Working Mission Solutions for the Integrated Distributed Force

The Cubic Approach

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The Perspective of Michael Twyman, Senior Vice President & President of Cubic Mission Solutions

August 20, 2020

By Robbin Laird

Clearly, the shift to joint warfare encompassing all domains, the impact of COVID-19 on the economy and work approaches and styles, and the growing impact of commercial investments in 5G communications or artificial intelligence in managing data are all having a significant impact on the way ahead for the U.S. military, its allies and its partners.

In the view of Mike Twyman, President of Cubic Mission Solutions, we are seeing a tsunami of change that is influencing battlespace composition, ISR solutions, protected communications and 5G.

Since he has come to Cubic, Mr. Twyman has focused on ways to build out the sector to evolve as the strategic environment changes and to shape the kind of C2/ISR capabilities the military needs both now and in the future.

In a recent interview with Twyman in his office in San Diego, he highlighted the focus of his mission solutions group and how they are contributing to the capabilities needed for the new strategic environment.

According to Cubic Mission Solutions, this is how the sector has been built over the past few years.

Cubic Datalinks (the legacy Cubic group) was the starting piece.

Cubic was a niche player in the CDL and Personnel Locator System market.

Then the sector was built with these acquisitions:

<u>Protected Comms & ISR (air, land, sea, cyber and space)</u>

- GATR
- Shield Aviation
- Nuvotronics

<u>Rugged Internet of Things</u>

- DTECH
- Vocality

<u>Digital Intelligence (C2ISR)</u>

- Teralogics
- MotionDSP
- Pixia

He argued that "we are focused on mission solutions, not systems. Our goal is to deliver solutions that enable future warfighting concepts.

"For example, our solutions empower C2, fueled by intelligent data, to create and close joint effect webs at machine-to-machine speeds."

Twyman underscored that the focus has been upon shaping what he labelled "a mission chain strategy."

"We have acquired and will continue to do so capabilities to address the entire subset of tools necessary to deliver mission chain solutions."

Here he is referring to being able to integrate core computational, C2, ISR and other services necessary to deliver entire solutions to the military customer.

Twyman characterized the future fight as one which the combat force needs a core capability to maneuver in the communications spectrum and to have an ability to discover and share ISR and C2 information in interactive kill webs.

"The challenge is to get that relevant ISR and C2 data to where you need it and at the time you need it."

He highlighted as well the importance of being able to work in both the commercial as well as military domains because increasingly the military is a user group, and less the definer of what the cutting-edge technology is going to be.

A key case in point is 5G.

Clearly, 5G is a significant commercial technology which will affect military networks and redefine them. Cubic is working in both the commercial and military space which Twyman thinks is critical given how significant the commercial impact of 5G has on 21st century societies.

Commercial 5G operating through millimeter wave bands will generate more bandwidth and more freedom of spectrum maneuver. It will allow for the flow through of more data at lower latencies; and there will be greater capability to protect the information being sent.

Obviously, such capabilities are both relevant and affect military communications; more as a user group than as the core definer of 5G systems themselves.

This is clearly similar to what is happening with regard to artificial intelligence (AI) technologies and decision-making aids; whereby commercial sectors are and will far outspend what the military sector will do; and it will be about leveraging commercial technologies as a user group for the military in this sector as well.

Twyman believes that the future fight will require empowering warfighters at the edge with precise access to data and shared battlespace awareness to speed decision cycles. There is enhanced computational power and services at the edge which can support more timely decisions across the warfighting domains.

He also believes that the U.S. and allied militaries are looking for non-stove piped C2 capabilities as well. He underscored that is why Cubic has built a protected wave form and made it available for the U.S. government to use as a basic standard.

"We are focused on continually innovating and seeking to deliver best-value to the government, rather than locking the government into proprietary wave forms that make stove piping inevitable."

Twyman argued that the internet of things was a key driver as well for new C2 and ISR solutions.

And as nations seek to build trusted supply chains and shape new approaches to domestic manufacturing, being able to manage the internet of things will be enhanced in importance going ahead as well.

Cubic Mission Solutions is focused on the evolution of commercial and military space, notably in the LEO constellation world. Here they are working with a number of commercial satellite providers with regard to Cubic's phased array communications antennas on satellites.

They are focused as well on evolving payloads and they have their own UAV as a flying battle lab to work on relevant payloads which fight into their concept of C2 decision making at the edge and kill web connectivity.

Twyman underscored that with C2 at the tactical edge becoming so critical, they are focused on ways to move away from traditional cloud-based computing to solutions which enable all warfighters at the edge to get the ISR they need at the point of attack or defense.

"We are focused on building resilient content dissemination strategies which can allow the warfighter at the edge to gain access to quality information at the relevant time."

In short, Twyman laid out a vision and practical solutions to shaping a way ahead for the evolving infrastructure for the C2/ISR enabled integrated distributed force.

Michael Twyman, Senior Vice President & President of Cubic Mission Solutions

In his CMS role, Twyman oversees the C4ISR businesses and strategy, including DTECH Labs, GATR Technologies, TeraLogics, XD Solutions and Cubic's Communications & Electronics offerings.

Twyman joined Cubic in June 2014 as senior vice president of air training and secure communications, and served most recently as executive vice president, training and communications systems.

In this role, he led the development of Cubic's C4ISR strategy as well as growth strategies for air training and secure communications, including common datalink, avionics, communication products, restricted communications and optical solutions.

Prior to Cubic, Twyman held a variety of executive leadership positions spanning more than 30 years at Northrop Grumman including sector vice president and general manager of the defense systems division, vice president of integrated C3I systems, vice president of joint network systems and vice president of communication and information systems.

Twyman graduated from California State University Long Beach with a Bachelor of Science degree in Applied Mechanics. He also holds a Master of Business Administration from George Mason University.

https://www.cubic.com/about/people/michael-twyman

Cubic Mission Solutions Evolution:

Working the Rugged Internet of Things at the Tactical Edge

4/22/20

By Robbin Laird

In a famous line from Molière's play Le Bourgeois gentilhomme, the aspiring social climber in the play discovers that: "For more than forty years I have been speaking prose while knowing nothing of it, and I am the most obliged person in the world to you for telling me so."

Much like the man who discovered he is speaking prose, the strategic shift which the US and core allied forces are undergoing is learning to speak "kill web."

And in learning to speak "kill web," we are refocusing on core issues and redefining them. A key case in point is the thrust and focus of C2.

From hierarchical C2, we are learning what is required to make decisions at the tactical edge.

How can forces can operate effectively at the tactical edge but ensure they are integratable to provide scalability to fit a crisis?

Recently, I had a chance to discuss what a shift from networking **to** the tactical edge to operating at the tactical edge meant in terms of a focus of activity within a company focused on communications and networking as a core competence.

Mike Barthlow, a former Marine C2 officer, is now working at Cubic Mission Solutions in shaping what they call the rugged internet of things.

We started by discussing what the Rugged Internet of Things meant within the company and why this name for his group was chosen in the first place.

"Our original focus was upon pursuing a tactical networking business, where the emphasis is upon pushing networking to the edge, and connectivity across the kill web."

"We realized that what is crucial is what happens at the edge of the network.

"You have pushed networking to the tactical edge; but what operational behavior happens in that context with networking capability?

"We are focused on the operator or warfighter or responder at the tactical edge and their view of the operational world.

"80% of my customer facing team are former warfighters; and I was a former chief of joint networking for central command. With the new networking capabilities, decision making at the edge is operarating in ways that in the past only happened at the command post or back in the Pentagon."

"We refer to this as the edge eating the cloud.

"The speed of decision-making means that the commander at the tactical edge will be making decisions without going back to leverage the cloud computing environment or to tap into its resources in order to make a decision.

"The edge decision makers do not have the time, but increasingly has resources at the tactical edge which are robust and survivable enough to make those decisions as well."

Question: What you are talking about distributed operations where decisions will be made at the tactical edge with the information available to the operators at the tactical edge.

What this means is that in effect you will operate with the resources most present in your combat cluster.

Is that a way to put it?

Barthlow: It is.

"And what we are seeing is a reflection of the evolution of warfighting which I saw at CENTCOM. The traffic patterns were primarily unit-to-unit, not up and down in a hierarchical chain.

"The preponderance of the traffic flow is to adjacent units who are in the engagement zone operating together. There is a sparse support team which needs to get information from the maneuver unit. It's about being able rapidly to share an evolving collective knowledge base in real time.

"And then the challenge is to improve the efficiency and effectiveness of the decision at that point of engagement."

"We're all collectively operating as one big cybernetic organism.

"And what already see with the F-35 formations is a capability to operate as one mind with precision and effectiveness.

"Our objective is to enable the ability of units at the tactical edge to operate as a collective mindset that's precise and effective to the lowest unit possible."

Question: If you are focused on how units and leaders operate at the edge, then you are focused on how they make decisions and how to build tools that allow them to make more accurate decisions more rapidly and more effectively.

What is your approach to this challenge?

Barthlow: Part of the challenge is managing a speed to thought transition, allowing the operators at the tactical edge to have a decision-making cycle advantage.

"How can I speed up the interfaces among the war fighters at the edge and make sure there's enough computation capability and bandwidth among them and we can find ways to grow that capability by orders of magnitude?

Question: In other words, your focus is upon the decision-making environment at the tactical edge and working to understand how you can improve that operating environment?

Barthlow: It is.

"We are focused upon product resiliency, flexibility, and capability, anticipating that not only the current but the future decision environment as well.

"We're focused in part on generating the kind of computing power we need in the smallest form factor possible for today's environment.

"We're pushing beyond what we think we need today.

"We're pushing over the horizon because we anticipate as more information is available more computational capability will be needed, and we need to work the kind of tools for aiding decisions, such as artificial intelligence, and/or augmented reality glasses, which are being developed and deployed."

Question: Your focus on the ruggedized internet of things is highlighting the mix and match capabilities which you want to make available at the warfighter at the tactical edge in the smallest form factor possible concomitant with the capabilities which are required.

Your literature mentions that the evolution of your approach as being customer driven.

Who is the core customer driving your focus on the internet of things at the tactical edge?

Barthlow: Our latest product in this area is the M3X product family.

"And we developed it with the Special Operations Community in mind to be able to provide them high performance and flexible small form factor capability at the edge of their SATCOM network.

"We focused on mission flexibility considering the needs of a small insertion force that can seamlessly scale up capability as the force size increases. Using our modular stack, they can have significant computational and networking power in a small logistical footprint.

"And as our conventional force customers have begun to focus more seriously on distributed operations, the work we have done for SOF becomes very relevant for distributed forces working at the tactical edge.

"As the multidomain needs of the force grows, we're layering in cross domain capabilities. For example, with regard to open source intelligence, it can get processed very rapidly and included in the edge common operating picture. What used to take them two weeks, they can now do in minutes.

"The decision-making which can happen at the edge is now much more rapid and more informed. And we can connect the distributed radio networks and push the data into a stack the size of a couple lunchboxes rather than the legacy big transit cases and data center rack.

"We are enabling data management at the tactical edge that used to take an entire data center capability. It needs to happen in a way that allows for the formation of a cohesive cybernetic organism that is a true rugged Internet of battlefield things. That allows them to operate as a fully synchronized and collectively informed force to execute the mission."

MIKE BARTHLOW

Mike Barthlow is Senior Vice President and General Manager for Rugged Internet of Things (IoT), part of the Cubic Mission Solutions business division. Barthlow brings over 20 years of progressive experience in communications solutions to Cubic's defense, intelligence and commercial markets. In his role, he is responsible for the growth and management of Cubic's Rugged IoT business.

Prior to joining Cubic in 2015, Barthlow held several executive leadership positions including vice president of U.S. DoD Sales for Harris Corporation's RF Communications Division; director of U.S. Air Force Sales for Harris Corporation; and director of business development and sales for Northrop Grumman.

Barthlow is a U.S. Marine Corps veteran who served as chief of joint data networks, U.S. Central Command during Operation Enduring Freedom and Operation Iraqi Freedom.

He received an MBA from California State University, a Master of Science in Information Systems from the University of Colorado, a Bachelor of Arts from the University of Pennsylvania and is a graduate of the Wharton School of Business, General Management Program.

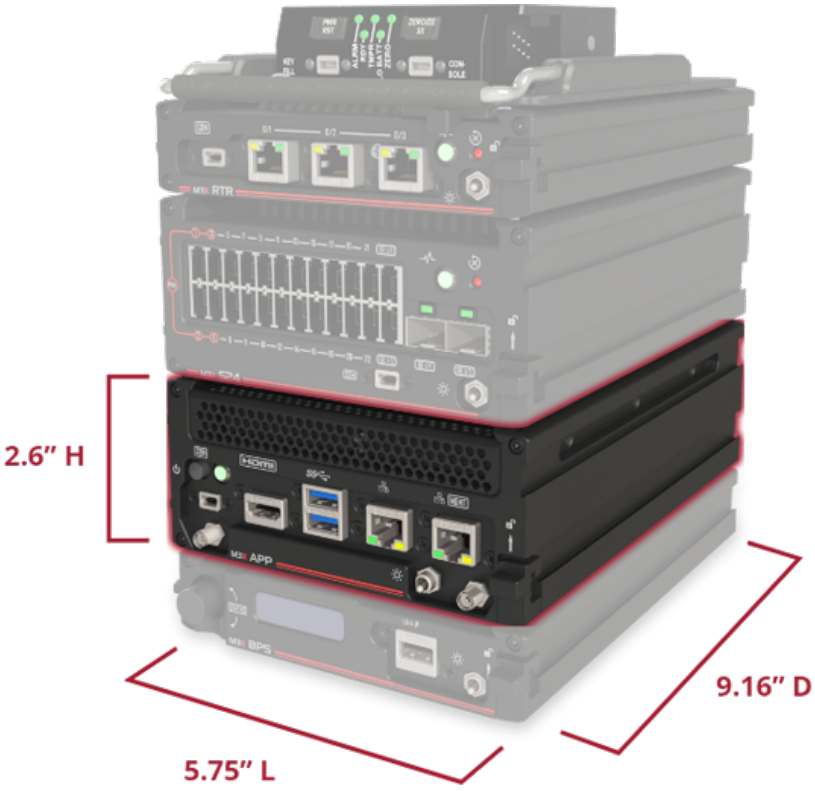

Figure 1 An M3X Stack

Shaping a 21st Century C2/ISR Infrastructure: The Emergence of C3

12/22/2019

By Robbin Laird

At the recent International Fighter Conference 2019, there was much discussion of the growing salience of the combat cloud to the "next" generation of air combat power.

This discussion was subsumed within a growing emphasis on multi-domain operations, and the need for the kind of C2 which can leverage the right information at the right time to make the right decisions within a multi-domain environment with the right package of combat force.

In effect, this capability is what precedes any discussion of what a 6th generation fighter aircraft might be.

What clearly the F-35 has generated is the "renorming of airpower" which we predicted some years ago.

But what it is also generating is a significant rethink of how to fight at the speed of light in terms of high confidence data to deliver capabilities to for decisive decision making at the tactical edge.

In effect, C3 is emerging as a key driver of change Command, Control and Confidence in the most relevant ISR data is required at the tactical edge to make the decisions necessary to prevail in the evolving battlespace.

At the International Fighter Conference 2019, Lt. General David Nahom, Director of Strategic Plans and Programs, for the USAF, underscored that a core focus in shaping the evolution of USAF airpower was upon joint all-domain command and control.

He argued that "we are building the high-speed highway on which to put the trucks."

The focus in his perspective needs to be upon building the C2/ISR infrastructure where "we can all work together."

The approach to shaping an advanced battle "manger" is no longer focused on a specific air platform, AWACS, Joint Starts or the like.

It is now focused on crafting, leveraging and evolving a distributed system which draw upon the "high-speed data highway."

Obviously, in such an approach, machine-to-machine interactions and artificial intelligence enabled decision making are foundational elements. And with a "high speed data highway" focus enabled by

the fifth-generation transition; the next generation fighter is not likely to be a single "truck" but a family of systems.

Clearly, a key component of the new high build out is already here and key element of the F-35 global fleet, namely, the CNI.

The significant impact of an INTEGRATED CNI solution simply is not part of the strategic discourse about the evolution of the U.S. and allied combat forces in a way that gets out of a fifth-generation marketing pitch, qua fifth gen.

It is not about fifth generation; it is about shaping the "high speed data highway" which the F-35 global enterprise can provide support to task forces engaged in an area of interest and enabling a key aspect of a targeted "combat cloud."

By DoD putting in motion the effort to build the F-35, the program has forced DoD to integrate its core combat fighter in ways that would not otherwise have occurred.

The CNI is to combat air as the smartphone is to the original Nokia mobile phone.

And it would NOT have happened without the F-35 program driving the need and the requirement.

Sensor fusion enabled by machine to machine operations and expanded by integratability across an F-35 fleet is a significant driver of air superiority now and lays down the way to the future being hypothesized at conferences like IFC 2019.

As the cards within the CNI are updated, modernized or transformed, along with the capabilities contained on those cards, and any accompanying hardware changes made, not only can an F-35 as a combat asset itself improve.

But the technology upgraded on that aircraft can reshape the combat elements on the air, sea or land which can benefit directly to F-35 connectivity and those demonstrated capabilities can inform decisions with regard to modernization or transformation of other combat assets which can employ similar variants of the new systems contained within the CNI.

Put in blunt terms, the integrated capability delivered by the CNI within the F-35 fleet is a key driver of change for the C2/ISR "highway" able to empower the integrated distributed force and deliver C3.

After the IFC 2019, I had a chance to discuss with Scott Rosebush of Cubic Mission Solutions, a company focused on enhancing capabilities for C2 and ISR at the tactical edge, including with regard to the F-35 and CNI.

We discussed how such a highway might be built out leveraging where we are today, and how emergent capabilities today can provide a way ahead with regard to this C2/ISR "highway" building effort.

Rosebush started the discussion by describing the vision of a High Capacity Backbone or HCB.

"The idea is to equip a select set of nodes with high throughput data links that could encapsulate data and pass it amongst themselves in a reliable way.

"Any node on the network to which the HCB nodes subscribes would then be able to access the date on the HCB."

He argued that this would bring the power of the cloud into multi-domain operations.

We discussed the combat cloud at length comparing the viability of network architectures that feature an enterprise network like a commercial WAN as compared a numerous set of smaller networks optimized for a particular task force that could potential be connected by a backbone.

The HCB could be built to facilitate this approach.

According to Rosebush: "By connecting multiple combat clouds, fusion applications could be generated to empower the combat force."

Rather than simply networking data, information and domain knowledge would be available to the tailored combat force through fusion applications including those empowered by artificial intelligence.

He underscored that the underlying HCB technology needed to realize the 21st century vision is ready for fielding now.

Advancements in phased array antennas paired with sophisticated digital beam forming technology enables the ability to produce and maintain numerous simultaneous high bandwidth directional communications links.

These solutions facilitate opportunities for data relays, networking bridging, and data format conversions leading to resilient and robust multi-domain networks.

The HCB highway can also be used to pass data that would traditionally be sent over congested time division multiple access networks like Link 16 freeing up capacity on those legacy networks.

Cybersecurity is a necessary focus area for the future of networked C2 and ISR objectives as well.

"The flip side to connectivity and interoperability is vulnerability to cyber-attack" said Rosebush.

He believes there isn't a silver bullet to ensure cybersecurity for the combat cloud, but instead thinks that "a mindful application of defense-in-depth principles and solutions while taking advantage of factors like the use of cryptography and directionality of the links can lead to an ultimately agreeable resultant security posture for the warfighter."

Rosebush argued that HCB technology is ready to field – with mass adoption feasible in the one to three-year timeframe.

He then focused on the next round of capability – the three to six-year time horizon — which he argued was in the domain of free space optical communications (aka laser-comm).

"Historically, the challenges associated with the precise pointing and tracking required to acquire and maintain FSOC links between dynamic platforms have been too problematic to overcome for mature solutions.

But with recent technology advances in these fields as well, the ability to point, acquire, and hold FSOC links on moving platforms is increasingly feasible.

A realistic long-term goal is to combine the laser communication options with a smart RF node to provide for hybrid data links."

In short, creating and enabling a cluster of data transportation solution sets or the data highway system is the "next" platform.

And in the course of doing so the redesign of platforms and what is expected from new platforms will be a work in progress.

The F-35, CNI Evolution, and Evolving the Combat Force

12/04/2019

By Robbin Laird

The F-35 is termed a fifth-generation platform, but is better understood as a first generation flying combat system.

Or a next generation capability or foundation for building a C2/ISR infrastructure for the integrated distributed force.

Because the F-35 is being stood up worldwide with both the U.S. Services and multiple core allies, how the F-35 global enterprise is being shaped has significant consequences for interactive transformation of those forces.

A key aspect of the F-35 comprises the onboard combat systems and data fusion inside the aircraft.

Because the software is upgradable and concomitant hardware changes have been made to facilitate major software upgrades, separate combat systems are affected by innovation driven within each combat system, and separate innovations and upgrades are driven by the core companies and the partners responsible for each combat system.

The companies driving change in each combat system, along with their partners, can reach a global user community and use these innovations while considering how such innovations could proliferate into their wider force structure development.

A key example is the CNI system.

I remember that one of the early criticisms by some F-35 analysts was that it did not have a radio. But that was good news, not an oversight.

According to Lockheed Martin:

"The Communications, Navigation and Identification (CNI) system is the most advanced integrated avionics system ever engineered. The integrated CNI has been developed by Northrop Grumman and affords F-35 pilots capabilities derived from more than 27 avionics functions. Through software-defined radio technology, the CNI allows for simultaneous operation of multiple critical functions, such as identification of friend or foe, precision navigation, and various voice and data communications, while greatly reducing size, weight, and power demands.

"When we visited the then-head of the USAF Warfare Center, we asked what he found most interesting about the F-35 as a new combat capability and he instantly latched on to a discussion of the CNI."

Major General Silveria, then head of the USAF Warfare Center and now Lt. General Silveria, Commandant of the USAF Academy, explained:

"Clearly, a key aspect of the F-35 is software upgradability. [It] provides for growth potential but requires a significantly different way to operate.

"This is difficult for people to grasp who do not fly the aircraft. One aspect associated with both fusion and software upgradability is that the F-35 is an integrated weapons system.

"Many articles have criticized this or that particular system on the aircraft; but [the F-35] aircraft is not really about this or that system; it is about the capability of a set of diverse systems to work together to deliver an effect and overall capabilities.

"Another key aspect is what software eliminates from the aircraft yet allows for enhanced combat effectiveness. A chief example is the CNI system. The plane has *none* of the items traditionally on airplanes that transmit and receive. It does not have any of those.

"Instead, it has two CNI com and navigation racks. It has two racks and you instruct the airplane: I would like to transmit in the UHF waveform; it generates that waveform and transmits in the UHF

waveform, which is a difficult concept to think about, because there is no UHF radio on the airplane. There is no ILS on the airplane.

"If I want an ILS, I have to go in, tap on my glass and say, 'hey, good morning jet, I'm going to need an ILS today, so I need you to generate the ILS waveform when I need it.'

"What does this mean in terms of performance and maintainability? I do not have to maintain what is not there; I do not need to be affected by failure rates of systems that are no longer there.

"Let me use the example of the IFF transponder, which I do not have on the plane as a separate system. On an F-15 E, you can walk to the ramp and open a panel where you'll find a little box that has all sorts of cannon plugs on it labeled 'IFF transponder.'

"If it failed during the operation, when you came back you told maintenance it did not work. They'd undo the cannon plugs, they'd pull out this IFF and send it to the back shop; they'd go through all the testing, they'd figure out, they'd fix it, and it would come back. They would put in another one. Well, the F-35 doesn't have that either to fail or to fix."

As the infrastructure for Command and Control (C2) and Intelligence, Surveillance, and Reconnaissance (ISR) evolves and transforms, the upgrades on the F-35 can benefit from those changes as well as generate them.

The CNI is a core case in point.

As the cards are transformed, along with the capabilities they enable, and any accompanying hardware changes occur, not only can an F-35 improve as a combat asset but the upgraded onboard technology can reshape the combat elements in the air, on sea, or land.

These can benefit F-35 connectivity directly and those demonstrated capabilities can inform decisions about modernization or transformation of other combat assets which can employ similar variants of the new systems contained in the CNI.

Cubic Mission Solutions' (CMS) involvement on the CNI system and its recent contract with Lockheed Martin exemplifies this dynamic.

The contract is designed to provide Full Motion Video (FMV) capabilities for the integrated battlespace.

Cubic Mission Systems expertise focuses in part on the innovations that FMV can deliver as part of the C2 and ISR infrastructure modernization for an integrated distributed force.

CMS' new contract with Lockheed Martin will provide new capabilities in the CNI, and they will bring that experience to bear for the benefit of the F-35 global enterprise.

They will also be able to work through the ways that communicating through FMV from the aircraft can impact related efforts for other key combat assets in the future.

A press release published by Cubic Corporation on June 11, 2019, highlighted the new contract:

Cubic Corporation today announced that its Cubic Mission Solutions business division was selected by Lockheed Martin as the Video Data Link (VDL) provider for the F-35 Lightning II Program. Cubic's VDL capability for the F-35 will significantly increase the aircraft's combat capability and is an essential capability to the overall F-35 follow-on modernization program.

"We are very pleased to partner with Lockheed Martin to provide a secure video data link capability for the F-35," said Mike Twyman, president, Cubic Mission Solutions. "Our team of protected communications experts has decades of experience supplying common data link systems and we look forward to partnering on this critical program."

"With our proven track record of managing a program from development through fielding, along with the proven performance of our software-defined radio products including the nano Multiband Miniature Transceiver, we are confident in our ability to deliver a low-risk, cost-effective Video Data Link solution with built-in life cycle enhancements," said James Parys, program director, Cubic Mission Solutions.

Cubic's offering is a secure and mission-enhancing system that easily fits within the allocated CNI subsystem volume. The software-defined, radio-based VDL solution features high-performance processing that can support future live video enhancements, while minimizing Size, Weight, Power and Cooling (SWaP-C). Cubic's solution enables the F-35 to transmit and receive sensor and metadata to and from multiple ground or airborne units.

The significance of this way forward rests in part on the changing C2 and ISR infrastructure and the evolving role of full motion video as integral to transforming the infrastructure itself.

In a recent interview with Vice President and General Manager Bradford Powell, Cubic Corporation's C2ISR Solutions business, he discussed FMV's enhanced role within the evolving C2 and ISR infrastructure for the integrated distributed force.

According to Powell, the clear trend line is toward significantly expanding access to imagery and FMV while improving integration between the two:

"We are working to provide context within the full motion video feeds, which will enable the operational user to make tactical decisions more effectively."

Powell described C2 as moving from a focus on maps to command and control operating from within full motion video. Such focus will require tools that provide context easily used by the tactical decision maker.

As a relatively simple example, Powell referred to how television networks superimpose yellow first-down markers over the video of a football game. Imagine, then, the various data clusters which could be laid down over the full motion video available to the tactical decision maker in his area of interest or the area where he is operating, and one can envision the coming future of video-driven context for C2 at the tactical edge.

The task is to insert relevant tactical data into the full motion video.

"The full motion video–focused C2 environment would thereby evolve to make a broader set of intelligence products discoverable in the video."

The overall focus is to give the local decision maker much greater context for what he is looking at in the full motion video.

Cubic's input into the CNI system will allow the F-35 to evolve along the lines suggested by Powell.

To expand my understanding of how this process was going to work, I had a chance to talk with James Parys at CMS, the man responsible for the teams working the new CNI capability into the F-35.

James Parys is the Director of Platform Communications Programs for Cubic Mission Solutions, a business division of Cubic Corporation. Mr. Parys has more than 25 years of experience in program management and business development in the defense, information technology, and computer science industries.

Parys began his career in the U.S. Navy and, after leaving the service, has worked in industry on a variety of C2 and ISR programs.

In his current role, he manages Cubic's platform-focused communication system program organization, which includes the F-35 Joint Strike Fighter and MQ-25 Unmanned Carrier-Launched UAS Video Data Link (VDL) programs for CMS.

As a combat system, the F-35 allows for significant upgrades over time, which is why some commentators' notion about the F-35's obsolescence makes little sense when one considers the aircraft's built-in software and related hardware upgradability.

According to Parys, "We're providing a set of cards that will integrate into our own segregated element of the CNI rack. It's basically going to be, for lack of a better term, a rack inside a rack.

"We will take video feeds from other very complex sophisticated sensors onboard the aircraft and communicate informationto other users, whether they're on other aircraft or on the ground, which they can leverage. Our data link's primary CONOPSis to support close air support."

Cubic has developed the ability to put into cards what once took up a lot of real estate and power generation to process the data and then communicate. Cubic is putting technology inside the F-35 that is battle-tested and matured within other systems operating in the battlespace.

The data fusion on the aircraft is unique and also leverages proven technologies in step with modernization of the CNI function on the aircraft.

In other words, Cubic is harvesting their experience elsewhere and putting it on the F-35 as the aircraft matures and evolves.

They will be able to harvest some of those solutions to benefit universal enhanced capability for an ISR C2 integrated infrastructure, which is evolving for the overall force development of the integrated distributed force.

A key element of the new capabilities Cubic is providing for the F-35 is an ability to pass over the middleman, or to reduce the need to send the data to a processing center which, in turn, sorts through the data and then sends it out to the user.

Cubic is significantly reducing what one might call the tooth-to-tail relationship in the C2 and ISR infrastructure.

Parys said, "We are supplying data directly from the F-35 to the ground combat elements that have not had access to before.

"We will provide very-high-resolution information coming off the F-35sensors directlyto the ground forces.

"With our solution, we're leveraging other capabilities, such as ISR Processing, Exploitation, and Dissemination (PED)–type capabilities to be able to clean up the video, and enable higher levels of resolution and higher contrast.

"By that I mean, being able to clear fog or see through smoke and share that view to the troops down on the ground, rather than the data having to be back-hauled to a PED station somewhere.

"The troops on the ground receive that data directly, which helps them make better, time-urgentdecisions."

Effectively, this capability contributes to building an infrastructure that connects the ground combat element to the aircraft's systems.

The modernized CNI takes abundant visual data and transforms it to shape a more usable data stream that supports combat operations.

Parys added, "We are going to reduce the whole timeline of the mission and what they need to do.

"This information can be sent to other aircraft; it can also be sent to other ground units.

"It means taking this advanced sensor in the sky and making its information available for whoever needs to leverage it and use it, whatever their mission is.

"The information will be available at an enterprise level rather than be limited to the traditional single stakeholder to single stakeholder process."

I have argued elsewhere that one advantage of the F-35 global enterprise for defense companies, and not just the prime contractor, is to provide global users with the experience of working with a variety of companies they might not have experienced before.

This certainly is the case with Kongsberg and its F-35 Joint Strike Missile (JSM), which additionally has led to broader understanding of what their technology can provide to other combat elements.

This was demonstrated when the U.S. Navy adopted a Kongsberg strike missile being coproduced with Raytheon.

A similar positive outcome is predictable for Cubic and its engagement on the F-35.

As users become familiar with innovative processes of incorporating full motion video into a decision-making flow, we will see a demand to replicate such experiences elsewhere for other combat forces.

Parys highlighted: "We're taking what we're putting on the F-35 and we're making it even smaller; fully packaged, but even smaller, and we're putting it in the hands of users on the ground as well."

Shaping C2 for a Degraded Operational Environment: The Role of GATR

06/12/2019

By Robbin Laird

With the central role which crisis management will play for the U.S. and its allies, a key area of change is in the area of C2. Distributed operations which will be an essential part of the strategic shift will require distributed C2.

And C2 will have to operate in degraded operations environments.

A tested technology which can provided capabilities to support flexible insertion forces in the higher end and support for HADR operations on the lower end is the GATR system.

The GATR system provides a very flexible, mobile, deployable solution to ensure for reliable communications on the fly which can be used to support military insertion forces or to provide for connectivity when natural disasters have brought down normal operating systems.

I recently had a chance to talk with Cubic's Victor Vega, Director of Emerging Solutions, about the GATR system.

I first became aware of both Mr. Vega and GATR from the role of the system in dealing with the HADR situation in Puerto Rico in 2017.

In an article by Debra Werner of Space News published on December 5, 2017, the role of GATR was highlighted.

Cubic Corporation's GATR satellite antennas continue to provide communications links for residents and community leaders in Puerto Rico more than two months after Hurricane Maria devastated the U.S. territory and nearby Caribbean islands.

Employees of GATR Technologies, part of Cubic Corporation's Mission Solutions Division, were in the U.S. Virgin Islands working to reestablish communications in the wake of Hurricane Irma, when Help.NGO's Disaster Immediate Response Team and Cisco Systems' Tactical Operations Team called for assistance in Puerto Rico.

Victor Vega, GATR Technologies director of emerging solutions, and his colleagues packed inflatable satellite antennas in suitcases and brought them to areas of Puerto Rico where hurricane-force winds and fallen trees had dismantled the terrestrial communications infrastructure. They installed inflatable GATR 2.4 meter antennas on rooftops, including two U.S. Army National Guard buildings that served as a distribution point for food and water.

Vega noted that he has been with the GATR program from the early days when it was produced by a small startup company (GATR Technologies) which was acquired by Cubic Corporation in 2015.

He argued that the acquisition has been good for the GATR effort as "We have been able to move from being an antenna provider to being part of a broader effort to become a satcom provider and to provide systems to DoD as a program of record."

But he underscored that the core GATR capability is really about rapid response. He pointed out that when they began, the already contributed capability to the Hurricane Katrina disaster. The factory is located in Huntsville, Alabama and they put GATR into a truck and drove to the disaster area and provided sat com capabilities for the first responders.

"The prototype already allowed FEMA to get Internet access so people could come in and fill out the FEMA request forms and to communicate with their familes to let them know they were alright."

He underscored that since that time, the GATR system has been a frequent contributor to HADR C2. The graphic below shows the HADR events at which GATR has provided C2 in a degraded operational environment.

2

Our Disaster Response

- Hurricanes
  - Katrina - 2005
  - Ike - 2008
  - Typhoon Hiyan (Philippines) – 2013
  - Sandy - 2012
  - Harvey, Maria, Irma – 2017
  - Michael – 2018
  - Idai (Mozambique) - 2019
- Tornados
  - North Alabama - 2011
  - Kansas - 2013
- Earthquakes
  - Haiti - 2010
  - Nepal - 2015

CUBIC GATR

Verga argued that given the centrality of communications to modern society, re-establishing C2 has become a central focus for relief agencies which providing HADR rebuild efforts. "The faster C2 can be restored, the more rapidly can order be re-established and chaos mitigated."

GATR has virtually no logistics footprint so to speak. It can be packed along with suitcases for transport with other cargo; it does not need specialized vans or specialized lift helos or aircraft to bring to the area of interest. The small logistical footprint means it can be brought to the area of interest by a wide range of ground or air or sea transport systems.

This also means for insertion forces in higher end contingencies, a distributed C2 capability can be laid down rapidly and with minimal lift required. The system can be and has been carried with airborne troops and precision air dropped to the area of interest as well.

Because the focus is shifting from the big established bases of the Middle East land wars, to an ability to operate across the combat spectrum in a crisis situation with distributed forces, such a flexible coms capability is an essential part of the mobility and flexibility which the evolving force structure needs to prioritize.

With regard to HADR operations, FEMA has become a customer of GATR as well as several NGOs which operate in the HADR environment. For example, in HADR operations in 2017, the following partners worked with GATR in support of operations:

In other words, GATR can support a wide range of missions operating in a disrupted or degraded environment.

I noted that the US military is clearly reworking island hopping as part of the US-allied strategy in the Pacific.

Vega commented that GATR clearly has a role in such a strategy and provided this example.

A US Army Unit based in Hawaii has been using GATR for some time to support exercises across the Hawaiian Island chain.

One of the officers of this particular unit told Vega that "we can not do our mission operating out of ice cream truck satcom. We cannot move all that equipment and get our job done."

To do their mission, this US Army unit transitioned from the legacy system of trucks and antennas to GATR, a clear harbinger for a more flexible approach, one needed for HADR or other mission sets.

Re-shaping C-2: Decision Making at the Tactical Edge

05/22/2019

By Robbin Laird

With the introduction of new communications and video technologies, military decision making has changed over the past twenty years.

A significant point of change was the introduction of Rover which created what Secretary Wynne, under whose mandate Rover was introduced, referred to as the democratization of the battlefield.

In a 2012 interview with one of the key shapers of the Rover technology, the impact of Rover on C2 was highlighted.

Rover has been a key element of democratizing the battlefield.

The General has the generally same picture as the guy in the field does.

And this rover essentially creates a horizontal command structure where any Special Forces Team or Captain or a Lieutenant on the ground or a Battalion Commander or a theater committee can call in the air strike commensurate with the Rules of Engagement (ROE).

It's really the story about the JTACS and how they into very effective fighting tools that we have used in Iraq and Afghanistan.

This democratization of the battlefield has unfolded in the context of the land wars in the Middle East and has been an essential part of a significant reshaping of what air support means to the ground forces.

With the strategic shift from the land wars to higher intensity operations, how then to replicate the Rover experience but to do so for the distributed force operating in much higher tempo operations?

As noted in the last piece in this series on distributed C2, the coming of the F-35 and its sensor fusion provides a significant foundation for rethinking how C2 at the tactical edge could occur.

In some ways this is just the beginning of a significant shift in the capability which can be unleashed by new technologies and new approaches to command and control.

A key technology which could drive such change is the delivery of ubiquitous full motion video, embedded with overlays which can provide dynamical contextual awareness to the warfighter at the tactical edge.

With a proliferation of decision-making technology, risk can be reduced and decisions made more rapidly and with better outcomes.

But for a full motion video enabled force with embedded overlays to lead to the kind of change, which inherently it could, two related capabilities need to occur.

First, senior commanders have to avoid detail management through C2 intrusiveness and to focus on appropriate mission command.

The practices of the past twenty years where video technologies have often been used for intrusive controls at the tactical edge by senior commanders simply will not work in a high tempo operational environment and will take away the advantages which could accrue to a distributed force.

And, secondly, operators at the tactical edge need to learn how to make decisions using the context provided via overlays to the full motion video.

They need to understand how to implement mission command in a high tempo environment with enhanced decision-making tools made available to them.

In effect, the challenge facing today's F-35 pilots to shift from performing as an AWACs-like commander, to becoming a decision maker at the point of interest with the full motion video and overlays available to them, is a harbinger of a broader transformation of the C2 environment.

But this will not happen unless both aspects of change interactively occurs – namely, Generals lead but do not provide detailed intrusion; and distributed force commanders, operate on the SA which can be constructed with the tools available at the tactical edge.

And another challenge involves how the US has operated its intelligence processes.

In high tempo operations, it is not about collecting data, and culling it at some command post in the rear. It is about the intelligence function being embedded into a tactical edge rapid decision-making process.

Much of this information is fleeting, and it is a question of making better rather than worse decisions more rapidly; it is not about slowing down decision-making to the speed which hierarchical review requires.

Recently, I had a chance to talk with Bradford Powell, Vice President and General Manager of Cubic Corporation's C2ISR Solutions business, about the nature of change in the C2 sector.

We discussed both the general dynamics of change as well as some solutions being worked by Cubic as well.

According to Powell, the clear trend line is to expand significantly access to imagery and to full motion video (FMV), while improving integration between the two.

While today, access to FMV within the military is targeted and to some extent limited, a decade out, full motion video will be ubiquitous.

He noted that his group at Cubic has primarily focused on handling the movement of video from Airborne ISR platforms.

For example, they have provided means for getting MQ-9 video from point A to point B.

With the growing flood of video, the challenge will be not simply to manage it, but to turn the video stream into an effective decision-making tool at the tactical edge.

"We are working to provide context within the full motion video feeds, which will enable the operational user to make tactical decisions more effectively."

He described C2 as moving from a focus on maps, to command and control operating from within full motion video.

And to do so will require tools that provide context easily used by the tactical decision maker.

As a relatively simple example he referred to the television networks placing yellow first down markers over the video of a football game. If one then imagines the various data clusters which could be laid down over the full motion video available to the tactical decision maker, in his area of interest or the area where he is operating, then the coming future of video driven context for C2 at the tactical edge can be envisaged.

The task is to insert relevant tactical data into the full motion video.

"The full motion video focused C2 environment would then evolve to make a broader set of intelligence products discoverable in the video."

The overall focus is to provide the local decision maker with much greater context for what he is looking at in the full motion video.

Obviously, as this capability is introduced, refined and developed, artificial intelligence can be shaped to provide effective tools to help shape the data coming into the contextual shaping function for the full motion video.

In short, "what is the impact of full motion video in terms of making faster decisions and communicating those decisions in a more effective way and enabling decision making at the lower level?"

In other words, the template for decision making is changing.

A shift to a distributed force will be effective only if a new template for decision making is put in place, one that allows for 21st century mission command and decision making at the tactical edge operating in high tempo operations.