement and military activities. It is tasked with a multi-mission focus in support of the protection of the homeland, securing global trade, protecting against terrorist threats at sea, interdicting the sea-borne drug trade, assuring the safety of shipping, and participating in global collaboration in securing the global commons. At the same time, with the global financial downturn, the Coast Guard like most other U.S. agencies, must accomplish this with constrained resources.

Providing for operational flexibility with limited resources within a constrained budgetary environment is challenging. To do so requires shaping highly connected forces around capable multi-mission assets. Connectivity is central to effective knowledge shaping action; multi-mission assets are necessary to execute on the basis of that knowledge in a variety of different circumstances.



The Ocean Sentry and its mission systems palette provide significant new capabilities for the U.S. Coast Guard in executing maritime security missions. Photo credit: EADS

Without the physical assets required to operate in a more effective connected environment, enhanced connectivity will not lead to effective action. The ability to cover territory with aviation assets to

work with surface assets — whether on-ship or on-shore capabilities — is central to the success of the maritime security and safety team, of which the USCG is the pivotal player.

The maritime patrol aircraft, the HC-130s and the helicopters, form the surveillance, lift and action team which extends the reach of the USCG and joint surface assets. With the new platforms, now being introduced into the USCG — the Maritime Patrol Aircraft (MPA), the upgraded HC-130s and networked enabled helicopter assets — the ability to work with the joint team is significantly enhanced.

In an era of financial restrictions, making use of joint U.S. Navy, U.S. Air Force and U.S. Coast Guard assets is essential. The new connectivity-enabled air assets enable this. A key provider for such capability will be the systems on the new MPA.

Too often when one thinks of a maritime service, one thinks largely of ships. Yet in a 21st century maritime enterprise, data, communications, and integrated air and surface systems are really at the heart of effective operations....

The USCG uses its aviation assets to extend the reach of its other assets to craft greater operational capability. The aviation assets – helicopters and MPAs – exist as an extension of the ground and surface fleet capabilities.

For the USCG this means a simple truth: a surface ship without the long reach of an MPA or a UAV cannot see very far. By extending the sight and reach of a ship or a fleet, the ability to act and to protect and provide for maritime security are enhanced.



*The range and endurance of the new Ocean Sentry enable the reshaping of U.S. Coast Guard concepts of operations for maritime security.
Photo credit: EADS*

With the addition of the multi-mission capabilities to the MPAs, and with the ability to integrate the information gained by those systems within shipboard operations and decision making, notably with the new USCG cutter, the MPAs become especially significant extenders of fleet activity.

Without this extended reach, drugs may well enter the U.S., illegal immigrants may well not be seen, and illegal shipping may enter U.S. waterways. Inadequate resources leads to the inability to operate effectively.

The new MPA's concept of operations is essential as well to the functioning of the 21st century USCG. The new MPAs are significant enablers for the legacy and modernized fleet.

The con-ops typically depends on the mission and is essentially the same as the HC-130. Part of this calculation is the determination of proper track spacing (distance between search legs), which is a function of the size of the target (man in the water would require a very small track spacing for example), sea state, visibility, cloud cover, etc.

Night searches are done if the target is thought to be capable of detection by radar, possess radio or signaling equipment. Typically a ship would

be controlling one or more MPA/helicopters and continuously updating which areas have been searched and the results.

This function can be done by a shore station as well. The primary purpose if the ship is involved at all is to be available as a helicopter platform and/or to launch a boarding party or engage the target, if hostile, or to recover survivors.

However, the HC-144 or *Ocean Sentry* can do more than just pass target position information or provide vectors. It has the ability to take photos and download them.

So the ship can have information on the number of people aboard the target craft (good to know if they are bad guys) and perhaps even information on arms.

Finally, fixed-wing MPAs are often required to loiter over targets or follow them until a surface asset can intercept. Endurance is critical here and a major shortcoming of the HU-25. The HU-25 has about four hours of endurance regardless of the altitude. It can fly much further high up than down low, but four hours is what you get. The HC-144 can provide ten hours....

MIAMI AIR STATION: USCG AND CARIBBEAN MARITIME SECURITY

In June 2010, SLD talked with the USCG Miami Air Station Commander, Captain Richard Kenin, USCG and staff about their Area of Operations (AOR), their con-ops and the coming addition of the latest USCG aircraft, the *Ocean Sentry*. The Air Station faces a challenging AOR with significant maritime and air traffic that shapes commerce, law enforcement and environmental challenges. Dealing with illegal immigration and drug trafficking is a major concern and because many of these migrants come from outside the region, in areas of known terrorist activity, even “normal” immigration issues carry with them national security concerns...



*The first Ocean Sentry for the Miami Station in June 2010.
Photo credit: SLD*

SLD: How many aircraft do you have at the air station currently?

Captain Kenin: Right now, we have ten aircraft. When I was here in 1991, we had 21 aircraft at this unit.

SLD: And presumably, your geographical area of responsibility has not shifted?

Captain Kenin: No. What has changed is that the interdiction mission has shifted to Jacksonville and our helicopters were sent away. But those helicopters did a lot more than just drug interdiction. They did all the other missions for the air station. So they really downsized our air station in favor of standing up a single mission unit. We are phasing out the *Falcons* in favor of the

Ocean Sentry. Our first *Falcon* has already left.

So we now have five, and as the HC-144's come online, these aircraft will depart.

We have 430 days away from home station (DAHS). We have an aircraft deployed 24/7 somewhere down in the Caribbean. So we typically have four aircraft here and on a good day, we have three of those aircraft available for flying. The HC-144 that you saw out there is coming online here.

SLD: What are the major threats which you face in your AOR?

Captain Kenin: We have to cover a large and busy AOR with these aircraft and face a diversity of threats. The biggest threat right now is migrants. And the threat is not the Cuban migrant coming up from Cuba. They come across for economic reasons; that is really not a threat. The real threat for us from a Homeland Security perspective is people coming over from the Bahamas. It is very easy to get into the Bahamas, and then it is only 40 miles across from the Bahamas to the U.S. We have picked up boatloads of Sri Lankans, Nigerians, and Pakistanis. These are people with the national security threat that we are really concerned about. The 40 mile boat ride from Bimini is only an hour and a half away. And there is a serious threat from a search and rescue perspective as well.

SLD: How will you shape your ISR mission with the new aircraft?

Captain Kenin: When the HU-25 came online in 1980 it was designed for a mission that we do not have anymore. We needed an aircraft that could locate a vessel in distress quickly and then we needed a helicopter that would find them and then pick them out the water. It was designed for that, and it did it very well. It had very good sprint capacity to do search and rescue at distance. It had great dash speed, and it was designed for a minimal amount of loiter time, and then it had to come back.

SLD: Presumably then you are saving the cost of the surface ship as well by using this aircraft.

Captain Kenin: Exactly. You had a plane that was taking the search out of search and rescue. The Coast Guard air force does it all. That was the leadership's thought in pushing us towards a jet and it did that mission very well. And it also moved into the air interdiction mission very well when we started interdicting drug smugglers, as it did that very well with a different radar.

But now the Coast Guard's mission for its fixed-wing aircraft has changed. We are now about maritime patrol. That aircraft cannot give you the endurance to do the new Coast Guard mission. We need an aircraft that has the sophisticated sensor packages. What we have done all these years with all the different things on that aircraft has made the aircraft much more complicated. The avionics system was much more complex, taking more maintenance and care to operate as it has many add-on capabilities.

SLD: But these capabilities are not integrated.

Captain Kenin: Right. We have hung more things on them. Individually, these packages are good. It is good radar and it is a good FLIR, but they do not integrate well. Plus the aircraft just cannot stay out there long enough to do the mission. When we find a go-fast mover, we cannot stay on scene with that aircraft to wait for the surface fleet to make the interdiction. We can find it, and we do that pretty well. But after we find it, if we have already been flying 2-1/2 hours, well, all we can do is report a

position and then go back and get fuel. The aircraft was optimized for a particular mission set and now we have a multi-mission set.

SLD: Do you mean multi-mission in terms of not just ISR but multi-mission in terms of lift and carry as well?

Captain Kenin: Yes. That gives us a lot of the flexibility given that we are a smaller air force — a lot of flexibility built into the new aircraft. Multi-mission is huge especially in this AOR because there are so many different places that we need to reach and we need to shift tasks in flight.

SLD: The CASA aircraft was designed in part to operate in the Mediterranean and the Caribbean, and has a great deal of similarity. Is that a good fit?

Captain Kenin: It is and we need the loiter time that this aircraft has. We really need an airplane that can stay out seven or eight hours for a number of important reasons. First, it can cover the ground that we need to cover and it can get there fast. We have had problems in the past when we found the ship, but then lost it because we had to leave. By the time the rescue ship or another asset came, whether it was a Customs and Border Protection asset or another Coast Guard asset, it is either too difficult to find or it is simply gone. We play a lot of cat and mouse with smugglers in the Caribbean, so it is important to be able to track these folks and stay with them because they will dodge and hide until we are forced to leave.

SLD: So the multi-mission capabilities of the aircraft coupled with the loiter time of the aircraft fits your AOR and you multi-mission con-ops well?

Captain Kenin: We believe so. Our resources are multi-mission, our people are multi-mission. The Navy and DOD and the other services have that luxury of having specialized people. We don't. Our guys are running up front dropping a pump, going back to fill the aircraft, and doing all kinds of other stuff at the same time....

<http://www.sldinfo.com/?p=8625>

BUILDING THE OCEAN SENTRY

<http://www.sldinfo.com/?p=9101>



A new Ocean Sentry being built for the U.S. Coast Guard as seen in May 2010. Photo credit: SLD



The Ocean Sentry production process takes approximately 40 days. Photo credit: SLD

On May 18, 2010, SLD visited the factory in Spain where the CN-235 is built. The USCG variant is called the *Ocean Sentry* and two planes were being built on the 4 station line in Seville at the time.

Prudencio Escamilla, site manager as well as the Head of the Light and Medium aircraft Final Assembly Line (FAL) for Airbus Military, provided the tour of the FAL.

Several things were evident from touring the factory.

First, the USCG has bought an aircraft from a mature production facility. The heritage company has built more than 300 light and medium aircraft.

Second, the CN-235 has been purchased by many countries, several of which are partners with the USCG in providing for security in the Caribbean.

Indeed, the first Mexican CN-235 Maritime Patrol aircraft was parked on the tarmac outside of the FAL. This aircraft is virtually similar to the *Ocean Sentry* with the obvious exception of the mission systems.

Third, the factory uses modern production techniques, as one would expect, notably lean manufacturing techniques.

Fourth, the CN-235 is built with a mature, multi-national supply chain.

The origin of the CN-235 was a joint program between Spain and Indonesia, which the N represents. There are separate series numberings represented the Spanish and Indonesian based production runs.

During the visit, *Ocean Sentry* 10 was viewed and this represented series production 183 in the Spanish production run. The Indonesian numbering is more than 50 and is numbered as such.

The day of the visit there were two *Ocean Sentry*'s in the bays being worked on. The production rhythm is 10 days on the line after which the planes move to the flight test lines for testing and then preparation for customer acceptance. The entire process takes approximately 40 days.

THE NEW U.S. COAST GUARD CUTTER: A “CHAOS MANAGEMENT SYSTEM”

In June 2010, the *Second Line of Defense* team visited the latest National Security Cutter, the USCGC Waesche (WMSL-751). The team toured the vessel while it was ported in San Diego for a training and repair mission. Captain Lance Bardo, the Commanding Officer of the Waesche, who retired in late 2010, provided an overview on the ship, its con-ops and missions.

EADS provides a significant piece of the Cutter’s capabilities, namely the shipboard multimode acquisition radar, the TRS-3D radar. As of August 2010, a total of three National Security Cutters had been outfitted with the TRS-3D radar for air and surface search operations, with another two systems in the process of integration.

The TRS-3D is also aboard the Lockheed Martin version of the U.S. Navy’s Littoral Combat Ship – a fast, agile platform designed for operation in near-shore environments with additional aptitude for open-ocean missions. It is designed to defeat asymmetric “anti-access” threats such as mines, quiet diesel submarines and fast surface craft.

The new U.S. Coast Guard cutter is a significant improvement over the existing legacy cutters, and is designed to provide capabilities, which allows the service to operate fewer cutters.

The new cutter includes significant C4ISR capabilities, digital capabilities for operations and maintenance, an ability to operate much larger helicopters on its decks, an ability to operate remotely piloted vehicles, significant endurance, and an ability to operate for extended period of time at sea.

In crises such as Hurricane Katrina or the Gulf oil spill, the new cutter brings significant command and control capabilities to any task force managing a disruptive event.

SLD: Can you summarize what sets this Coast Guard asset apart?

Captain Bardo: When you have an event like Katrina, you don’t have power lines. I can push through the Panama Canal and be up there in a

day and a half and when I arrive I have the ability to make my own water. I have three months worth of food on board. I can talk to anybody in the world, literally, continuously. I can fly helicopters. I can launch boats. I can rescue people. I can coordinate significant numbers of aircraft

because I'm basically a miniature airport with a control tower.

In a crisis you need to build and coordinate a coalition of different agencies in a scenario where there is no power, which means there's no ability to communicate. The cell towers are down so you have to figure out how to communicate with other folks. We can easily move this platform to the area to manage a crisis event, so it's a chaos management system.

This asset is large enough with enough capability built into it actually to manage the response. I mean that literally. We have nothing else in the Coast Guard or the Navy, for that matter, to manage domestic response the way this platform can. The Coast Guard has demonstrated over and over again -- as recently as the current Deepwater Horizon oil spill and the Haitian earthquake -- that we are at our best when we respond to domestic emergencies, and a major offshore cutter is often the center of that. The Navy is a great partner in those emergencies but it's just not their primary mission.

SLD: What are the unique features of the ship you would underscore?

Captain Bardo: Endurance; if you have endurance you've got stability. You've got command capabilities. You've got a lot of flexibility inherent in the ship itself and the crew. The platform enables this kind of tool set; the toolset synergistically interacts with the platform.

SLD: What other capabilities would you emphasize?

Captain Bardo: Our flight deck is literally twice as big as our older cutters; four-thousand square feet versus twenty-three hundred on a High-endurance Cutter (378), and I can land a "sixty". I can land all variety of helicopters on the 751 that I can't on the 378.

When the sea is tossing the ship around, I have the stability to allow helicopters and UAVs to operate.

On a 378, I had to make really hard decisions by taking saltwater into my fuel tanks; it took three days to get rid of that water when you wanted to then fill up the tanks with fuel. With this ship I don't have that problem because I have a segregated tank.

I don't know what helicopters we will have in the future but I can tell you this, I can operate with a lot more flexibility with the 751. I always had to manage my fuel on a 378; for aviation I had eight thousand gallons of fuel. I've got a 35,000 gallon aviation fuel capacity on this ship, so I can fly those helicopters for a long, long time on four times the amount of fuel. This really gives us a tremendous amount of flexibility; it's definitely not a platform-for-platform replacement for a 378. It's a tremendous leap ahead in terms of growth capability as well.

SLD: How would you summarize the impact of the new cutter on operations?

Captain Bardo: We can be fifteen hundred miles from where a crisis is occurring and be there in a matter of two days. We have the ability to talk to anyone anywhere in the world. We have the ability to organize a lot of different agencies because of the ability to communicate. We have the ability to put people on the scene with boats and aircraft. We have the ability to remain on station for up to ninety days. We can make our own water; we make our own electricity; we're essentially a small city and a small commanding tool that can function as a global command and control platform.

<http://www.sldinfo.com/?p=10225>

THE U.S. COAST GUARD: 7,000 FOOT RESCUE SHOWS IMPACT OF NEW EQUIPMENT ON LIFE SAVING CAPABILITIES

In March 2010, *Second Line of Defense* talked with the current Executive Officer of the USCG Aviation Technical Training Center (ATTC) at the Elizabeth City USCG facility about a dramatic rescue conducted three years ago at 7,000 feet on the West Coast, in which he played a key role in hoisting an injured climber to safety.

On May 27th, 2007, the Coast Guard hoisted a person off of Brother Mountain in Port Angeles, Washington, after local authorities notified Coast Guard Sector Seattle that a 64-year-old male had been injured and was immobile on the summit. A HH-65C *Dolphin* helicopter crew from Coast Guard Air Station Port Angeles hoisted the injured male from an altitude of just over 7,000 feet, the highest altitude rescue ever performed by the Coast Guard in the region.

This rescue demonstrates the synergy between man and machine in delivering capability for public safety and security. For many years the U.S. Coast Guard have operated helicopters and fixed wing aircraft capable of water landings under certain conditions. Advantages for this capability and its limitations are obvious.

During the early 1980s, the Coast Guard selected the HH-65 *Dolphin* as its short-range recovery helicopter, and it has been the workhorse of the services short-range fleet for years. More than 90 HH-65s are currently in service.

Before the recent introduction of the National Security Cutter produced by the Deepwater Program, the *Dolphin* was the only Coast Guard helicopter capable of routine operations from its ships. It has an empty weight of slightly more than 6,000 pounds and a maximum gross weight of more than 9,000 pounds. It was the first of the service's helicopters that did not have the ability to land on the water.

Amphibian helicopters were phased out with the transition to the HH-60 for medium range search and recovery. This created a need for the rescue swimmer program made famous by hundreds of real-life dramatic rescues, as well as Kevin Costner's movie, *The Guardian*.

The *Dolphin's* weight grew over the years because of mission changes. More powerful engines were required, and the Turbomeca 2C2 engine was selected: two were installed on each *Dolphin* helicopter with funding from the Deepwater Program.

Coast Guard helicopters routinely respond to land emergencies. The higher-powered engines provide vital extra margins of safety should there be a problem during critical evolutions, such as hoist operations. While the *Dolphin's* new and more powerful engines enabled this miraculous 7,000-foot rescue, the skilled Coast Guard crew — with nerves of steel — made it happen.

A senior USCG official added further insight into the significance of the modernization effort:

The difference between the Alpha and Charlie model and putting new engines is this: in the old days when we used to do hoists and the engine failed, we knew we were going in the water, period. There was no chance that we were going to swim out of this. And now if the engine fails, you have a 50/50 or better chance that you are going to fly it out on a single engine. That is the difference in the C model aircraft versus the old engines. You could not do that with an A model. With the A model, the crew died if you lost an engine. And we lost engines routinely.

The issue of hoisting at 7,000 feet, I do not know how many rescues we actually do with that altitude. But every day we go out and we hoist with that aircraft low over the water.

<http://www.sldinfo.com/?p=6680>

*M*eeting the Challenge of Maritime Security is a publication of *Second Line of Defense*, a dynamic web site that focuses on the development and sustainment of U.S. and allied military and security capabilities in shaping a global security enterprise within which growth and stability are possible.

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Sea

Search and Rescue: Why the Coast Guard Needs Help

By **Robbin Laird**

Published: June 15, 2011

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Photo by China Photos/Getty Images

The Coast Guard plays important roles combating piracy and keeping America's shores safe, but unless the President is an alchemist and can turn words into money, the service soon won't be able to do what Congress says it must do.

There is no military area where gap between words and deeds yawns wider than in the Coast Guard. Recently, President Obama noted "we know that the complex missions asked of our Coast Guard have never been more important. Around the world, we need you to partner with other nations to secure their ports, protect the vital shipping lanes of the Persian Gulf, combat piracy off the Horn of Africa, and help train foreign partners from the Americas to Africa to Asia. Here at home, we need you to stop those smugglers, and protect our oceans, and prevent terrorists from slipping deadly weapons into our ports."

He pledged the nation would "do everything in our power to help you succeed. That's why we're investing in the new ships and national security cutters and aircraft that you need to get the job done. It's why we're adding new inspectors and investigators and support personnel to keep pace with today's missions."

But the Obama Administration is retiring ships and other key assets more quickly than it is building new ones. The Obama Administration is making it difficult for the Coast Guard to build new National Security Cutters and it

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is resisting building the Offshore Patrol Cutters which are to compliment the NSCs. And the Obama Administration is not supporting fully funding the new maritime patrol aircraft.

The Obama Administration is not providing the money or the policy to deal with the core Arctic challenges facing the nation, where the five claimants to significant resources are increasingly meeting toe to toe. The administration has talked of working collectively on Arctic search and rescue but without building new icebreakers it is difficult to understand how the Administration will do this. There are no shore assets to do Search and Rescue; you [need the icebreaker as the command and implementation asset](#).

And the task of providing security for offshore drilling is difficult to meet without new regulators, new equipment and new capabilities to operate offshore. A core provider of equipment to the Coast Guard – Eurocopter -- is [building a whole new class of copters to deal with offshore challenges](#), but it would be difficult to find the program put in place to acquire these new assets.

At the heart of the difficulties facing the Obama Administration's approach is where the Coast Guard sits. Although both a military and civilian service, it is found in a civilian agency, the so-called Department of Homeland Security. The approach of the current Secretary of DHS is more upon security at home than projection outward to provide for homeland security. The focus is more upon shaping capabilities inside the U.S. to deal with threats than engagements outside the U.S. to deter threats.

As a result, the Coast Guard's ability to fulfill its obligations under Title X – its military obligations – have suffered. The DHS and Office of Management and Budget of the Obama Administration have resisted supporting the National Security Cutter in part because it is not simply an inland waterway or harbor asset. It is designed to operate in international waterways to engage threats outside of the 200-mile limits.

For the Obama administration's homeland security team, such capabilities are expensive and unnecessary. As one DHS official told me: "This is the US Navy's job." To say the least, this is an interesting interpretation of the Coast Guard's Title X obligations.

The President mentioned that he recently met a Coast Guard officer stationed in Afghanistan. One is tempted to ask the president if he understood why the Coast Guard operates abroad and how much support DHS is providing for its foreign missions.

The other difficulty is not simply lack of support or real understanding for the USCG global engagement but the lack of understanding in the Obama Administration and Congress about the central importance of new equipment to play the game.

The "bad guys" can buy and build stealthy airplanes, fast boats, submarines and have access to state of the art communications equipment. The Coast Guard continues to operate equipment that was operated when "I love Lucy" dominated the airways. This is a joke. Why we ask 21st century professionals to operate second-class equipment is beyond me. Why doesn't the President fly around in 1950s aircraft with communications equipment from the same era and see how he likes it!

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Where are the congressional hearings on why the Obama administration and Congress can not deliver support a 21st-century Coast Guard?

Examples abound of the ways new equipment can improve the Coast Guard's ability to protect the homeland, secure our coastal waters and save lives.

A stunning example was the impact of the new C-130J mission systems on saving a life in early January 2010, a [dramatic rescue effected by the USCG](#) was done in cooperation with the US Navy to save a man's life at sea. This rescue involved key C4ISR assets on the new USCG MC-130Js

The impact of modernization on operations could not be clearer than in this case of rescuing a sailor at sea. Not only did the new mission systems and C4ISR assets play a central role in allowing the USCG professionals to save this man's life, it would have been unlikely that either the effort or the joint team communication involved in the effort would have been possible.

Here the redundancy of the new mission systems allowed the crew to operate in extremely challenging conditions. The systems allowed them to locate the man miles before they would have been able to with the old systems; time was of the essence and the new systems gave them that time. And when the MC130J became mission critical with regard to fuel, they were able to hand off through the C4ISR systems, the data that they had generated to the replacement MC130J. This allowed for continuity at a crucial moment. <http://www.sldinfo.com/?p=5533>

But it's not just its ships, planes and helicopters that need replacing. Coast Guard shore facilities are crumbling before our eyes. For example, the Elizabeth City Coast Guard Station in North Carolina is the base from which much of the East Coast operations for the Air Arm are supported and operated. Yet the floor is crumbling in the main warehouse where parts for all Coast Guard air assets are stored at what its recently retired commander Capt. FIRST NAME Bennett calls this "vintage World War II base."

A typical example of the problem on the base is its aircraft maintenance facility.

"This is the hub where it all happens, all the spare parts, all major maintenance comes through here -- Elizabeth City, North Carolina.

And currently our warehouse, which has a lot of these spare parts, is in need of great repair; we have a crumbling floor right now, which we're buttressing up. This part of the country, we're close to the Dismal Swamp, we have a lot of underground water.

Actually, the warehouse is on top of kind of an underground river.

So the floor is sagging, so we're looking forward to getting a new warehouse so we can adequately house all of the spare parts and get a state-of-the-art warehousing.

Because if we have a failure here within Elizabeth City for the aircraft maintenance, it'll affect the whole fleet throughout the Coastguard. We are a single point of failure.

So that's a huge infrastructure issue that we're looking forward to working

through.
But right now, we kind of a bridging strategy with a temporary fix on the floor, if you will." <http://www.sldinfo.com/?p=10783>

While we bailed out GM and other large companies, we have provided piteously little to modernize the Coast Guard, or to recognize its global mission. This is a game with consequences.

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Walter

i spent 22 years in CGR, we didn't qualify some years cuz of the shortage of bullets. Its better now but this has been aproblem with the CG for many years. Hand me down crap, and OH yes and keep it running

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Shaping Arctic Strategy

General Charles Jacoby on the Arctic Perspective

Arriving at Yellowknife airport, Northwest Territories, from left: General Walt Natynczyk, Canada's then Chief of the Defence Staff; U.S. Army General Charles H. Jacoby; Chief Warrant Officer Gilles Larouche, Joint Task Force North; and JTFN Commander, Brigadier-General Guy Hamel.

The Arctic is a region of growing global significance. With global warming and pressures on global resources, the region is of increasingly strategic importance. The main current claimants on the Arctic – Russia, Canada, Norway, Denmark and the United States, have formed an Arctic Council to manage their interests.

But all are not equal in terms of committing resources to protecting those interests or shaping proactive policies. The Russians are clearly the leaders in this domain, in part because of the clear understanding of the strategic impact of the region on their future.

As the Northern Route opens up, they will be able to connect their Atlantic and Pacific fleets for the first time. They will be able to shape an air capability covering their Atlantic and Pacific interests. They will add to their significant position as a commodity producer and have access to a number of rare minerals and other assets.

Over time, Northern Europe will become more closely linked to the Pacific powers. The shift already seen within Europe whereby the North-South divide is growing could be accelerated as the “Arctic century” unfolds.

Although the United States has been a more reluctant Arctic power, **General Charles Jacoby**, the dual hatted NORAD and NORTHCOM commander seeks to rectify this. A key theme for the General is the need to build capabilities and presence over time, and to do so with the cooperative engagement of U.S. allies, and with clear headed thinking about how to evolve capabilities over time.



2012 PHOTO: SGT FRANK HUDEC, CF CANADA COMMAND

Overall, he underscores the need to concentrate resources on the priority tasks emerging in protecting North American arctic interests. He believes the Canadian-American relationship provides the clear bedrock for doing so, including the need to share resources, and develop thinking and plans to leverage resources in the security, commercial and defense domains.

General Jacoby echoes recent statements by the USMC Commandant that “according to our allies, virtual presence is actual absence.” He recently met with **Robbin Laird** at the Pentagon to candidly discuss, for a *FrontLine* article, the current situation and the evolution of the Arctic.

Question: How important are security and defense considerations to the future of Arctic development?

They are very significant. For some, the development of the Arctic is about com-

mercial or environmental issues alone. But without security in the Arctic, one cannot have sound commercial or environmental development.

And it is important for us to get out in front on the Arctic, because if we don't, other nations will define our Arctic future for us. And if we make smart investments over time in security and defense for the Arctic, we can get ahead of the game.

As I look at the Arctic, I think of it in terms of where there is key terrain that we must be prepared to defend. Just like I look at where our key terrain is in the homeland – Washington, D.C., or the New York Stock Exchange, for example – I need to know where the key terrain is in the Arctic.

The Bering Strait, for instance, has the potential to become another Strait of Malacca. As the ice melts, it will take on significant and global economic impor-

tance. There are also locations where mining or energy extraction will take place.

Capability gaps create vulnerabilities. I have direction in the Unified Command Plan to look carefully at what these might be, and advocate for ways to fill them. Of course, we will not do this alone. Our principal ally in the Arctic is Canada, and we have a shared stake with them in the peaceful development of the Arctic.

But it's important to remember that the Bering Strait is not the Strait of Hormuz. This is an evolving issue, not a today issue. We need to make advances over time that allow us to stay ahead of evolving problems, with a solid strategic direction defined and in place.

There is a school of thought that says we can have competitive commercial and economic interests in the Arctic, but not have any associated security challenges – that's simply not the way the world works.

Economic opportunities and challenges shape or imply security interests. We need to not only be prepared to take advantage of and exploit the economic opportunities in the Arctic, but also be prepared to address security challenges.

Question: The environment is a difficult one and shaping a proper infrastructure to support Arctic operations both now and in the future is complex. What are your thoughts on how to deal with the infrastructure challenge?

The Arctic is a challenging environment in which to work and for which to plan. A key element is to shape a flexible, agile and responsive approach with our mission partners. Instead of having separate bases and facilitates in the region, we are looking to have a consolidated approach.

We simply cannot afford to have unnecessarily redundant facilities in the Arctic region. The different stakeholders need to work together to share in building these capabilities. We need an inclusive approach to this challenge, and in this case, an opportunity as well.

Earlier this year, (U.S. Coast Guard Commandant) Admiral Papp and I identified four key capability gaps in the Arctic. Those are: communications, domain awareness, infrastructure, and presence. We need to focus our investments in enhancing capabilities in each of those areas over time.

We are using our exercise programs to explore capabilities gaps, and look for high-payoff investments that we can make. We

are working with our components, especially the Navy and Air Force, to help build to those capabilities. And because we are taking an allied and whole-of-government approach, capabilities can be leveraged not just from the services, but from other agencies, from the commercial sector, or from allies like Canada.

Question: Do you see a significant uptake in activity by countries like Russia and China in the Arctic?

We do. The Chinese are building icebreakers, which clearly are not for operation in the South China Sea. Russia is the most active. There are concerns about freedom of navigation in the Northern Sea Route.

These developments do not have to be contentious, but it is foolish to think that economic and resource competition won't lead to occasional disagreements. And as there starts to be more human activity in the Arctic, for us it will require communications, domain awareness, infrastructure and presence of some sort.

We could wait and be behind the curve in the Arctic. But in a harsh climate like that, when you're behind, you're way behind. By not rolling out capabilities on a steady basis, at any given time we're not just one season away, we're three seasons away from having that runway, that hangar, that piece of concrete, or that pier that we might need to support operations.

Question: Also on infrastructure, what is your thinking about offshore and shore based infrastructure requirements for an Arctic presence?

A key element is to shape forward operating bases in Alaska and the Arctic. There are going to be several stakeholders in the area. We need to be willing and looking at ways to share amongst all stakeholders. Shore-based facilities might need to be complemented with offshore facilitates.

Even in the warm season – in fact, *especially* in the warm season – hardened ships,

whether they're icebreakers or hardened Arctic-capable ships, are going to be required to do our most basic missions of safety, security and defense. You won't be able to do it completely from shore-based facilities.

Question: Canada is a crucial partner in all of this. How would characterize the Canadian role from your perspective? It will be important to leverage one another's investments and capabilities, I would assume?

It will be critical to do so. We will need better satellite coverage of the region. But it doesn't have to be a DoD satellite, or even an American satellite. There are investments that all the stakeholders can make, whether they are the U.S. government, Canada, the State of Alaska, or commercial enterprises. One of the things we're doing as part of our Arctic campaign plan is we're forming an Arctic board with the University of Alaska at Fairbanks to bring together all of the stakeholders to talk about this.

With such an approach we can leverage and share resources. For example, we might learn through these discussions that we need a piece of concrete within 200 miles of the North Slope. And if so, who are the different partners who can use that and invest in that so we can share the capability.

And Canada will be represented in that process. There's a natural affinity between NORTHCOM and the new Canadian Joint Operations Command, and between Joint Task Force Alaska and Canadian Joint Task Force North, and we're trying to enhance cooperation among those groups.

With my NORAD hat on, I have the ability to help both the U.S. and Canada plan together and say, okay, 'what do we need in the Arctic in terms of presence, in terms of domain awareness, in terms of communications ability for our joint defense?' **FL**

Clearly, the Arctic is both an emerging opportunity and challenge. It requires vision. We need to see past the near term. If we wait for the first oil gusher, the first cruise ship to run aground, the first environmental catastrophe, or the first security challenge to arise before we start investing in these capability gaps, we will be too late. That's why we are working with all of the stakeholders today to start meeting this challenge.

In short, Jacoby's approach is clear: we need to map a strategic direction and invest to meet core needs. There is a clear need to fill core capability gaps, identified in terms of communications, ISR, presence and infrastructure. This is a clear warning as well, as the US continues to loose icebreakers and the Chinese add them. "Virtual presence is actual absence." **FL**

Robbin Laird is...

Bold Alligator 2012: Re-Shaping Maneuver Warfare from the Sea

By Dr. Robbin Laird



Off the shores of Tripoli, the U.S. and the allies began the process of shaping a post-Afghanistan military. After a decade of land warfare, the challenge of strategic redesign and reshaping is a major one. And doing so in a fiscally strained environment in Europe and the United States augments the challenge.

In the Libyan operations, the U.S. and its allies leveraged both land and seabases in dealing with the defeat of Gaddafi's forces. The Libyan operations demonstrated how the sea base can be integrated into an overall strike and sustainment operation. At the heart of the new approach is the ability to engage and to dominate through SUSTAINED operations. Such operations will require forces able to strike, to control the battlespace and then to prevail through the necessary period of the operation to achieve strategic and tactical objectives.

To sustain will mean that the sea bases will not just show up for a show of force, but be part of a sweep and sustainment operation. This will mean that the ability to operate from land, whether in close proximity or distance will be integrated into the thinking about the USN-USMC strike force.

Early in 2012, the largest amphibious exercise in more than a decade was held off another coast, this time the East Coast of the United States. According to an official press release:

"Amphibious forces are a critical element of maritime power projection that ought to be a high priority for support, even in

a resource constrained environment, because they are a cost effective option for accomplishing a wide range of military operations," said Adm. John C. Harvey, commander, USFF.

The units involved include the Enterprise Carrier Strike Group (CSG), Expeditionary Strike Group 2 (ESG-2), 2d Marine Expeditionary Brigade (MEB), Iwo Jima Amphibious Ready Group (ARG), 24th Marine Expeditionary Unit (MEU), Naval Expeditionary Combat Command (NECC) as well as various other ships and units.

Nine countries are participating in exercise BA12, providing maritime, land and air units or observers. The countries participating with the U.S. forces are Australia, Canada, France, Italy, Netherlands, New Zealand, Spain and the United Kingdom.

One of the exercise's priorities is to incorporate lessons learned over the past 10 years of challenging combat operations, overseas contingency operations, humanitarian assistance/disaster relief (HA/DR), noncombatant evacuation operations (NEO) and homeland defense."

http://www.navy.mil/search/display.asp?story_id=64978

A Coalition Perspective

Several allies were involved in the exercise and indeed contributed capabilities to the effort. Among those allies participating were the following:

- The UK provided 120 Marines, fleet diving unit and staff augments;
- Italy provided staff augments and observers;
- France provided 1 LHD, 1 escort, 21 LCMs, 1 EDA-H, 300 landing troops, Navy Commando Group, 6 Helos, 50 staff augments;
- Spain provided staff augments and observers;
- The Netherlands provided 100 Marines, Boat Platoon, Fire Support Team and Staff Augments;
- Australia provided staff augments and observers;
- Germany provided staff augment and observers;
- Canada provided 2 MCM and EOD capabilities
- New Zealand provided staff augments and observers.

The chief exercise planner who is a Dutch Naval officer provided a broad perspective on the coalition engagement.

Lieutenant Commander George Pastoor is a Dutch Naval Officer with Expeditionary Strike Force 2 and functioned as the lead planner for Bold Alligator.

"I'm basically on the inside, as I am a Naval Officer embedded in the Expeditionary Strike Group 2 staff, as well as coalition member, and so I'm seeing the process from both sides. I'm on the receiving end on one side, and I'm on the giving end on the other side as being the developer of the operations and the plans."

Coalition is a key part of Bold Alligator. It's been there from beginning. From the very first concept development conferences in the beginning a year ago, coalition engagement was central.

Nowadays operations aren't done without coalitions. The Bold Alligator process is U.S. and coalition as one team from beginning onwards. It is really working well, getting to the same goals, doing the planning process together, working in close coordination with the French Task Group, having their plans over, having 6 to 10 officers from New Zealand flying in for planning conference.

We have a lot of coalition participants in our staff for the operation itself really emphasizes the importance of coalition.



In an interview after the exercise, Pastoor emphasized that problems with translation of information from SIPERNET to CENTRIX posed a problem during the exercise but that the will to share information was central to the exercise's success. Pastoor underscored that planning needs to be done in CENTRIX so that there is a seamless flow to exercise and operational collaboration.

Another observer from the U.S. side emphasized the need to make the information sharing crucial to the way ahead. This source underscored that on many of the U.S. ships there was not a widely available CENTRIX capability.

Pastoor highlighted the centrality of shaping a new approach to maneuver warfare. *"We had Dutch observers in the raid 165 miles inland to Fort Pickett and the Canadians inserted forces along with the Americans. The Osprey allowed the range and speed to do deep penetration raids and this was an eye opener for many allies. But at the heart of the new approach is the ability to insert forces where the enemy is not and to move those forces over the chessboard at several miles at a time, which the Osprey facilitates."*



A challenge throughout was C2 in the sense of bringing forces from the ships to the shore and sorting out where the C2 element was to be focused. On the U.S. side C2 shifts from the fleet to the ground commander at a point of transition; when the French who led the major allied insertion went ashore there was the double problem of shifting C2 from the French Navy to the French Army and then from the French Army which then went under the command of the 2nd MEF commander, Brigadier General Owens.

Another aspect of C2 in the exercise was that much of the C2 remained aboard the ships. This was a force insertion and extraction exercise and highlights possible future requirements as well.

Pastoor argued that the new maneuver concept from the sea is about power projection that can go where the enemy is not and to be able move more rapidly than the enemy in the battlespace.

The French Engagement

The French were a major ally engaged in the exercise. The French and the USN-USMC had worked closely in the operations off of Libya and the French Army has worked closely with the USMC in Afghanistan. This cooperation continued in the Bold Alligator exercise. This was not a NATO exercise, but a bilateral one from the point of view of the USN-USMC and French team.

The key asset engaged in the exercise was the Mistral. This sea base has been built around commercial practices and costs approximately 300 million Euros. The third Mistral built for the French forces is currently being delivered to the French navy. During the Libyan operations, the new Tiger attack helicopter was used as a lead element for French operations and ground attack in Libya. During Bold Alligator the Tiger was not there due to its operational use in Afghanistan.

The key helos operating off of the Mistral were the Pumas and Gazelles. The Pumas were part of a special Army group to support the insertion of the artillery for forward deployment. The Pumas either carry the artillery externally for rapid deployment or internally for assembly on the battlefield. The Gazelles are used for either reconnaissance or close air support. Both were involved in the Libyan operations as well.

The exercise functioned as an opportunity for US-French training. The Mistral was certified with US amphibious vehicles and ships, such as the air cushioned LCAC. Additionally, the Marines and US Navy got a close up look at the new French landing vehicle, the EDAR. The EDAR was delivered to the French navy in November 2011 and this was the first time this craft has been deployed with the BPC class of ship (the Mistral).

Capitaine de Vaisseau Emmanuel Gué, Captain of the French Amphibious Task Group, on board the Mistral, underscored: *"This kind of operation goes well beyond a simple disembarking: it is a large-scale military action from the sea to the land and it requires a multitude of technical know-how one has to coordinate in an optimal manner."*

On February 6th, D-day of Bold Alligator 2012, 300 men of the 6th BLB (6e brigade légère blindée or Light armored brigade) and some 80 vehicles were brought from sea to shore in a matter of six hours via about twenty sea and six air rotations in accordance with the initial scenario planned on a multilateral level during the previous months (compared to 400 men and 90 vehicles during rehearsal the week before).

The 6th BLB has been deployed on various fronts - from Bosnia, Kosovo, Ivory Coast, Afghanistan, Lebanon, the Central African Republic, the Democratic Republic of Congo, to the Republic of Chad. But for many of these young soldiers, BA12 is their first amphibious experience of this scale and the first time they got to live on a French Navy ship for such a long period of time (the Mistral left Toulon on January 5th). This was a common feeling shared with their fellow U.S. Marines

The last French amphibious operation happened off the coast of Lebanon in 2006 to evacuate French citizens. Part of the 1st Foreign Engineer Regiment, crews of the TRM10000 CLD and EGAME - Engin du Génie d'AMénagement du terrain - are the first to beach

after the infiltration forces and the last to leave the shore (just before the latter) making sure all vehicles are safely landing and going back to the ship once the mission is achieved.

Helicopters were extensively used during BA12 as a complement to sea rotations and a potential substitute in case of inclement weather. Amphibious operations are extremely difficult to plan as so many factors such as the weather and sea conditions have to be taken into consideration: several backup plans are more than ever required in such a context.



During Bold Alligator, the Pumas were used as logistic assets including for an artillery raid exercise (RAID AR) conducted the day after "D-Day" as part of continued bilateral training with the American forces. Two Pumas carried two 120mm mortar on site for the Marine artillery troops to unload in specific delays and operate.

This artillery raid exercise involved the 3rd RAMA and was conducted on February 7th, 2012 in the context of bilateral training with the Americans nearby. The 300 kilos mortar is already a logistical challenge on its own and can be delivered fully mounted as sling loads or in several pieces inside a helicopter. This was the method selected for this exercise, two mortars being carried by two pumas in three major 100 kilos pieces.

The rules of engagement can also differ among coalition partners, the French preferring to first use lightning mortar ammunition before shooting." In the case of an exercise on the US soil, another logistic challenge had to do with legal safety issues, whether transporting and stocking French ammunition from the BPC to the US territory or regarding individual safety protection required by US laws for such shooting to occur on US bases.

Command and control are key in any operation, but especially in this kind of training exercise, as three factors tend to complicate matters :

1. In a French amphibious operation, given the fact that both the Navy and the Army are involved, a Transfer of Authority (TOA) must take place when the ground forces are not subordinated to the Navy Command authority anymore and when in this case the Mistral supports the ground forces in a sea-basing function : the TOA took place on February 6th at 23:00.

2. Contrary to a Franco-French operation, in Bold Alligator, the French troops passed under US Command authorities : one of the main objective of BA12 is to develop the best channel of communications possible for current and future joint operations.
3. BA12 relied as well on simulation assets being injected in real life forces : the difficulty is to have the proper inter-face to conduct such a mission within a coalition.

Before any land insertion, ground elements must come ashore ahead of time for reconnaissance purpose. An amphibious operation is in many ways a race against the clock, and in this case the window to secure the landing craft was 45 minutes because of the tide. But it can be a truck stuck in the sand, a tank stuck in the water and the whole synchronization of the operation can be called into question, hence the need for quick decision-making on which plan B to activate... or not.

In an amphibious operation, one of the keys to success is to reduce the transit time on water as well as the time necessary to load and unload people and equipment. These are all periods of high vulnerability for the troops, hence the major role of all those involved in such tasks. The navigator of the EDAR (the newest French landing craft of interest to the USN and the USMC) had a specific challenge during BA12, as it was the first time the latter was used outside the French waters.

The Way Ahead

Bold Alligator is part of a re-shaping of U.S and allied forces moving forward into the next decade of the 21st century. Learning how to leverage the sea base to find ways to provide for new capabilities and new power projection approaches is central.

An example is the impact of the new Middle East in terms of leveraging the sea base to be able to work with coalition partner's land based capabilities.

With the Arab Spring, the security and defense framework, which the West has underwritten over the past thirty years, is shattered. The Arab Spring states are in upheaval, the Iranians are preparing to enter the stage as a nuclear power, the Conservative Arab states have to prepare to defend themselves against Iran, and the interaction between Arab Spring forces and the stability

of the key conservative Arab states is significant. Who will the West be aiding and abetting if the Arab Spring continues to pull the rug out from under the de facto Conservative Arab, Israeli and Western alliance?

Will Western states be able and willing to deploy land based forces, whether ground or air, on Arab soil? And given uncertainties even in key Arab allied states, how might the West best defend its interests, and to ensure energy security in the region?

The answer in part is provided by the BA-12 exercise. In the exercise, Harriers based on the USS Kersarge worked closely with land-based air to provide for a significant air combat capability to shape the battlespace. This model can be followed with Arab Air Forces, the Israeli Air Force or Western Air Forces deployed temporarily on Arab soil.

The point is that the organizer of the spear is on the sea-base, and this capability can be conjoined with the various air combat centers extant or being developed in the region.

In short, re-shaping maneuver warfare from the sea by encompassing allied and US land-based air and other support and strike capabilities is a crucial element of the way ahead.

New uses of the sea base, new capabilities deployed from the sea base will allow the U.S. and its allies to deploy scalable forces and to shape a force appropriate to the mission. An economy of force approach can be shaped to ensure that mission and forces match, but with scalability other capabilities can augment the force to ensure mission success.

*Dr. Robbin F. Laird is an analyst of European, U.S. and Asian strategic affairs. He has worked in three Administrations on intelligence and policy issues. He is the co-founder of Second Line of Defense (<http://www.sldinfo.com>)(<http://www.sldinfo.com>) and has published several books leveraging the interviews and analysis on the website. The most recent are *Re-Norming Air Operations*, *The Challenges of Maritime Security* and *21st Century Air Capabilities*. Dr. Laird lives in Paris, France, as well as Arlington, VA. He travels regularly in the United States and abroad and has extensive knowledge of US and Allied militaries as well as defense industrial capabilities.*



August 27, 2012

The Space Impact of the Euro Crisis

◀ ROBBIN LAIRD and HARALD MALMGREN ▶

The European sovereign debt crisis is not simply a bump in historical progress; it is the end of a period of history and a critical point in European and global transition in the 21st century.

The confluence of several trend lines — the unification of Germany, the end of the Soviet Union, the collapse of the Berlin Wall, the expansion of NATO, the expansion of the European Union (EU) and the creation of the single currency — constitutes a unique period in modern European history.

The trend line was also defined by moving the borders of Europe eastward with the expectation that an expanded Europe would manage its own internal dynamics well and provide stability in a historically unstable region of the world.

However, the European crisis is also gradually revealing serious flaws in the functionality of both the European Union and NATO. The two decades of European consolidation and expansion are now confronted with new centrifugal forces that are again widening political, social, economic and security differences within the EU and among its neighbors. Deepening recession and the severity of its impact on employment and the well-being of citizens are increasing these differences and encouraging re-energized nationalism and renewed political localization.

Europe will now be challenged in the form of rollbacks of the many intertwined strands of integration, fraying what has been an intricate but incomplete tapestry. It is questionable whether Europe will be able to prevent stalling of the integration process in the face of widening gaps among the interests of each nation and even within each nation.

Since the birth of the euro, the French and Germans were in the lead in

ing to hide the reality of European bank weaknesses. The main reason is that eurozone economies are far more bank-dependent than economies like those in the United States or United Kingdom, where substantial nonbank financing alternatives exist for the corporate sector.

In the eurozone, banks are the financial markets; in the U.S., banks are but one segment of a multifaceted financial market. Eurozone govern-

of the savings of millions of European citizens.

European leaders are also attempting to initiate a more comprehensive fiscal union, with new decision-making mechanisms that transfer sovereignty in parallel with the new banking union. We do not believe that any of the eurozone governments are ready for such a political transition in which citizens in each nation must agree to be under leadership of people appointed or elected in some other nation among the European Union members.

The way ahead in dealing with the crisis will have a significant impact on the space business in Europe and beyond. A key element will be reshaping the euro around the German policy agenda. The Germans will be key players in reshaping the euro and downsizing the eurozone to what might be called the Ger-Euro. The economic and political weight of Germany will go up as the euro crisis goes on, and the weight of German influence will be to reshape the eurozone into a more cohesive, "responsible" and integrated "core."

But this is a united Germany, which is shaping a European-cohesive process, not a divided Germany, which had to accept the dictates of smaller European powers to gain an end of national division.

The weight of Germany in shaping

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The weight of Germany in shaping European space policy and business approaches will clearly go up. And the role of Germany already in the launch side of the business within Europe was on the ascendancy prior to the highly visible euro crisis.

resisting transfer of national regulatory power to the European Central Bank or some other eurozone-wide entity. Other euro governments have also insisted on keeping local supervision of banks. What really lies behind this continuing resistance is that national governments and their banks do not wish to reveal the true leverage and the weakness of capital among European banks.

Eurozone governments are still try-

ing to hide the reality of European bank weaknesses. The main reason is that eurozone economies are far more bank-dependent than economies like those in the United States or United Kingdom, where substantial nonbank financing alternatives exist for the corporate sector. In the eurozone, banks are the financial markets; in the U.S., banks are but one segment of a multifaceted financial market. Eurozone govern-

50 Years after Mariner 2: Exploration at a Crossroads

◀ ROGER D. LAUNIUS ▶

Solar system exploration is approaching a major turning point just as it is surpassing a major milestone. Fifty years ago, on Aug. 27, 1962, NASA launched the first successful planetary probe, Mariner 2, which visited Venus later in that same year. Regarded as both the evening and the morning star, Venus had long enchanted humans, and all the more so since astronomers had realized that it was shrouded in a mysterious cloak of clouds permanently hiding the surface from view. Mariner 2 was a triumph in helping to reveal the closest planet to ours, and a near twin in terms of size, mass and gravitation, to the billions on Earth.

Although Mariner 1 was lost during a launch failure, its twin, Mariner 2, flew by Venus on Dec. 14, 1962, at a distance of 34,800 kilometers. A 204-kilogram spacecraft, it carried six scientific instruments, a two-way radio, a solar-power system and assorted electronic and mechanical devices. Mariner 2 probed the clouds, estimated planetary temperatures and pressures, measured the

charged particle environment and looked for a magnetic field similar to Earth's magnetosphere (but found none). Most important, it found that the planet's surface was a fairly uniform 460 degrees Celsius, thereby making unlikely the theory that life existed on Venus.

There had been longstand-

Earth's turn, this pop culture belief suggested that Mars had once been habitable and that life on Venus was now just beginning to evolve. Beneath the clouds of the planet, the concept offered, was a warm, watery world and the possibility of aquatic and amphibious life. "Mariner: Mission to Venus," a 1963 NASA publication about

the same steamy atmosphere could be a possibility."

Mariner 2 helped to determine that none of these speculations was true. The second in a series of planetary exploration spacecraft, this was the world's first fly-by of a planet. Part of a 1961 NASA planetary exploration initiative that took some of its design from the Ranger

spacecraft on Jan. 2, 1963, and it is now in orbit around the sun.

This important milestone in planetary exploration signaled by Mariner 2's mission to Venus is an appropriate cause for celebration. It is also an ideal time to reflect and take stock of U.S. efforts to understand our solar system because the planetary exploration program is stalling through a lack of resources and technology necessary to advance it. Unfortunately, after years of success in planetary exploration, NASA's efforts are beginning to wane. Since the 1990s NASA has sent an armada of spacecraft to the red planet, of which the Curiosity rover is the most recent, and two outer planetary missions — Galileo and Cassini-Huygens — have opened the jovian planets to study. The New Horizons space probe to Pluto and the Kuiper Belt at the outer reaches of this system promises to do the same in the coming years. Not to be outdone, Messenger has expanded knowledge of Venus and the inner solar system. A range of smaller and less-com-

SEE LAUNIUS PAGE 21

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ing speculation that life might be present on Venus. In the first half of the 20th century, a popular conception held that the sun had gradually been cooling for millennia and that as it did so, the terrestrial planets of the solar system had a turn as a haven for life of various types. Although it was now

the Mariner 2 mission, noted, "It was reasoned that if the oceans of Venus still exist, then the Venusian clouds may be composed of water droplets; if Venus were covered by water, it was suggested that it might be inhabited by Venusian equivalents of Earth's Cambrian period of 500 million years ago, and

program, Mariner 2 bore a striking resemblance to the basic framework, solar panels and antennas of its Ranger predecessor. Its controllers, numbering roughly 75, worked from NASA's Jet Propulsion Laboratory in Pasadena, Calif. Although Mariner 2 did its job well, NASA lost contact with the

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European space policy and business approaches will clearly go up. And the role of Germany already in the launch side of the business within Europe was on the ascendancy prior to the highly visible euro crisis.

Also likely is an acceleration of global partnerships and presence. We have seen Airbus announce plans to come to the United States; will space businesses follow into the non-eurozone? Will Europe recast its business face toward a more significant industrial presence outside of Europe to shape a long-term response to the euro crisis?

It is also likely that partnerships with countries like India and Japan need to be deep-

ened to ensure that core European space capabilities are maintained and sustained.

In other words, one outcome to the euro crisis could be to propel Europe into a leading position in reshaping the global space business and strategic partnering. And such an outcome would have a significant impact on the United States, if the U.S. cannot shape a more effective global partnership and export system.

Robbin Laird is co-founder of Second Line of Defense and an analyst of defense, space and security issues, based in Paris and Washington. Harald Malmgren is a global strategic analyst with a specialty in political economic affairs. This piece is based in part on the report "The Euro-Crisis and its Strategic Consequences," which is available on the Second Line of Defense website at www.sldinfo.com/products/july-2012-sip.

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plex spacecraft have also undertaken significant investigations.

But we are at the point where not much in the way of planetary exploration is currently approved, under development and moving toward launch. The Mars Atmosphere and Volatile Evolution, or Maven, mission is set to launch in 2013, and it promises to capture important data about the red planet's upper atmosphere, ionosphere and interactions with the sun and solar wind. An outer planet flagship mission — probably either to Saturn's moon Titan or Jupiter's Europa — is also in the planning stage but will probably not be launched for many years, if at all. Some smaller missions — for example, the Osiris-Rex probe to take samples from an asteroid — are also under way. Indeed, of the major projects currently under study or in development by the NASA Science Mission Directorate, only five are planetary spacecraft (two of which are lunar probes), while one of these is the just announced InSight Mars lander as a part of the NASA Discovery program. Most of these projects are Earth science (15), astrophysics (eight) and heliophysics (seven) spacecraft.

Pure numbers of missions are not the key criteria for assessing the current state of the planetary program, of course, but the planetary science budget also took major hits in federal budget projections, down from \$1.5 billion in fiscal year 2012 to \$1.2 billion in 2013, with no indication of any increase coming in the next five years. While some outer planet missions remain on the books, only concept studies are approved. There has also been a modest investment in technology development to support planetary exploration, such as the development of the Advanced Stirling Radioisotope

Generator that is necessary for outer planetary missions and the restarting of the plutonium-238 production line.

Since the 1990s, America has participated in a golden age of scientific discovery about the solar system, made possible by coordinated efforts to create expansive, challenging and engaging programs — such as the "Follow the Water" agenda for Mars — that have benefited everyone from the millions of students jazzed by the latest images from the martian surface to elders who reflect on how we have advanced and altered our understanding of the cosmos in their lifetimes.

In the critically acclaimed television situation comedy "Sports Night," about a team that produced a nightly cable sports broadcast, one episode in 2001 included a powerful statement that relates directly to NASA's planetary science program. Actor Robert Guillaume announced on the show, "You put an X anyplace in the solar system, and the engineers at NASA can land a spacecraft on it." Through 50 years of planetary exploration that began with Mariner 2, NASA scientists and engineers have engaged in the stunning feats — Curiosity's landing is only the most recent — that Guillaume spoke about. While I hope I am wrong, I am concerned that there may not be many more "X marks the spot" planetary missions in the near future. Will efforts be expansive and engaging, as in the past, or limited and passé, as the direction we are presently heading. Since the results of decisions taken today may not be felt for several years, what are the prospects in planetary exploration into the 2020s and thereafter? Do we accept those decisions, and if not, what are we to do about it?

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V-22 OSPREY

Expanding the Operational Space

As Canada considers its search and rescue options, the V-22 is an obvious candidate to be in the mix. “Too expensive” will be the immediate response from those who have not seriously looked at the operational flexibility that such a platform offers. The range and speed of the V-22, coupled distinct possibilities for increased acquisition numbers all make it a player.

Looking at Canada’s defense capability enhancements for the decades ahead, it is crucial to consider value propositions. The off-the-shelf price of a platform is neither indicative of its full mission value nor does it accurately represent potential hidden costs or savings as it impacts across the entire military mission spectrum.

For instance, the V-22 has operationally demonstrated a number of cost-avoidance impacts on U.S. Marine Corps operations. Notably, in both Iraq and

Afghanistan, the plane can cover the entire operational battlespace. As such, costly and dangerous forward operating bases have been obviated. The V-22 has been able to operate from single operational bases to facilitate support and maintenance, and has proven it can cover the entire operational territory.

It is a plane, not a rotorcraft. It is a tilt-rotor airplane and has confounded commentators as to how to classify it or how to assess its operational impacts.

Fortunately for Canada, extensive use of the Osprey by both the USAF and the USMC has answered many of the questions about its utility, operational impact and durability.

And with the evolution of Arctic missions clearly expanding, a capacity to operate with greater range and speed is an obvious necessity.

Getting it Right

One difficulty with any complex multi-mission system is that it takes time to get it right in the development, production and manufacturing process. In today’s internet age, however, those critical stages are being negatively affected, as blogs and articles at various phases of that evolution become “google finds” forever, and “growing pains” receive more, and repeated, attention than in the past.

The problem is that context is lost and operational experience is negated. Many examples abound: from the A380, to the 787, to the A400M, the V-22 and the F-35. These platforms are significant enhancements over what came before, but all have been deemed “troubled programs”, which simply reminds us that evolution takes time – but *transformation* takes time and effort.

Today, the Osprey has progressed from a “troubled program” to an operational reality which is transforming Air Force and Marine Corps operations. Its demonstrated use in Iraq, Afghanistan, in Operation *Odyssey Dawn*, and worldwide at this point, is transforming the way the USMC operates, and with it the U.S. Navy-USMC team.

It has gone from “troubled” to “transformational” – but only the operators seem to have noticed.





A U.S. Customs and Border Patrol helicopter awaits passengers as a Navy MV-22 Osprey tilt-rotor aircraft lands in the background near the U.S. Embassy in Port-au-Prince, Haiti. The U.S. military is conducting humanitarian and disaster relief operations as part of Operation Unified Response after a 7.0 magnitude earthquake caused severe damage in Haiti, Jan. 12.

U.S. NAVY PHOTO: MASS COMMUNICATION SPECIALIST 2ND CLASS CANDICE VILLARREAL

The Osprey at 5 years

The V-22 has completed its first five operational years with the USMC. Over those five years, I have interviewed operators, maintainers and many Osprey squadron commanders. During this time, the plane has gone through various phases of deployment evolution – and with that evolution, the Marines have worked with the contractors to evolve the support capabilities for the plane.

In September 2007, the Osprey was deployed for the first time to Iraq. USMC Commandant General James T. Conway, and Deputy Commandant of Aviation LtGen John Castellaw announced a decision to deploy the Osprey into combat in spite of the fact that virtually all public commentators thought this was too early for what they deemed an “untested” aircraft.

The plane has not only performed well, but in five short years has demonstrated its capability to not only have a significant impact on combat ops but to re-shape thinking about concepts of operations.

The evolution of the con-ops surrounding this aircraft provides a solid foundation for innovation and transformation of operational concepts for the USN-USMC team – if boldness can overcome timidity.

The plane started in Iraq, built around a famous diagram showing the speed and

range of the aircraft in covering the vast countryside. As one Marine commented: “The MV-22 in the AO was like turning the size of the state of Texas into the size of Rhode Island.”

It was the only “helicopter” that could completely cover Iraqi territory. In this role, however, the testing of support and operational capabilities was somewhat limited as Marines tested out capabilities and dealt with operational challenges. The plane was largely used for passenger and cargo transport in support operations in difficult terrain and operating conditions, yet its impact was immediate. As Major General Walsh, now Deputy Commander of the USMC Combat Command, and then the air boss of Marine Air in Iraq, commented:

“With the CH-46s in Iraq, I had to put out Forward Arming and Refueling Points (FARPs) to support them. This meant sending convoys, equipment, and Marines out to operate and secure the FARPs. This also required protecting the FARPs after they were in place.

“With the Osprey, I could simply leap past all of that. The Osprey completely changed how we operated. The demand became to use the Ospreys throughout Iraq because it could go through Iraq in one day easily, and just run around the battle space. It changed completely how we used our heliborne assets.”

The V-22 was used for assault operations from the beginning but, over time, the role would expand as the support structure matured, readiness rates grew, and airplane availability become increasingly robust.

From the beginning, the aircraft impressed and foreshadowed later developments. With the withdrawal of U.S. forces from Iraq there was a roll up of forward operating bases. This meant the remaining forces had to cover more ground and provide protection at greater distance. Enter the Osprey, which did not require FOBs to provide lift and support to forward deployed forces.

Next on the agenda was the beginning of deployments to Afghanistan, which of course continue. The Afghan phase of deployments has seen the aircraft and its operators transition to more assault combat operations over time – to the point where the latest Osprey squadron just came back from Afghanistan with record setting assault operations for the platform.

A metric to measure the transition can be seen in the number of named operations the Osprey squadron participated in in Afghanistan. Over time, the Osprey squadrons have significantly increased their involvement in what the military calls “named operations” (air assault operations in support of U.S. and coalition forces). The latest squadron VMM-365 (*the Blue Knights*) conducted nearly 200 named operations – a 20-fold increase over the preceding squadron in Afghanistan.

But it took a while for the concepts of operations to change and for commanders to understand fully that they didn’t have to operate in the constricted operational box of a couple of hundred miles for the ARG-MEU, and could instead consider a 1,000 plus operational area.

Suddenly the situation in Libya hit the news, and linking the Osprey to the USN-USMC Gator navy opened up a whole new capability. The ability to seamlessly link support services ashore with the deployed fleet via the Osprey allowed the Harriers aboard the USS *Kearsarge* to increase their sortie rates dramatically. By providing a whole new speed and range enablement of the strike fleet aboard a large deck amphibious ship, the future was being re-defined by the Osprey.

And now fast forward to Bold Alligator 2012, the largest amphibious exercise held since 1996. A major difference from 1996 to 2012 was the appearance of the Osprey.

Indeed, the existence and deployment of the Osprey changed the entire approach to thinking about amphibious assault.

While observers stood on the beach waiting for the assault, Ospreys were already part of taking an “enemy” fort deep in the terrain. And not only that, one of the Ospreys had deployed from a supply ship!

Over this 5-year period, the Marines built up a significant and growing number of “Osprey Nation” members, and these folks then generated further capacity to learn and change. For Canada, this “Osprey Nation” would be a key asset as part of its solution set to Search and Rescue.

The US Army, which does not operate Ospreys has often, asked the Marines to operate MEDEVAC missions for them in Afghanistan. As Lt.Col. Christian Harshberger, Commanding Officer of VMM 365, the Blue Knights, commented about the US Army and the Osprey in Afghanistan:

“They became very interested in working with us on Medevac missions. They would pop their equipment modules into the Osprey and have us fly to where the injured soldier was operated throughout the AOR. There were a couple of times we got to the action so quickly that the Army was bringing the wounded up to the Forward Operating Base and we were arriving. What would take a helo 35 minutes to do we could do in 13.”

Expanding Mission Options

Lieutenant Colonel Boniface led and witnessed the impact of the Osprey on U.S. operations in *Odyssey Dawn*. he also led the Ospreys in *Bold Alligator 2012*, and from his perspective, the dynamics of change are simply beginning.

“There is a tsunami of change coming when we talk about the ability to fight an enemy and to support Marines ashore. We can increase our area of operations (AOR) exponentially because we can spread out our ships; now we have an aviation connector that can move Marines a tremendous amount of distance and in a very short amount of time. We can also use this capability to leverage our other aviation assets like our AV8-Bs, CH-53’s, AH-1Ws and UH-1Ys to support the MAGTF and ulti-



mately damage the enemy’s will to fight. Let’s not just move 50-100 miles ashore, but let’s move 200-500 miles ashore, and do it at an increased speed, range and lethality.”

There is change, not just for the USMC, but other U.S. services as well. The impact of putting F-35Bs and Ospreys aboard the new USS America class assault ship will transform that new large deck amphibious ship into a significant strike asset. And with the retirement of the USS *Enterprise*, provides a new “aircraft carrier” capability for the USN-USMC team. The Osprey is clearly a key enabler of this evolution.

The USN itself is considering a major buy of Ospreys for its large deck carriers. The Osprey can replace the C-2 Greyhounds and provide combat capability in place of simple transporters. It can also be modified to become an air-refueling asset. Currently, the USN is hampered by using F-18s to refuel F-18s, which certainly limits carrier operations. With the Osprey as an air refueler, whole new possibilities are opened up for USN aviation as well.

To date, the Osprey has limited connectivity and C2 functionalities. This clearly will change as the Marines bring on the F-35B and rethink connectivity in the battlespace. And clearly the USN and USMC will invest in evolving C2 capabilities for the fleet; this is another development from which Canada might benefit.

“Clearly, the number 1 change next up for the Osprey is to get significant upgrades in capability to work with other assets,”

said LtCol Boniface. “We have an excellent mission computer but it is largely designed to operate the plane and is not designed to link either as a fleet or with the force. We need to modify the mission computer to be network enabled. This will be especially important as the F-35 Bravo joins the fleet. We will have a significant C5ISR asset and we need to ensure that it has seamless connectivity with the Osprey.”

The USAF Special Operations forces (AFSOC) using the Osprey have already invested in various specialized elements aboard the Osprey which can facilitate its expanded operational envelope.

According to the USAF:

“The CV-22 can perform missions that normally would require both fixed-wing and rotary-wing aircraft. The CV-22 takes off vertically and, once airborne, the nacelles (engine and prop-rotor group) on each wing can rotate into a forward position.

“The CV-22 is equipped with integrated threat countermeasures, terrain-following radar, forward-looking infrared sensor and other advanced avionics systems that allow it to operate at low altitude in adverse weather conditions and medium- to high-threat environments.”

And over time, the USAF is likely to expand the mission sets of the Ospreys, notably in conjunction with other deployment packages. Recent dynamics in Benghazi and Gaza underscore the need for insertable and tailorable force packages, and for the USAF, their Ospreys could well be in the mix.

Global Strike

The U.S. may need a ready “global strike force”, able to insert within a very short period of time to go up against the kind of enemy the West may face, on a very regular basis, and in so doing the Osprey contribution would be highlighted.

The focus on global strike has largely been on a peer competitor; but the lessons of the last decade highlight the need for insertion forces which can do some of what was done in Iraq and Afghanistan without rolling out half of the deployable U.S. military.

The recent Israel test of an offense defense enterprise against the Hamas and Iranian power projection included several elements: defensive anti-missile systems, strike systems against missiles and tunnels, and the targeting of Hamas leadership.

The Israel version of insertable strike was demonstrated in Gaza as a key element of the package. Perhaps the USAF and related elements can craft such a relevant capability.

Bundling Ospreys and fighters into an insertable strike package could prove a useful asset, but the organization needs to incorporate such a capability in its planning. UAVs require long periods of preparation for target determination, however, rapid reaction needs appropriate tools in place and someone in the cockpit.

This is more Special Forces or USMC, but the recrafting of USAF air capabilities into small tailored strike packages able to scramble from anywhere in the world on short notice might well be a core capability to deal with a range of threats to be met in the period ahead.

Rather than baptizing the term “global strike” with ICBMs, why not focus on tailorable Osprey/fighter/tanker packages?

In short, the Osprey is having a growing impact on US military operations across the board. These roles will make the Osprey a very viable program for a long period to come.

For Canada, this means that there is a core community of a wide range of Osprey users in the United States, which can be leveraged. What may have looked like a gamble 10 years ago is now a sure bet for performance and evolution of capability based on a transformational program. **F**

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June 25, 2012

Shaping Redundant Response U.S. Military Space Capabilities

◀ ROBBIN LAIRD and ED TIMPERLAKE ▶

In a recent report by the U.S.-China Economic and Security Review Commission, the evolving threat to U.S. space capabilities was highlighted. "China is pressing forward with an ambitious counterspace program, including a ground- and space-based space surveillance systems, electronic warfare capabilities, and kinetic kill vehicles," the report said.

As the United States shapes an Asian pivot, the ability to network U.S. and allied forces is growing in importance. The Chinese understand this, and their counterspace program is designed precisely to degrade such U.S. and allied capabilities and to undercut confidence in what the U.S. and its allies can do to deal with threats in the Pacific and beyond.

The answer to such a challenge is clearly robust and redundant space-enabled C5ISR(command, control, communications, computers, combat systems, intelligence, surveillance and reconnaissance) capabilities. But the response is not simply in terms of space platforms, it is about building from the recognition that air breathing systems being deployed and about to be deployed into the Pacific provide crucial building blocks for robust redundancy.

"No platform fights alone" is a key point in understanding the design of the attack and defense enterprise of the 21st century. Space platforms are not being tasked to provide the only response to a Chinese counterspace threat. Rather, the entire C5ISR enterprise built into a honeycomb is the correct response and approach.

The Pacific capability of the U.S. mili-

tary can be built around three principles: presence, economy of force and scalability. Presence refers to having U.S. forces present and interdependent with allied forces in the Pacific. Economy of force is built around not having to bring overwhelming force to presence. But that only works if the force is scalable and has the capability to reach back and up to a surge of capability to provide for overwhelming force as necessary.

The key linchpin to do this is the C5ISR enterprise in the Pacific. With robust and redundant ISR, the enterprise enables a distributed force presence to be honeycombed. That is, the network is not about hierarchy and the ability of an adversary to

any Chinese thought of a first strike on U.S. military space systems. It makes such a strike significantly less effective and useful to Chinese military planners. From the outset, the deployed fleet and space systems forge a powerful deterrent capability.

To understand how the F-35 can intersect with the deployed C5ISR systems and provide robust redundancy for military space, it is important to understand briefly what the F-35 actually is. The F-35 is often simply referred to as a tactical aircraft, and a replacement for fourth-generation or legacy aircraft. It is really something quite different.

It represents a dramatic shift from the past. Individual F-35 pilots will have the

able to network and direct engagements at more than 1,200 kilometers in 360 degrees of three-dimensional space out to all connected platforms.

A fleet of F-35s will be able to share their fused information display at the speed of light to other aircraft and other platforms, such as ships, subs, satellites and land-based forces, including unmanned aerial vehicles and eventually robots. Tactically, "Aegis is my wingman," "SSGN is my fire support" will be developed for conventional warfare.

This enables a "tactical" aircraft to evolve into a key technology for strategic operations and impacts.

The F-35 is known as a fifth-generation player in the state-of-the-art for both the air-to-air fighter and air-to-air attack combat roles. It also adds an electronic warfare component to the fight.

Electronic warfare is a complex subject with many discreet but also connected elements. It was designed inherently into the F-35 airframe and C5ISR-D (for decision) cockpit.

Electronic warfare can include offensive operations to identify opponents' emissions in order to fry, spoof or jam their systems. In successful electronic war, often-kinetic kill weapons can be fired. An F-35 can be a single sensor/shooter or offload its track to other platforms such as planes, ships and subs and eventually unmanned aerial combat systems.

The kinetic kill shot is usually a high-speed missile designed to home on jam. It has been said on the modern battlefield — air, sea or land — if not done correctly,

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"No platform fights alone" is a key point in understanding the design of the attack and defense enterprise of the 21st century.

whack the head of the hierarchy; it is about a honeycomb of deployed and distributed capability that no adversary can cripple with a single or easy blow.

A key element for shaping a robust and redundant ISR system in the Pacific is the F-35, a tactical aircraft with strategic impact. The new aircraft is a flying combat system that has C5ISR built into the cockpit. As a fleet, the F-35s provide a critical layer in shaping a robust and redundant ISR system, which is both synergistic with space systems and complementary to those systems.

A deployed fleet of F-35s — allied and U.S. — provides a powerful deterrent to

best database of real-time knowledge in the history of combat aviation. And all of this is internal to their cockpit and enabled by advances in computer processing and sensor information fusing.

Each F-35 pilot combined with human sensing (seeing visual cues outside the cockpit) will be enabled by machine-driven sensor fusion to have combat situational awareness better than any opponent.

Concurrent with their ability to look-see, which is limited by physical realities, the F-35 pilots will be able to "see" using cockpit electronic displays and signals to their helmet allowing them not to just fight with their individual aircraft but be

The Last Compact Disc and Digital Assurance

◀ STEVEN M. HUYBRECHTS and JEFFRY S. WELSH ▶

One of us, on a visit with his daughters (ages 6 and 8) to their grandparents who still own such things, showed them a cassette tape. With only slight interest, they stared at the bizarre contraption wondering what such an odd thing could be.

Back in 1984, CDs were new and wondrous, their shiny surfaces and digital perfection almost magical. This year, the music industry may well produce the very last mass-market CD. An era that began with Thomas Edison — when music went from something that was live to something etched into a physical item you could buy in a store — will soon be behind us. Walking down a cold, wet street in Stuttgart, Germany, last year under the perpetually gray sky, one of us heard a song playing from a fruit vendor's store that he hadn't heard in 15 years. Within minutes, four different remixes were downloaded from iTunes and added to his favorites playlist.

Thus Moore's Law and the network effect, the exponential im-

pact of increased interconnectivity, have radically changed an industry — everything from how we experience music to how executives profit from it. We have gone from shelves full of 33 rpm records to carrying our entire music collection on our cellphones.

If information technology (IT) has swept radical change across the entertainment content delivery business, its impact on the newspaper business has been a tidal wave. Almost overnight it wiped out well over half of an average newspaper's revenue stream, leading a once fiercely localized industry to collapse to a handful of global brands whose news is increasingly co-mingled on tablet apps and websites rather than delivered on cold winter mornings to your front door. It has radically and forever changed publishing, the way we use libraries, the Post Office, communications, Christmas shopping and, certainly, how we will fight future wars. But one place it has barely touched is spacecraft development.

And therein lies an enormous opportunity.

Spacecraft engineers, managers and corporations are notoriously conservative people — and rightly so. These billion-dollar machines are unique in that they become almost untouchable well before they are ever turned on in their harsh operating locations. At the dawn of the Space Age, smart people set about developing a process to manage this risk that today we call systems engineering. Requirements are painstakingly decomposed by hand to their lowest component level. Components are painstakingly tested to those requirements as they are laboriously connected together into ever more complex assemblies — until a spacecraft is born. Every bolt has a pedigree and we have built a vast army of quality assurance professionals to ensure the integrity of the process. It works, no doubt, but it is very expensive and represents a large part of a satellite's cost.

The systems engineering process, developed in an era of

slide rules, is essentially a paper process that scales poorly as system complexity goes up. Overhead transparencies may have been replaced by thousands of projected PowerPoint charts, but as a decision-making experience, a three-day PowerPoint design review session is not much different from staring at transparencies, or paper copies, for those same days. Essentially, we have inculcated a paper decision-making and review process that is frozen in time. The main contribution of IT has been a dramatic increase in the ability to generate paper for this process. Witness, before it was canceled, the proposals submitted for the U.S. Air Force's T-Sat program that had to be delivered in semi-trucks.

As a method of describing systems of ever-increasing complexity, paper proposals are a highly inefficient mechanism. Similarly, PowerPoint — with its associated abstraction, necessitated simplification and the power of the message primarily in the hands of the presenter — is a lousy way to make

decisions in the modern age.

We believe that a significant portion of the troubles in recent space acquisition can be traced to a paper systems engineering process that is straining under the stress of space systems that are becoming more complex with every generation. Additionally, the development of these systems is increasingly becoming about the software — which the paper systems engineering process of requirements decomposition and testing addresses poorly.

In the late 20th century, music recordings, which were essentially Edison's needle and groove idea, got better and better — until they hit a wall. A sea change was needed to progress, first to digital on CDs, which eventually led to direct content streaming. We believe that space acquisition similarly needs a sea change. The systems engineering process should be modernized and become a digital assurance process.

With the world changing

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“you emit and you die.”

Defensively in electronic warfare there are a lot of other issues, such as electronic countermeasures, electronic counter-countermeasures, and all things “cyberwar,” which is a subject unto itself, extremely complex and not well understood.

Electromagnetic pulse concerns, infrared sensing, always protecting “signals in space” of the friendly info being transmitted and, as mentioned, jamming opponents’ signals, all are key considerations in electronic warfare.

What is necessary to succeed in evolving capabilities to fight in the age of electronic warfare?

In taking a lesson from history, before World War II, AT&T long lines research found that in order to build and keep operational a U.S. phone system, the key to success was the need for “robust and redundant” systems.

Two generations later, the F-35 was designed as both inherently robust and redundant with many sensors and systems built into the airframe structure from initial design forward. All the F-35 systems designed and developed sent electronic information into the aircraft cockpit “fusion engine.” Trusted fusion information generated by inherent aircraft systems, queued up electronically by threat, will send to the cockpit displays and the pilot’s helmet battle-ready, instantaneous situational awareness.

The ability of the deployed F-35s — again owned by allies as well as U.S. forces — presents a diversified and honeycombed presence and scalable force. This baseline force is significantly enhanced by reachback to space assets, but the space assets now receive redundancy by being complemented as well by a deployed fleet of flying combat systems. This joint capability means that the value of space-based tar-

gets goes down to the Chinese or whomever, and diversification provides significant enhancement of deterrence as well.

In short, in rethinking the way ahead with regard to military space — notably in a period of financial stringency — getting best value out of your entire warfighting enterprise is highlighted. Reorganizing the space enterprise within an overall C5ISR approach enabled by a honeycombed fleet of F-35s is a strategic opportunity of the first order.

And this re-enforces an American and allied advantage in facing competitors like China. In countless articles on the People’s Liberation Army and its way of war, author after author refer to the brilliance of Sun Tzu and his “Art of War.” The point they often make is always be alert to advantages accruing to the side that creates an “asymmetric war” advantage.

The evolving capability described above actually foreshadows U.S. and allied asymmetric robust and redundant strategic technologies. It is the beginning of a new level of deterrence against proliferating 21st century threats.

However, one of the best examples of the American “Art of War” was forcefully stated by William Tecumseh Sherman, a West Point-trained officer who arguably was one of the most visionary and capable generals in history. His words 150 years ago cautioning the South not to trigger a war still ring true to this day: “You are rushing into war with one of the most powerful, ingeniously mechanical and determined people on Earth — right at your doors. You are bound to fail.”

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around it, the space acquisition community should embrace the opportunity to apply the accelerating network effect to its acquisition system.

It should design a system with the world of 2030 in mind, rather than the world of 1970.

It should ask itself what a proposal, preliminary design review and critical design review should look like in an era of computer-aided design and ubiquitous connectivity within and between factories of 3-D printers and intelligent self-aware tools.

It should ask itself what oversight should look like with a young work force that naturally collaborates through social networks and rapid, multilayered simultaneous conversations.

It should ask how satellite designs should be documented and reviewed given the existence of virtual worlds and ever more so-

phisticated gaming technologies.

It should ask itself what acceptance testing means when computing power is such that systems can be modeled at the atomic level and every engineer has immediate access to the sum total of the world’s knowledge wirelessly.

With the iGeneration coming of age, when almost every major space acquisition of the past decade has experienced major crises, and with budgets from the U.S. Department of Defense to NASA under tremendous pressure, what better time to start this thinking than now?

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Bold Alligator 2012 was significantly more than an amphibious exercise. And in a real sense, it was not. It was a littoral force engagement exercise leveraging the sea base to operate over a very large battlespace. And it was an exercise that



By Robbin Laird, a co-founder of the Second Line of Defense website and a longtime defense and security analyst. This op-ed reflects interviews he and his team conducted before, during and after Bold Alligator 2012, and can be found at the website: www.sldinfo.com/special-report-bold-alligator-2012-and-the-future-of-the-expeditionary-strike-group operation and in Bold Alligator, provided glimpses of the future.

Bold Alligator took place from Jan. 30 to Feb. 12 along the Atlantic coast of the United States. The exercise demonstrated that the sea base can be linked ship to

picked up lessons learned from NATO's operation in Libya last year and carried them forward.

When compared with the U.S. Navy's last major amphibious exercise — "Operation Purple Star," conducted in 1996 — one of the clear differences was the impact of the Osprey tilt-rotor aircraft. The Osprey's speed and range, demonstrated in the Libyan operation and

ship, from ship to shore, from shore to ship and back again.

During the exercise, the Osprey landed on the dry cargo ship Robert E. Peary, and participated in a simulated raid 185 miles away on Fort Pickett, Va.

As the chief coalition officer involved in Bold Alligator 2012, Navy Lt. Cmdr. George Pastoor argued, "This really is about power projection from the sea and the ability to move the insertion force from and to the sea base and to operate throughout the battlespace."

The promise of the expeditionary strike group (ESG) enabled by the Osprey and the coming F-35B, the vertical-takeoff version of the Joint Strike Fighter, is really rather simple. The ESG enabled by the Osprey and the F-35B is neither a carrier battle group (CBG) nor an amphibious ready group (ARG).

It is far more flexible than a CBG in that it is a modular mix-and-match capability, which can include allies as it did in the exercise, or in Libyan operations.

And it is not simply an "ARG on steroids," as one of the Harrier squadron commanders noted. "It is far more capable."

An ESG will allow for an economy of force whereby the ARG-U.S. Marine Corps Expeditionary Unit can be scaled up to include

other sea-based or air assets to dominate the battlespace. It is scalable, both in terms of assets contained within the sea base or contributed by various land support structures, air or ground.

According to the 2nd Marine Expeditionary Force commander in the exercise, Brig. Gen. Christopher Owens, who will soon be moving to Okinawa, by strengthening the ability of the sea base to provide for logistics ashore, one can insert force without moving an iron mountain with it ashore.

And "we get away from that image of amphibious assault where we're going into a limited area, and that you have limited places you can land, so the enemy knows you're coming to one of these two places. The goal of the ESG is to hit them where they're not."

The distributed character of the sea base seen in this exercise and highlighted by the evolving ESG allows for a modular mix-and-match quality that can embody the key elements of what one wants in 21st-century forces: presence, economy of force and scalability.

The F-35B will become a key enabler for an ESG and provide a significant opportunity to redefine and rescope the role of the large-deck carrier.

As the commanding general of 2nd Marine Aircraft Wing, Gen.

Jon "Dog" Davis, who rode on the F-35 test bed during the exercise, has argued, "The F-35 community of users — sea-based and land-based — will be able to create a pretty tight air grid over the top of the distributed battlespace so we can share information very freely out there. The key is to have these airplanes networked over top, where they're able to see deep into the enemy battlespace, or the objective area, but also sharing that information."

And as Col. Kevin Iiams, Davis' deputy at 2nd Marine Aircraft Wing and a fellow rider on the F-35 combat systems test bed, added, "We're right-sizing our assault so that we put the right force in the right place at the right time against the right enemy and objective, while minimizing overall footprint/exposure ashore."

As for the strategic relevance of the newly reconfigured ESG, it is not hard to look at current events to find its central role. The evolving Middle East is rapidly creating the need for such a capability, and such a transformation of U.S. and allied forces. And remember the core role that allies played in Bold Alligator.

With the Arab Spring, the security and defense framework the West has underwritten over the past 30 years is shattered. The Arab Spring states are in up-

heaval, the Iranians are preparing to emerge as a nuclear power, the conservative Arab states have to prepare to defend themselves against Iran, and the interaction between Arab Spring forces and the stability of the key conservative Arab states is significant.

Who will the West be aiding and abetting if the Arab Spring continues to pull the rug out from under the de facto conservative Arab, Israeli and Western alliance? Will Western states be able and willing to deploy land-based forces, whether ground or air, on Arab soil? And given uncertainties even in key Arab allied states, how might the West best defend its interests and ensure energy security in the region?

There are several elements pre-saged in Bold Alligator that are relevant to the reshaping of Western capabilities to protect Western interests. One of these was suggested by the role of Harrier jump jets in the exercise. Harriers based on the amphibious assault ship Kearsarge worked closely with land-based air assets to provide a significant air combat capability to shape the battlespace.

This model can be followed with Arab air forces, the Israel Air Force or Western air forces deployed temporarily on Arab soil.

The point is that the organizer of the spear is on the sea base, and this capability can be conjoined with the various air combat centers extant or being developed in the region. This is a role the evolving ESG, under the twin influence of the Osprey and the F-35B, will be well suited to play. □



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COVER: A bronze statue of a Marine sentry at Jacksonville, N.C.'s Beirut Memorial guards the break in the wall signifying the Marines' peacekeeping mission in Beirut from 1982 to 1984. Photo by CWO-4 Randy Gaddo, USMC (Ret). Copies of the cover may be obtained by sending \$2 (for mailing costs) to *Leatherneck Magazine*, P.O. Box 1775, Quantico, VA 22134-0775.

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Shaping Marine Corps Aviation's Future in the MAGTF: The VMX-22 Contribution



Aviation Boatswain's Mate (Handling) Second Class Luiz Diaz signals to an MV-22 Osprey from Marine Tiltrotor Operational Test and Evaluation Squadron (VMX) 22 as the aircraft prepares to land on the flight deck of USS *George H. W. Bush* (CVN-77), Jan. 29, 2013. (Photo by MC2 Tony D. Curtis, USN)

By Robbin Laird and Ed Timperlake

During a July 2013 visit to Marine Corps Air Station New River, N.C., we had a chance to talk with Colonel Michael R. Orr, Commanding Officer, Marine Tiltrotor Operational Test and Evaluation Squadron (VMX) 22. The squadron is charged with conducting operational testing with the U.S. Marine Corps' aviation assets and with helping shape Marine Corps aviation's contribution to the mission success of the Marine air-ground task force (MAGTF). Several years ago, VMX-22 led the way with the first deployments of Ospreys to Iraq.

The command has a flat organizational structure. The size of the command is approximately 140 Marines. A 30-man

detachment is at Edwards Air Force Base, Calif., working on the F-35 Lightning II, and a small detachment is at MCAS Yuma, Ariz., working with unmanned systems and command and control systems, such as the Gator radar, while most of the MV-22 Osprey and CH-53K work is done at New River.

VMX-22 is in transition as it will move to Yuma, by 2015. At Yuma, it will be collocated with Marine Aviation Weapons and Tactics Squadron (MAWTS) 1 and the F-35B aircraft, the next-generation strike-fighter for the Marine Corps, with the clear goal of working integration across the aviation elements in support of the MAGTF.

Testing, with regard to VMX-22, refers to operational testing rather than develop-

mental testing. The focus is upon enhanced mission effectiveness.

"We don't have white coats," said Col Orr. "We focus on operational tests: Does this new weapon system enhance mission effectiveness? Does this new variation of a platform make sense from a mission effectiveness point of view?"

To do this work, the command is built from the recruitment of aviators with significant combat and Marine expeditionary unit (MEU) experience. The focus upon mission effectiveness allows "us to speak language which the MEU commander will understand. He is not reading through a Pentagon capabilities-requirements-production document; he is looking to enhance his mission effectiveness. That is what he is looking to do, and we are

focused on meeting his needs along those lines," said Orr.

Another key aspect of the command is building out the future of Marine aviation from the standpoint of the twin impact of the Osprey and the F-35B. The core platform which has provided for disruptive change is the Osprey. VMX-22 was stood up in August 2003 and laid the groundwork for Marine Medium Tiltrotor Squadron (VMM) 263, the first operational Osprey squadron which was stood up in March 2006.

With speed and range, combining qualities of a plane with a rotorcraft, the Marine Corps has gradually introduced change throughout the MAGTF. No other service has experienced the fundamental change which the aircraft has introduced into the deployed force.

The Osprey has been a USMC platform, but now foreign partners clearly are interested in and are in the process of acquiring the aircraft. The U.S. Navy has worked with VMX-22 to determine the Osprey's role on the large-deck carrier. The USN is looking at the Osprey as a C-2 Greyhound aircraft replacement, but obviously it could be far more than that for the large-deck-carrier community.

According to Col Orr, "Assisting the Navy with the COD [carrier onboard delivery] military utility assessment has been a significant effort and has involved most of the V-22 flying portion of the squadron over the past few months. We've conducted four at-sea periods on both the USS *Bush* [USS *George H. W. Bush* (CVN-77)] and the USS *Truman* [USS *Harry S. Truman* (CVN-75)] to try to help the Navy to perform an assessment on the viability of the Osprey as a carrier onboard delivery, or COD platform.

"This has been a significant effort from the squadron, but it has been time well spent. For our last evolution, we deployed with a VRC logistics squadron to Mayport, Florida, to replicate the traditional COD role as closely as possible.

"The purpose of the assessment has been to determine the impact of the Osprey on the aircraft carrier's cyclic air operations.

"After all, we know the aircraft can perform well, moving people and parts to and from ships—it was designed and built to do that.

"The question we're answering is 'What impact will Osprey operations have on cyclic air operations?'

"Carrier launch and recovery cycles are a finely orchestrated aerial ballet, and we wanted to find out what impact, if any, the Osprey would have. Part of our preparations involved making sure our crews were well-trained to handle the different



Above: Ospreys sit ready on the flight line at MCAS New River, N.C. (Photo courtesy of Second Line of Defense)



LCP KELYR CHASE

Above left: Cpl Ryan Simmons, left, an MV-22 crew chief with VMM-263, conducts post-flight maintenance on an MV-22 Osprey as Sgt Kenneth Mionske, a VMM-263 air frames quality assurance representative, looks on at the flight line at Al Asad, Iraq, Jan. 31, 2008.



LCP KELYR CHASE

Above right: Cpl Charles Bishop, left, an MV-22 crew chief with VMM-263, receives instruction from MSgt Maurice Defino, a VMM-263 avionics chief, on the flight line at Al Asad, Jan. 31, 2008.

launch and recovery operations in and around the ship.

"Navy leaders will be using our data to make the final determination to write this assessment. We'll be helping COMOPTEVFOR [Commander Operational Test and Evaluation Force] analyze the data and will assist the Navy in conducting the analysis.

"From my perspective, I think the assessment went very well. We were able to complete all the necessary looks, and the crews and equipment worked magnificently."

The Osprey has prepared the USMC for its next big innovation, the F-35B Light-

ning II. The Marines are replacing three types of aircraft—the F/A-18 Hornet, the AV-8B Harrier and the EA-6B Prowler—with the F-35B. This "flying combat system" will deliver intelligence, surveillance and reconnaissance (ISR) and command and control (C2) to the force, and for the first time the amphibious fleet will have its own organic electronic warfare (EW) and ISR capability built into a strike asset.

And with the capability of the F-35 to share information across the fleet, the key reality of the aircraft will be reach, not range. Deploying with other F-35s in the Pacific, for example, will allow the Marine Corps F-35Bs to share situational



SECOND LINE OF DEFENSE

During a July 2013 visit to VMX-22 at MCAS New River, the authors observed the forming of an aviation combat element for a Marine expeditionary unit. This UH-1Y "Venom" and the new AH-1Z Super Cobra share more than 80 percent commonality in parts, making aviation maintenance much easier for deployed units.

awareness and decision making with other F-35s in the allied and American fleets.

Col Orr underscored how important the collocation was going to be to better understand and shape the way ahead on 21st-century combat operations.

"We will begin to bring together all of the key elements of USMC aviation under one roof at Yuma. We are going to do all aviation testing under VMX-22 collocated with the weapons and tactics school. We think there are major synergies to be gained from such an approach. This will allow us to move forward on dealing with the important challenges of interoperability, sharing data or more effective integration approaches across all of your platforms. That is where the magic will really come from," according to Col Orr.

The command will have a key role in shaping the future of unmanned systems. For the USMC, unmanned systems are one part of the future of airpower, not the cornerstone of the future of airpower. The leadership of the Marine Corps sees unmanned systems as a key element in the mix of evolving air capabilities, but rooted in a solid transformational manned-aircraft foundation.

Orr added, "There is no area of Marine Corps aviation more ripe for change than in the unmanned-air-systems area."

Orr suggested three lines of change that the USMC is clearly examining.

First, the Marine Corps has used unmanned aerial vehicles (UAVs) to support Iraq and Afghan operations. "These systems were line-of-sight systems, or essentially flying binoculars. As an expeditionary force, this is very limiting. We need non-line-of-sight UAVs to really

support the deploying and deployed force. We are building distributed operations or dispersed force, so look to UAVs to work with that paradigm, not supporting a fixed force sitting in forward operating bases."

Second, the USMC is looking to leverage the investments of other services. "We are a frugal service and have a long tradition of leveraging other people's systems and then reinventing them for our approach. We will start by testing new approaches with existing systems, which are returning from Afghanistan and have no real future for operations. With a surplus of UAVs coming back, this will give us a good chance to experiment as well."

Third, the future of UAVs lies in not replicating the big airplanes and making expensive combat UAVs mimicking the production approaches and costs of manned systems. "The real future lies in building modular UAVs, which can carry a variety of payloads. For example, with EW payloads we can test out defenses and adversary capabilities and then based on that information shape our approach. UAVs can offer the possibility that they are the exact reverse of manned aircraft—expedient. But this advantage can only be leveraged if they are cheap."

Col Orr highlighted modularity as a key element in part because the same UAV airframe could contain a variety of payloads, and, as such, this could create inherent confusion in the adversary's mind. "By shaping complexity in terms of delivering a capability, one can gain a combat advantage, especially for a distributed force," he said.

The overall approach of VMX-22 is to bring about synergy among the various

aviation elements and to deliver enhanced combat effectiveness to the MAGTF.

According to Col Orr, "My experience in the F/A-18 world has demonstrated what a robust link network can do to increase warfighting capability. I think about bringing some of the warfighting benefits that come from increased battlespace awareness to the entire aviation combat element and not just the strike and fighter elements.

"Think about what you can do if you have linked situational awareness, not just between individual aircraft of the ACE [aviation combat element of the MAGTF], but also of the supported ground component commander that's riding in your aircraft. By using systems to increase the MAGTF commanders' situational awareness, we will see revolutionary improvements to the synergy across the MAGTF and joint force.

"For VMX-22, our vision is to be that organization that brings together all of those different pieces and parts of the ACE for the express purpose of driving new tactics, new concepts for employment and information sharing for effective decision making."

Nonetheless, to get to such an innovative future clearly requires leadership. There has been much resistance to the introduction of the Osprey into the Marine Corps. But as retiring (in only one sense of the word) Osprey commander Col Christopher C. Seymour put it during the MCAS New River visit: "We had to make it clear to the internal critics and those attached to the past. You are not stakeholders; you are Marines."

Editor's note: The USMC approach is detailed in a new book, "Three Dimensional Warriors" (Second Edition), and can be purchased on Kindle and from other e-book publishers.

The authors also have written "Rebuilding American Military Power in the Pacific, A 21st-Century Strategy," to be published by Praeger in November.

Robbin Laird is the co-founder of Second Line of Defense and a longtime analyst of global defense issues and in recent years has followed closely the evolution of the new 21st-century aviation capabilities worldwide. Ed Timperlake is the editor of Second Line of Defense Forum and a former commanding officer of VMFA-321.



Leatherneck—On the Web

See more photos of VMX in action and a video interview with the CO at www.mca-marines.org/leatherneck/VMX

Pivot point:

Re-shaping US maritime strategy to the Pacific



A multinational armada seen underway during the RIMPAC 2012 exercise. RIMPAC and similar regional exercises will take on an increasing importance as the US seeks to improve interoperability and strengthen engagement with partners across the Pacific region.

The strategic pivot toward the Asia-Pacific region is intended to rebalance the projection and focus of US military power in the years ahead. However, it will not be without its challenges. **Robbin Laird** and **Ed Timperlake** offer this analysis

During the past 18 months President Barack Obama's administration has put in motion a set of policy changes that will re-shape US strategy in the Pacific. The challenge in successfully implementing this is that, after more than a decade of war in Iraq and Afghanistan, the US military is confronting a depleted set of key capabilities.

New defence guidance, maritime strategy and shaping capabilities are essential to ensuring a successful transition in the Pacific. However, in the presence of looming resource constraints, how will this happen and what kind of innovative thinking might drive a shift in Pacific strategy? If 'hollow thinking' goes along with hollowing out the force, no 'Pivot to the Pacific' will actually succeed.

Furthermore, there will not be a set of briefing charts that can express what a successful Pacific strategy might look like.

The strategy will be remade by responses to events, and leveraging new technologies in the Pacific as US forces work with allies and other partners to deal with various threats and challenges as they emerge across the region. A new Pacific strategy will only be successful if based on partnership.

Strategic challenges

The challenges currently confronting the US armed services in the Pacific are far different than those of 2001. Not only have conflicts in Afghanistan and Iraq consumed US defence investment and taken critical thinking away from air-sea maritime theatres such as the Pacific, but new threats and challenges have substantially re-shaped the theatre.

The most obvious change has been the rise of China and its emergence not only as the key economic partner of the major trading nations

in the Pacific, but also their major strategic challenge. The issue facing the United States and its allies is how to shape a strategy that allows robust economic collaboration with China, while simultaneously developing a capacity to constrain Chinese ambitions and influence in the Pacific and beyond. To retain the upper, the United States has postulated a new and inherently scalable concept that combines forward presence with high levels of interoperability with regional allies.

Another significant strategic challenge is the rapid emergence of the Arctic Ocean areas as key drivers of global economic and energy development, as well as opening up new, shorter transit routes to European markets from Pacific ports. This will additionally enable Russia, should it require to do so, to coalesce its European and Pacific maritime forces. China will also be able to use transit

routes in the Arctic and be a key player in the economic development of Arctic areas where it can exert strategic influence. Meanwhile, the five-nation “Arctic 5” group – Canada, Denmark, Norway, Russia and the United States – will seek to shape a strategic agenda at the top of the world.

In addition to the new strategic dynamic is the role of nuclear weapons in what defence strategist Paul Bracken calls the ‘second nuclear age’. Any realistic US strategy for the Pacific has to be built around nuclear deterrence as a bedrock element, but increasingly some strategists in the US wish to rule nuclear weapons ‘out of the equation’.

The strategic reality is quite different. Deterrence in a region like the Pacific will be significantly shaped by the presence of nuclear weapons. China is strengthening and diversifying its nuclear force, while North Korea is building and expanding.

Another dynamic is the growing military capability of key allies in the Pacific such as Australia, Japan, and South Korea. Each of these is building specific capabilities to secure their national interests, and the challenge for the United States will be to work more effectively with those allies in constraining China’s rise.

In effect, the United States will need to shape a new strategy in the Pacific. Any US-China rivalry in the region will revolve around who has the most effective allied strategy, and whether or not the United States delivers what the allies are looking for. In short, presence, engagement and effective capabilities to deflect Chinese efforts to dominate in the region.

Integrated approach

Accordingly, the US Navy (USN) and US Marine Corps (USMC) – complemented by the US Air Force (USAF) and the US Coast Guard (USGC) – are having to think afresh to shape a different approach in the Pacific. One expression of such ‘integrationist’ thinking has been the Air-Sea Battle construct.

The Air-Sea Battle is ultimately about the future of power projection in the region, and overcoming the challenges posed by China’s growing anti-access/area denial (A2/AD) capabilities. The objective of the Air-Sea Battle is clear: to enhance conventional deterrence in the Pacific to offset the rise of Chinese political, military and economic influence.

For the authors of the Pentagon’s Joint Operational Access Concept (JOAC), the Air-Sea Battle is a subset of the broader

strategic problem of presence and access. Nonetheless, the document contains a very clear statement regarding what it believes is the focal point of the Air-Sea Battle concept: “The intent of Air-Sea Battle is to improve the integration of air, land, naval, space, and cyberspace forces to provide combatant commanders with the capabilities needed to deter and, if necessary, defeat an adversary employing sophisticated [A2/AD] capabilities. It focuses on ensuring that joint forces will possess the ability to project force as required to preserve and defend US interests well into the future.

“However, it is important to note that Air-Sea Battle is a limited operational concept that focuses on the development of integrated air and naval forces in the context of [A2/AD] threats. The concept identifies the actions needed to defeat those threats and the materiel and non-materiel investments required to execute those actions.”

The capacity to work more effectively across the US military services in delivering capabilities to the combatant commanders to support operations is central to the Air-Sea Battle concept. As then Chief of Staff of the USAF General Norton Schwartz commented in the JOAC document: “Our testing last year of an [Lockheed Martin] F-22 [fighter] in-flight, re-targeting a Tomahawk cruise missile that was launched from a [USN] submarine, is an example of how we are moving closer to this joint pre-integration under our Air-Sea Battle concept.”

Admiral Jonathan Greenert, Chief of Naval Operations, provided another characterisation during the same presentation, observing: “Air-Sea Battle uses integrated forces for what we like to think as three main lines of effort. It’s integrated operations across domains to complete, as I said, our kill chain,

but it’s also Air-Sea Battle lines of effort to break the adversary’s kill or effects chain. We want to disrupt the C4ISR piece of it; decision superiority.

“How do we get into that information superiority area? Defeat of weapons launch, get to the archer, or defeat the weapon kinetically to defeat the arrow?”

“Looking at those three lines of effort, kind of summarises how we approach that? Air-Sea Battle is a subset of a broader presence and engagement challenge.”

If China and North Korea are the foci, then re-enforcing the entire US precision strike enterprise is the priority. The objective is to have as many forces as possible that can be deployed forward to strike Chinese or North Korean assets in time of war.

Precision strike coming by air, ground, and sea forces would be the means to target as many aim points as possible to create escalation dominance and to win the Air-Sea Battle. In a more traditional mindset sense, the onus falls on carrier strike groups, air/expeditionary strike groups, and systems like long-range bombers that can deliver large strike packages.

However, what if the Air-Sea Battle really is more about shaping a presence with reach back to other capabilities to support a different kind of force architecture and a different set of objectives? If so, deploying precision strike on as many platforms as possible is not the means to the end. Rather, a different set of ends could well drive a new approach.

Maximising presence forces able to operate across the entire spectrum of security and military operations then becomes the focus. These forces need to be effective, agile, and scalable with both significant interoperability in the region and reach-back to surge forces operating on the fringes of the Pacific.



US Secretary of the Navy Ray Mabus meets with Chinese officials in Beijing in November 2012. Mabus visited China as the United States is rebalancing its maritime force towards the Pacific.

Assuming the approach is not primarily about striking Chinese and North Korean assets, but to constrain adversary operations in the Pacific and beyond, the tools needed are presence, partnership building and operations – and an ability to put in place distributed, forward-deployed capabilities that can be rapidly augmented.

Indeed, USN and USMC leaders are discussing presence in terms of the Single Naval Battle. Rather than a monolithic strategy, it is a mindset about how to shape templates for more effective integration of naval forces in the epoch ahead.

The USN and USMC might not use the term 'single naval battle', because in today's media world, one would spend endless time debating what the concept means. The point is less about the concept and more about how to shape a mindset, which will lead to tighter integration of the key elements of naval power projection.

Commanders' perspectives

During recent interviews conducted by IHS Jane's with US commanders involved in Pacific operations, a common thread was simply the size of the Pacific Area of Responsibility (AOR), and the challenge of operating limited forces over such a large region.

There is also concern with the limitations on available resources to operate throughout the depth and scope of the Pacific. For example, the USGC is concerned about the absence of major vessels and how many of the improved

National Security Cutters will be procured. This concern was matched by worries about the numbers of amphibious ships.

In all discussions, the demand on resources was highlighted. For example, Marine Forces Pacific conducted more than 100 exercises and events during 2012, spread across 48 countries, both inside and outside the AOR. This included deploying the first marines to start a more permanent presence in Australia.

Through the training efforts, the USMC established an operational presence throughout the entire region. Training kept deployed marines as the ready force to respond when crises occurred, and through forward training in the region, the USN and USMC teams were able to respond when a crisis such as the flooding in Thailand and the Philippines with forces that were already in theatre.

Furthermore, it was clear from the interviews that ongoing operational demands made it difficult to move forward on a new strategy without additional investment in platforms and systems. Implicitly, if the US does not invest in new platforms and systems, there will inevitably be a shortfall in future US capabilities in the Pacific.

For General Mike Hostage Commander, Air Combat Command, there is no alternative but to build out air capability with Lockheed Martin F-35 Lightning II Joint Strike Fighter aircraft. He is clearly concerned with numbers and the need to procure a serious fleet of F-35s to provide the kind of "combat cloud" crucial to cover an area as vast as the Pacific. The fleet

implications are also about innovative new ways to work with allies. Gen Hostage said: "The F-35s are central to the transition. We are operating in contested air space and need to shape a distributed air operations capability."

"The F-22s aggregated in appropriate numbers can do some amazing and essential tasks, and with a significant number of F-35s, we can reshape the operational space."

"The ability of the planes to work with each other over a secure distributed battlespace is the essential foundation from which the air combat cloud can be built. And the advantage of the F-35 is the nature of the global fleet."

"Allied and American F-35s, whether USAF, USN, or USMC, can talk with one another and set up the distributed operational system. Such a development can allow for significant innovation in shaping the air combat cloud for distributed operations in support of the Joint Force Commander."

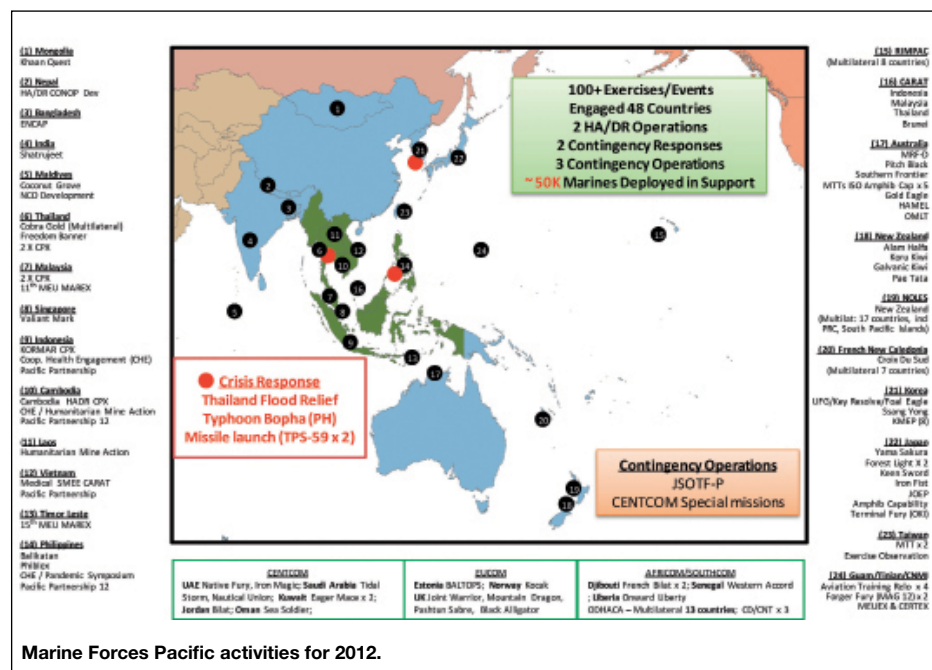
In addition to diminishing platform numbers, many leaders expressed concerns about new challenges and emerging threats. For General Charles Jacoby, US Northern Command and North American Aerospace Defense Command chief the addition of the Arctic as an operating environment meant new challenges and new demands for resources:

"We need to make advances over time that [will] allow us to stay ahead of evolving problems, with a solid strategic direction defined and in place. There is a school of thought that says we can have competitive commercial and economic interests in the Arctic, but not have any associated security challenges. That is simply not the way the world works."

"Economic opportunities and challenges shape or imply security interests. We need to not only be prepared to take advantage of and exploit the economic opportunities in the Arctic, but also to be prepared to address security challenges."

For Lieutenant General Jan-Marc Jouas, deputy commander of United Nations Command Korea and US Forces Korea, the evolving North Korean missile capabilities ramps up the challenges to providing for the kind of air superiority crucial to deterrence in the future: "Air power is an essential element in Korea. This is a 'come as you are' fight over here. No one is going to let us reinforce for six months; when people take on the United States, they know they don't want to give us the time to build up our forces."

By air power, Gen Jouas was discussing the full range of integrated assets whether on land or at sea. He emphasised the central role



of support from the sea to the evolving threat environment on the Korean peninsula.

A common emphasis throughout was the need for what Lieutenant General Terry Robling, Commander, US Marine Corps Forces Pacific, called “persistent presence.” If you are not there, you are not a player: “The United States has been a significant presence in the region throughout the post-war period. That presence has been significant glue in the region facilitating both security and economic growth. Our allies and partners certainly recognise this and are looking at new ways to work with us to get that persistent presence.

“A key driver of demand is from partner nations, as well as the more obvious allies. South Korea, Japan, Australia and Thailand are certainly core allies, but we have growing demand from and opportunities with Cambodia, Vietnam, India, Malaysia and Indonesia for expanded working relationships.”

Coupled with “persistent presence” was a significant emphasis upon partnering and alliances and innovations in ways of working with other forces.

As Vice Admiral Manson Brown, then head



The guided-missile destroyers USS Fitzgerald (DDG 62) and USS McCampbell (DDG 85) manoeuvre with the Chinese People's Liberation Army Navy Type 052B destroyer Guangzhou off the coast of North Sulawesi, Indonesia, in 2009. The rise of China represents the biggest challenge to US influence in the Pacific.

US Navy - 1405130

of the USCG in the Pacific, emphasised: “It’s presence in a competitive sense, because if we are not there, someone else will be there, whether it’s the illegal fishers or whether it’s Chinese influence in the region. We need to be very concerned about the balance of power in the neighbourhood.

“If you take a look at some of the other players that are operating in the neighbour-

hood there is clearly an active power game going on.”

A key theme for the commanders was shaping an effective logistic and sustainment approach to supporting a widely deployed fleet of aircraft and ships. The head of the Military Sealift Command, Rear Admiral Mark H Buzby, provided an important “reality” check to the challenge of supporting deployed assets

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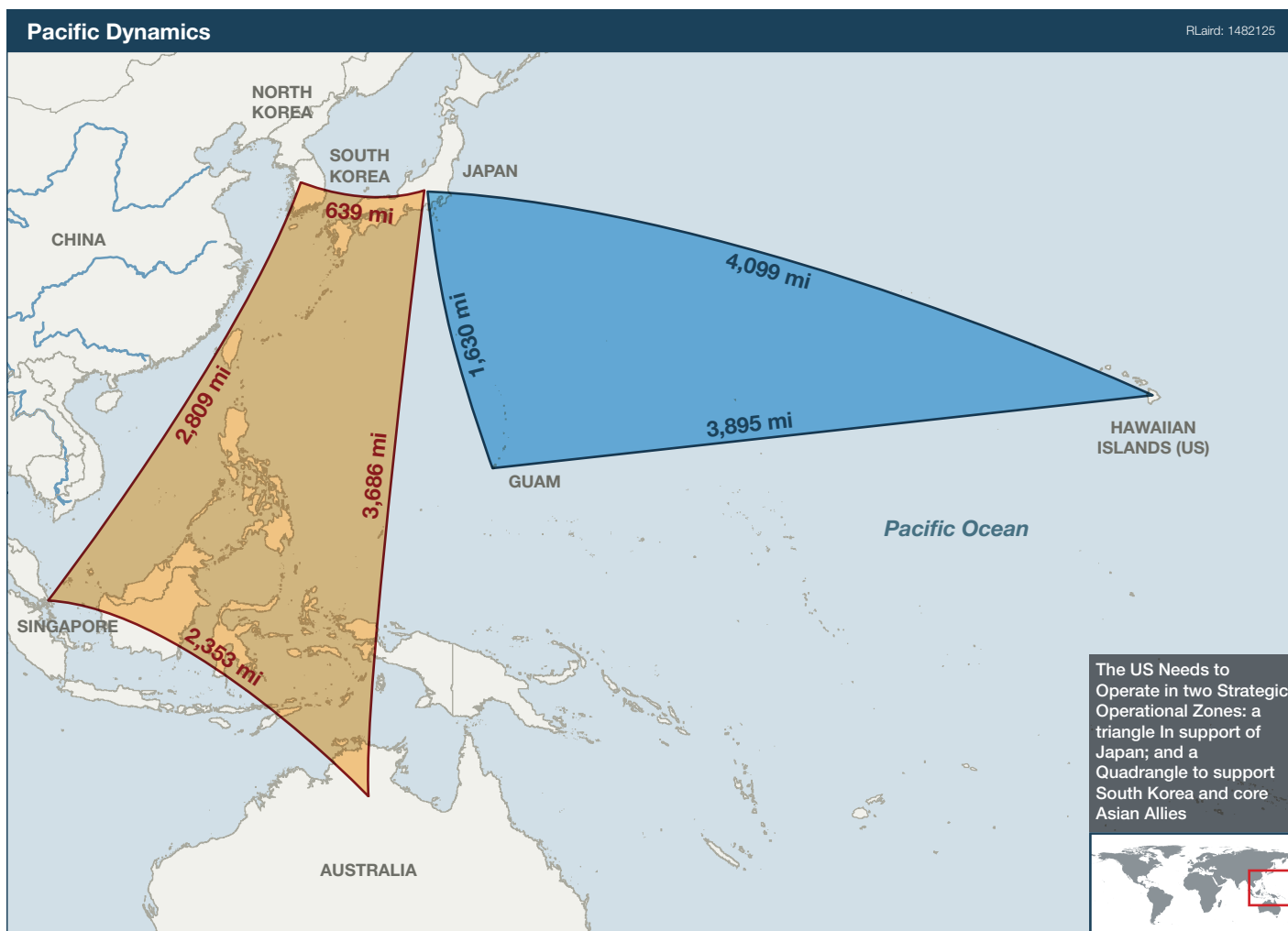
- 7.62 mm / 12.7 mm MG
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- 12.7 mm GAU-19/A Gatling Gun

STOP System:

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over a wide swath of ocean, pointing out that the kind of distributed fleet operations central to the future would place significant logistical demands on the fleet as well.

Several of the commanders cited operational innovations they were making to try to cope with the gap between demand and supply for security and defence forces.

For example, Major General Christopher Owens, Commanding General, 1st Marine Aircraft Wing, discussed how the Bell-Boeing MV-22 Osprey tilt-rotor aircraft was being leveraged to allow USMC forces to operate over a wider area and on a wider variety of platforms and locations to shape presence capabilities. “When I was a young lieutenant and captain, I think we had somewhere in the neighbourhood of 65 amphibious warships in the navy inventory. Now, we have 28 and they’re spread about as thin as they possibly can be. We’re running through their lifecycle faster than anticipated, and yet they’re never enough.

“Going back to the whole challenge in this

AOR is getting to where you need to be with some capability. Being able to stretch the legs of the aircraft and operate from austere sites is critical.”

An important modernisation effort involves command and control (C2) and information warfare systems to be developed, deployed, and integrated with US and allied forces in the Pacific. There are clear flashpoints or decision points, which can be leveraged to highlight modernisation opportunities.

A final theme, which was discussed but not highlighted in the interviews, was the A2/AD challenge posed by China, among others. Because these were commanders, they were not treating the problem as fixed in concrete, but very much in terms of dealing with a reactive opponent. A2/AD is an operational problem, not a final statement of an inability to deal with the challenge.

One commander who spoke to *IHS Jane’s* about the A2/AD challenge argued that thinking among many strategists is too narrowly focused: “The Chinese have an

advantage if they can use their resources on the mainland to support operations fairly close to their territory, he said”. That is not the strategic direction in which they are headed. They are coming out into the Pacific. And if we build the appropriate distributed force able to work closely with allies, then they have a different kind of anti-access, anti-denial problem of their own.”

Strategy will emerge in response to crises and when leveraging new technologies and allied relationships in the decades ahead, leadership will be imperative. Between the two world wars, the United States faced significant challenges to redefine naval strategy. As such, leadership emerged and guided the transformation of maritime forces and capabilities that paid dividends during the Second World War.

What was demonstrated by key leaders at that time was a profound grasp of the harsh reality that all military technology is evolving, and thus in a constant relative action/reaction cycle against a reactive enemy.

So how might US forces be shaped and work with allies to execute a 21st-century maritime strategy, one which draws on the diversity of air, ground and sea assets necessary for success?

There are two ways to think of the strategic objectives of force structuring in the period ahead. The first can be called shaping an attack and defence enterprise. The second can be labeled as the 21st century equivalent of the "big blue" blanket that the USN crafted to succeed in the Pacific in the Second World War.

The evolution of 21st-century weapon technology is breaking down barriers between offensive and defensive systems. Is missile defence about providing defence or is it about enabling global reach, for offence or defence? Likewise, the new fifth-generation aircraft have been largely misunderstood because they are inherently multi-mission systems, designed for both forward defence and forward offensive operations.

Indeed, an inherent characteristic of many new weapons systems is that they are really about presence, and laying a 'grid' over an

operational area so as to enable both strike and/or defence within an integrated context. In the 20th century, surge was built upon the notion of signaling: one would put in a particular combat capability – a carrier battle group, amphibious ready group, or air expeditionary wing – to put down a marker and to warn a potential adversary that you were there and ready to be taken seriously. If one

needed to, additional forces would be sent in to escalate and build up the force.

With today's new multi-mission systems – fifth-generation aircraft and the Aegis battle management system for example – the key is presence and integration with those same assets able to support strike or defence missions in a single operational presence capability. Now the adversary cannot be certain that



A2/AD challenges are spurring new programmes, such as DARPA's Long Range Anti-Ship Missile prototype demonstration programme.

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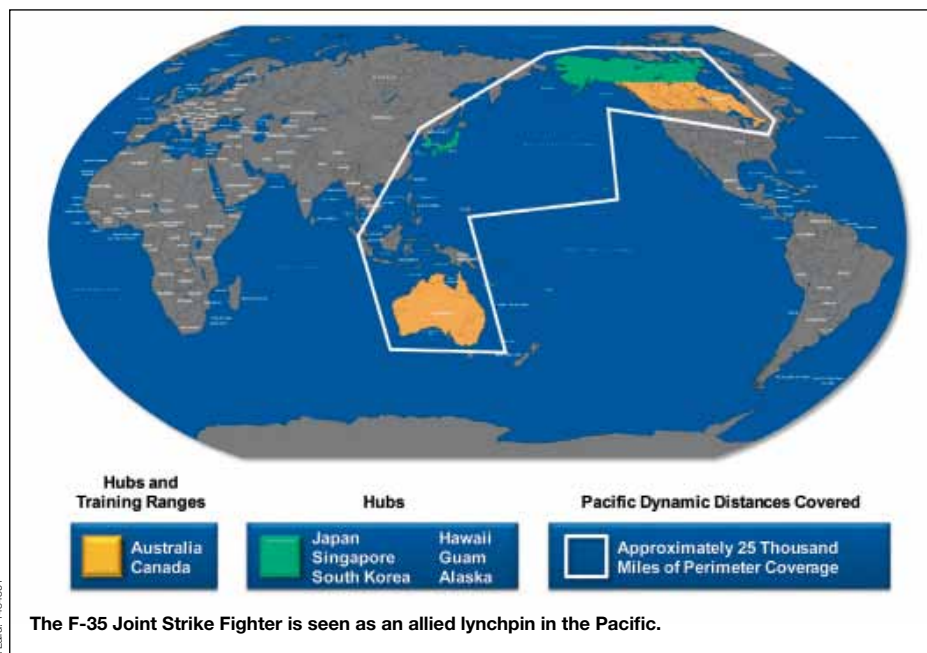
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The wake of the future



one is simply putting down a marker. This is what then USAF Secretary Michael Wynne called the “attack and defence enterprise”.

The strategic thrust of integrating modern systems is to create a grid that can operate in an area as a seamless whole, able to strike or defend simultaneously. This is enabled by the evolution of C5ISR (Command, Control, Communications, Computers, Combat Systems, Intelligence, Surveillance, and Reconnaissance), and it is why Wynne has underscored for more than a decade that fifth-generation aircraft are not merely replacements for existing tactical systems, but a whole new approach to integrating defence and offence.

By shaping a C5ISR system inextricably intertwined with platforms and assets that can ‘honeycomb’ an area of operation, an attack and defence enterprise can operate to deter aggressors and adversaries or to conduct successful military operations.

Inherent in such an enterprise is scalability and reach-back. By deploying the C5ISR ‘honeycomb’, the shooters in the enterprise can reach back to each other to enable the entire grid of operation, for either defence or offence.

In effect, what could be established from the US perspective is a ‘plug-in’ approach rather than a ‘push’ approach to projecting power. Allies are always forward deployed; the US does not attempt to replicate what those partners need to do in their own defence.

But what the US can offer is strategic depth to those allies. At the same time if interoperability and interactive sustainabil-

ity are recognised as a strategic objective of the first order, then the US can shape a more realistic approach than one which now rests on trying to proliferate power projection platforms, when neither the money nor the numbers are there.

Geo-political realities

As things stand, the core for the US effort from Hawaii outward is to enable a central strategic triangle, one that reaches from Hawaii to Guam and to Japan. This triangle is at the heart of the US’ ability to project power into the Western Pacific. With a 20th-century approach, one which is platform centric and rooted in step by step augmentation of force, each point of the triangle needs to be garrisoned with significant numbers of platforms which can be pushed forward.

To be clear, having capability in this triangle is a key element of what the United States can bring to the party for Pacific operations, and it remains fundamental. However, with a new approach to an attack and defence enterprise, one would use this capability differently from simply providing for push forward and sequential escalation dominance.

Rather than focusing simply on projecting power forward, what is crucial to a successful Pacific strategy is enabling a strategic quadrangle in the Western Pacific, anchored on Australia, Japan, Singapore, and South Korea. This will not be simple. Competition, even mutual suspicion, among US allies in the Western Pacific is historically deep-rooted; as

a former US 7th Air Force commander underscored, “history still matters in impeding allied co-operation.” But in spite of these challenges and impediments, enabling the quadrangle to do a better job of defending itself and shaping interoperability across separate nations has to become a central strategic US goal.

This will require significant cultural change for the United States. Rather than thinking of allies after its own strategy, it will need to reverse its logic. Without enabled allies in the Western Pacific, the United States will not be able to execute an effective Pacific strategy. It is not about to have a 600-ship navy; and putting Littoral Combat Ships into Singapore is a metaphor for the problem, not the solution.

The quadrangle can be populated by systems that form a C5ISR grid, in turn supporting a network of deployed forces. The population of the area with various sensors – aboard new tankers, fighter aircraft, air battle managers, unmanned aerial vehicles, ships, and submarines – creates the pre-conditions for shaping a powerful grid of intersecting capabilities. Indeed, the US can shape an attack-and-defence enterprise in the Western Pacific that it can easily plug into, if indeed it prioritises interoperability and the mutual leveraging of capabilities.

At the heart of re-crafting a 21st century US maritime strategy will be the grasp of new technologies and partnerships that will allow a credible evolution of a war winning and scalable presence force for Pacific deterrence. Among the core principles for building such a force is the recognition that not only is all weapon technology relative against a reactive enemy, but it is also relative amongst allied fighting forces.

In Max Hastings’ book ‘Inferno: The World at War 1939-1945’, he characterises the USN as showing itself to be “...the most impressive of its nation’s fighting services.”

Hastings goes on to stress that it took the relief of some early commanders, who did not understand the lessons of Carrier Operations (provided by the visionary insight of Admiral William S Sims at the Naval War College in 1924) that “carriers presented a 360-degree range of firepower via their aircraft that far outdistanced the radius of a battleships’ guns.” The navy wanted a “big blue blanket” to cover the distances of Pacific combat that required a lot of ships.

Now, everything has evolved to the 21st-century version of a “Big Blue ‘Tron’ Blanket” of US and allied forces. True, the number of submarines, ships and aircraft still matter



Deploying the first-of-class Littoral Combat Ship USS Freedom to work alongside regional partners in southeast Asia is totemic of the new US engagement in the Pacific region.

R. Lant: 1478631

greatly. At the same time the technology soon arriving in the F-35 will allow each aircraft to network and direct engagements in 360-degrees of 3-D space by handing off tracks to other air/land/sea platforms, including UAVs and robots. F-35 pilots will not only have situational awareness, they will have situational decision-making that is truly revolutionary. They will all have the best real-time battle information database.

It is not enough to have just "things." Elemental accounting of quantitative differences can often overlook qualitative differences such as the intangibles of C2, training and tactics and logistic support. The "modernisation" of aircrew proficiency along with all other human components in the military is essential.

Again, if the past is prologue, UAV battlefield evolution in the stain of Afghanistan and Iraq has an invaluable dimension. Recognising

that UAVs are not the future of aviation but a component of the future of aviation has been discussed largely in technology terms.

However, the real force multiplier is the actual battlefield skill-set learned by a cadre of junior officers who are RPA operators. A new generation is being born that understand how datalinks work half a world away to fight and win combat engagements. Marrying up this new fighting force with the F-35 situational decision-making pilot linked to all air/land/sea combat systems is a formula for 21st century warfighting that embraces the future.

The United States' and allies' innovation in understanding the evolving 21st-century "information revolution" and making that technology combat effective is a path to out-maneuvering and out-fighting the People's Liberation Army (PLA), should conflict ever come to pass. A battle-ready force of distributed weapons platforms and precision weapons all networked vertically and horizontally from submarines to satellites empowering combat situational decision making at all levels at the speed of light is something PLA forces have not yet demonstrated.

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