DEFENSE.info

Tale of Three Carriers

June 4, 2018

Building the Next Generation of Carriers: The USS America, HMS Queen Elizabeth and the USS Gerald Ford

By Robbin Laird

As published by our partner India Strategic

http://www.indiastrategic.in/topstories3766_A_Tale_of_Three_Carriers.htm

Newport News, Pascagoula, Mississippi, and Rosyth Scotland.

In the famous opening lines of Charles Dickens Tale of Two Cities, he noted that "it was the best of times; it was the worst of times."

So it is for aircraft carriers.

The critics of aircraft carriers focus on their vulnerability and the rise of capabilities such as the DF-21 Chinese "carrier killer" missiles; yet new carriers are emerging tailored for 21st century operations.

It is clear that the USN, the USMC, the Royal Air Force and the Royal Navy are all pursuing new carrier programmes designed to thrive, not just survive in 21st century operations.

I have had the rare opportunity to be aboard all three of the new carriers: the 52,000-ton USS America, which is the amphibious assault ship ever built; the 100,000-ton CVN-78 or the USS Gerald Ford, and the 65,000 ton HMS Queen Elizabeth.

The ships have several 21st century technologies in common: the construction of vastly improved command and control (C2) capabilities, working in sync with networked forces in a distributed operational environment.

The ships will have a 40 plus service life (although combat has its own logic), and will host significant transformation with regard to the combat assets carried aboard.

But each ship is built around significant airpower modernisation.

The USS America will host the Ospreys (including refueling Ospreys), F-35Bs, and the CH-53K (which can carry externally three times the load of the CH-53E); CVN-78 will see the new Hawkeye, the F-35C, and UCAS aboard her; and the HMS Queen Elizabeth is built around the F-35B as well as new airborne command capabilities.

And the Ford and the Queen Elizabeth have advanced electric power generation capabilities to take on board directed energy weapons as those capabilities evolve. Both ships have significant connectivity, with miles of fibre-optic cables, and reconfigurable C2 workstations to allow for operations against the ROMO (Range of Military Operations).

Aircraft Carriers are very good for a spectrum of operations, both in securing strategic interests through deterrence and war fighting capabilities but also for humanitarian assistance and disaster relief.

The three carriers mentioned have sufficient flexibility in this perspective.

They also ensure logistical integrity permitting operations from the sea without having to set up land bases.

Their air power allows them to leverage their strike capabilities for subsurface, surface, landbased and even aerial or space assets.

It was from a ship that the US shot down a satellite using a Raytheon missile. Each ship though is unique. But each one has the flexibility to adapt to the varied requirements as they arise.

USS America: Reinventing Amphibious Assault

The USS America is the largest amphibious ship ever built by the United States.

The ship has been built at the Huntington Ingalls shipyard in Pascagoula, Mississippi and departed mid-July 2014 for its trip to its initial home port at San Diego, California and then was commissioned in San Francisco in mid-October 2014. It is now undergoing its final trials and preparing to enter the fleet.

The USMC is the only tilt rotor-enabled assault force in the world.

The USS America has been built to facilitate this capability and will be augmented as the F-35B is added to the Ospreys, and helicopters already operating from the ship. Later, unmanned aircraft will also become a regular operational element.

Figure 1 Sailors assigned to the amphibious assault ship USS America (LHA 6) attaching ordnance to an MH-60S Sea Hawk helicopter assigned to the "Wildcards" of Helicopter Sea Combat Squadron (HSC) 23 on the flight deck. US Navy, March 6, 2018.

The Boeing-Bell Osprey has obviously been a game changer, where today, the basic three ship formation used by the Amphibious Ready Group-Marine Expeditionary Unit can "disaggregate" and operate over a three-ship distributed 1,000-mile operational area.

Having the communications and ISR to operate over a greater area, and to have sustainment for a disaggregated fleet is a major challenge facing the future of the USN-USMC team. The combination of Ospreys and F-35 B will be deadly for any foe.

A major change in the ship can be seen below the flight deck, and these changes are what allow the assault force enabled by new USMC aviation capabilities to operate at greater range and ops tempo. The ship has three synergistic decks, which work together to support flight deck operations.

Unlike a traditional large deck amphibious ship where maintenance has to be done topside, maintenance is done in a hangar deck below the flight deck. And below that deck is the intermediate area, where large workspaces exist to support operations with weapons, logistics and sustainment activities.

The ship can hold more than 20 F-35Bs. The Ospreys would be used to carry fuel and or weapons, so that the F-35B can move to the mission and operate in a distributed base. This is what the Marines refer to as shaping distributed STOVL ops for the F-35B within which a sea base is a key lily pad from which the plane could operate or move from.

Alternatively, the F-35B could operate for ISR (Intelligence, Surveillance and Reconnaissance). Understandably, all US assets area already networked through satellites.

The other new onboard asset is Sikorsky's CH-53K, which will be backbone for an airborne amphibious strike force. It will be able to carry three times the load external to itself than can a CH-53E and has many operational improvements, such as a fly-by-wire system.

These elements constitute a true enabler for a 21st century amphibious assault force.

CVN-78: Redefining the Large-Deck Carrier

The coming of the USS Gerald R. Ford sets in motion a very different type of large-deck carrier. The hull form of the Ford is a tribute to the very successful Nimitz-class hull design. But that is where the comparisons end.

In effect, the new nuclear-powered carrier provides infrastructure for – significantly – the US Navy as well as its coalition forces.

It is designed to operate more effectively with an evolving air wing over its 50-year life span. The high increase in electric power generation, three times greater than Nimitz, is designed to allow the electronic systems associated with defense, attack and C2 to grow over time.

The carrier's new launch and recovery systems (EMALS – Electromagnetic Aircraft Launch System and AAG-Advanced Arresting Gear), the weapons handling system and many other improvements are visible signs of new capabilities.

The onboard super computers manage everything from electric power to fire power, and give outstanding support to the crew. Laser weapons will be a reality on Gerald Ford.

The next generation in active sensor technology, with great bandwidth in the dual band radars, provides a solid foundation, not simply for the organic defence and strike capability of the carrier but for the entire battle fleet.

In a recent interview Captain John Meier, the designated skipper of CVN-78, highlighted a number of innovations, two of which are the new launch system and the second is the new weaponisation systems and pit stop approach to operating aircraft.

The first involves the shift from steam catapults to an electronic system or EMALS. "The EMALS system will allow us to provide for an ability to launch aircraft more smoothly and with less wear and tear on the airplanes and the pilots. Coupled with the new advanced arresting gear, we will be able to launch and recover a variety of types of aircraft, including future designs that haven't been developed."

As for directed energy systems, he observed: "You have a great capacity for diversity of weapons, and the advanced weapon elevators themselves are located on the ship to facilitate faster movement and loading of the weapons.

That's the underlying principle of the advanced weapon elevators. They carry more weight and they go faster, twice the speed and twice the weight essentially of the legacy weapons elevators" bringing ordnance right near an aircraft for loading.

Combat jets will be loaded in "pit stops" aboard the deck and then launched from the EMALS system.

And with the coming of the F-35 C, the head of Naval Air Warfare, Rear Admiral Manazir noted in an interview done after the visit to the Ford:

"Reach not range is a key aspect of looking at the carrier air wing and its ability to work with joint and coalition forces.

This is clearly enhanced with the F-35.The carrier has a core ability to operate organically but its real impact comes from its synergy with the joint and coalition force, which will only go up as the global F-35 fleet emerges.

And this will get better with the coming of the USS Ford. What the Ford does is it optimises the things that we think are the most important."

HMS Queen Elizabeth: Reinventing the Large Deck Carrier

The Brits invented carrier warfare; and in many ways with their new 65,000-ton carrier they are reinventing the large deck carrier and providing something of a hybrid between the USS America and CVN-78.

The flight deck is impressive and is about 90 per cent of the size of the Nimitz class and has a very wide deck.

When I stood at the end of the ski jump and looked down at the flight deck, its width was significant.

And I learned that the flight deck was built by Laird Shipbuilding (unfortunately no relation!).

This ship is designed to operate F-35Bs, which means that the RAF (Royal Air Force) and RN (Royal Navy) will drive every bit of innovation out of the aircraft to provide C2, ISR and strike capabilities.

There will be natural interoperability between the US and British forces, right from training to operations.

Walking the ship takes time, but several innovations one sees aboard the Ford can be found aboard the HMS Queen Elizabeth: significant energy generation, significant C2 capabilities, very large rooms for reconfigurable C2 suites for

operations across the ROMO, as well as well designed work areas for the F-35B crews which will handle the operations and data generated by the F-35 to the fleet.

It is a ship designed to transform both the RAF and the RN for it will integrate significantly with the surface and subsurface fleet and the land-based air for the RAF.

To take an example, with RAF jets operating from Cyprus or in the Middle East, the HMS Queen Elizabeth can mesh its air assets with the land based assets and the command centre directing the air operations could be on the ship, on land at an operating base, or in the air, even in the new tankers.

Conclusion

Despite the critics, new carriers are being designed and built to work more effectively in an integrated operational space to provide both defence and offence to a joint and coalition force.

They are key elements of the distributed force, one which is forging a 21st century approach to offense-defense enterprise across the spectrum of military operations.

The author would like to thank Ed Timperlake for his contribution to the thinking underlying this article.

This article was first published on June 3, 2015.

Standing up the New Carrier Capability at Portsmouth, England

By Robbin Laird

I had the chance to visit HMS Queen Elizabeth in Scotland as the carrier was being built.

During a visit to Portsmouth in late April 2018, I had a chance to see the carrier again and to talk with senior UK Navy and industrial personnel involved in working the carrier into an operational combat system.

The carrier will come later this year to the United States for F-35 integration efforts, and will be doing sea trials next year which will involve the USMC as well.

I had a chance during my visit to meet again with Captain (retired) Chris Alcock. The last time we met was during a meeting to discuss the carrier and the way ahead for the RAF and Royal Navy with the carrier at the Ministry of Defence in 2015.

Captain Chris Alcock was then Head of the Carrier Strike Division in Navy Command Headquarters. Hewas Programme Manager for the QEC Carriers and also responsible for capability Integration of the Carrier Air Wing into the platform, specifically LII F35B, Merlin Mk2 and Crows nest.

And during that interview he highlighted how significant a change bringing the new carrier into the UK force structure was for the future of UK defense:

Question: How demanding a shift in RN thinking is the introduction of this ship?

Alcock: It is an important shift.

There are a lot of people that have never been on a carrier before, and the Royal Navy, since the demise of the carriers, has been very much a frigate Navy.

We are generating a new Maritime Task Force concept (MTF) to shape the concept of operations going forward.

This clearly draws on elements of the past, but requires a fresh think as well.

People say it's not all about the carrier, but it is all about the carrier, because that will be the center of gravity around which we will provide all the other enablers for the other elements of the task group.

The constitution of the task group is critical to depending on what we do with the carrier but the carrier and its air wing are the centerpiece enabling the entire task force.

We have worked closely with the USN and the USMC in the regeneration of Carrier Strike and the close working relationship has been hugely appreciated and also the work they have done for us and with us in support of this aim.

The build of the new carrier in the UK shaped a very innovative approach to building a new large ship which mobilized UK industry and built the ship from sections shipped from various parts of the country to the Scottish shipyard.

The HMS Queen Elizabeth Delivery Director, Jon Pearson is now at Portsmouth and Chris Alcock and I met briefly with him during this visit as well.

Pearson is now identified as the Warship Support Director and wrote this note earlier in April prior to my visit.

As Warship Support Director at BAE Systems Maritime Services, part of what I do involves overseeing the work done here at Portsmouth Naval Base to support HMS Queen Elizabeth on behalf of the Royal Navy.

You could say I know a little bit about the Royal Navy's new flagship aircraft carrier.

My involvement in the carrier programme spans from 2003 during the completion phase, all the way through to last year when, as the Aircraft Carrier Alliance's Queen Elizabeth Delivery Director, it was my responsibility to get her ready for her delivery to Portsmouth and hand over to the Royal Navy.

Since the beginning of the carrier programme the vessels really captured the British public's imagination. They seem to have an affinity with the Royal Navy, the military in general, and anything connected to it.

This is the biggest ship we've built for the Royal Navy, and it fills a gap in capability that's been there since the 1970s when we lost the ability to fly fixed wing aircraft from carriers, plus it's a symbol of British military might and the role we play in the world.

Because of that, the programme has really been delivered from the outset squarely in the public eye, with scrutiny from senior politicians, senior Royal Navy officers, and senior members of all three organisations involved in the build – BAE Systems, Thales and Babcock.

That's certainly added an extra dimension to building the largest warships the Royal Navy has ever had.

Building any first in class ship is difficult, especially the latter stages when you're incorporating all the systems and getting it ready for trials, but building something the size of HMS Queen Elizabeth, the volumes we were dealing with on a day to day basis, was something else entirely.

We had to install over 3 million meters of cable, test 80,000 pipes, commission nearly 300 systems and handover 3,000 compartments.

But throughout the programme there has been a real sense of pride in what we have delivered, not just from the ACA but also the Royal Navy and the ship's company in particular – they were excited about being the first ship's company even before they had a ship they were able to sail!

The interest around Exit Rosyth, and then the international coverage of First Entry Portsmouth, plus the thousands of people who came to Portsmouth very early that August morning to welcome her in, really showed us that our pride is shared across the nation and beyond.

Chris Alcock now works for Pearson and discussed the building of the carrier and shaping the way ahead.

"The ship was designed and built in sections. There were 26 key sections of the ship, which were built around the country at 7 locations and taken to the shipyard in Scotland.

"Even though the tolerances were tight, when the ship was put together it created the largest warship Britain has ever built.

Figure 2 HMS Queen Elizabeth Delivery Director, Jon Pearson and Captain (Retired) Chris Alcock

"It is an expression of the brilliant industrial brainsof the nation and of the nation in general; and from this point of view, it is no small engineering achievement on the part of British industry and Navy leadership."

"The ship arrived last August and has recently been undergoing sea trials, including operating helicopters off of its deck in the Mediterranean."

We then discussed the challenges associated with bringing such a large ship to Portsmouth and its impact on the area and upon Royal Naval operations.

Chris Alcock: "How would the enterprise to support the carrier be set up and to do so in such a manner that the carrier would not simply overwhelm the base and crowd out other key activities.

"We set in motion an 18-month training cycle to put together an enterprise approach to support the carrier in such a way as to fit into the base rather than disrupt it.

"This was a challenge as we have several hundred contractors on base to support the ship, have IT systems in place to support the workload in supporting the carrier, and have a larger crew certainly than the Type 45 destroyer which is home ported here.

"We had to look more generally at the infrastructure of the base as well, road systems, storage areas, IT systems, working the waterfront modifications, just to mention a few aspects of working a new infrastructure approach for the base."

And a key part of shaping a new infrastructure system is clearly the logistics support for carrier operations itself.

As you drive around the base, the impact of working the logistics side of the equation is quite obvious as older facilities are being replaced and newer ones being built.

To bring the different elements together and to shape a common approach, the Queen Elizabeth-Class Portsmouth Readiness Group was created to manage the process of infrastructure change.

A five-phased training program was put in place involving the key stakeholders in the carrier, including leadership of the base, the defence equipment support elements at Abbey Wood and the heads of all the key stakeholder areas.

According to Alcock, they developed their approach from watching the learning process from the standup of Terminals 5 and 2 at Heathrow airport. The standup at Terminal Five is a noted example of what not to do. When they came to set up Terminal 2, a process was put in place to test the terminal extensively prior to opening it up.

"They spent a year doing the training prior to opening the terminal, including running through about 30,000 non paying passengers to test the workflow and performance of Terminal 2."

Alcock described the process for standing up the naval base for carrier operations.

"The first phase was making sure all the documentation was right. We looked at what documentation was already in place and determined what was applicable to the carrier.

"But where there were deltas, we identified deltas.

"How we would fill that delta with a new procedure or investment in infrastructure. That was done from June through Christmas of last year.

"Then from January to the end of February, the infrastructure team leader created a mock-up of the forward lift of the ship at a mean height of tide. And he also put a high-water and a low-water passenger access point.

'On the ship there are two points of access, one is through the traditional way of the gang-way going up to the ship and then there's through the aircraft lift which you'll have seen on the U.S. carriers. You can get a high volume of people on, a high volume of people off, through a brow that goes to the aircraft lift.

"There are then two bespoke bows that go to a forward and an after reception point on the ship. They are fully hydraulic telescopic powered lifts that go in and out with the tide and they move laterally as well to cope with the movement of the ship.

"So we did a load of testing on those by creating scaffolding mock-ups with cutouts of the doors there. We put them up against it and we tested with people, we tested for emergencies, we tested getting casualties off.

"And then we got cranes in, we got lorries in, we dropped loads on them, just to get a sense of how we would do things. We got bespoke cradles made to go on top of ISO's. So it's a very quick lift process.

"Then we were going to have the Royal Fleet Auxiliary to come alongside and we'd use it as though it was an aircraft carrier, and then we'd test all our procedures.

"But unfortunately, due to all the operational commitments, we couldn't get one of our own assets, so the USNS Robert E. Peary, which was in UK waters, came to Portsmouth to play this role.

"This enabled us to test the fender units which are 60 ton ballasted units that go up and down with the tide. We used the Peary to act as the surrogate carrier.

"We did this through the end of March.

"After that phase we focused on working through putting stress on the procedures to see how they worked and to make modifications as we needed to.

"As a result when the ship arrived in August, we were ready to support her.

And the key point of all the preparation to stand up 21st century carrier support?

"She's here, she's fully integrated into the Naval Base, and it's business as usual now."

UK Defense Transformation: The Impact of HMS Queen Elizabeth

By Robbin Laird

Recently, I had a chance to visit Portsmouth, UK and talk with senior Royal Navy officers about the coming of the carrier and did so after talking with the team of senior RAF and Royal Navy officers standing up F-35 at RAF Marham.

But getting a chance to see HMS Queen Elizabeth again and to talk with the RAF and the Royal Navy about her as well provided an opportunity to think about the context in which the carrier is being launched and about its impact on that context.

I have just finished a new Special Report which focuses on the approach of the Nordics to the strategic shift and the need to operate in what a senior Norwegian official referred to as the "new normal," namely, dealing with the impact of Russian capabilities and behavior on the defense of the North Atlantic.

This has had a major impact on the UK, which the Chief of the Royal Air Force highlighted during his presentation earlier this year in Canberra at the Williams Foundation seminar on the strategic shift:

Let me offer some examples of how this feels at the moment from a British perspective. Just over two weeks ago, a foreign country, Russia, used military-grade nerve agent in an attempt to murder people on the streets of the United Kingdom.

Not only an extraordinarily aggressive and reckless act, but the first offensive use of a nerve agent in Europe since 1945.

Russia's also illegally annexed Crimea, the first time since the Second World War that one sovereign nation has forcibly annexed territory from another in Europe. This is in addition to the appalling destruction, which has been visited on the Syrian civilian population by the Russian military itself, and the criminal activities of the Russian state under Putin in cyberspace and elsewhere; they're well known.

So the post-Second World War consensus that has provided the basis of the rules-based international order and, I might say, peace in Europe, is being challenged and undermined.

We must respond, collectively, to reassure our citizens that hostile acts by Russia against our countries, our interests, and our values, will not be tolerated. And closer to home here, we can see many of these same issues and concerns being played out in relation to, for example, North Korea.

The UK like several other liberal democracies are responding to the strategic shift by transforming their military capabilities.

But the UK has another strategic dynamic at play, namely, the negotiation of it new relationship with the European Union, known as Brexit.

A key aspect of defining a post-Brexit Britain is clearly reworking the nature of the UK defense relationship with Europe as well sorting out how UK defense transformation relates to a post-Brexit UK defense narrative.

The new UK carrier is coming into this strategic context, which is complex enough, without the considerations of operationally standing up the carrier.

And the new carrier is itself a trigger or magnet to a UK force transformation process.

In the recent update published this year by the UK government of its earlier 2015 defense review, the carrier was highlighted a centerpiece of joint force transformation.

"The Joint Force that we are building will need to be versatile and agile. It will need to be effective in the full range of environments and across all five domains – land, sea, air, space and cyber.

"It will be international by design, routinely exercising and operating with allies and partners.

"It will be credible and capable of addressing state and non-state threats both alongside other nations and on our own."

"Notably, the report then identified the major elements of defense modernization designed for Joint Force 2025 to meet these criteria and with little surprise the first one identified was as follows:

"A maritime task group centered on a Queen Elizabeth Class aircraft carrier with F-35 Lightning combat aircraft."

Most of the analysis of the new carrier really focuses on the platform and what is necessary to get that platform operational but that is far too narrow an approach.

The carrier is a centerpiece, trigger or magnet for broader UK defense transformation within a unique historical context, namely, the broader strategic shift to dealing with higher end operations and the coming of Brexit.

From a force structure transformation piece, the focus on the carrier can be approached in several ways.

The first way is to look at the workups and training associated with getting the carrier ready for its 2021 maiden deployment.

This is a significant challenge and the focus of attention of the Royal Navy and its industrial partners and a major element of my discussions while at Portsmouth.

From this point of view, the integration of the aircraft to fly on the carrier is a major challenge as well, and includes three new aircraft, the F-35, Commando Merlin, and the Crow's Nest.

The second way is to look at the impact of the new carrier on the Royal Navy as it shifts from a single ship deployment focus to reshaping the Navy as a maritime task force navy.

And given how different the new UK carrier is from the US large deck carriers, this maritime task force will draw upon US experience but shape a new approach as well.

The shift to a maritime task force requires other changes as well with new shapes and capabilities coming to the fleet, new aircraft, new missiles and ultimately directed energy as well to the force.

The third way to look at the carrier is how the coming of the F-35 to the RAF and Royal Navy will intersect with the global partners also flying the aircraft, and notably the partners within Europe.

With the UK flying the same aircraft as the Northern Europeans, including the Dutch, this shapes new opportunities and capabilities as well.

And the close working relationship with the US Navy and Marine Corps will be evident as the HMS Queen Elizabeth comes this summer for F-35 integration training off of the Virginia Coast and when the Marines operate off of the ship, including next year during further ship trials off of the British coast as well.

The fourth way to look at the carrier is the impact of distributed decision-making, distributed operations and mobile basing upon the concepts of operations which the carrier will enable and participate in.

Put in another way, the concepts of operations being shaped 21st century combat forces are in transformation, a transformation which is built around distributed capabilities, distributed C2 and flexible or agile basing.

The new carrier both supports and interacts with all of these trends.

How will the carrier both contribute to and learn from these broader macro allied military transformation dynamics?

The fifth way to look at the coming of the carrier is to examine its intersection with and contribution to the transformation of airpower more generally.

The F-35 is a multi-domain flying combat system, rather than being a legacy multi-mission aircraft.

This provides an opportunity to both leverage and reshape multi-domain capabilities, as other aircraft are modernized or new assets added to the air combat force.

Clearly, the modernization of Typhoon is being done in close alignment with the coming of the F-35 and provides a significant plus up of the overall air combat force.

The coming of the P-8 to RAF Lossiemouth will provide as well a maritime domain awareness strike aircraft, which will provide a significant capability, which will be part of the operational envelope of the new maritime task force navy being forged around carrier.

In short, one can take a picture of the carrier.

But what one is not seeing is the tissue of relationships being reshaped by what you see in that picture.

It is a multi-domain warfare asset, which can only be understood as a driver for change within an overall UK defense transformation process and the new strategic setting.

The Coming of the USS Gerald Ford

By Ed Timperlake and Robbin Laird

The coming of the USS Gerald R. Ford sets in motion a very different type of large-deck carrier. The hull form of the Ford is a tribute to the very successful Nimitz-class hull design. That is where the comparisons basically end.

As the first CO of CVN 78 put it in an interview with *Second Line of Defense* at the Newport News shipyard on January 9. 2015:

"We share the same hull design in this class carrier with the Nimitz but everything else is either heavily modified or completely new."

In effect, the new carrier is built to provide an infrastructure for 21st century warfighting, not just for the U.S. Navy, but for the joint and coalition force as well.

The ship is designed to operate more effectively with an evolving airwing, which will change over the 50+ year life of the carrier.

It has as well significantly greater C2 capabilities so that the carrier can play an expanded role in evolving 21st century U.S. and alliance distributed operations which will be central to U.S. warfighting capabilities going forward.

The significant increase in electric power generation, three times greater than Nimitz, is designed to allow the electronic systems associated with defense, attack and C2 to grow over time as well.

A number of the changes associated with the ship are quite visible: the new launching and recovery systems, the weapons handling system and many other improvements.

For example, an important safety and damage control issue is independently generating steam in a modern galley, which precludes steam lines running through the ship. Another example is the special application of non-skid coatings, which means less upkeep.

All of these changes are significant and important.

But central to rethinking the role of the carrier is the revolution in C2 underway.

In the graphic below, the key elements of the infrastructure enabling the Ford to become a unique C2 asset for the maritime or joint or coalition force.

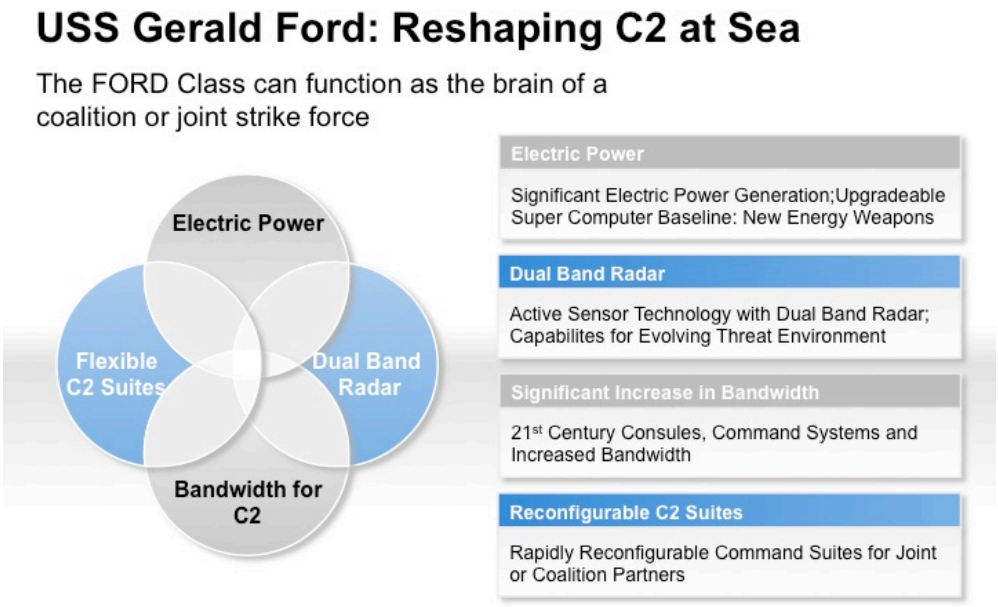

Figure 3 Reshaping C2 at Sea: Second Line of Defense Graphic

The super computers onboard the ship, with the power to support them as well as having significant power available for system cooling along with the deployment of future laser weapons is a crucial baseline for building out of C2 capabilities.

The next generation in active sensor technology in the dual band radars provides a solid foundation, not simply for the organic defense and strikes capability of the carrier, but for the battle fleet as a whole.

Significant increase in bandwidth is a fundamental requirement for an expanded C2 capability at sea which can support land, sea and air operations.

And the unique rapidly reconfigurable command suites on board allow for C2 to be provided for joint or coalition partners in a manner appropriate to the mission set.

As Rear Admiral Manazir, Director of Naval Air Warfare, put in the interview we did with him:

Reach not range is a key aspect of looking at the carrier airwing and its ability to work with joint and coalition forces. This is clearly enhanced with the F-35.

What you can do with a Carrier, given joint and coalition perspectives is the Carrier automatically extends your reach because you can put it anywhere you want. The mobility of the carrier is a key point.

You can put it up against the problem set the national command authority or the joint force commander wishes to address; and then you can move it to deal with an evolving target or operational set of challenges, again aligned with the commander's intent, you can move the reach of the carrier wing as you redeploy it and connect with joint or coalition assets.

The carrier has a core ability to operate organically but its real impact comes from its synergy with the joint and coalition force, which will only go up as the global F-35 fleet emerges.

And this will get better with the coming of the USS Ford. What the Ford does is it optimizes the things that we think are the most important.

Some of those capabilities are clear:

- ***Enhanced sortie generation capabilities or the number of times you can get airplanes into the mix to keep the reach out there***
- ***The power generation capability, so advanced systems can operate off of the ship.***
- ***The ability to take the information that is brought back through the airborne network into the ship and be able to disseminate it to decision makers is enhanced over the Nimitz class.***
- ***The enhanced reliability of the entire ship that should result in fewer yard visits, thus extending the ability to deploy more often.***

The interview with the Captain highlighted a number of the key elements of change associated with the Ford, which will allow it to play a robust 21st century warfighting role.

The Captain's background suggests a robust capability to think through the kind of innovation the ship will foster.

He comes from the electronic attack community and then went through the demanding nuclear schools of the USN and became the Executive Officer of the USS Harry S. Truman and then the for his "deep draft" tour he was CO of the USS Gunston Hall.

His increasing responsibility at sea from flying off the deck to Command provides a solid foundation for the kind of innovative and creative thinking that is necessary to put together operationally such a complex enterprise as a 21s Century large deck carrier and its air wing.

"Clearly, the ship is designed to enhance the sortie generation rate of the airwing.

But, less noticeable, is that the Ford is a vastly improved command and control platform as well.

The new phased array radars are going to be the most capable ones on the water. They will open up a window on new levels of C2 and new ways of fighting and communicating and controlling communication flows."

Question: The new launch and recovery systems coupled with the new weapons handling systems will give you significant flexibility as the air wing evolves.

Could you give us your perspective on this?

Captain Meier: The EMALs system we will visit on board the ship and will allow us to provide for an ability to launch aircraft more smoothly and with less wear and tear on the airplanes and the pilots.

Coupled with the new advanced arresting gear, we will be able to launch and recover a variety of types of aircraft, including future designs that haven't been developed.

What the arresting gear and the catapult do is they give you better energy absorption, meaning you can launch heavier, faster aircraft than are on the drawing boards today.

You can also launch and recover lighter aircraft than currently fielded.. The legacy landing systems are essentially at their limits in terms of weights of aircraft and maintainability."

Question: What you're basically saying is the Navy is enhancing its ability to be able to launch different types of aircraft because you're not constrained by a catapult system that has to be resized for each aircraft coming out of the launch.

So you can mix and match packages appropriate to mission set.

Could you comment on this development?

Captain Meier: Your point is absolutely right on.

That also goes to not just launch and recovery of aircraft, but the types of ordinance that'll be happening 30, 40, 50 years from now as well will change dramatically.

We anticipate directed energy weapons being onboard the ship, and a significant evolution of the weapons carried by the carrier.

The new weapons handling system is designed to be able to handle the weapons of the future as well.

You have a great capacity for diversity of weapons, and the advanced weapon elevators themselves are located on the ship to facilitate faster movement and loading of the weapons. That's the underlying principle of the advanced weapon elevators.

The elevators carry more weight and they go faster, twice the speed and twice the weight essentially of the legacy weapons elevators.

They're located in the flight deck, which puts them positionally where the crew will spend a lot less time from an ergonomics perspective pushing the ordnance around.

The ordnance comes up right near the aircraft and facilitates more efficient weapons loading.

Question: Could you discuss the power generation capability of the ship and its impacts?

Captain Meier: We've got three times the electrical power generated onboard Ford compared to Nimitz. Nimitz is pretty much at the edge of her envelope for available electrical energy.

We've got tons of room for growth.

We have excess power, the excess electrical capacity for weapons systems that we don't know about yet like lasers, direct energies, all those sorts of things are in the art of the possible in the period ahead.

Question: The power generation and cooling, and the computer-based capabilities of the ship coupled with the new radars clearly create a foundation for the evolution of C2.

But what is not widely realized, and we certainly did not before coming onboard the ship, is the impact of what you call flexible infrastructure.

Could you explain what this is and what its impact might well be?

Captain Meier: Flexible infrastructure is a part of the ship built with reconfigurable work areas. Imagine this part of the ship as offices with movable walls where you could set up workspaces how you want them to operate for the task. And you have electrical power in this space to use as you wish.

These spaces can be configured appropriate to a particular C2 scenario whether for the USN, the joint or coalition force onboard the ship.

Question: This ship is built with 21st century engineering, design and manufacturing tools.

Obviously, first of class is always more expensive than what later members of the class cost, and with the Ford when the first is built you have the design tools in place as well.

Could you comment on how one should look at the use of the new design and manufacturing tools to create the USS Gerald R. Ford?

Captain Meier: The manufacturing changes are substantial. When we talk about modeling and simulation, we have a simulator, which can model, down to the level of people walking across the flight deck, whether it's moving ordnance or aircraft.

That's the level of detail that we have in some of that modeling. One of the other great products of the ship has developed and the Navy's purchased is the 3D model which is essentially designed in a computer to provide a complete 3D model of the ship and its operations.

So you could in the computer design even with 3D goggles.

You can move assets around to determine where best to place it or better position it.

There are many components or large sized components that may need to be removed so, from a design perspective, a ship has designed removable paths and you can do all of that.

The models will also be used to drive change plans down the road. And they are also important in doing maintenance on the ships.

Question: Clearly, the ship has a lot of up front design and infrastructure built in to make it a more cost effective ship to operate from a maintenance point of view. Could you give us a sense of the importance of this build-into the ship?

Captain Meier: By design there are fewer components and the components that we have are generally designed for the life of the ship.

Many of the components here will last the life of the ship.

The design of having fewer components and more robustly designed components clearly will enhance maintainability.

And with other changes built into the ship, we will reduce the required crew size as well, with 700 fewer Sailors being required to operate an even more complex warship than the Nimitz.

This would not have been possible without 21st century design and manufacturing techniques.

This article was first published on January 24, 2015

Captain Nick Walker Provides an Update on the New Uk Carriers

By Robbin Laird

At the Williams Foundation held their latest seminar on 5th generation enabled combat held in August 2016, new approaches to air-sea integration was the focus of attention.

At that seminar Captain Nick Walker of the Royal Navy provided an overview on the new UK carrier.

Earlier, we interviewed Captain Walker as part of a RN and RAF team discussing the carrier and strike aviation during an interview conducted at Whitehall in the first quarter of 2014.

He was then Commander Nick Walker and serving as the Chief of Staff Carrier Strike in the Carrier Strike and Aviation Division within Navy Command Headquarters in Portsmouth.

http://sldinfo.com/the-new-uk-aircraft-carrier-reshaping-the-royal-navy-and-the-royal-air-force/

During that interview, Captain Walker underscored a key point about the new capability for the national decision makers:

Question: How does this evolving capability affect a possible rethink about the way ahead for the forces?

Walker: This evolving capability will give the decision maker a lot of flexible tools to respond or prepare for crises.

The Maritime Task Force can be well integrated with land based air but does not need a lot of forward ground presence to generate combat effects.

This can give decision makers significant flexibility with regard to a crisis or to have the ability to move to crises rather than having to generate force build up in a particular place in order to intervene.

Captain Walker certainly picked up on that theme and wove the carrier discussion within a broader emphasis on how it both triggered and reflected the transformation process for the UK power projection forces.

He underscored that both the F-35 and the carrier are being brought into service together, and together they are key definers of the new power projection approach for an information age.

The carrier is being introduced from the ground up as a joint asset; not simply a maritime asset.

"The carrier strike journey is driving significant cultural change in the forces as well."

He started by focusing on the core point that the carrier is coming into service as part of the overall transformation of UK power projection capabilities. Indeed, the CEPP or Carrier Enabled Power Projection statement of intent highlights the way ahead:

"An integrated and sustainable joint capability, interoperable with NATO, that enables the projection of UK Carrier Strike and Littoral Manoeuvre power as well as delivering humanitarian assistance and defence diplomacy, enabling joint effect across the maritime, land and air environments at a time and place of political choosing."

He noted that the role of Special Forces has been highlighted since this original statement and will be folded into the revised statement of intent with regard to the role of the carrier within the UK forces.

CEPP has been maintained within the Ministry of Defence. This is in distinction to most other capabilities, which have been given to the front line commands. This allows joint forces command and the services to focus on CEPP as a joint capability.

The deck of the Queen Elizabeth carrier is 85% of the size (i.e. area) of a Nimitz class carrier; which can carry up to 36 F-35Bs along with a Merlin Crowsnests and a Merlin Mk2 ASW helo. Alternatively, the ship can be used in the projection of land forces from the sea in terms of Marines and helo insertion capabilities as well.

But it is the carrier strike focus which is definitional for the new carrier.

The ship has been designed from the ground up to support F-35B, in terms of weapons, C2, and ISR integration.

"We have also built from the ground up interoperability, and have worked closely with the USN and USMC with regard to this capability. And we are working on a broader approach to NATO interoperability as well."

He provided an overview of the timing of the build out of the ship and the process of marrying it with the movement of the UK F-35Bs being prepared and trained in the United States to its permanent location in the UK at RAF Marham.

The initial carrier IOC is projected to be December 2020 with the fully integrated F-35 and carrier having full operational capability by 2025.

Much like the leadership of the Royal Australian Navy focused on in their presentations at the seminar, Walker emphasized new approaches to task forces as key part of their transformation approach.

Clearly, the UK is looking at the evolving impact of introducing carrier strike upon the overall change in the RAF and Royal Navy as well. And a key aspect of this transformation is working the evolving integration of fifth gen upon legacy capabilities.

Captain Walker highlighted the shift from a legacy mindset, which focused on thinking of maritime versus air environments to an integrated information dominance environment.

"A key cultural change is that we are looking at air and maritime as an integrated domain; and we are looking at the interaction among the environmental seams of our forces driven by a kill web approach and capability."

A clear challenge is reworking C2.

"We need to shape a more mission order vice a directive Air Tasking Order approach to the use of an integrated air-maritime force."

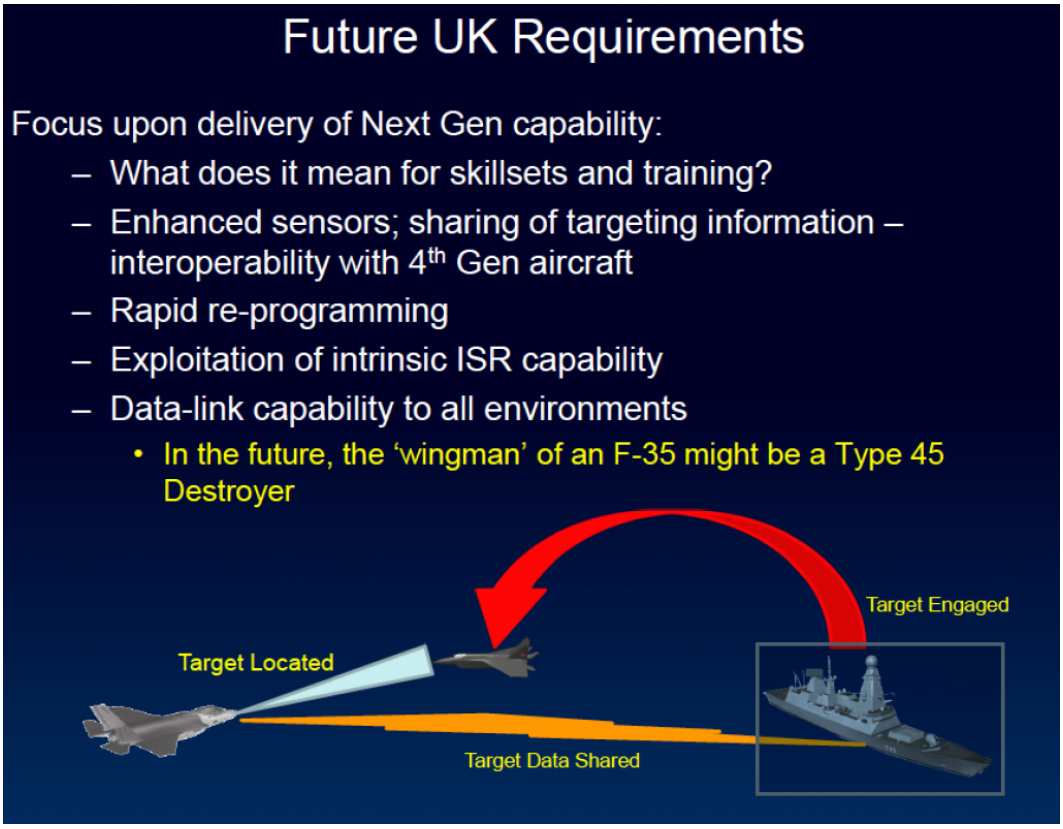

Figure 4 From Captain Walker's Williams Foundation Presentation, August 2016.

Putting the new carriers in play completely integrated with the F-35 will provide the foundation for shaping the way ahead for the UK power projection forces.

Put bluntly, shaping the way ahead will be defined by the operational experiences entailed in operating and deploying the new carrier strike force and leveraging that capability will be crucial in thinking through future procurement decisions as well.

"We are focused on being more platform agnostic; and ironically, the F-35 can be looked at as a new platform an keep in the old platform-centric approach but we are looking at it as lever of change for next generation thinking and capabilities.

"We are taking the kill web concept very seriously, and examining how best to shape the desired outcome from nodes in the operational force, rather than focusing on specialized platforms.

"How do we generate operational tasks to be delivered from the integrated force?"

"How do we bring the Typhoon which is a key air asset into the kill web?

"Rapid reprogramming of platforms is a crucial way ahead for sure.

"The ability to exploit the intrinsic ISR capability of the force, rather than simply relying on specialized ISR platforms is a key way ahead as well.

"The ability to deliver effect throughout the force with data-link capabilities such as in the future the wingman of an F-35 could well be the Type 45 destroyer"

In short, Captain Walker saw significant commonality in terms of the Australian rethink about the way ahead for their navy and how the UK was thinking about the transformation of its power projection capabilities.

Remaking the Amphibious Task Force: Marines Onboard the USS America

By Todd Miller

"We'd always say 'if its really a bad air to air (A2A) threat, get some additional jets up there, get some more capability.'

I have no pause or hesitation that this jet will dominate in an A2A environment, would dominate in a strike environment, dominate in a CAS environment, and would also do a very nice job in an electronic warfare realm as well."

Marines. At their mention I suspect most think, "storming the beaches." Amphibious vehicles first in, troops storm ashore. That capability still exists, but today there is a far greater capability, one that will provide a vexing challenge for any adversary.

Already transformed by the mobility of the Osprey, the F-35B offers a critical upgrade to the Marine Air-Ground Task Force (MAGTF) and amphibious assault. The first wave is no longer limited to the beach or uncontested space, it can effectively reach locations 450 miles from the shipborne base – even in contested airspace.

What once came ashore like a wave, now comes as lightning strikes in a violent storm.

Marines on the beach, Marines from behind, and Marines within the adversary's territory. Marines striking swiftly with maximum effect to deal with high value targets, including terror cells – all with the stand alone capability to do so.

This is the "Aerial Amphibious Assault" Force, and these are the Marines of the 21st century battlespace.

It is a capability the US Marine Corps (USMC) has patiently and steadfastly build towards, and the pieces are coming together;

- **Integration with the US Navy LHA Class Amphibious Assault Carrier – The USS America & USS Tripoli (under construction). The LHA class offers enhanced dedicated support for Marine aviation assets.**
- **MV-22B Osprey. The Osprey offers extended range and speed for troop insertion, as well as air to air refueling support.**
- **Existing Attack Helicopters (UH-1Y Venom & AH-1Z Viper).**
- **F-35B Lightning II. The F-35B replaces the AV-8B, F/A-18 Hornet & EA-6B Prowler. The aircraft offers exceptional performance Air to Air (A2A), Air to Ground (A2G), Close Air Support (CAS), Electronic Warfare (EW), Command, Control, Communications and**

Computers (C4), Intelligence, Surveillance and Reconnaissance (ISR) all with the capability to operate stealthily within contested areas.

- **CH-53K "King Stallion" When introduced (2019) the CH-53K will provide nearly 3x the heavy lift capability of the CH-53E.**

The USS America (LHA-6) a maritime base, provides unrivaled flexibility.

Park it where you want in international waters. Forward deploy it to a region for any contingency, and a Marine Expeditionary Unit (MEU) is at the ready. The LHA platform is ideal for military operations involving troop insertion, (anti-terrorism activities) where the objective is to infiltrate, accomplish the mission and leave no boots behind on the ground.

The LHA offers the flexibility to adjust mix from heavy jet (F-35B) to heavy tiltrotor (MV-22B) or rotor wing. Utilizing the MV-22B and the F-35B, the USMC can effectively insert troops 450 miles from the ship in under 2 hours.

The platform offers the flexibility to work together with additional amphibious assault carriers (LHD) when amphibious vehicles are desired, as well as with the support of the USN Supercarrier.

Not a replacement for either, the LHA provides flexibility for the military to tailor a force most suitable for the mission at hand.

Second Line of Defense and a handful of gathered journalists recently had the opportunity to visit with Lt. General Jon "Dog" Davis, USMC Deputy Commandant for Aviation, and Col. George "Sack" Rowell, Commanding Officer of VMX-1 (Marine Operational Test & Evaluation Squadron).

The visit took place after DT-III, during a "Proof of Concept" demonstration on the USS America, November 18-20, 2016.

General Davis, can you describe the tactical implications of the USS America with F-35B, MV-22B & other Marine aviation assets?

The MV-22 is an incredible platform, it can go a long way at a high rate of speed, it can receive air refueling, and it can be configured to provide air refueling.

It can move Marines, and (configured) it can pass fuel to other MV-22's or F-35s. That is a tremendous capability for the Marines and the Naval services.

These ships are designed for amphibious operations, MAGTF operations with the standard mix of Marine units that will go out (Marine Expeditionary Units – MEU), but occasionally we need to configure this to be jet heavy or helicopter heavy. In this case, this is a jet heavy deck. We could take up to 20 F-35Bs onboard, we put 12 on this time.

This is a 5th Gen strike capability that the nation does not currently have from a sea base. It is a tremendous capability. We had Vice Admiral Rowden (Vice Admiral Thomas Rowden, Commander Naval Surface Forces) onboard today.

One of the things we did as part of this test was the AEGIS integration with the F-35B. That's a big deal. That's a big deal for our Nation, our Navy and our Marine Corps.

The Marine Corps is a force that fights across the range of the military operations, and this could be something that a combatant commander, or a fleet commander decides that we need to be able to do for a time.

Like we did during Operation Iraqi Freedom, where I think we had 4 decks loaded up with Harriers. We sailed over with helicopters on board and then flew Harriers in and flew off those ships because that was the best way for us to operate.

Practically speaking, what is the operational range from ship of the F-35B/MV-22B tandem?

Unrefueled you could do 450 miles, refueled, you could do more. MV-22s are an incredible platform for assault, delivering Marines or for getting Special Operations forces where they need to go. The F-35B is a very nice complement to get that MV-22 into a contested area.

If I was a bad guy I would hate the MV-22. If you hate the MV-22 you want to try and go after it, and the F-35 will create the conditions for the success of the MV-22.

It will sanitize a target area, go after target defenses, provide close air support for the assault force in the objective area and then help bring them back home, utilizing A2A, A2G, situational awareness and electronic warfare.

We think we have a real winner in the combination of platforms out there, but it is not just about F-35Bs & MV-22s. We have attack helicopters, UH-1Y, AH-1Z, CH-53Es and soon we'll have the CH-53Ks.

The most important part of all is the young marines that are supported by a ride in those aircraft and get supported by these weapons systems.

The F-35 weaves a lot of things together that we have not had in a long time. EW for our MEUs which we've never had before in this kind of capability; a very, very high end air defense and counter air capability; and an all-weather ground attack CAS system that allows us to provide CAS in virtually any environment out there.

We are very pleased with what we are seeing. And this is a beautiful new ship. It's my first time on the America, and I am very impressed with the ship, and I am really impressed with the sailors, and their attitude. The Marines are beaming, and the sailors are also very happy.

We're talking about deployments in 2018, would you feel confident if you had to deploy to a CENTCOM AOR Firebase?

I'd do it tomorrow. Tomorrow.

The squadron commander (CO) of VMFA-211 is chomping at the bit, he would deploy them, so would the CO of VMFA-121. They are ready. These airplanes are highly capable and ready to go.

We have a commitment to move to Japan with VMFA-121. As Marines we live up to our promises.

We have promised to take 5th Gen capability to Japan, so we're doing that. And we are going to do that in January.

We will deploy on timeline with these other capabilities unless something requires us to go sooner or faster. They are ready. They are ready. The Marine Corps is busy right now, so I'm not trying to put anything else on anybody's plate, nor is anyone else.

But the nation has a 5th Gen capability that can operate from a sea base, and could do it tomorrow if need be.

As you debate how to tackle a contested area, and operate in a multi-domain environment, and highly dispersed units, it sounds as if the F-35 are they key to that, how?

Absolutely.

We are operating on a sea base right now. This is a great platform to operate from. It makes the sea base more powerful, more potent.

However, we can also move to FOBs, continue to operate, then back to the ship. We have Royal Air Force (RAF) pilots out here watching this today, and that was their operational concept when I was an exchange officer with the RAF. Going from a main base to what we call distributed operations all over.

We have done that when in an A2/AD threat condition. That is a tremendous capability for the Marine Corps today.

We bought this airplane so that we could better support the troops on the ground. That means flying from whatever operating base is most advantageous from an operations perspective and threat perspective. It might be the sea base, it might be a base ashore.

The Marine Corp has units called the Marine Wing Support Squadrons (MWSS), they are the Marine Corps carriers ashore. We have the Carrier at sea, and then we have these units that create operating bases ashore.

We can move those around as need be to give us the extended reach and play if we don't have a set base or a road to operate these airplanes. Wherever you have enough road to land a C-130J and offload jet fuel, you can put F-35Bs to go operate for a period of time.

We just did the hot rearm, hot refuel with the F-35Bs. We have been doing that with Harriers 12 years now, and we do it with F/A-18s. We did it at WTI for the F-35Bs. 2 F-35s came in and landed, we never shut them down, we refueled, reloaded them with ordinance and took off in less than 20 mins. That's a significant capability.

We are not going to hot rearm on the ship during this exercise, but we are hot refueling. We are always looking for ways to make things go a little bit faster.

We did that in Afghanistan with our Harriers, for the Marjah operation. The Harriers took off out of Kandahar, got overhead Marjah, did their CAS.

We built a small FOB called FOB Dwyer with one of the MWSSs very close to Marjah. Once aircraft dropped their ordinance, they landed at FOB Dwyer, rearmed and refueled without shutting down and took off again in about 15 mins. We made 12 Harriers look like 36 Harriers.

Now we are doing it with the F-35s.

I understand the Marines are looking to accelerate full motion video capability. When & Why (I believe it is scheduled for Block 4.3)?

I do believe we found a way to bring it on faster than Block 4.3. It's one of the things we use (actually we were one of the pioneers for streaming video out of our lightning pods) for our guys on the ground. Our forward air controllers (FACs) love using that.

I think they'll also like the other capabilities of this airplane too like the Synthetic Aperture Radar (SAR) map through the clouds. The full motion video does not provide that at all right now, it's really streaming video (not full motion video). Bottom line, if the customer wants it, we try and provide it. I believe it may be implemented for Block 4.1 or 4.2.

Figure 5 F-35B Onbaord the USS America. Todd Miller

Can we discuss the AEGIS integration & practical effects?

I wish I had my Navy counterpart here, Admiral Rowden was very excited about it. It was a Navy idea. Col. Rowell (Col. George "Sack" Rowell, VMX-1 Commanding Officer) will you address AEGIS integration?

Rowell; The first experience took place 2 months ago with the "AEGIS" at White Sands (Desert Ship). An F-35 targeted a cruise missile surrogate and provided the targeting data to the AEGIS platform. What AEGIS really brings is a weapons payload.

The General just talked about hot loading the aircraft with weapons. AEGIS cruisers bring a weapons payload, that just could not fit on an airplane.

We are talking about dozens and dozens of missiles. SM-6s that can be targeted by airborne platforms at a much greater distance than they could independently target.

Does this fit in with distributed lethality?

Absolutely. The F-35 digitally sent the targeting data through to the AEGIS using multi-function advanced datalink (MADL) and the AEGIS shot – and that was a live shoot, a live SM-6 came out of White Sands and destroyed the target.

Are there any other aircraft that can do that?

No, nothing else (using MADL) can do that. The Navy has AEGIS cruisers all over. We establish data links with local cruisers. DT-III did everything shy of shooting the missile, established the data link, passed the data, and validated the data.

Davis; *The F-35 & AEGIS are a great Naval integration story, there is a lot of potential, a lot of excitement. Not a Harrier, or Hornet, this is a totally a new and different capability. The MV-22 was a disruptive technology and it changed our assumptions about how we are going to operate an assault platform from a sea base. It also changed drastically what we do ashore.*

This jet will do that for us as well, and I am proud of the Marine Corps for being up front and leading this thing. And if you had enough real estate to put as many aircraft as possible on a ship like this, there are conditions and situations where you would want to do that.

I think its primary mode will be as an amphibious ship loaded with our typical MEU capability. But there are times we would want to load up like this (jet heavy).

This ship would normally carry 1500 Marines, with a surge capacity of 1800. Two battalion of Marines, Americas most potent weapon, the Marine Rifleman.

Can you discuss the big Picture deployment to Japan? How does tomorrows demo fit in with it?

We are investigating the right mix of assets on the ship to support the MEU. Is it 6 or 8 F-35Bs? We want a solid deployment, move out to Japan and establish normal operations as a 5th Gen platform in the Pacific Region. We've been planning for this for a long time.

I want to send F-35s to Japan and have them operate as successfully as we do in Yuma, AZ & Beaufort, SC and extend this 5th Gen capability for our forces in the Asia Pacific. I think its tailor made for that region.

It has an incredible capability, it's got great sensors, great weapons, great radars, great agility, great flexibility, and its tailor made for a dynamic region like the Asia Pacific.

Our Harriers have a set amount of capability, and we've been deploying our MEUs with Harriers but the Harrier is not as combat capable as an F-35. I mean for the full range of military operations. We'd always say "if its really a bad air to air (A2A) threat, get some additional jets up there, get some more capability."

I have no pause or hesitation that this jet will dominate in an A2A environment, would dominate in a strike environment, dominate in a CAS environment, and would also do a very nice job in an electronic warfare realm as well. And I think that we talk about higher threat systems out there.

We do a good job escorting our assault support platforms, with our attack helicopters. But our jets do helicopter escort as well and I think the F-35B is going to be one of those escort platforms that we are going to rely on for MV-22s, certainly for going into contested areas.

Can you provide an overview of the mission tomorrow, and the message it sends?

We are doing MV-22 escort with a six ship F-35B strike. Bottom line going into a contested environment, set the MV-22s down, deliver a notional group of Marines.

Airplanes are dedicated to the escort mission and strikes, some A2A and A2G. So we are practicing what we will perform for the MEU of the future.

With those final comments the interview came to an end, yet the picture was clear;

The integration of the F-35B with the MAGTF changes everything.

We wish to thank Lt. General Jon "Dog" Davis, USMC Deputy Commandant for Aviation; USMC VMX-1 Commanding Officer, Col. George "Sack" Rowell and Sylvia Pierson, Brandi Schiff, JSF/JPO PA; Capt. Sarah Burns and 1st Lt. Maida Zheng, USMC PAOs.

This article was first published on December 4, 2016.

The US Navy works with French Naval Air Wings

The ship is seen in the Atlantic Ocean conducting carrier air wing exercises with the French navy.

In a two part series published by USNI News, the activities aboard the Bush were discussed.

ABOARD AIRCRAFT CARRIER USS GEORGE H.W. BUSH, IN THE VIRGINIA CAPES OPERATING AREA

Performing touch-and-go's, catapult launches and arrested landings, French naval aviators are now qualifying aboard USS George H.W. Bush (CVN-77) and speeding up the timeline for their carrier to be combat ready.

Dubbed exercise Chesapeake 2018, about 350 French aircraft maintainers, flight deck crew members, and Dassault Rafale M fighter and Northrop Grumman E-2C Hawkeye pilots are spending about a fortnight aboard George H.W. Bush, preparing for when France's aircraft carrier FS Charles de Gaulle (R91) is ready to return to service this summer, French Navy officials said.

"We are beginning early what we're supposed to do next autumn," said Cmdr. Marc, the French airwing commander aboard George H.W. Bush. Citing security concerns, French Navy officials asked to be identified using first names only. "That's a great to start for us and being really ready to start again with Charles de Gaul next autumn."

Charles de Gaulle is France's only carrier with catapults and arresting wires. Unlike in the U.S., which currently has 11 such carriers, when France's sole carrier is in the shipyard, French aircrews do not have another platform to operate from.

If the French sailors had not come to train and perform carrier qualifications in the U.S., Cmdr. Marc said Charles de Gaulle would require many more months of training and exercises before being ready for combat missions.

Charles de Gaulle last deployed to the Eastern Mediterranean in 2016. When that deployment ended, the carrier entered the yard for an 18-month maintenance period, which is expected to be completed this summer, Cmdr. Marc said.

During past deployments, Charles de Gaulle has played an integral role in the fight against ISIS in Syria and Iraq. For several months in 2015 and 2016, during a lull in U.S. carrier operations in the Middle East, Charles de Gaulle led the allied strikes against ISIS targets in the region and served as the command element for U.S. Naval Forces Central Command's Task Force 50 – the first time a non-U.S. ship has served as a Task Force commander.

https://news.usni.org/2018/05/15/33590?utm_source=USNI+News&utm_campaign=78a947edb6-USNI_NEWS_DAILY&utm_medium=email&utm_term=0_0dd4a1450b-78a947edb6-230422265&mc_cid=78a947edb6&mc_eid=d5b4bb05ef

When Chief of Naval Operations Adm. John Richardson and Chief of Staff of the French Navy Adm. Christophe Prazuck stood together on the flight deck of carrier USS George H.W. Bush (CVN-77) on Monday, pairs of fighters flew overhead – one American F/A-18E-F Super Hornet, one French Rafale at its side.

E-2C Hawkeyes – the U.S. Navy planes with plain gray radar domes, the Marine Nationale ones with their anchor and bullseye naval aviation emblem painted on – sat on the flight deck, set to be used interchangeably in later flight operations.

A flurry of colorfully clad flight deck crew members scurried around the admirals, with the only easily identifiable marker of nationality being the French crews' distinct purple pants compared to the U.S. Navy's khaki or dark pants.

This level of integration is exactly what the admirals hoped to gain from exercise Chesapeake 2018, originally conceived of as a means to get French pilots back at sea while their sole carrier wraps up a deep maintenance period.

"As we look out on the flight deck waiting to see the next launch, it's almost impossible to tell the difference between U.S. sailors and French sailors as they prepare for the next launch," Richardson said in the ship's bridge, in a message broadcast to the ship over the 1MC.

"This is exactly the level of teamwork we're going to need as we confront high-end competitors at sea in high-end blue-water warfare. We're going to need our partners and allies to fight with us in the most advanced ways at sea to maintain sea control, maintain air control and protect this international order we've worked so hard to build together over the last 70 years."

https://news.usni.org/2018/05/15/cno-u-s-french-integrated-air-wing-helping-develop-one-larger-team-to-tackle-maritime-operations?utm_source=USNI+News&utm_campaign=78a947edb6-USNI_NEWS_DAILY&utm_medium=email&utm_term=0_0dd4a1450b-78a947edb6-230422265&mc_cid=78a947edb6&mc_eid=d5b4bb05ef

Col. Wellons, MAWTS-1: Shaping a Way Ahead for the USMC and the Joint Force

By Robbin Laird

MAWTS-1 plays a unique role within the USMC and in the joint force.

In our book on the reshaping of Pacific strategy and the role of new technologies and concepts of operations, we highlighted the role of the warfighting centers in the development and evolution of US forces, for which MAWTS-1 has played a key role with the Marines first introducing Ospreys and then F-35s into the warfighting force.

MAWTS pilots and trainers are looking at the impact of V-22 and F-35 on the changes in tactics and training generated by the new aircraft. MAWTS is taking a much older curriculum and adjusting it to the realities of the impact of the V-22 and the anticipated impacts of the F-35.

MAWTS is highly interactive with the various centers of excellence in shaping F-35 transition such as Nellis AFB, Eglin AFB, the Navy/ Marine test community at Pax River, Maryland, and with the United Kingdom.

In fact, the advantage of having a common fleet will be to provide for significant advances in cross-service training and CONOPS evolutions.

Additionally, the fact that MAWTS is studying the way the USAF trains combat pilots to be effective flying the F-22 in shaping the Marine F-35B Training and Readiness Manual is a testimony to a joint-service approach.

This is all extremely important in how MAWTS is addressing the future.

An emerging approach may well be to take functions and then to redesign the curriculum around those functions.1

What we forecast in our book is certainly happening.

During my recent visit to Yuma Marine Corps Air Station in May 2018, I had a chance to discuss the recent experience of Marines shaping and participating in the latest warfighting exercise or WTI Course.

The course is a seven-week training event hosted by the squadron's cadre. The squadron provides standardized tactical training and certification of unit instructor qualifications to support Marine aviation training and readiness and assists in developing and employing aviation weapons and tactics.

The role of the WTI was described in an article by Sgt. Sarah Fiocco and published on April 21, 2015 as follows:

In a seven-week period, the cost of sending one Marine through Weapons and Tactics Instructors course is comparable to the cost of a four-year education at an Ivy League university.

Sponsored by Marine Aviation Weapons and Tactics Squadron 1, the cost to graduate one certified weapons and tactics instructor from the course is $200,000. A cost, which puts each candidate through a full range of advanced aviation operations.

The course serves to train the best pilots in the Marine Corps to return to their units as training experts. This process requires countless hours from the MAWTS-1 instructors and staff to ensure they are sending exceptionally-trained WTIs back to the fleet Marine force.

"These students will be the people, who the commanding officer looks to when it comes to handling the training plan of an entire squadron," said the Academic Department Head, WTI, MAWTS-1. "He looks at them to be the guy, who says, 'We're good to go to combat.'

"He's the guy the CO will trust."

Before pilots can even attend the advanced course, they must fulfill a slew of prerequisite certifications, to include low-altitude tactics instructor and air combat tactics instructor. Pilots achieve most of these certifications from their units, building their experience base in order to qualify them for the WTI course.

"These pilots are already instructors before they come out here," the Academic Department Head said. "We also go see these Marines fly three to six times a year before they come to WTI.

"We can say, based off our experience, if a Marine we observed is ready to go to WTI, or if they need to work on something."

On the first day of class, the pilots receive a 50-question inventory test. This is followed by nearly two months of classroom instruction, flight simulators and piloting training flights on their specific aircraft.

The course begins with instruction exclusive to each student's aircraft then expands to advance training that incorporates other platforms and units.

The students will graduate as experts on their particular aircraft, with the knowledge of how to plan and how to train others. These skills acquired from the course will ultimately be applied to their fleet units and Marine Corps operations as part of the Marine Air Ground Task Force.

"During the final exercise, everyone is working together. From close air support, to battalion lifts, the whole MAGTF is involved," the Academic Department Head said. "When we get to that final exercise in WTI, it's all on the students. They know how to put together a plan and execute, so we are sitting back for the most part just being safety backstops."

Much like the selection process for the students, the staff is selected for the high-level of expertise they bring to course. WTI instructors' contribution to training and standardization of coursework is what makes WTI the valuable asset it is to the Marine Corps.

"All the instructors, who teach here are handpicked," the Academic Department Head said. "We do everything we can to ensure the fleet is getting back the best instructors possible."

The Weapons and Tactics Instructor Course is a seven-week course consisting of advanced tactical aviation training designed to produce weapons and tactics instructors.

The course will serve in key training officer billets to act as a training expert in the fleet, ensuring that Marine aviation units continue to train effectively and to a standard across the Marine Corps. It is courses like WTI, which reinforce the Marine Corps' role as our nation's force in readiness.

WTI has become especially significant as the Marines are going through the strategic shift from a predominant counter-insurgency and stability operations period of warfare to preparing for higher-intensity, peer-to-peer conflict.

It means as well that crisis management in a counter-insurgency operations is clearly different from those involving higher levels of conflict and potentially including peer competitiors.

And as the Marines have already introduced the F-35 into the MAGTF and are adding the CH-53K and other new capabilities, there is a clearly a shaping and learning process underway for the USMC and the joint force.

MAWTS-1 is clearly at the center of this process.

During this visit, I had a chance to talk with the outgoing CO of MAWTS, Col. Jim Wellons about his time at MAWTS.

We have talked before during his time at MAWTS and those interviews as well as follow-ons can be read here:

https://sldinfo.com/2016/12/the-way-ahead-for-usmc-con-ops-the-perspective-of-col-wellons-co-of-mawts-1/

https://sldinfo.com/2017/11/evolving-the-capabilities-of-the-magtf-the-case-study-of-the-f-35-and-himars/

https://sldinfo.com/2017/11/an-overview-on-wti-1-18/

With the coming of the F-35, the Marines have led the way at the outset for the US services which has meant that the Marines have been working closely with the USAF as that service brings its F-35s into initial operating capabilities.

According to Col. Wellons: "We have always had a close relationship with the US Navy.

"We are after all Naval aviators.

"I cannot over-emphasize our close working relationship with the US Navy and Top Gun, where we have always had several USMC aviators filling highly sought after exchange tours.

"We have some challenges but also many opportunities.

"Top Gun has a strong emphasis on Super Hornet and are just beginning to roll out their F-35C course, which we intend to support.

"We have legacy F/A-18s but do not fly the Super Hornet and the USMC has been leaning forward on the establishment of the full spectrum of F-35 tactics, having already executed five WTI classes with the F-35B.

"Recently we have made huge strides in establishing ASLA joint communications standards and we are closer now than ever before to aligning all the service standards with joint communications – all the service weapons schools have been cooperating in this effort.

"With regard to working with the USAF — over the past decade, as we operated together during the wars in Iraq and Afghanistan, we became much closer and better integrated across the service weapons schools.

"But the advent of the F-35 has really accelerated our close working relationship with the USAF.

"The standup of F-35 was "joint" from the very beginning, and the USMC has been aggressive with the stand up of our operational F-35s – the first of all the services to declare IOC, deploy overseas, and conduct weapons school courses with the F-35.

"As a result, we have been at the forefront of lessons-learned with the aircraft in terms of sustainment, deployability, expeditionary operations and tactical employment."

"We currently have a former USMC F/A-18 instructor pilot flying F-35As on an exchange tour with the USAF Weapons School, and we will soon have the first USAF F-35 exchange pilot coming to Yuma for a tour as instructor pilot in the F-35 division at MAWTS-1.

"We are all learning about employing, supporting and sustaining the F-35, and deploying it to places like the Western Pacific, where VMF-121 has been in place now a year."

Question: During my time in Australia earlier this year, the Commander of the 11th Air Force raised a key question about the need for the USAF to ramp up its mobile basing capabilities.

How has the USAF interacted with the Marines at Yuma with regard to working through a new approach?

Col. Wellons: "Within the USMC, expeditionary operations are our bread and butter. In a contested environment, we will need to operate for hours at a base rather than weeks or months.

"At WTI we are working hard on mobile basing and, with the F-35, we are taking particular advantage of every opportunity to do distributed STOVL operations.

"It is a work in progress but at the heart of our DNA.

"We will fly an Osprey or C-130 to a FOB, bring in the F-35s, refuel them and load them with weapons while the engines are still running, and then depart. In a very short period of time, we are taking off with a full load of fuel and weapons, and the Ospreys and/or C-130s follow close behind.

"We are constantly working on solutions to speed up the process, like faster fuel-flow rates, and hasty maintenance in such situations.

"Of course, we have operated off of ships with our F-35s from the beginning, and that is certainly an expeditionary basing platform.

“We have been pleased with what we have seen so far in regard to F-35 readiness at WTI.

“For example, in the last WTI class we had six F-35s and we had five out of six up every day, which was certainly as good as anything we have seen with legacy aircraft.

“During the most recent class, F-35s supported us with over 95 sorties and a negligible cancellation rate.

“Our readiness rates at WTI are not representative of the fleet, where we continue to work on enhancing overall readiness goals with F-35.”

We then discussed the F-35 and USMC operations beyond MAWTS-1.

Col. Wellons: “This is still an early variant of this airplane.

“It is the early days for the F-35 and we are working things like software evolution.

“Yet the aircraft has already had an impact in the PACOM AOR.

“We can put this airplane anywhere in the world, sustain it and fly it and get a key deterrent impact, as we have already begun to see.”

Figure 6 Colonel Wellons at MCAS Yuma. Credit: USMC

Question: Looking back at your two and half years in command at MAWTS-1, what are some of your thoughts about the dynamics of change which you have seen while here?

Col. Wellons: “When I came here, the squadron was in great shape. I had the impression that what I needed to do was to focus on trying to sustain the standard of excellence that had already been established, because the squadron was really firing on all cylinders.

“I felt we were training at a world-class level and were training to the appropriate skills.

"But during my first year we faced dramatic and significant readiness challenges across Marine aviation, almost at an historic level.

"This led to significant reductions in the level of pilot proficiency and material readiness, and challenged our ability to meet training objectives during WTI."

"The readiness cratering also impacted morale and placed our staff in a difficult position. If you have students that are coming to WTI that are barely qualified, who have just barely achieved the prerequisites necessary to come to a WTI class, that creates a risk management problem and makes it difficult to train at the graduate level.

"We were looking at dips in proficiency from flying 15-20 hours a month down to 10 or 11 hours a month or lower, and this required us to make some substantial adjustments to how we approached and ran the WTI class.

"Fortunately, this situation has dramatically changed for the better.

"During this last WTI course we had the highest level of readiness that I think we have ever seen for our fixed wing fleet, and our pilots are back above 20 hours a month across all communities.

"I would caution that we view this readiness recovery as fragile at this point, but it is definitely headed in the right direction."

Question: Clearly, there is a strategic shift underway for US and allied forces to now operate in contested environments. That has happened during your time here.

How has that affected what you have had MAWTS-1 focus upon?

Col. Wellons: The team at 29 Palms as well as at Yuma have ramped up the contested and degraded environment that we present to our training audience at WTI and across all the other service level MAGTF training venues.

"We have challenged our students, especially this year, to operate in environments where communications and navigation systems are challenged, facing the most sophisticated and capable adversaries we can find.

"We focused on the idea that in the future fight our primary means of navigation and communication will probably be denied, and certainly degraded and our operators may have to use old fashioned techniques to get bombs on target."

Question: You are clearly working what might be called F-35 2.0 while flushing out the dynamics of 1.0.

And one key area where that is happening is with regard to the sensor-shooter relationship.

We talked last year about this dynamic, what has been happening since then?

Col. Wellons: In part, it is about the transformation of the amphibious fleet whereby the shipboard strike systems or sensor systems can work with the reach of the F-35 as a fleet.

"For example, we see clear interest from the Navy's side in exploiting 5th generation capabilities in the amphibious fleet using the Up-Gunned ESG, that will better leverage the capability they have got with the F-35.

"Naval integration will be a major line of effort in the WTI course going forward."

"The F-35 is leading to a fundamental reworking of where we can take the sensor-shooter relationship.

"We tend to focus on the airplane's sensor and how that sensor can go out and find a target and employ its own ordinance on that target.

"That is certainly something which the F-35 can do.

"But it can also enable an off-board shot, as in the case of HIMARS/F-35 integration.

"Or it can work with the G/ATOR radar on the ship or the ground to enable weapons solutions for other platforms in the distributed battlespace.

"It then becomes a question of how do I maximize the number of targets I can hit with the F-35 distributed force rather than how many targets can an individual fighter hit."

"This is part of the combat learning we are working on at MAWTS-1 as well."

Question: Assuming readiness remains at an appropriate level, what challenges do you see in the near term with regard to training?

Col. Wellons: Clearly, a major challenge we face is the limitations of our training ranges.

"We need to expand the potential of tasks we can do on these ranges to replicate a realistic and lethal contested environment.

"This is another consequence of our budget challenges in recent years, and we are pushing hard for upgrades of all our emitters, target sets, and simulation capability in order to enable full spectrum training at the high end."

The featured photo shows Col. Wellons at MCAS Yuma. Credit Photo: USMC

Footnotes:

1. **Laird, Robbin; Timperlake, Edward; Weitz, Richard (2013-10-28).** ***Rebuilding American Military Power in the Pacific: A 21st-Century Strategy: A 21st-Century Strategy*** **(Praeger Security International) (pp. 258-259). ABC-CLIO. Kindle Edition.**

Viking Enablement: The US Navy Selects a Norwegian Missile

By Robbin Laird

Recently, the Pentagon announced that Raytheon has won a $14.8 million contract to purchase the Naval Strike Missile for the Littoral Combat Ship and to put it in line to do the same for the new class of frigates which the US Navy is postured to buy.

According to a story published by USNI News:

The award calls for the delivery of the Kongsberg designed, "encanistered missiles loaded into launching mechanisms; and a single fire control suite." The contract did not specify how many missiles were paid for in the contract, but USNI News understands the Thursday award buys about a dozen missiles.

The subsonic NSM has been in service with the Royal Norwegian Navy since 2012. The weapon has a range of about 100 nautical miles with a cost of slightly less than the Raytheon Tomahawk Block IV cruise missile (the Navy quotes the price per round of the TLAMs at $569,000 per round in FY 1999 dollars (about $868,000 in 2018, adjusted for inflation).

The companies announced they would pair together to compete for new U.S. anti-ship missile contracts in 2015. In 2016 Raytheon and Kongsberg agreed to assemble and test the Norwegian missile's components in Raytheon's Tucson, Ariz. facility and the launchers at Raytheon's plant in Louisville, Ky.

Raytheon has paired with Kongsberg Defence and Aerospace (KDA) in the missile world for some time, and they have a recent win as well in an Australian competition where the NASAMhas been selected by the Australian Army.

As described on the Kongsberg website:

When searching for missiles for its new frigates and coastal corvettes, the Royal Norwegian Navy studied thoroughly existing missiles on the market and the planned upgrades of these. None of these missiles were found to satisfy the requirements of a modern navy well into 2015 and beyond. It was therefore decided to develop a completely new missile based on latest technology, the NSM.

NSM is the only fifth generation long range precision strike missile in existence as per today. Already chosen by the Royal Norwegian Navy for its new frigates and new coastal corvettes, the NSM will be fully operational on these ships when they enter service in the near future. The NSM is also selected by the Polish Navy for use on its new coastal artillery installations.

The NSM is a very flexible system which can be launched from a variety of platforms against a variety of targets.

The airframe design and the high thrust to weight ratio gives the NSM extremely good maneuverability. The missile is completely passive, has proven its excellent sea skimming capabilities and with its advance terminal maneuvers it will survive the enemy air defences. The Autonomous Target Recognition (ATR) of the seeker ensures that the correct target is detected, recognised and hit, at sea or on land.

Obviously, the US Navy agrees.

And in a little noticed deployment in 2014, the Norwegians brought a frigate to RIMPAC.

Chris Cavas of Defense News has highlighted the importance of the missile exporting mission as a motivator for coming to RIMPAC 14.

And the crew of the Aegis frigate Fridtjof Nansen — the first Norwegian ship to take part in the huge Rim of the Pacific (RIMPAC) exercises — did just that when they fired a single surface-to-surface missile and scored a dramatic hit on an old target ship.

"It was a very successful shot.

The missile performed exactly as programmed and expected," Cmdr. Per Rostad, the ship's commanding officer, said in an interview Saturday.

Speaking via satellite phone while his ship was underway near Hawaii, Rostad would not provide details of specific features demonstrated in the July 10 live fire exercise, when the Fridtjof Nansen launched a Naval Strike Missile (NSM) at the decommissioned US Navy amphibious ship Ogden.

"But the missile system has a number of features that make it unique on the market and we were able to demonstrate those features," Rostad said. "We also demonstrated some agility."

Developed by Kongsberg, the NSM is designed to be highly maneuverable, and features an autonomous target recognition capability that allows it to recognize ships of a particular class or design, and even to target specific areas of a ship based on its silhouette.

"The key takeaway from the NSM exercise," Rostad said, "is the missile was demonstrated to work just as well in a tropical climate as in an arctic climate.

The NSM comes into the context of a broader set of developments underscoring the advantages of shaping a family of missile systems for a fleet as well.=

The JSM is designed to be a family of systems, with an air launched variant, and this has been a key driver for Norwegian government investment.

In looking at the F-35 as a global program, not simply an aircraft but a key enabler of a 21st century air-combat enterprise, we noted earlier:

With the F-35 the situation is totally different. The F-35A to be purchased by Norway has the same software as every other global F-35, and so integration on the Norwegian F-35 provides an instant global marketplace for Kongsberg. And the international team marketing the aircraft – is de facto – working for Kongsberg as well.

It is very likely, for example, that Asian partners in the F-35 will find this capability to be extremely interesting and important. And so Kongsberg's global reach is embedded in the global reach of the F-35 itself.

And since I wrote that in 2014, both the Australians and Japanese are working with Kongsberg along these lines.

In a story we published on June 29, 2107, we highlighted the allied engagement around this family of systems.

During a visit to Norway earlier this year, the Norwegian Deputy Minister of Defense underscored the importance of allies building new missile capabilities for the F-35 as a coalition aircraft.

In the discussion with Mr. Øystein BØ, the State Secretary and Deputy Defense Minister at the Norwegian Ministry of Defense, the F-35 and the Norwegian JSM was discussed as follows:

An aspect of the F-35 program, which is not generally realized, is the importance of allied investments in capabilities, which can be used across the F-35 global enterprise.

In the Norwegian case, the Joint Strike Missile (JSM), which is considered a crucial asset in providing for maritime defense of Norway, is available to other NATO-allies flying the F-35 as well.

"This is a 21st century aspect of burden sharing as our investments in 'our' missile benefits all F-35 users of this missile across the globe, whether in Japan, Australia or in Europe."

"It is not money that just goes directly into our armed forces, but it's a lot of money that goes into developing capabilities that the alliance needs. It is about contributing to our joint security as well."

According to Australian Aviation:

Kongsberg Defence Systems has entered into a contract with Defence for the integration of a new capability in the Joint Strike Missile (JSM) worth the equivalent of $23 million.

The unique, state-of-the-art radio frequency (RF) seeker sensor developed by BAE Systems Australia will enable the JSM to locate targets on the basis of their electronic signature, Kongsberg said in a statement.

This contract is a result of an agreement between Australia and Norway to cooperate on the further development of the JSM that was announced in February 2015.

"JSM is the fifth-generation long-range precision strike missile that will be integrated for internal carriage on the F-35," Kongsberg stated. "Using a combination of advanced materials, ability to fly low, while following the terrain and using advanced passive seekers, the missile is extremely difficult to detect and stop, even for the most advanced countermeasures and defence systems."

BAE Systems stated that the signing of the contract will enable Kongsberg to continue the integration and qualification of the passive RF sensor.

"The company will provide a low-cost, lightweight and highly sensitive electronic support measure receiver for incorporation on JSM, which will feature an additional land attack and littoral attack capability, as well as a two-way communications line for target adjustment and inflight termination," BAE Systems stated.

"In its work with Kongsberg, BAE Systems has delivered a pre-production passive RF sensor for the JSM program, which was used to perform fit checks, system integration and support flight-testing in a development-standard missile."

In support of the contract, BAE Systems will supply new sensors to Kongsberg for use in its qualification activities.

"This is a great example of niche technology being developed through government and industry collaboration that has the potential to provide long-term, sustainable exports for Australia," said BAE Systems Australia chief executive Glynn Phillips.

The company stated that the technology was developed with the support of a Defence-funded program, and that it received a grant in 2013 to help commercialise the technology.

"We are very pleased that Australia joins the development of JSM by funding the integration of the RF seeker, and that we together can increase the JSM capabilities," said Eirik Lie, president of Kongsberg Defence Systems.

Now Japan is moving forward in considering JSM for its own F-35s as a land attack and naval attack component for its air combat force.

According to a June 26, 2017 article published by Yomiuri Shimbun, the Japanese Government mulls equipping F-35s with air-to-surface missiles.

The government is considering equipping cutting-edge F-35 stealth fighters with air-to-surface missiles, which are capable of striking remote targets on land, and plans to deploy these fighters to the Air Self-Defense Force, The Yomiuri Shimbun has learned.

It will become the first introduction of such missiles for the Self-Defense Forces. The government hopes to allocate relevant expenses in the fiscal 2018 budget, according to sources close to the government. The main purpose of the introduction is to prepare for emergencies on remote Japanese islands, while some experts believe the government is also eyeing possession of the capability of attacking targets such as enemy bases for the purpose of defending the country.

According to the sources, F-35 fighter jets that will replace the ASDF's F-4 fighter aircraft are employed by U.S. forces and others. The F-35 aircraft has an advanced stealth capability that makes the aircraft less visible on enemy radar. The ASDF plans to introduce a total of 42 units of the F-35 and gradually deploy them to the Misawa Air Base in Aomori Prefecture starting at the end of this fiscal year. The government is considering introducing some additional capabilities for the aircraft.

The most likely option the government is currently focusing on is the Joint Strike Missile (JSM) that is being developed mainly by Norway, which also participated in an international project to develop the F-35. The ASDF currently has no air-to-surface missile capabilities, but the JSM has both air-to-ship and air-to-surface capabilities, with an estimated range of about 300 kilometers.

The Defense Ministry is building up national defense systems to defend remote islands, such as the Nansei Islands. In addition to deploying new Osprey transport aircraft to the Ground Self-Defense Force, the ministry plans to create an amphibious rapid deployment brigade, similar to other nations' marines.

As an air-to-surface missile has a long range, it is possible to effectively strike a target from safe airspace. For this to be possible, the ministry decided it was necessary to consider introducing the JSM to prepare for situations such as preventing foreign military vessels from approaching remote islands or the SDF launching an operation to regain control of an occupied island.

Meanwhile, if the F-35 aircraft with an advanced stealth capability is equipped with long-range air-to-surface missiles, it will effectively be possible to use the F-35 to attack bases in foreign countries.

The government has said that the Constitution allows Japan to possess the capability of striking enemy bases, but the nation does not actually possess the capability as its political decisions have been based on an exclusively defense-oriented policy.

If Japan introduces air-to-surface missiles, it could prompt opposition from neighboring countries. Therefore, the government is believed to be seeking the understanding of those countries by explaining that it does not intend to use the capability to attack enemy bases, but to defend remote islands.

However, with North Korea continuing its nuclear and missile development programs and repeatedly conducting provocative actions, there are growing calls for the government to possess the capability to strike enemy bases to improve Japan's deterrence.

Amid such a situation, Prime Minister Shinzo Abe has expressed on multiple occasions his intention to consider the issue. On June 20, the Liberal Democratic Party's Research Commission on Security compiled an interim report on proposals for the next medium-term defense program for fiscal 2019-23, in which it called for the government to swiftly start discussions on possessing the capability to attack enemy bases.

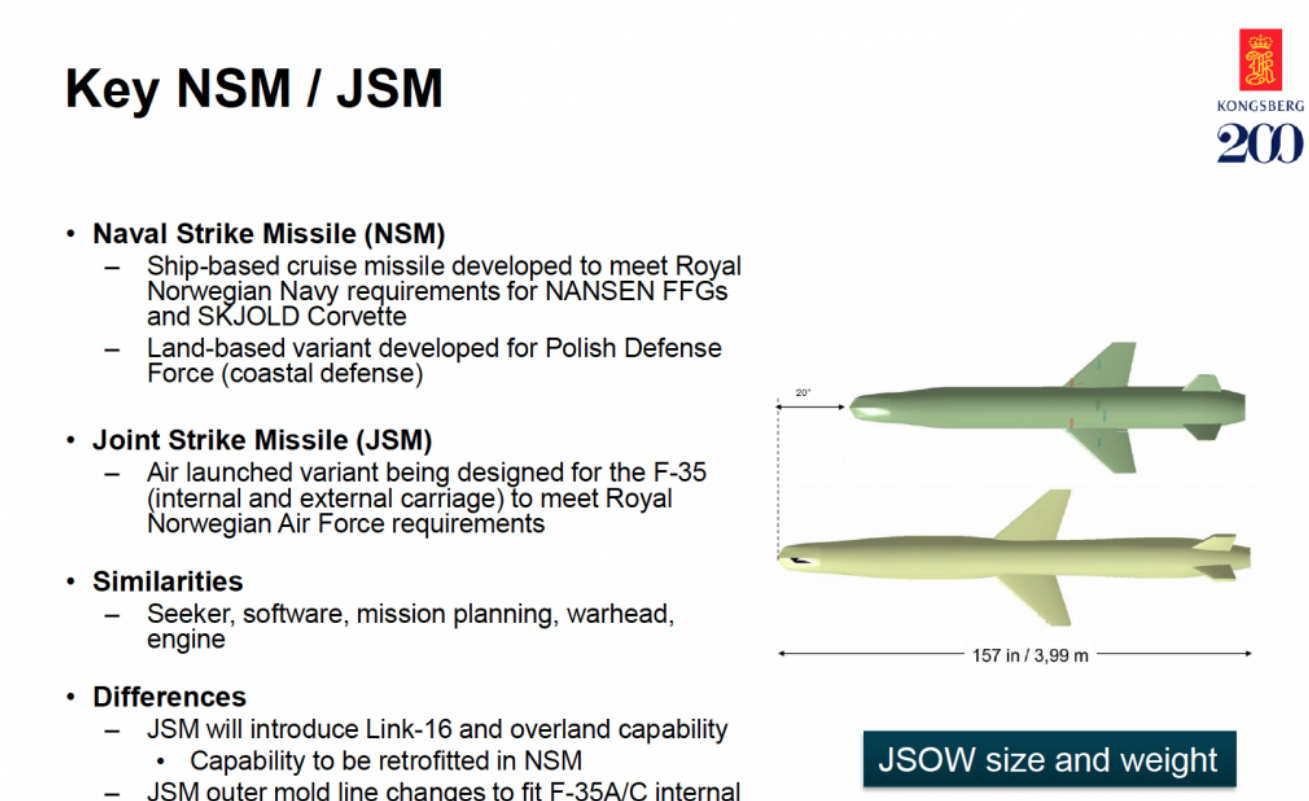

Figure 7 JSM and NSM Compared: Kongsberg Briefing

In short, the US is leveraging allied investments along the line which I highlighted in my report on the strategic opportunity to do so.

As the US looks to develop new capabilities, in many ways, a key way to accelerate modernization is embracing foreign capabilities

The shift from slo mo to preparing for high tempo and high intensity operations is a major challenge for the US military and its allies. It is about a culture shift, a procurement shift, an investment shift. But mobilization is even more important than modernization.

To get ready for the shift, inventory needs to become more robust, notably with regard to weapons. In visiting US bases, a common theme in addition to readiness and training shortfalls, is the challenge of basic inventory shortfalls.

The Trump Administration has come to power promising to correct much of this. But there simply is not enough time and money to do readiness and training plus ups, mobilization and rapid modernization.

Donald Trump as a businessman might take a look at how DoD could actually functions as an effective business in equipping the force and having highlighted the question of allies might be pleased to learn of significant allied investments in new combat systems which his own forces can use, thus saving money and enhancing capability at the same time.

One way to augment the force would be to do something which would seem to be at odds with the Make America Great notion. As one of my Danish friends put it well: "I have no problem with the idea of making America great again. For me, the question is how?"

One way to do so would be leverage extant allied programs and capabilities which if adopted by the US forces would save money but even more importantly ramp up the operational capability of the US forces and their ability to work with allies in the shortest time possible. By so doing, the US could target investments where possible in break through programs which allies are NOT investing in.

https://sldinfo.com/2017/08/leverage-allied-investments-and-combat-learning-experience-in-modernizing-the-u-s-military/

The Coming of the HMS Queen Elizabeth

In the video of the week, the Captain of the HMS Queen Elizabeth discussed the impact of the ship on the Royal Navy, the UK Armed forces and the nation.

This video was first published on May 25, 2016.

Recently, we visited HMS Queen Elizabeth at Portsmouth to have an update on the ship.

This video was done prior to its initial sea trials in the North Sea and its arrival in Portsmouth earlier this year.

It provided an overview of the expectations, which are clearly being met.

Visiting RAF Lossiemouth

The Royal Air Force is in transition as the Tornado is retired, the Typhoon is modernized and the P-8 and F-35 are introduced. Infrastructure of key bases is being modernized as well.

This transition as seen by officers involved in the operation and support of combat aircraft at RAF Lossiemouth is presented in this report.

This report was first published in 2016 and provides perspective as of the date of publication.

For a flipbook version of the report, see below:

http://online.anyflip.com/xgio/wibu/mobile/index.html

And for a PDF version of the report, see below.

https://defense.info/special-reports/2018/06/visiting-raf-lossiemouth/

Featured Defense System: A330MRTT

According to a story published April 12, 2108 on the UK Royal Navy website, the training of the Voyager tankers with UK F-35s was highlighted.

Thousands of feet above the Eastern Seaboard of the USA four British jets of tomorrow take on fuel from an RAF tanker – preparation for their impending arrival in the UK.

Fleet Air Arm and RAF crews are preparing around the clock to deliver the first F-35B Lightning II stealth fighters – the striking power of the nation's two new aircraft carriers – to their new home at RAF Marham in East Anglia.

Having learned the art of flying fast jets in the UK – earning their wings on Hawk trainers at RAF Valley – all pilots selected for the F-35 programme cross the Atlantic and learn to master the new fifth-generation fighter at the US Marine Corps' base at Beaufort in South Carolina.

Training on the multi-million pound jets will remain Stateside, but the UK's front-line F-35 squadrons – firstly 617 Sqn RAF, later 809 NAS – will operate from Marham, each with mixed RN/RAF air and ground crew.

There's just the small matter of 4,134 miles separating Beaufort and Marham – most of it Atlantic Ocean and the F-35B has a range of about 1,000 miles.

Hence the need for air-to-air refuelling (aka 'tanking')…several times.

So the RAF dispatched one of its Voyager tankers from 10 Squadron at Brize Norton to Cecil Airport in Jacksonville, Florida, to practise refuelling manoeuvres by day and night with the jets over the USA's east coast.

It's not the first air-to-air refuelling with the F-35Bs… but it is the first crewed entirely by the RAF.

Two RN and two RAF Lightning IIs manouevred into position to take on fuel – inserting the nozzle of their fuel intake (the probe), into the funnel-shaped drogue which delivers that fuel.

The tanker – a modified Airbus 330 airliner – can pump as much as 132,000lb of fuel over a five hour mission, or enough fuel to fill an F-35B's tank nine times.

The coming few months mark a key period in the rebirth of Britain's carrier strike force. As well as 617 Sqn debuting at Marham, in the late summer HMS Queen Elizabeth will conduct her first trials with the new aircraft off the east coast of the USA.

https://defense.info/defense-systems/raf-refuels-uk-f-35s-with-the-uk-a330mrtt/

A UK Air Combat Strategy: Context and Options for the Way Ahead

The UK Minister of Defence announced in February 2018 that the government is working a new Air Combat strategy.

With Brexit and the current European dynamics, how will the UK air combat strategy interact with European initiatives?

How will the UK leverage Typhoon and shape a post-Typhoon strategy?

How will the UK leverage the launch of its new carrier and the coming of the F-35 to shape a way ahead for a 21st century air combat strategy?

Will the new Air Combat Strategy live up to the legacy of Air Marshal Dowding and his focus on the right concepts of operations for the RAF to deal with evolving threats and challenges?

Strategic Insights Report, 2

https://defense.info/strategic-insights/a-uk-air-combat-strategy-context-and-options-for-the-way-ahead/

Reshaping Combat Platforms: Re-Imaging the Energy Dimension

By Danny Lam

Firepower, Mobility and Protection are universal concepts that applies to any combat platform on land, at sea, underwater in air or space.

Efficiency and effectiveness, however, are difficult concepts. General Deptula's combat cloudconcept was based on a look at cost per desired effect which often yields very different values from economic costs.

A different perspective on cost per desired effect is to look at energy expended per desired effect.

The industrial age brought us specialized machines that made propulsion, firepower, protection and sensors unique specialties that each developed into a different field or discipline, with their own architectures, conventions, technological trajectories and way of thinking. i.e. Gunners and ship engineers are different groups, each with their own silos.

The architecture of firepower evolved from the earliest catapults to cannons to missiles or torpedoes "in water".

The goal of each of these systems is to deliver a unit of energy at a distance to cause disruption or destruction. Kinetic effects is the term of art.

Protection evolved from two directions. Passive protection in the form of armor that utilized a material that deflected / dissipated incoming kinetic energy. Or active protection in either kinetically or "mission killing" an incoming projectile or weapon or delivery platform.

Emission detection of energy and other signatures, and the use of energy to generate detectable signals is another application of energy for situation awareness systems.

Mobility, in turn, is a function of energy conversion that enable a platform to maneuver.

The common factor in these tasks is that it is all about creation, conversion, and transformation of energy.

During the industrial age, each of the specialized functions required its own unique means to do so.

Artillery utilize stored chemical energy in propellant to transport a projectile loaded with an explosive that released its energy in a way to cause damage. Armor have to be carried around whose purpose is to dissipate incoming energy.

Mobility in turn, relied on a specialized power plant that produced power transmitted through a dedicated drive train (often mechanically linked) that propelled the platform.

Reduction of each and every of these functions to its essential function described as energy enable a radical rethink of the purpose of a combat platform.

A modern tank firing a depleted uranium round essentially expends its kinetic energy (generated chemically) for transportation to the target, conversion to kinetic to defeat the protective armor of the target, and then utilities the small amount of energy remaining to damage the fragile internal components of the target.

A very small portion of the total energy released stored in the chemical propellant end up doing the work of destroying the target by causing spalling or post penetration destruction of fragile internal components — particularly the crew.

The same exercise applied to carrier borne aircraft engaging in air-to-air combat yields a depressing story of enormous energy consumed to transport aircraft, get it into position to engage enemy fighters, and then to dispatch a handful of Air-to-Air missiles to detonate a proximity warhead nearby that perhaps transfers less than one tenth of 1% of its energy to the target to destroy it.

Capt. Michael W. Byrnes writing in the Air & Space Power Journal noted that a single armor piercing incendiary round accurately fired by an unmanned platform that actually struck a vulnerable part of a manned fighter like the first compressor stage of the engine is enough to destroy it.

His work illustrates how far energy efficiency can conceivably be improved based on existing technologies better deployed.

Yet, the architecture of current systems, rather than prioritize improvement in accuracy and "first shot, first kill", still predominantly relies on industrial age concepts of massed firepower. The ultimate expression of this thinking is to fit a 20mm autocannon on the F-35 fighter. Properly deployed, it is hard to conceive of too many instances when a cannon can be useful without serious risks (e.g. from ground fire).

Massive energy wastage is the defining characteristic of our current combat systems.

Before the era of precision munitions, raids by thousands of bombers was required for a handful of bombs to find their target.

Precision munitions so improved on productivity that quite often, two munitions with a Pk .9 did the job that formerly required a massive strike package dropping tons of ordinance.

Is there room for a similar quantum jump in improvement in energy efficiency from new, as opposed to existing technologies as Captain Byrnes suggest?

Directed energy weapons that deliver their energy at the speed of light to target offer a quantum jump in efficiency similar from dumb to precision munitions. DE weapons often have the attribute that it can be dialed up and down as required: (i.e. radiation to produce a mission kill by blinding sensors or disrupting electronics, or kill with energy).

Scaling energy required to task is an attribute not practical for most chemical propellant powered kinetic weapons.

A related application of directed energy is Electronic Warfare that soft or mission kill hostile systems.

In terms of energy efficiency, these are revolutionary compared to weapons that depend on traditional kinetic weapons.

The sheer efficiency of DE suggest that the transition from conventional kinetic energy weapons to DE will move quickly, inhibited primarily by bureaucratic and organizational inertia common to all militaries.

In industry, where there is a market drive, industrial applications of lasers have exploded and far exceed the military space.

Indeed, many military lasers are but adapted commercial rather than special purpose military only lasers of the Star Wars era.

Soft kills are now viewed as just as valid and important as kinetic kills.

The advent of DE weapons reopen the question of whether the dominant mobility energy conversion architecture is ideal.

Since power plants will have to be able to both generate large amounts of excess (or exportable) energy, and also to store it for rapid dispatch to "surge" needs for DE systems, it raises a question of how best to store and convert energy aboard future combat platforms.

The dominant design for most naval vessels and land vehicles is for a powerpack (typically an internal combustion engine or gas turbine) to be directly coupled to the energy converter system (i.e. transmission) to the propeller / thruster or drivetrain.

Likewise, aircraft are optimized to generate power to "fly" with exportable power as a very distant second thought.

Optimization for large exportable power generation, the provision of space for energy storage and support for DE will obsolete most existing land, air and naval platforms.

If exportable energy is to be stored as electricity (i.e. super capacitors) as opposed to kinetic energy (i.e. flywheel), then it suggest that going "all electric" like the Zumwalt Class Destroyer rather than directly providing power for mobility via a drivetrain may be a far more effective solution.

Commercial cruise ships have recognized the advantage being able to dynamically reallocating energy; balancing mobility and hotel loads "on the fly". Cruise ships typically use typically use diesel, or gas turbine generators powering electric propulsors rather than a mechanically coupled drivetrain.

On land, a hybrid electric Wheeled Armored Fighting Vehicle that is powered by electric motors at each wheel have the advantage of a much more robust drivetrain that is more survivable if (e.g. one wheel) is destroyed by a mine. A tracked vehicle that encounter a mine and lose a track inevitably becomes a mobility and often mission kill even if the crew is unharmed.

Aviation will require considerable rethink and new architectures if priority is expressed not in payload of conventional weapons, but exportable energy generated and stored for DE systems.

A less obvious benefit of storing energy in liquid fuels (e.g. diesel) is that it is less volatile and dangerous compared to any chemical explosive or propellant. That in turn simplifies safety and reduce the need for protection of munition stores and supply.

The biggest bonus from going "all electric" is energy can be dynamically allocated to weapons, defense, communications or ECM or mobility far more seamlessly than existing dedicated architectures.

The overwhelming advantage enjoyed by specialist energy systems (e.g. missiles and cannon) against solutions that manage generic "energy" from a central pool is diminishing with the advent of directed energy weapons for both defense and offense, and the coming increase in energy requirements for ECM or future systems like rail guns.

Reframing the objective of many weapons systems as enabling a tiny fraction of the energy expended to be delivered "to target" in sufficient quantity and quality to either disrupt or disable an enemy opens the way to thinking about how weapons systems can be more energy efficient. Or, more efficient in terms of expenditure of energy (and other resources) for "desired effect".

It is time for a fundamental rethink of energy systems across all combat systems architectures.

The present architectures may be as outdated as infantry equipped with bolt action rifles in 1914.

This article was first published on February 22, 2018 and was the last piece produced by Danny Lam for us prior to his death and in his honor we have named our op ed section Danny's Corner