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USMC + MQ-9:

A Bold New Vision for
Expeditionary Warfare
in the Indo-Pacific



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New challenges for the future of warfare have prompted the U.S. Marine Corps to respond by doing three things it does best: improvise, adapt and overcome.

The Marines have replaced outdated doctrine and assumptions with a fresh and bold new vision for expeditionary, amphibious and littoral operations in the coming century.

SITREP

The service calls them Expeditionary Advanced Base Operations and Littoral Operations in

Contested Environments.

Although this vision applies to any region, it is especially relevant for U.S. national security interests to overcome the challenges presented by the vast reaches of the largely air and maritime domains in the Western Pacific.

The new naval expeditionary stand-in forces will combine some completely new equipment and systems with many existing ones used in novel ways, of which the keystone is the MQ-9A Reaper.

The Marine Air Ground Task Force Unmanned Aerial System Expeditionary program, or MUX – relying on the combat-proven MQ-9A – has emerged as the commandant’s top aviation acquisition priority to support naval warfighters.

This means the MQ-9 isn’t only vital to the future vision for America’s naval forces. Because of the central role those forces play in U.S. and allied strategies for maintaining security and deterrence in the Indo-Pacific, it means the MQ-9 is the fulcrum for these broad efforts, too.

A Proven Advantage

With primary missions such as airborne early warning, communications and data networking/relay, maritime surface search, electronic warfare and persistent offensive air support, the Marines’ MUX capability will provide a highly agile and lethal system of systems against peer or near-peer threats. And with the recent acquisition of two MQ-9As, plus another 16 on order, the Reaper will



The MQ-9 enables a plank of the Marines' new expeditionary strategy: distributed postures.

be a central part of the plan.

MQ-9 variants can serve as the hub of the wheel, or as its spokes, or both, in concert with U.S. Marine Corps units but also with those of many other American or allied services. To understand how, it's important to understand what makes the aircraft unique.

The medium-altitude, long-endurance Reaper, its predecessors and other General Atomics Aeronautical System unmanned platforms have proven themselves as difference-makers with over 7 million combined flight hours in operations all over the world.

GA-ASI's ability to provide extremely reliable, long-range and long-endurance unmanned platforms, combined with an array of high-quality mission payloads, allowed the U.S. Air Force, U.S. Army and other agencies to conduct intelligence, surveillance and reconnaissance missions effectively and efficiently in support of operations in Afghanistan, Iraq and Syria. Global War on Terror.

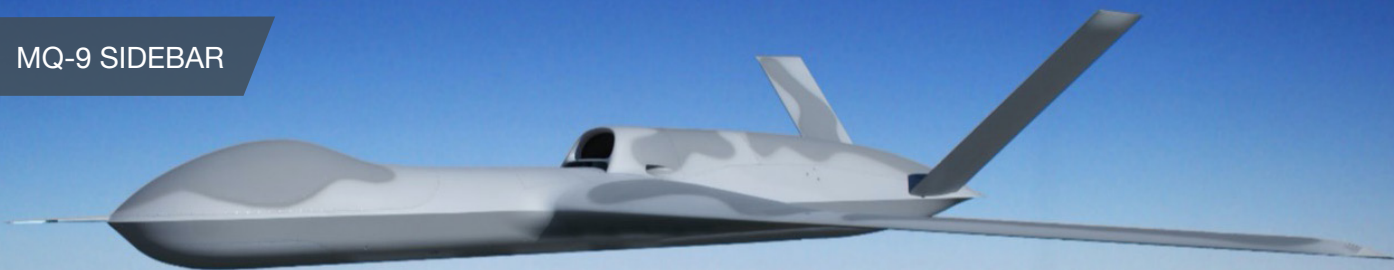
Building on that foundation, the Marine Corps is poised to change the game in the Indo-Pacific in the event it must operate against a near-peer adversary. One way the Marines are doing that is by preparing to go in close – to stand in against potential adversaries from a rugged and flexible archipelago of expeditionary advanced bases, distributed along key maritime terrain with an array of systems and weapons that places adversaries' forces at risk.

Moving by sea and air among these small, transitory bases, Marines will influence large sections of the maritime domain with an enterprise of long-range anti-ship and anti-air weapons, as well as the presence of nimble amphibious raiding and other units.

Overwatch at Sea

These new Marine Littoral Regiments need high-quality intelligence, surveillance and recon-

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From Revolutionary to Extraordinary: Advent of Autonomy

Unmanned aircraft systems will continue to change military operations in the coming years in ways that look nothing like the traditional stick-and-rudder work of piloting conventional aircraft. In fact, they won't even look like the ways many unmanned aircraft are flown today.

With the foundational concepts and technology proven over more than 7 million operational hours, General Atomics Aeronautical Systems Inc. is leading the way again on new paths of practical innovation, including with autonomy and manned-unmanned teaming.

The company's MQ-1 Predator-series aircraft and MQ-9 Reaper changed warfare forever, by providing persistent, high-quality intelligence, surveillance and reconnaissance.

Combatant commanders, intelligence consumers and others have long understood the value these aircraft bring to the fight, keeping them in high operational tempo for years while consistently asking Congress for more. That meant ever-greater demands for personnel to operate and sustain these aircraft and then process and exploit the insights they yielded.

If the need for high-quality ISR

won't ever decline, however, the personnel required will, thanks to cutting-edge software and other products from GA-ASI. These systems mean ever fewer human beings are required to operate ever greater numbers of unmanned aircraft, which in turn are adding more new capabilities all the time that make them more valuable than ever.

Satellite-guided automated takeoff and landing capabilities simplify basic operations and reduce deployed personnel. A library of new payloads increases the survivability and versatility of each UAS, including via new small UAS, such as Sparrowhawk, which can launch from and be recovered by a larger UAS in mid-flight.

Artificial intelligence, automation and manned-unmanned teaming also mean that the MQ-9 and its newer siblings can contribute more capabilities to the joint force, including in whole new arenas such as in counter-air roles.

GA-ASI's advanced, jet-powered Avenger, for example, pairs with a human-piloted fighter sweep and helps search for hostile targets, freeing up air crews and other units. When an Avenger detects a hostile aircraft, for example by using an infrared

search-and-track pod, it relays that target and track information to a fifth-generation Air Force fighter and the friendly forces can act accordingly, even if they did not spot the potential threat with their own onboard sensors. The Air Force is proving out what's possible with these capabilities in regular exercises over the Western United States.

Another example is with GA-ASI's multi-mission control capability, in which one human operator can be responsible for a flight of four or more MQ-9 Reapers. The aircraft patrol autonomously and alert their controller if they detect something of interest. Or a local team of human operators could take active control of one aircraft for part of its flight to manage an urgent mission – then hand it back to a different controller to sustain the automated reconnaissance.

As operational demand intensifies from the U.S. Air Force and the world's other most sophisticated militaries, unmanned aircraft won't only evolve in terms of their physical construction or the capabilities they bring to the battlefield. Software, networking and integration are just as critical, as GA-ASI has demonstrated. //

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naissance to tie together all these capabilities. MLRs are small but lethal, low-signature, mobile, relatively simple to maintain and sustain forces designed to operate across the competition continuum within a contested area as the leading edge of a maritime defense-in-depth to disrupt the plans of an adversary. They're the blade of the knife held close to the enemy to deter any sudden moves.

MQ-9s overhead preserve awareness about vessel and air traffic to provide airborne and maritime domain awareness and disseminate this information to these stand-in forces and Navy warships, plus other joint forces and intelligence consumers in the United States.

It's a bold vision. But couldn't a big regional military power easily find and target Marine Littoral Regiments that were positioned so close to its own nearby islands and waters? Doesn't everything inside the bubble need to be stealthy?

That's not a practical option, Marine Corps leaders argue, because the U.S. can't afford to withdraw and replace every single ship and aircraft with an ostensibly low-observable new version.

Also, the size of the air and maritime expanses within the Indo-Pacific region are as much an advantage for the Marines in these scenarios as for any regional powers. American and allied forces have huge amounts of territory in which they also can use camouflage, cover, concealment, detection and deception – or C3D2 – to keep from being detected.

One way in which the MQ-9 supports this is by denying adversaries the ability to move around in

the region unobserved, a capability that's been dubbed "deterrence by detection."

No regional power can mass troops near a tense border or vessels in key waters and then spring an attack without first having been observed. This doesn't mean an enemy couldn't try to fire at the Reaper – but doing so would be a powerful clue as to their intentions, as similar experiences have shown American forces in the Central Command Area of Operations.

And another key difference is that the MUX program will have a suite of sensors allowing for full-spectrum threat warning. That'll permit the MQ-9 to remain well outside of the threat rings of

potentially hostile players -- at distances that make it a challenging target. And even if, in a crisis, an MQ-9 were lost, its remote human crew would remain safe. That can't be said of today's legacy ISR platforms such as the Air Force's AWACS and Rivet Joint or the Navy's Poseidon. Moreover, those high-value, human-crewed platforms are also high-cost assets.

A Reaper isn't "expensive" -- but it is much cheaper to acquire and losing one is preferable, in every way, to the other aircraft.

These kinds of enhancements not only keep proven and comparatively affordable systems like the MQ-9 relevant, they enable a third plank of the Marines' new expeditionary strategy: distributed postures, in which no single loss can defeat the entire allied force because it is so well spread out and every other node and system is just as lethal and effective. Survivability in the new era is about the totality of the entire system, the Marines



Marine Littoral Regiments need high-quality intelligence, surveillance and reconnaissance.

believe, more than any individual wonder weapon or high-value platform.

With a New Vision Comes New Potential

The adaptability of the MQ-9 means that it isn't only the keystone of the arch for the Marines' vision. The aircraft and newer siblings also have roles to play across the joint force as it reorients itself in response to the new era of tests and challenges.

MQ-9 will help the Navy increase its maritime domain awareness via its new surface-search and anti-submarine capabilities. New small UAS that can be launched and recovered in mid-flight will contribute an arsenal of new stand-in electronic attack and other capabilities. Counter-air roles for new UAS mean they'll join operations against hostile fighters and defend high-value air assets.

And revolutionary new automation and intuitive manned-unmanned teaming will knit together these and other platforms in ways that make each node in the network as effective as it can be, with the need for fewer personnel and less human concentration that can be focused more productively elsewhere.

As for the Marines' new construct for expeditionary warfare, it required vision from the commandant and top leaders willing to re-imagine the service in a fundamentally different role, prepared to operate inside actively contested maritime spaces in support of fleet operations. This inflection point is as monumental as the Marine Corps' transition to amphibious operations in the two decades preceding World War II. It'll require a significant shift in thinking, some new hardware and a lot of integration to realize – but the MQ-9 is ready today. //

The MQ-9 is ready today for the Marines' new construct for expeditionary warfare.



The Art of Anti-Submarine Warfare

Submarines are highly dangerous, difficult to find and tough to kill.

The bad news is submarines today are more of each than ever. The good news is a new remotely operated aircraft is ready now to join U.S. and allied naval commanders in protecting their forces at sea.

The MQ-9 Reaper and its newer sibling, the MQ-9B SeaGuardian, built by San Diego-based General Atomics Aeronautical Systems, can join human-occupied shipboard helicopters and larger land-based patrol aircraft in the hunt for hostile submarines.

Not only can these aircraft scan the ocean's surface with a number of sensors to look for periscopes or snorkels – masts used by diesel-electric subs to covertly suck down air to operate their engines while submerged – they can search below the surface, too.

The MQ-9 is the only aircraft of its type that can carry a large number of sonobuoys, which pop from cannisters on the aircraft and glide to the water under a parachute. When a sonobouy enters the water, it jettisons its parachute and automatically orients itself to begin searching for submarines in concert with other sensors and its battle network.

A sonobouy might only listen for sonic signatures under the water that could suggest the presence of a submarine. Or it might switch on its active sonar and emit a ping in order to pinpoint its target.



The MQ-9, overhead, can help manage the signals from the sonobuoys in concert with other units involved in the search for a submarine. The aircraft's wingspan – greater than that of earlier-model siblings – means it can operate from more airfields to be closer to where commanders need it, then spend hour upon hour in the air. Its human pilot and sensor operator, meanwhile, can work from a ground control station sited virtually anywhere, either at a shore base or on a ship.

For example, when an MQ-9 first demonstrated that it could seek, detect and track a submarine target in a test off the West Coast of the United States, the crew was located more than 200 miles inland in Yuma, Ariz. In subsequent tests, remote crews piloted the MQ-9 when it integrated closely into the naval operations of the U.S. Navy, in international exercises off the coast of the United Kingdom, and in many other recent exploits.

This flexibility, combined with the proven, hours-long persistence of remotely piloted aircraft, provides a force multi-

plier for current anti-submarine practices -- and yields great new flexibility for commanders. A SeaGuardian might begin searching a section of ocean well ahead of the scheduled arrival of a Navy strike group, for example, at the fraction of the cost of another land-based patrol aircraft. Then the ships and aircraft of the strike group could join in with their own systems.

Or U.S. or allied naval commanders might identify a patch of ocean to monitor at all times – a strategic island or choke point, for example – over which MQ-9 could orbit to preserve constant awareness. Not only would that permit the allied force to track what shipping came and went on the surface, but it would mean an aircraft was poised on station to initiate the search for a submarine if needed.

Working in concert with human-crewed shipboard helicopters and land-based patrol aircraft – at a much smaller cost per hour to operate – the MQ-9 helps naval forces work for longer and cover more territory in the search for submarines. //

