

***COMBINED ARMS
OPERATIONS OF MANNED
AIRCRAFT WITH MARITIME
AUTONOMOUS SYSTEMS***

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ROBBIN LAIRD

CHAPTER 1

HOW TO THINK ABOUT MARITIME AUTONOMOUS SYSTEMS

GENERALLY, when autonomous systems are discussed in relation to manned systems, the focus is upon teaming. Images of the Australian Loyal Wingman come to mind whereby the autonomous system is seen as a slaved system to a manned aircraft, hence the term teaming.

TEAMING

A key capability of the manned air system is the ability to communicate with and digitally manage the autonomous system.

In my own discussions with NAVAIR concerning the coming of the CH-53K, I focused on such a future for the manned aircraft working with an autonomous system.

In my visit to NAVAIR in January 2020, I discussed this approach with Col Jack Perrin, then the Program Manager, PMA-261 H53 Heavy Lift Helicopters, U.S. Naval Air Systems Command at Pax River Naval Air Station.

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,

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

What this means, according to Colonel Perrin, 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. The CH-53K in a FARP or Forward Arming and Refueling Point Mission could bring weapons on-board and the unmanned “mules” could bring the fuel bladders along with the main hook, or in the future the three hook system.

Such manned-unmanned teaming requires a lot of digital capability and bandwidth to manage, 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 Forward Arming and Refueling Points (FARPs) or Forward Operating Base (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, especially when one builds in its ability to direct the operations with autonomous “mules” working with it.

TASKING TO DELIVER MISSION THREADS AS AN AUTONOMOUS SUPPORT FORCE

A second way autonomous systems have been discussed has been in terms of mission threads tasked to an autonomous system or swarm or wolfpack which then is directed to do a mission which then the manned force can exploit in terms of associated operations.

We have seen in the Ukraine war many examples of drones being sent to do a single one-way mission, but this is not only way to think the single-mission focused unmanned system. These one-way drones are conceived of more terms of how missiles are used than in terms of providing a robust partner for ongoing manned platforms.

Autonomous or unmanned systems seen in this way will reach another level when they can swarm to deliver the capability needed for a mission thread.

Although this capability can be foreseen it is not here yet, but learning how to use unmanned and autonomous systems to perform a core mission thread is the necessary step towards a swarming future. If you don't use them, you will not build them into your force anticipating the swarming future.

As Keirin Joyce, an Australian Air Force Officer who also served in the Australian Army, a leading expert on unmanned and autonomous systems put it in a 2020 article:

What does true swarming look like? Imagine UAVs are operating across the sky, providing aerial observation, targeting, data networks, delivery of even smaller UAV and precision navigation and timing services, with ground robots that can be tasked to take action in a wide spectrum from logistics to combat and casualty evacuation.

That robotic swarm is a heterogeneous cross-domain team, consisting of dynamic configurations, sensing capabilities, spatial footprints and behavioural strategies, independent of centralised control, synchronised to work with, and cued by, their human teammates.

Imagining a more expansive vignette of robotic swarming is not too difficult:

It is 2030, and an Australian joint task force (JTF) is deployed on stabilisation operations in the near region against a force of insurgents who have

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been equipped and trained by a technologically sophisticated, militarised nation-state seeking to gain power at a regional pivot point.

The Australian JTF includes swarming machines in support of an Army brigade. Multiple unmanned assets come and go with trusted permission from the networked combat teams, and they operate in all five domains: on and underwater, on land, in the air, in space, and interacting with the cyber/electromagnetic spectrum.

These assets started their capability life cycle in the 2010s as small tactical unmanned aerial systems (UAS), ground robots, teleoperated armoured vehicles, and armed medium altitude long endurance (MALE) remotely piloted aircraft systems (RPAS). They are now semi- and fully autonomous.

Their configurations are dynamic, changing which assets are leading or following and adapting routes to account for unpredictable weather, changes which are frequent and difficult to predict in the Pacific.

The systems take evasive action from insurgent threats in the kinetic, electromagnetic, and cyber spectrum. The insurgents are well equipped with mobile, radar-cued surface-to-air missiles and counter-UAS systems. At higher altitudes, a Loyal Wingman swarm protects the crewed Wedgetail by changing flight altitudes and profiles to account for radar threats. Down at ground level, machines in the team sense themselves and their surroundings to adapt to conceal their signatures, and or to exploit the signatures of threat forces.

This adaptation occurs across a wide spectrum of sound, vibration, colour, light, electromagnetic, radar, and particulate sensing.

The machine sensing can algorithmically adjust its behaviour depending on the tactical and operational scenario and mission guidance: passive, reactive, overt, covert, offensive, defensive, or population interactive.

Humans issue the orders and the mission commands, and, as the team rolls through the area of operations, the machines are cued and prioritised by the humans and their robot teammates.

Robots are sacrificed, they use automated/autonomous kinetic engagement to shield their machine and human teammates, and they undertake the dull, dirty, and dangerous roles to enable the humans in the team to do what they do best.

This is science fiction becoming science fact. The advent of true machine swarming behaviour is coming: an armada of machines, evolved algorithms,

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distributed intelligence, and complex autonomous behaviours – just as in a colony of bees.

However, true swarming is not here yet. In the meantime, we need to dial down the use of the term ‘swarm’ when discussing multiple unmanned aircraft.¹

A COMBINED ARMS OPERATION

But there is a third way in which one can discuss maritime autonomous systems working with manned air systems. One can build combat clusters which work in a combined arms operation.

This would particularly refer to manned systems working with a package of maritime autonomous systems to deliver them to a point of operation where they then could do a mission thread for the force commander.

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1. Keirin Joyce, “Swarm Robotics: What Will it Look Like?” Defense.info (May 20, 2020), <https://defense.info/williams-foundation/2020/05/swarm-robotics-what-will-it-look-like/>

CHAPTER 2

THE LAUNCH POINT: WHY A COMBINED ARMS OPERATION WITH MARITIME AUTONOMOUS SYSTEMS?

PRIOR TO FURTHER DISCUSSING HOW TO craft combat clusters which work in a combined arms operation involving a manned air system with autonomous maritime systems especially working as a wolf pack, I would like to focus on why one would want to be able to do so.

For me, the answer to this lies in my assessments of the Marines and their focus on enhanced force mobility to deal with the threats from peer adversaries.

The focus has been upon an ability to distribute a force, to reduce the signature of that distributed force and to move more rapidly across the combat chessboard in order to be able to target the adversary more effectively from the points of interest where those dynamic distributed forces operate.

During my visits to MAWTS-1 in Yuma Arizona since 2018, there is a clearly evident focus on finding ways to be able to do what I have just described. During my November 2023 visit, such a focus was evident throughout the interviews with the officers at the command.

For example, I noted after the visit:

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When I was last at MAWTS-1 in 2020, they were starting to work on how to enhance the deployability and mobility of the Marine Corps and to do so in formations smaller than the traditional MAGTF.

During this visit, my discussions with the department heads underscored how much work they have done in terms of doing expeditionary basing, innovations in Forward Refueling and Re-Arming points and ways to reduce the signature of the deployed force."

In that visit, my discussion with the Aviation Ground Support (AGS) Department Head, Maj Justin Atkins, a USMC combat engineer, focused on the signature management challenge.

Atkins noted that in his deployments to date, they had not really focused on signature management. When fighting the land wars, signature management was not a key issue.

But when dealing with more advanced adversaries, obviously operations in the electro-magnetic spectrum had a key effect on the movement and operation of forces.

With regard to Expeditionary Advanced Base Operations (EABO), the question of how to manage forces across the combat chessboard is clearly affected by signature management and the need to organize force in ways to reduce it or to mask it. He noted that most of AGS activities are focused on FARP operations as the means to do EABOs.

They have worked multiple configurations of FARPs to do so but have not found an optimal solution.

He noted: "We are building small tactical teams and exploring ways to sense, communicate, and to operate in the battlespace with mobility. But how to ensure that such teams have the desired effects?"

He noted that they work with the spectrum warfare department to do two things. First, they work with them to reduce their spectrum signature footprint. Second, they are working as well to copy that footprint to provide means to mask operations as well.

Maj Atkins underscored: "Before coming to MAWTS, I never looked at the question of electromagnetic spectrum whatsoever. Now it is a central consideration of my focus and effort."

In other words, the Marines at MAWTS have been working new ways to do FARPS as a way to do EABOs, but there are key limitations

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to what one can do in the real world. And ultimately, the key combat question can be put simply:

What combat effect can you create with an EABO? How does the joint force use an EABO in creating a joint effect?

And what is the relationship of the creation of EABOs to what the Marines do when the National Command Authority calls on them to deploy?

My discussions with LtGen Heckl, Commanding General, Marine Corps Combat Development Command, and the Deputy Commandant for Combat Development and Integration, expanded on this challenge and highlighted the importance of introducing autonomous systems in the force to provide for the kind of force mobility and support the Marine Corps was looking for.

LtGen Heckl argued in one of our interviews:

It is about survivability and a key to being able to do that is signature management. We are keenly focused on reduced electronic magnetic signature management in how we think about deployment of the force and doing so with an eye to how the deployed force can integrate sensors with strike.

It really is about a kill web in which the real value proposition is reconnaissance and counter-reconnaissance reducing your vulnerabilities and exposing those of the adversary and enabling effective strike.

It is in this context that Heckl discussed autonomous systems.

We are focusing on a broad range of autonomous systems capabilities. They aid significantly in signature management. If they are unmanned, you don't have the weight or equipment necessary for a man onboard whether it be a ship or an airborne system. It means as well you can get better value out of your manned aviation assets or your ships.

With regard to our lift assets – C-130s, CH-53s, or Ospreys – they can carry the most essential elements to an EABO but can be supplemented by a variety of autonomous systems which reduces the overall signature of the force and allows for enhanced flexibility of the force.

Logistics in LtGen Heckl's view is the pacing function for a distributed force. How to sustain a distributed force? This will be a combination of the air and sea manned assets as well various autonomous systems. He highlighted work being done for the USMC

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to build unmanned surface vessels to carry logistics to the point of need.¹

In another interview with him, LtGen Heckl added this core point:

The real value proposition we are putting forward as the Stand in Force for the joint force is our sensing capability. The insertion of Expeditionary Advanced Base Operations (EABO) of a sensing capability that can link with other assets, such as the F-35, allows us to sense, connect, and operate even in the face of the denial of space-based assets.

When we're in an integrated environment, everything we're doing, we're approaching from that perspective so that we will still be active even when an adversary takes action to degrade our ability to connect, we will still be connected.²

For me, the discussions at MAWTS-1 and with LtGen Heckl provide the launch point for considering why a combined arms operation of manned air systems with a maritime autonomous system wolf-pack can be a significant innovation in rethinking how to leverage the force you have now to have the future capability you want now.

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1. Robbin Laird, "Crafting a Kill Web Force: The Role of Autonomous Systems," Second Line of Defense (December 12, 2023), <https://sldinfo.com/2023/12/crafting-a-kill-web-force-the-role-of-autonomous-systems/>
 2. Robbin Laird, "USMC Transformation Path: A Discussion with LtGen Heckl," Defense.info (February 9, 2024), <https://defense.info/multi-domain-dynamics/2024/02/usmc-transformation-path-a-discussion-with-ltgen-heckl/>

CHAPTER 3

EABOS, THE U.S. NAVY AND RESHAPING COMBAT CLUSTERS FOR INSERTION OF EFFECTIVE FORCE

THE MARINES ARE BUILDING new capabilities for force insertion which complement more traditional ways of operating.

How do you insert force in various locations to hit the enemy where he isn't?

The basic concept of "hit where the enemy isn't" was well articulated in an interview, I did with the II MEF commander after a Bold Alligator Exercise in 2012.

This is what BG Owens said in that interview:

On the Navy side we need to show the agility and the flexibility to maneuver. We've got to use our shaping capabilities for both kinetic and non-kinetic operations; we've got to use solid deception operations, demonstrations and so forth.

And we've got to basically show the enemy that we can hold his entire coastline at risk, and force him to make decisions to spread his forces out that will allow us to find a weak spot. Or force him to concentrate forces in the wrong area, in which we can go into an area that he either hasn't reached yet or simply can't cover because he doesn't have enough forces. We've got to hit them where they're not.

In doing so, we get away from that image of amphibious assault where we're going into a limited area, and that you have limited places you can land,

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so the enemy knows you're coming to one of these two places. And once they know you're coming to the island, there is no surprise left.

In most situations, we're not going to be assaulting an island less than ten miles in length; we're going to be holding a larger coastline at risk. And we will force the enemy to make decisions, and through that, hopefully make mistakes that we can exploit.

And that's kind of how the scenario played out in Bold Alligator. We ended up landing where the enemy was not quite able to reach us yet, and even though we did have some threats in the beach area, we were able to mitigate those so that the forces came ashore without taking casualties.¹

As the Navy and the USMC evolve their approach to distributed operations a decade later, they are leveraging new technologies and new concepts of operations to find new ways to achieve the objective of "We've got to hit them where they're not."

With a kill web approach, the focus is leveraging payloads from various points of operation to create the effects needed and to do so in ways where you combine distributed forces to create greater aggregate combat effect.

You are creating combat mass from aggregation of effects delivered by various combat clusters interwoven into a combined force.

One illustration of how the Navy is working such an approach was highlighted in an interview which I did last year with Rear Admiral Jablon in his office in Hawaii.

Rear Admiral Jeffrey Jablon at the time of the interview was the Submarine Force, U.S. Pacific Fleet (SUBPAC) commander.

This how he highlighted the nature of a combat cluster in our discussion which we had.

The role of the submarine in the joint and coalition force is being expanded. The submarine force is part of the joint fires solution. The submarine force can operate independently or work with the joint or coalition force in providing joint or coalition force combined effects.

As the joint force works enhanced kill web capabilities, combat clusters can operate together to deliver joint fires solutions.

As Ed Timperlake and I have argued in our book on the evolution of the maritime kill web: "Force packages or combat clusters are deployed under mission command with enough organic C2 and ISR to monitor their situa-

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tions and integrate the platforms that are part of that combat cluster and to operate effectively at a point of interest.

“Within that combat cluster, the C2 and ISR systems allow for reachback to non-organic combat assets which are then conjoined operational for a period of time to that combat cluster and becomes part of an expanded modular task force.

“With the right kind of security arrangement, and C2 and ISR capabilities, the presence force, now an expanded modular task force, need not be American to expand the reach and effectiveness of the operational force in the extended battlespace.

“Such an approach and capabilities are the essence of what a kill-web enabled force is and how such integratability can close the geographical and combat seams which 21st century authoritarian powers are focused on generating.

“This allows for the kind of escalation management and control crucial for the competition with the 21st Century authoritarian powers. It is not about getting to World War III as rapidly as possible or generating nuclear exchanges early in a widening conflict.

“It is about escalation control and management, and an ability to close seams which adversaries seek to open to gain significant escalation dominance as they expand the reach and range of those 21st century authoritarian powers.”

Rear Admiral Jablon underscored the nature of the shift as follows: “The submarine force is now becoming part of the ‘combat clusters’ that you’re talking about instead of an independent operator.

“In the Cold War, we operated independently, alone, and unafraid. During the land wars, we started becoming part of the joint force as we provided land fires via the TLAM.

“Now, we are fully integrated with the joint force in terms of targeting and communications. But, of course, we can also conduct independent operations as the ‘silent service’ when directed.”

The broadening of the submarine’s role within joint warfighting is being expanded by the arrival and then growth in capability of autonomous systems. In my own view, rather than seeing autonomous systems in the short- or medium-term creating ghost fleets, their role will be to expand the range, capability, and lethality of capital assets.

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Rather than looking simply at the organic capability on a specific platform, we will consider surface ships using such capabilities as becoming mother ships and submarines will share in this development as well.

Rear Admiral Jablon specifically mentioned two types of autonomous developments of note for the submarine fleet. One is the ability to operate a UUV out of a torpedo tube, with the UUV coming back after its mission to offload data specifically onboard the submarine.

The second autonomous development is the ability to launch a UAV while submerged to enable joint fires. Rear Admiral Jablon said that they had specifically worked this with the USMC as the force develops its Expeditionary Advanced Base Operations (EABO) solution set.²

But the USMC can leverage autonomous systems in other ways to support their EABOs and to deliver combat effects from their distributed forces inserted in the chessboard of operations.

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1. Robbin Laird, "Brigadier General Owens on Bold Alligator 2012: "We've got to him where they're not!" *Second Line of Defense* (March 15, 2012), <https://sldinfo.com/2012/03/brigadier-general-owens-on-bold-alligator-2012-weve-got-to-hit-them-where-theyre-not/>
 2. Robbin Laird, "Rear Admiral Jeffrey Jablon on the U.S. Pacific Submarine Force," *Second Line of Defense* (May 12, 2023), <https://sldinfo.com/2023/05/rear-admiral-jeffrey-jablon-on-the-u-s-pacific-submarine-force/>

CHAPTER 4

PAYLOADS, LIFT, AUTONOMOUS SYSTEMS AND EABOS

THE MARINES in focusing on EABOs have two key lift assets which can deliver autonomous systems payloads to an EABO and to do so with the reduced signature goal which has been highlighted by LtGen Heckl.

Maritime autonomous systems can be delivered to an EABO via an Osprey/CH-53K combination.

The payloads for the maritime autonomous systems could be delivered to an EABO by a single Osprey which would land and offload the Marines, the payloads for the maritime autonomous systems and the support which the Marines would need for a short duration mission. The Osprey could deliver the payloads and land the Marines and leave rapidly.

An incoming CH-53K – both the Osprey and the CH-53K are air refillable and could land at the remote location operating as a transient EABO in a wide variety of locations determined operationally significant by the Navy/Marine Corps command element.

The CH-53K as one Marine intimately involved with the program has noted can be thought of in these terms:

I would argue we should be putting the new age into the back of our helicopter. We are really talking about new technology and new capabilities and

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doing roll on roll off packages and inserting them into the back of our cargo helicopter which to me shouldn't be that big of a leap mentally.

We carry cargo in the back, we just we just need to think differently about the type of cargo we're carrying and the capabilities of the cargo itself.

The Osprey could carry C2, ISR, Counter-ISR or weapons payloads to the transient location for the EABO. The CH-53K could bring maritime autonomous systems such as those provided by the family of systems built and operated today by MARTAC.

The Marines could use one of the boats provided to leave the EABO if rapid turn around and maximum reduction of the signature is a key requirement, or the Marines could simply depart onboard the CH-53K after having launched the MARTAC wolfpack of autonomous systems.

I asked the CEO of MARTAC, Bruce Hanson, after carefully examining the cargo capability of the CH-53K, what could be carried by the aircraft to an EABO.

The answer: On the hook, carried beneath the aircraft could be one of the larger boats, the T-38, or a T-50 or T-60 with the number suggesting the length of the boat. Inside the aircraft could comfortably carry three T-18s and 6 T-12s.

This means that if the Marines departed by the CH-53K a wolfpack of the larger boat with an additional nine boats could be launched with a decent range to set up a C2 mesh network, and ISR mesh network or a counter-ISR deception network or if desired weaponized with either torpedoes or UAVs such as longer-range loitering munitions on the boats.

In addition, most of these vessels can hide undetected for long periods of time in "Gator Mode" awaiting instructions.

The Marines could choose to reduce signature by leaving some of the boats. The quantity of boats would be correlated to how many Marines are necessary to marry the payloads to the boats.

I have provided extensive detail in this book concerning the range of possible payloads in relationship to the wolfpack boat operations.

But C2, ISR, Counter-ISR payloads have all been tested on these boats, and the wolfpack operating capabilities of the boats working together with various sizes have been clearly demonstrated. Weapons

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have also been demonstrated but I think for the near term, the focus is on mesh networks of C2, ISR or counter-ISR payloads.

The importance of counter-ISR is especially significant. As LtGen Heckl put it about his desired EABOs:

The real value proposition we are putting forward as the Stand in Force for the joint force is our sensing capability. The insertion of Expeditionary Advanced Base Operations (EABO) of a sensing capability that can link with other assets, such as the F-35, allows us to sense, connect, and operate even in the face of the denial of space-based assets.

A combined operation of the sort suggested here is an additional way to do this which reduces the time on station for the Marines to do so, thereby enhancing signature management.

The central importance of counter-ISR was underscored in a meeting I had last year with a senior Admiral involved in Pacific operations. This is what he told me:

Counter-ISR is the number one priority for me, to deny the adversary with to high confidence in his targeting capabilities. I need to deceive them and to make a needle look like a needle in a haystack of needles. It is important to have the capability to look like a black hole in the middle of nothing.

Dropping in numbers of MARTAC wolfpacks makes for a lot of cost-effective haystacks.

A combined arms operations of Marine air with maritime autonomous systems is one way to do that now and provide a key building block for shaping future operations.