DEFENSE.info

USMC's Digital Interoperability Initiative and Effort

By Robbin Laird
April 20, 2020

Rethinking the Amphibious Task Force: Digital Interoperability and the Transformation of USMC Aviation

12/31/2019

With the transformation of Marine Corps Aviation, the older notion of the ARG-MEU is being replaced by a much more flexible concept of the amphibious task force.

And with the central importance of dealing with full spectrum crisis management, the capabilities resident in the task force as well as its enhanced capabilities to reachback to capabilities not organic to the task force is changing the concept of operations as well.

With the coming of the Osprey, the tyranny of helicopter range was broken, which allowed for the expansion of the core ARG-MEU to be able to cover a much wider range of operations.

With the addition of the F-35B to the force, and the building of a new class of large amphibious ships, the combing of Ospreys with F-35Bs has allowed the emergence of a new ampbhious based assault carrier concept.

By committing Marine Corps Aviation to shaping a digital interoperability capability, and with the coming of the CNI enabled F-35, the amphibious task force can add other new capabilities to extend its operational approach and envelope.

And enhanced capabilities to move data throughout the force to enable its capabilities to operate as an integrated distributed force means that the amphibious task force can be tailored to the threat and leverage reachback assets to the wider Navy fleet or Air Force assets as well.

Envisaged more than a decade ago, the Lightning Carrier concept is becoming a reality.

In an article by Megan Eckstein published by USNI News on October 23, 2019, the test of concept was highlighted.

The Navy and Marine Corps recently tested out the "Lightning Carrier" concept of packing an amphibious assault ship with F-35B Lightning II Joint Strike Fighter jets, and they will likely continue to expand and exercise this capability.

On Oct. 8, USS America (LHA-8) was photographed with 13 F-35Bs from Marine Fighter Attack Squadron (VMFA) 122 on its deck. America is one of two aviation-centric amphibious assault ships in the fleet, eliminating a well deck from its design and instead using that vast space for aviation maintenance areas, greater jet fuel storage and more.

Knowing that America and sister ship Tripoli (LHA-7) would have the capability to support so many F-35Bs, the services have long talked about the Lightning Carrier concept as a capability that would be useful in a high-end fight.

The jets' stealth, ability to collect and distribute vast data and strike targets would make them ideal for the opening of a fight: they could come off a ship at sea and take out enemy defenses with jamming and missiles, collect information and share it with the rest of the fleet at sea and Marines on the ground or heading ashore.

Still, though the jets routinely operate on the forward-deployed big-deck in Japan and have conducted a deployment from the U.S.-based Essex Amphibious Ready Group, operating so many at once is much different than previous operations with about six jets onboard and supplemented by tiltrotors and helicopters.

With the ampphibious task force concept, the Marines and the Navy can rethink what constitute the platforms which can become part of the task force going forward as well.

During a National Defense Industrial Association's annual Expeditionary Warfare Conference held last October, several panels and speakers addressed the idea of what comes next for the mix of ships in the amphibious fleet.

Megan Eckstein in her article published on October 29, 2019 reported on some of those discussions.

Under a "think exercise" explained by Congressional Budget Office senior analyst for naval weapons and forces Eric Labs, some LPD funding would be diverted to pay for the alternate ship. Labs made clear this was not a recommendation but rather an exercise to show what other kinds of fleets could be bought for the same money.

Under the long-range shipbuilding plan today, the Navy over the next 30 years would buy eight America-class LHAs and 20 San Antonio-class LPDs, which gives it a force of 37 ships in 2040 and just 35 in 2049. This current plan comes with a $75 billion price tag.

Under a new plan that diverts some LPD funding and invests in ships that cost $600 million to $700 million apiece, that same $75 billion could instead buy the eight LHAs and 60 to 70 alternate ships. That would create a force of 57 to 61 ships in 2040 and 83 to 93 ships by 2049.

Labs said the $600 million figure is more than an Expeditionary Fast Transport (EPF) and more than an LCS but less than an amphib. What that alternate ship looks like is unclear, but it could be a modified EPF with greater range, it could be a Landing Ship, Tank (LST) connector that is modified to support other missions beyond tank transport ashore, or it could be a commercial ship modified to support the movement of Marines from ship to shore and island to island.

Other speakers during the conference kicked around other ideas; John Berry, the director of the concepts branch at the Marine Corps' Combat Development and Integration directorate, suggested something akin to an Australian stern landing ship or a Danish Absalon-class support ship.

While many speakers focused on this new alternate amphib ship, one was highly focused on how to modernize or adjust today's LPDs and LHAs to better support operations. Rear Adm. Cedric Pringle, who until recently commanded Expeditionary Strike Group 3 and now serves as the commandant of the National War College, is focused on how today's ships can be better optimized for the fight he sees coming.

For example, Pringle said during the conference, "how do we actually get the LPD-17-class ship to give fuel to some of the smaller ships that are operating in the littorals? So right now the LCS, the Mk-6, all of the EPFs, as well as a lot of other assets that are being developed at speed; we have a lot of great assets that are coming online – the expeditionary staging base, the expeditionary staging dock – all of those assets will operate in the same battle space as our amphibious ships, who are already there, who are already delivering Marines to the mission set, who are already providing that command and control," he described.

"Why not have that integrated command and control? Why not figure out how to have the ships integrated, so that when the smaller ships need a drink of gas, so to speak, they don't have to go to the big-deck amphib, which currently is the only ship that can give fuel?"

He said he had the chance to speak to students at the Naval Postgraduate School in California during the course of his last assignment, and he told them he wanted to see thesis papers on these kinds of topics. Another he gave as an example is how to update today's steam-powered amphibious assault ships to include more modern hybrid propulsion systems that reduce operations and maintenance costs: would it be better to backfit the hybrid propulsion system onto existing ships, or build new ones to replace them ahead of the end of their service lives?

"My personal opinion is, it's probably cheaper to build a new ship from the keel up, because that gives you that foundation of technology that you can then build upon. And to me – and I'm biased, having commanded Makin Island," which is the first hybrid propulsion drive amphib that runs on electric auxiliary propulsion motors at low speeds and gas turbines at higher speeds.

"I think that as we start looking at directed energy weapons systems and some of those things, we have to look at the underpinnings for those systems as well. And Makin Island has a high-voltage electrical system; why can't we have something similar to that on future ships?"

It is clear that the digital interoperability piece is crucial to any such operational remaking of the amphibious fleet to become an effective full spectrum crisis management task force.

And at the heart of this capability is the transformation of the Naval aviation, from the Osprey, to the F-35B, to the modernization of the attack helicopters, the Venom and the Zulu, to the coming of the CH-53K, to the preparation to integrate a new air remote system to the force (MUX), to operating an ashore radar system which can call in fires from a variety of combat sources (G/ATOR), and doing so with a core focus on integratability and ability to operate in a full spectrum combat environment.

It is not just that there are new air platforms added to the force which open up new combat capabilities, but it is the ongoing modernization opportunities for the force to leverage those new capabilities through interactive modernization cycles.

A good case in point is the next phase of Osprey modernization, which is clearly driven by the coming of the F-35B to the force and anticipating the coming of the CH-53K and the MUX.

As Col Matthew Kelly, who is in charge of the V-22 Joint Program Office (PMA-275), put it in a recent interview with us:

Col. Kelly has come to the program with a major shift underway for the Marines.

That shift requires the aircraft not simply to be a robust distance runner but to become smart in the digital battlespace.

This requires major modifications to the aircraft in terms of its ability to work with data, generate data and to work in the evolving C2 and ISR infrastructure which the Marine Corps is building for its approach to building an integrated distributed force.

Coming from the F-35 program provides Kelly with a leg up in terms of understanding what that aircraft can contribute to the Osprey and how, in turn, the V-22 aircraft needs to be modified to a more useful member of the integrated distributed force.

"With the Marine in the back of the Osprey working with his MAG-Tab (tablet), he or she is able to gain access to information flowing in from other platforms in the battlespace.

"And that is one key aspect of what we are focused on as we rework the program.

"Indeed, we have already done exercises at MAWTS-1 and VMX-1 where the Marine in the back of a V-22 can be looking on his MAG-TAB at a video generated from an H-1 or an F-35 operating in the same battlespace."

And the V-22 working with the F-35 is a key element of being able for the Marine Corps/Navy team to work a Lightening carrier approach whereby an LHD like the USS America can operate a significant number of F-35s with accompanying Ospreys.

And this approach clearly is about changing dramatically the nature of what a Marine Corps assault force looks like as well as the combat effect it can achieve.

Col. Kelly, in language reminiscent of how the ADF describes the impact of the F-35 on its combat transformation, refers to what he calls a fifth-generation assault force.

And that process this means changes need to and are being made to the Osprey itself....

The interactive modernization piece driven by integrative dynamics is clearly seen with regard to the next phase of Osprey modernization.

The aircraft which replaced the CH-46 became a physically wondrous asset that changed how the Marines could operate in the Middle East land wars to now becoming part of the fifth-generation revolution.

The USMC and Digital Interoperability: Shaping an Integrated Distributed Force

04/03/2020

As the first combat force in the world to operate the F-35, the Marines experienced the challenge but also the impacts of what a fifth-generation aircraft can deliver to the battlespace.

At the heart of what a four-ship formation of F-35s can deliver is an integrated core combat capability of sensor fusion.

And this combined sensor fusion can be shared across four platforms, able to work seamlessly through the Communication, Navigation & Identification (CNI) system, and with the Multifunction Advanced Data Link (MADL) wave form able to communicate and share situational awareness and to operate in contested air space and make decisions at the tactical edge.

It sets the standards for what being able to operate in a contested environment is all about.

Unfortunately, its current operational capabilities are not well understood in spite of the emphasis on great power competition and the challenge of operating in contested airspace.

Contested airspace ultimately is the ability to operate within that battlespace and to shape effective decisions about how to disrupt the adversaries command and control (C2) and key nodes of combat capability to enable the entire force to be used effectively in shaping escalation dominance.

Moving forward highlights the importance of shaping a more integrated combat force one which can operate in distributed battlespace but be aggregated at the point of attack as the opportunity and need arrives.

It is about reshaping the combat force to become more integratable and when considering new platforms ensuring that integratability is built into these platforms.

But it also about dominance.

As Secretary Wynne put it:

My own doctrine: If you are ever involved in a fair fight; it is the result of poor planning." Emphasizes proper action throughout the OODA loop; and entails actions by resource decision makers and

department leadership to maintain our strength and resilience in periods of high activity and periods of pause.

So for the Marines it starts by leveraging what the F-35 global enterprise can yield in terms of their crisis management insertion missions require.

The ability to share C2 decision making data across the F-35 global enterprise and make that data available to the Marine Air Ground Task Force (MAGTF) is essential to its ability to work at the higher end of the fight.

But the ability to enhance the capability of key Marine Corps platforms operating from seabases or in land environments is crucial.

With the evolution of the capabilities of the new combat platforms generated through Marine Corps aviation, the ability of the Marines to operate in an integrated, air, ground, and sea environment have been enhanced.

To take the next step requires investments in the core platforms to enhance their integratability.

The Marines refer to this as building out digital interoperability and have a plan in place to shape an effective way ahead.

And this way ahead entails both shaping core capabilities to manage networks and the data they can provide as well as to build into existing assets greater capability to participate in the networks most relevant to the operational envelope of particular platforms.

The USMC 2019 Aviation Plan defines the digital interoperability effort as follows:

Digital interoperability is the seamless integration of digital systems and exchange of data, across all domains and networks throughout the MAGTF, naval, joint, and coalition forces, to include communication in degraded or denied environments, to rapidly share accurate information, provide greater situational awareness, accelerate the kill chain, and enhance survivability in order to outmaneuver and defeat the threat across the ROMO.

The threat that can deny, degrade, and effectively employ the latest commercial technology to achieve its military aims must be answered with a superior capability that mitigates the threat's effectiveness.

MAGTF DI encompasses a multi domain, multi-disciplinary effort that harnesses commercial technological development and previous military investment in a consolidated vision that makes the most out of precious and limited assets across the domains of land, sea, air, space, and cyber.

USMC aviation's approach to digital interoperability is that of building blocks that are developed through an incremental and iterative process in concert with MCCDC and cooperation with other services and other government agencies.

The goal of MAGTF DI is to provide the required information to the right participants at the right time, in order to ensure mission success, i.e. defeat the threat, while improving efficiency and effectiveness….

The approach being taken is incremental, and working to bring the "disadvantaged user" into the information dominance process.

It must be realized that there will be tiers of access for the end users.

These tiers are in part driven because of the different operational capabilities of the various MAGTF platforms well as the function of what those platforms will perform in the hands of the members of a MAGTF.

There is no magic wand to achieve DI.

It must be built as the MAGTF continues to be used in crisis management in the real world.

It is not about having the optimal plan; but having an effective path to enhance integrability over time.

And it is important to remember that having access to cutting edge capabilities such as the F-35 is part of the survivability of the MAGTF.

Although it is not about every platform having to have the processing power of an F-35, but certainly a diverse range of platforms can have access to C2 and SA via Link 16 and evolving wave forms.

In the case of the F-35 requires only a card swap and which has multi-layer security which provides for a switching out of data relevant to the different security caveats which are put in place for the sharing of information on an appropriate security level.

But how to start the process and to shape greater DI within the MAGTF?

In the next article, I will look at how the Marines are doing this and shaping a way ahead for digital interoperability.

But a good way to begin is to look at this article published July 25, 2015 and written by Cpl. Jason Jimenez and 1st Lt. Maida Zheng.

MARINE CORPS AIR STATION CHERRY POINT, N.C. – Innovative technology such as tactical data links are changing the way battles are won and strategies are implemented on the battlefield.

Marine Light Attack Helicopter Squadron 467, Marine Unmanned Aerial Vehicle Squadron 2, and U.S. Marine Corps Forces, Special Operations Command, participated in an exercise testing data movement between different tactical networks.

"This exercise focused on integrating field radios and commercial 'off the shelf' tablet systems to rapidly and securely pass converted LINK 16 messages to HMLA aircraft in a tactical training exercise," said Capt. Justin Pavlischek, the intelligence officer with VMU-2.

Access to LINK 16 data allows interoperability between pilots of certain aircraft, joint terminal attack controller, maneuver units and VMU aircrew, provided the assets and the conversion protocols are present and can be utilized.

"A lot of our systems have requirements and are difficult to modify," said Capt. Michael Marron Jr., an AH-1W Super Cobra pilot with HMLA-467. "We overcome that by leveraging a specific combination of current technology to provide access to two tactical networks and move some specific messages between those networks – in this case LINK 16 and ANW2."

According to Marron, digital interoperability is the way the Marine Corps will be able to communicate between multiple type/model/series aircraft in an objective area that is comprised of enemy threats, friendly air positions and ground forces.

"For the rotary-wing aircraft, up until recently, the Marine Corps has been using paper maps and objective area diagrams to plot friendly and enemy locations using a pen or pencil," said Marron. "Now with tablets, we have modern technology in an aircraft that is 30 years old. It allows us to tap into a tactical picture that was previously out of our reach."

Assets that are LINK 16 capable can send information to unmanned aerial systems ground control stations, which acts as a network gateway to then push out specific information in a readable format to non-LINK 16 enabled aircraft. Those aircraft can then see that information, provided they are carrying a specific radio and tablet running an application called "KILSWITCH" (Kinetic Integration Lightweight Software Individual Tactical Combat Handheld).

Systems that monitor the aircraft's status can also be tapped into and that information can be transmitted off the aircraft. "In the future, it will tell how much fuel an aircraft has and how many weapons it possesses," said Capt. Christopher Cain, a pilot training officer with HMLA-467.

Additionally, there are efforts underway to integrate technologies that will have the ability to populate threats. "If one aircraft can see a threat, it can notify everyone connected, show how far away and how to stay away to mitigate it ... It will speed-up the kill chain."

Among the military aviation community, the jargon "speed-up the kill chain" refers to utilizing the most efficient method toward negotiating a nine-line expeditiously. A nine-line is the method of establishing the scene of an objective area and incorporating necessary information to achieve mission success.

"Passing of that nine-line over the radio is going to take a minute or two, at the very least," said Cain. "The building of a nine-line using KILSWITCH can take as little as 30 seconds. There is less of an opportunity to copy down a wrong grid or mix up information."

With this upgraded technology, someone building an attack brief in a KILSWITCH tablet can send it electronically, and quickly ask for read-backs – ultimately the close-air support players will be more effective and able to get more attacks in during their time on station, said Cain.

"The longer it takes to figure out where the enemy is and where the friendlies are, the longer it will take to put down effective fire on the enemy" added Marron. "If I have situational awareness before I show up into an objective area, then I don't have to spend precious time figuring out what's going on."

By design, unmanned aircraft are capable of providing persistent coverage and can be fitted with "plug-and-play" radios and payloads, which will extend the ranges and capability of digital networks into disparate battlefields and areas of operation, explained Pavlischek.

When fitted with these payloads and radios, the MQ-21A Blackjack will be ideally suited to provide airborne data network relay and gateways for aviation and ground units.

In addition to the VMU's traditional role of providing aerial reconnaissance, the VMU's mission has recently been expanded to include "supporting arms coordination and control." The foresight developed into this exercise demonstrated a potential role the VMUs could fill in the future – enhancing the lethal and non-lethal capabilities of the Aviation Combat Element and Marine Air-Ground Task Force through digital interoperability.

According to the 2015 Marine Aviation Plan, digital interoperability will be tested and validated with an "integration through innovation and experimentation" approach. This exercise between VMU-2 and HMLA-467 is one example of this innovation and experimentation within the fleet, explained Pavlischek. It demonstrates how technology present in the Marine unmanned aviation ground control station can provide a critical link, or node, in extending and enhancing the situational awareness, survivability, intelligence, surveillance and reconnaissance (ISR) capability for ground units and aircraft distributed across the battlefield.

The USMC and Digital Interoperability: The MANGL Approach

04/12/2020

As highlighted earlier, USMC aviation is focused on ways to enhance its ability to connect with the MAGTF and to work integrated solutions at the tactical edge.

But how to start the process and to shape greater digital interoperability (DI) within the MAGTF?

Recently, I had the chance to talk with Major Salvador Jauregui and Mr. Lowell Schweickart from the USMC Aviation Headquarters who are working on the digital interoperability effort.

At the heart of our discussion, was the central importance of MAGTF Agile Network Gateway Link (MANGL).

The approach is to shape a template for enhanced connectivity and the Marines are focusing upon MANGL as the foundation from which DI will be enhanced over time.

Their role is to build upon the direction provided by CD&I (USMC Combat Development Command, Combat Development and Integration) and the larger naval force.

The focus is upon coordinating the implementation efforts across the aviation combat element in support of the larger MAGTF and joint force.

There are a number of key takeaways from our discussion as well as insights gained from working through a number of background documents which focus on the digital interoperability initiative.

According to the USMC:

MANGL is designed to be installed aboard airborne assault support platforms to enable better connectivity and persistence in the areas most in need. From a hardware perspective, it is simply a collection of radios that will be shortly replaced by a singular SRP, or Software Reconfigurable Payload which can:

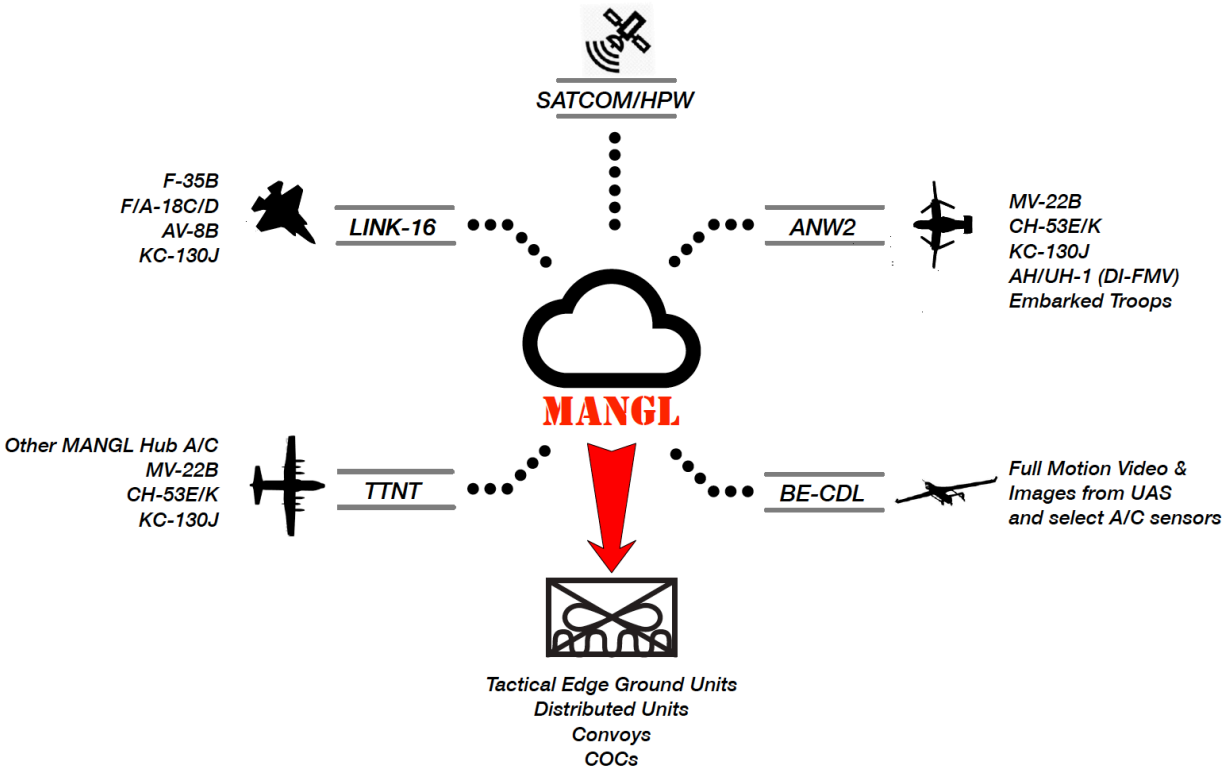
- *Receive network signals from multiple networks,*
- *Translate them from their specific message formats and protocols, and*
- *Retransmit specific information exchange requirement over other networks that reach different users or by using waveforms that are more suited to long distance or that have greater available bandwidth*

MANGL consists of three primary technologies.

The first is the gateway or the mesh network manager.

The second is the software programable payload. MANGL is focused on a transition to SRP to replace the “collection of radios.” SRP-2 will be re-programmable and in the initial instantiation will support the four key waveforms highlighted in the graphic below.

Third is the interface or the MAGTAB which is the Marine Air Ground Tablet.



What the Marines are highlighting is the importance of shaping a template for ways to enhance connectivity and integratability without having to acquire a new all-encompassing C2 system. Rather than funding a whole new highway, they are looking to find ways to work around any bumps or holes in the road.

As the DI team put it: "We have designed an ecosystem where new technologies can be on-ramped with a minimum amount of time, and well inside of the typical acquisition structure, and everything has been done with a focus on speed, right down to our acquisition approach.

"While we are developing iterative technologies and we recognize that our first go-around is not going to be perfect, the acquisition approach to accomplish that has to be complementary, because if we took a traditional acquisition approach, then we wouldn't also be able to execute in a iterative technological approach.

"The two have to be paired."

They are looking to provide additive capabilities by adding modular, extensible kits in already existing air platforms, while leveraging the advantages of software upgradeability to evolve the software defined radios in pace with the evolution of networks.

And they highlighted that key part of the approach was working with the fleet, with warfighting centers to test out new options, to get feedback and then to bring new capabilities into the force within a relatively short period of time.

They provided an example of how they are working with MAWTS-1 at MCAS Yuma.

“For example at WTI, we have engineers down there twice a year, knee-to-knee with Marines talking about, does this application work for you? How do you want this thing to work?

“Would it be better if the sensors were here or there?

“And then they go and do a refactoring phase over the summer and they redesign a system, or they field the new applications and they come back in the Fall and they ask them again: is this what you expected?

“And the by the next spring, a year later, they are already flying. Not just a prototype, but a fielded application, or a new fielded feature.”

There is a key question of size constraints which comes into play.

Given the limited space on any combat aircraft, size, weight, and power (SWaP) must be managed and reduced to improve operational efficiency and logistics, increase mission life, and reduce the total cost of system ownership. System upgrades are driving added functionality and increased performance, placing additional attention on SWaP.

Because the team needs to work with a wide range of aircraft, each of which has its own dynamic of upgradeability, the approach being taken to connectivity is to have an upgrade path across the fleet but not tied to any particular platform.

Hence, the logic of separating platform upgradeability from C2 connectivity upgradability but finding ways to cross link such dynamic developments.

In shaping the way ahead, the Marines have identified what they believe to be the four key pillars for each interoperable platform.

Those four key pillars are relevant sensors, processors on board to process data to be part of the C2 loop, interfaces which allow for interacting with network generated data and information, and network radios which are normally designed for specific environments whether air-to-air, air-to-ground or ground-to-ground.

This four-pillar template is how the Marines hope to be able to address any innovations to be woven into the DI architecture.

The four pillars are really about configuration management and understanding the essential elements to consider for DI.

As the DI foundation is shaped and executed, moving forward with software upgradeability in the C2 hubs will allow for innovations going forward.

The strategic goal of the MANGL approach is to step out of the platform approach and look at the MAGTF as a whole.

In my view, what the Marines are doing is shaping a template to move forward, which is not a final statement of where they are but rather a trajectory of change.

The Marines are shaping an approach which allows them to have ownership of their digital infrastructure and leverage contractors as partners in shaping code evolution for various pieces in the software upgradeable systems working together to deliver DI.

The Marines are bridging stove piped systems which have been built for tailored tasks or missions.

With the coming of new software defined systems, there is a growing capability to think beyond task-oriented networks and towards cross cutting integratability.

The goal is to use existing radios and find ways to work these existing capabilities to work more effectively together, rather than laying down a new integrated approach and then buying new C2 sets to execute a new integratable approach.

Every Marine Corps aviation asset will have a way to access the MANGL system.

It is clear that the coming of the F-35 has driven this change in part because it is a flying combat system or server rack if you will.

In other words, gateways are the key enablers of the approach.

Processors within the gateways translate all messages and pass them on to the correct radios.

Gateways allow the data to be shared across disparate networks across diverse networks using existing radios and waveforms.

MANGL currently is deigned to link four tactical networks and communicate using different wave forms.

The first is Link-16 which is used primarily for airborne command and control.

The second is BE-CDL is the standard for relaying imagery and video.

The third is ANW2 which is the primary wave form for Marine Corps ground and assault support platforms.

The fourth is Tactical Targeting Network Technology (TTNT) which is a key waveform used by the Navy and is a high bandwidth waveform for sending large amounts of information over long distances.

It is important to understand that data is generated via various networks, not by a single combat cloud, and that the users of these networks clearly have levels of confidence in the data, which is in part driven by their experience with various networks.

It is about networked enabled paths of communication so certainly in my view, it is about how users in various combat environments make decisions and which data sources will have the most credibility to support those decisions.

This is why in my view; it is information confidence and not just about C2.

It is about Command, Control and Confidence in that information.

When making decisions at the tactical edge, what information do the tactical decision makers use to decide to act?

And this is about judgements about the reliability of information from a particular network versus another network. In the intelligence community, it is widely understood that not all networks deliver the same reliability of information; this is also true with the information coming through networks in the combat force.

It is clear that is shaping a foundation for moving forward, but not the end of the process.

And that process was described by the DI team as one working integratability across the MAGTF.

According to the team: "We are constantly consulting with both MCSC and NAVAIR programs to prevent any one platform from fielding a capability that makes them into a "digital orphan."

"Some programs are adequately funded and pursue cutting edge technologies which are great for some unique task relevant to that platform, but oblivious to the fact that they fight in concert with the MAGTAF and might be creating digital divides that less adequately funded programs will never be able to overcome."

"The opposite is also true; some programs which have transitioned to sustainment can neglect the information environment and the gains that can be made with incremental investments.

"They eventually find themselves decades behind and little chance of bridging the digital divides.

"With this in mind, we focus on being "fast followers" of CD&I.

"Because of how we've architected the MANGL systems, we are never more than 1-2 years of funding away from implementing the newest waveform, application, or protocol.

"When the Service decides on a future LPI/LPD waveform, MANGL will be well positioned to implement it quickly and at scale with common SRP radios waiting for software updates.

"When the Joint Tactical Grid implements a new application to enhance sensor sharing, every MANGL processor will be a candidate for the new software load.

"In this way, we have designed a technical capability that reflects the institutional paradigms and acquisition realities of the real world.

"It's never going to be perfect, but it will be agile enough to provide a foundation for the information environment that with the Marine Corps' will need in future conflicts."

Platforms, Innovation and Integratability: The Case of the Osprey

Earlier, we focused on the interaction between platform innovation and integratability.

With the evolution of the capabilities of the new combat platforms generated through Marine Corps aviation, the ability of the Marines to operate in an integrated, air, ground, and sea environment have been enhanced.

To take the next step requires investments in the core platforms to enhance their integratability.

The Marines refer to this as building out digital interoperability and have a plan in place to shape an effective way ahead.

And this way ahead entails both shaping core capabilities to manage networks and the data they can provide as well as to build into existing assets greater capability to participate in the networks most relevant to the operational envelope of particular platforms.

The challenge is a highly interactive one. New platforms shape new opportunities to define new concepts of operations and to shape new combat capabilities. Driving such innovation is crucial which means that new platform introduction will often be disruptive of the existing concepts of operations. New platforms can provide a forcing function dynamic for change.

At the same time, new platforms need to operate with other elements of the combat force, and that tension between platform innovations and inherited concepts of operations is an ongoing dynamic driving change.

What digital interoperability provides is an opportunity to both enhance the capabilities of the existing platforms as well as to share the benefits of what new platforms bring to the combat force.

A key question is posed: How do new platforms interact with and shape integratability challenges, and how digital connectivity can enhance what these new platforms bring to the combat force as well as how can the "legacy" platforms make greater contributions to a combat force being driven by change from new platform introduction?

A clear case in point has been the introduction of the Osprey.

If integration with the legacy force was the key mantra for the USMC, the Osprey would never been introduced. But it was and it introduced range and speed considerations to the insert of the Ground Combat Element which have been historically unprecedented.

If a CH-46 replacement had truly been that disruption would not have occurred, and significant innovation in concepts of operations driven by the disruptive force which the Osprey has provided would not have as well.

The US Army is the lead on a new Future Vertical Lift helicopter which is being designed to have similar reach and range to the Osprey. How this will impact the entire approach to shaping the future US Army is a key strategic question.

But the Marines have already been living in the world of FVL for a decade and a half.

Thinking outside of the helo defined operational box has been a key game changer in thinking about the concepts of operations for the USMC for some time, and adjustments to their concepts of operations have been driven by its operational capabilities.

In order to get full benefit from the Osprey forcing function, the Osprey needed to become a more integratable capability within the MAGTF. Digital interoperability provides a key bridge to do so.

In the next piece I will return to my discussions with Major Salvador Jauregui and Mr. Lowell Schweickart from the USMC Aviation Headquarters who are working on the digital interoperability effort.

And in that piece will focus directly on the question of what DI brings to various platforms in the MAGTF, and how what that brings to those specific platforms can lead to further capability enhancements or changes in concepts of operations.

But here, I want to return to a number of pieces we published in 2014 which highlight how the digital interoperability piece became highlighted as a significant opportunity for Osprey nation.

The speed and range of the Osprey has meant that it can outrun the embarked Marines capability to have the situational awareness they needed when disembarking in the objective area.

How then to solve that problem?

In the following piece published on January 18, 2014, we identified why C2 innovation when coupled with the capabilities of the Osprey created new options for the MAGTF.

With a new system, as innovative as the Osprey, it takes time to shape the course of change.

With its successful use in combat, its ability to work effectively with other elements of the MAGTF, and its core role in shaping innovations such as Special Purpose MAGTF-Crisis Response, the Osprey is becoming a key change agent throughout the MAGTF.

Although the Osprey is a tilt-rotor aircraft, its heart and sole is in supporting the Ground Combat Element (GCE) differently than any airborne capability seen before.

The Marines work the relationship between the GCE and the Air Combat Element (ACE) to shape a capability, which is expeditionary, flexible, and with the Osprey more rapid with greater range for force insertion than before.

But to get to the next phase requires further innovation, this time in terms of how the MAGTF (GCE and ACE) can better use the new emerging capabilities, specifically C3I and fires, to execute its mission more effectively.

The Osprey and KC130J pairing provides an ability to operate at distance and to rethink various missions such as force insertion, extraction of embassy personnel, TRAP and others, to include limited objective MAGTF strike operations.

By not being a relatively slow-moving helicopter that typically requires forward operating bases to conduct long-range operations, the Osprey allows the USMC (and the USAF) to think about how to use the speed and range of the Osprey when paired with organic tanking capabilities to operate fundamentally different from past approaches.

Over the past year, during three separate, long-range, Marine Air-Ground exercises, the Marine Infantry Officer Course (IOC) has worked closely with multiple aviation units to attack this required culture change.

During these experiments, the combined air-ground team has sought different approaches to achieve more effective outcomes, and have used these exercises as means to shape future technological adaptations.

A recent example of this approach was seen in a long-range Non-Combatant Evacuation Operation (NEO) that IOC, serving as a simulated Company Landing Team(CLT), executed into a semi-permissive environment from 29Palms to Fort Hood Texas.

The exercise was called TALON REACH and was the culminating event for IOC Class 1-14. This event was conducted under one period of darkness between 29 Palms California and Ft Hood Texas.

This exercise was made possible by the teaming of the USMC MV-22s and KC-130Js.

During this experiment and those previous, the long-range insertion method proved interesting, but the innovation to drive enhanced capabilities is even more so.

To get a sense of how this innovation process is unfolding, I talked with a participant in the exercise, Lt. Col. Bill Hendricks.

Hendricks is a Cobra driver, and currently is assigned to USMC Aviation Headquarters as the air-ground weapons requirements officer.

A key element of the discussion focused on how mission planning can change significantly with the new configuration of insertion forces and how that approach can, in turn, significantly shorten the time

from launch to operating in the objective area. Rather than several hours on the ground planning the mission and then launching the force mission, now the time associated with the Rapid Response Planning Process can be significantly reduced. A new process is being developed.

The insertion force takes off and then does the planning in route (given the range and time in transit) and provides real time information to the GCE and ACE commanders aboard the Osprey prior to going into the objective area.

And this most recent experiment is really only the tip of the iceberg so to speak. Given that the Ospreys are paired with KC-130Js there is no inherent reason that the bigger planes cannot carry mission planning and management support systems.

And as the Harvest Hawk configured C-130s return from Afghanistan, these planes could be used as the lead element in the insertion of a long-range insertion package as well.

Lt. Col. Hendricks started by explaining the role of the CLT within the insertion force.

The CLT is based around highly trained, educated, and equipped infantry Marines, basically pulled out of the regular battalion and they tend to be your more qualified individuals.

The CLT can do raids of duration that are a little bit longer than a standard company could do; but shorter in duration than a battalion could support.

And they could do that because they have the best equipment and they have the best or most highly trained individuals.

The CLT is somewhere on the spectrum between a standard Marine rifle company and a MARSOC unit, as far as the skills that they bring.

It is clear that the CLT requires good ability to have systems for C2, ISR and an ability to work effectively as they move off of the air asset.

The CLT, combined with the MAGTF's 21st century ACE, provides the nation a unique capability that already is (South Sudan) and will increasingly be in great demand.

To make this happen, the CLT's current legacy equipment needs to change. The concern is that a lot of their equipment is legacy at best, and very heavy and bulky and not very effective.

And the red force, that they were up against, were outpacing them, as far as their ability to command and control with their own personal IPhones, chat, text messaging, and widely commercially available systems.

These opportunities and concerns bring us back to the focus of Talon Reach. A key focus of the exercise was upon how to close the gap and to give the GCE, in this case the CLT, more effective tools to support force insertion. And to exercise also allows USMC Aviation to better understand the technology, which is most desired and effective for the GCE in their missions operating off of aircraft.

A key shift is from the GCE being primarily voice directed to a combination of voice-directed AND image enabled, combined with a data capability. In the past few years, the GCE receives via voice communication from intelligence officers conclusions about the situation in the objective area determined by data obtained from systems like UAVs.

The approach used in the exercise was significantly different.

Lt. Col. Hendricks :

We had a command center set up in Miramar and via satcom we were sending information updates, via chat messaging that was then received in the back of the airplane on hand-held tablets.

These were all scripted (for it was an exercise) but they would see things like:

"At 1350 zulu time, a crowd is seen gathering in front of the embassy."

This comes across the net and the four V-22's that were carrying the infantrymen en route could all see that on the tablet.

We could do the same with regard to imagery as well. We had Harriers out in front of the package that with their lighting pods were taking photos of the objective area where we were doing this insertion and these images were now being sent to the back of the airplanes and distributed as well.

And we had on the airplane full motion video as well. The video was coming from the lightning pod of the Harrier into the back of the lead V-22 with a subsequent re-transmission to the other V-22s.

This allowed as well what one might call the John Madden capability. Referring to John Madden used to call the football games so he had that magic pen that he could circle on the screen. We had the same capability where we could turn it into a still image, circle a certain part of it and then distribute that image amongst the CLT on these hand-held tablets.

You could literally just draw an arrow on the screen, hit send. Just like you would a text message and now everyone has a visual image.

Clearly, this is a work in progress and sorting out the value of still versus full image video is part of the challenge and to get the systems working fully.

Nonetheless, this was the first time that we were able to demonstrate this capability to close to 75 infantry officers to get their feedback.

It is clear that these new capabilities present a great potential for the MAGTF.

This change in equipment will force a re-examination of the current mindset and culture of warfighters accustomed to relying largely on voice-to-voice communications. The addition of imaged enabled communication and data capability will force operators to re-think how current mission profiles are planned and executed.

In the future, infantry squads will be able to plan in flight with regard to what they see and what they think the first approach should be.

Additionally, decision-making will likely be significantly improved as these same units work through what to do while in route to the objective rather than simply receiving intelligence inputs prior to departure.

Lt. Col. Hendricks highlighted the significant impact on time to departure to time on mission.

It is four hours to get there but you are not leaving until you have done up to six hours of planning.

This means that your real response time is ten hours from the time you receive something to actually being on station.

Based on mindset and culture shift, largely based on information and imagery and an enhanced ability to communicate, the future MAGTF could conduct planning en route to the objective area and thus cut response time in support of combatant commander's requirements in half.

The package, which deployed on this experiment, reflects that the effort is one in progress, moving forward at a rapid rate.

Lt. Col. Hendricks indicated that the six MV-22s included 4 to carry the troops and 2 from VMX-22 to facilitate the innovation in communication and information exchange.

The VMX-22 Ospreys were used to empower the network for the insertion force.

The kind of innovation needed for the next phase is clearly based on continued and effective collaboration between the GCE and the ACE.

According to Lt. Col. Hendricks:

As we go forward with developing these new capabilities we need a collaborative effort between Aviation and the GCE.

They tell us what they need, and we work to provide that to them.

The GCE is going to be a key driver for innovation within the MAGTF being reshaped under the influence of the Osprey and the F-35.

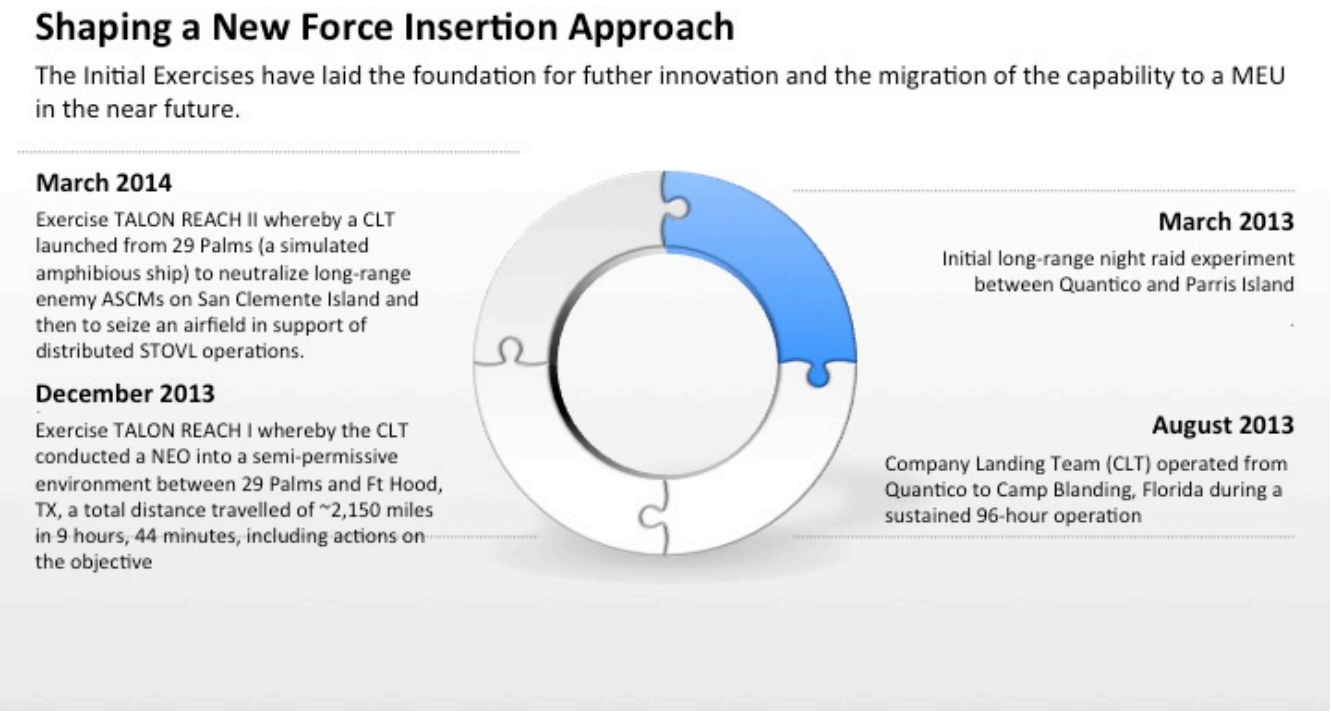
The above article and several accompanying articles which we published in 2014 highlighted the opportunity of combing the forcing function of the Osprey with new approaches to C2 reach to shape a more integratable force which would then have its own tactical and strategic impact.

In my view, this is really the opportunity being opened by the digital interoperability effort.

On the one hand, recognizing that new platforms provide forcing function opportunities.

But on the other hand, working more directly integratability in the C2/ISR domain to both take advantage of the forcing function drivers of change but also providing enhanced capabilities for the new platform by enhanced C2/ISR reach.

Note: In an interview we did with the Major Cuomo, the head of the Infantry Officer Course (IOC) at the time of the 2014 interview, we generated a graphic which highlighted the learning path to doing the Talon Reach effort, an approach which the leaders of the DI effort highlighted as an important on with regard to combat learning and the evolution of specific technologies being woven into the DI thread.



Exercising ways to enhance the GCE insertion capability. Credit Graphic: Second Line of Defense, 2014

Interactivity, Platforms, and Shaping a Way Ahead

What do enhanced network engagement capabilities bring to core USMC aviation platforms, and how does such efforts expand USMC capabilities and their contribution to the USN-USMC team?

My discussions with Major Salvador Jauregui and Mr. Lowell Schweickart from the USMC Aviation Headquarters who are working on the digital interoperability effort were a key input to this article, but I am going to provide some key takeaways from my discussions with them which highlight the interactivity between platforms and digital interoperability and how opening the network aperture can drive change.

Let us start by returning to the core MANGL diagram included earlier.

The digital interoperability team highlighted that in their view C2 was a weapon system and needed to be regarded as such. And they say the DI efforts as augmenting Marines perception of the importance of C2 and its role within the evolution of the force.

The team highlighted a core example of how the approach was reshaping capabilities.

"We have approximately 10,000 AN/PRC-117G radios in the inventory. This is a man-portable, tactical software-defined combat-net radio. It does advanced networking wave form, ANW2.

"To date if you wanted to give the Ground Combat Element (GCE) access to Link 16 data, they would have to be given Link-16 terminals. With the ANW2 connectivity on Marine Corps Aviation we can now provide access to Link-16 data to the GCE. By having access to a MAGTAB and a ANW2 enabled radio. We can provide the GCE with the Link 16 picture, with the information that they need."

With regard to BE-CDL, this is a DOD-wide mandated wave form for working with unmanned full motion video data transfers. With the growing impact of full motion video, where one can envisage such data becoming ubiquitous on the battlefield, clearly ensuring that USMC aviation assets can work with this wave form in their support of the GCE is crucial.

Tactical Targeting Network Technique or TTNT is a US Navy wave form. This allows for integration with the US Navy but it also was a launch point when the DI project was started.

"TTNT was one of a few wave forms that existed that we could link, daisy chain data together and move data from one end to the other across multiple nodes without losing significant amounts of data."

What is the overall objective of the DI effort?

"We are working to provide the Marines with common tactical picture. Regardless of where you plug in the combat cloud, you have a common picture. That allows me to collaborate and have the same point of reference as my counterpart who is plugged into a different injection point on that cloud."

They added: "If we expect to use C2 as a weapon system in the future, we will need to up our game. We will need to become proficient in C2 in a way we have not been."

The Viper Case

To provide one example of how the change is envisaged, one could take the case of the USMC attack helicopter, the Viper. The USMC/NAVY team is planning to install a miniaturized mesh network manager which can be set in the size constraints within the platform. This will be coupled with a small form factor link transceiver which will give them access to Link 16 and ANW2.

Additionally, the equipment will be supplemented with a BE-CDL capable transceiver, providing the ability to exchange full motion video.

These capabilities will be coupled with a MAGTAB in the cockpit. The MAGTAB end user interface will serve as a system interface, a planning / briefing /debriefing tool and will serve as the cockpit electronic knee board.

What then might this mean for the future role of the Viper in the combat force?

In my view (and not attributing this to the DI team), this can lead to a significant change in how the Viper can operate on the battlefield in support of the GCE and highlight a new role in its at sea role, namely, to contribute to sea control.

With the upgrades coming soon via the digital interoperability initiative, the Viper through its Link 16 upgrade along with its Full-Motion video connectivity upgrade, can have access to a much wider situational awareness capability which obviously enhances both its organic targeting capability and its ability to work with a larger swath of integrated combat space.

This means that the Viper can broaden its ability to support other air platforms for an air-to-air mission set, or the ground combat commander, or in the maritime space.

A key capability which the Viper has is its high-powered machine gun. Given that the Viper can easily land on virtually any ship which the Navy or MSC operates, it can bring its machine gun as well as its Hellfire missiles, or its rockets with a laser seeker into the sea control domain

The increasing threat from small boats and unmanned air vehicles or the coming threat from unmanned surface vessels highlights the importance of having a platform which can use a variety of strike capabilities to destroy these relatively low value assets with potentially a high impact on the fleet. Unmanned assets may look smart, but when running into a machine gun, they return to simply being drones.

The combination of what the organic asset can do with its expanded span of SA and shared targeting information through the DI upgrades provides a new role for the Viper within the maritime force. This role is inherent within its current configuration coupled with the DI upgrades.

The CH-53E to CH-53K and the DI Impact

Another example which highlights the approach is the transition from the CH-53E to the CH-53K.

With the CH-53E and the initial CH-53K aircraft, they are adding similar systems to deliver enhanced connectivity.

The legacy CH-53E, which is approaching its sundown will address DI in reduced fashion, targeting Link 16 and ANW2 for insertion into the heavy lift helicopter.

This will allow the legacy asset, the CH-53E to better connected into its ground support missions, and maintain an awareness and presence within the air C2 picture.

But the CH-53K is an all-digital aircraft with advanced avionics onboard the aircraft. These capabilities expand what the CH-53K can provide for a support or assault mission.

As I argued in a May 22, 2019 piece on the CH-53K:

One of those (new) capabilities is the new cockpit in the aircraft and how digital interoperability and integration with the evolution of the MAGTF more broadly is facilitated by the operation of a 21st century cockpit.

The cockpits are very different and fit in with a general trend for 21stcentury aircraft of having digital cockpits with combat flexibility management built in.

Because the flight crew is operating a digital aircraft, many of the functions which have to be done manually in the E, are done by the aircraft itself.

This allows the cockpit crew to focus on combat management and force insertion tasks.

And the systems within the cockpit allow for the crew to play this function.

This means that the K and its onboard Marines and cargo can be integrated into a digitally interoperable force.

This means as well that the K could provide a lead role for the insertion package, or provide for a variety of support roles beyond simply bringing Marines and cargo to the fight.

They are bringing information as well which can be distributed to the combat force in the area of interest.

As the CH-53K enters the fleet as an operational asset, the connectivity solution will be upgraded to allow for that solution set to tap into the information generated by the systems onboard the CH-53K and to then distribute that information to other blue side platforms in the battlespace.

But when a platform enters the force which is new and more capable such as the CH-53E to CH-53K transition, the approach needs to be able to leverage those new information generating capabilities for the force more generally.

In my discussion with the DI team, I drew upon my meeting with Colonel Perrin at Pax River to discuss the concept of Kilos flying with unmanned "Mules" to bring supplies in support of embarked Marines.

As Col. Perrin noted in our conversation: "The USMC has done many studies of distributed operations and throughout the analyses it is clear that heavy lift is an essential piece of the ability to do such operations."

And not just any heavy lift – but heavy lift built around a digital architecture.

Clearly, the CH-53E being more than 30 years old is not built in such a manner; but the CH-53K is.

What this means is that the CH-53K "can operate and fight on the digital battlefield."

And because the flight crew are enabled by the digital systems onboard, they can focus on the mission rather than focusing primarily on the mechanics of flying the aircraft. This will be crucial as the Marines shift to using unmanned systems more broadly than they do now.

For example, it is clearly a conceivable future that CH-53Ks would be flying a heavy lift operation with unmanned "mules" accompanying them. Such manned-unmanned teaming requires a lot of digital capability and bandwidth, a capability built into the CH-53K.

If one envisages the operational environment in distributed terms, this means that various types of sea bases, ranging from large deck carriers to various types of Maritime Sealift Command ships, along with expeditionary bases, or FARPs or FOBS, will need to be connected into a combined combat force.

To establish expeditionary bases, it is crucial to be able to set them up, operate and to leave such a base rapidly or in an expeditionary manner (sorry for the pun).

This will be virtually impossible to do without heavy lift, and vertical heavy lift, specifically.

Put in other terms, the new strategic environment requires new operating concepts; and in those operating concepts, the CH-53K provides significant requisite capabilities.

Their response to my Perrin discussion with regard to the coming of the CH-53K and its impact when DI is considered as well: "What you are suggesting is the creation and operation of a subnet. This makes a great deal of sense and is part of what we see emerging from our approach to DI."

This is how the DI team put it in the discussion:

"When it comes time to field the mesh network manager on the KILO, there will be an opportunity to integrate all of the capabilities that we've developed iteratively along the way.

"And then in addition to that, there will be an opportunity through the avionics buses, pull information off the 53-KILO and then populate it onto a network."

Conclusion

Going forward, there are clearly technology solutions to how to manage size constraints which could provide the Marines with options to build beyond currently prosecuted solution sets.

In the MANGL approach, there are hubs which can work the most complete translation and management effort, versus smaller sized nodes on platforms which are users, receivers or transmit points. These "smaller sized nodes" can create connections with other "smaller sized nodes" via a single waveform. In effect, we are talking about hubs and spokes within the overall MANGL approach.

In effect what is being underscored is the challenge of integrating the disparate networks and C2 systems to get a more effective integrated force. After all, C2 is a core weapon system, and my view crafting a full spectrum crisis management force able to make decisions at the tactical edge is the 6th generation force.