Manned/Unmanned Teaming to Transform the MAGTF

Deus Ex Machina*

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U.S. strategic guidance addresses the challenges of a future operating environment categorized by diverse and uncertain threats, distributed across the global commons. Violent extremism, transnational crime, failed and failing states, and emerging near-peer competitors are just a few of these challenges. Add to that the increasing proliferation of antiaccess/area denial (A2/AD) tools and the explosion of new and emerging technologies on the open market, those "other duties as the President may direct" become more complicated to execute.[1] The MAGTF must possess the capability and capacity to meet that challenge.[2]

Expeditionary Force 21 (*EF 21*) (Washington, DC: March 2014) is the capstone concept guiding the development of the MAGTF of the future. Since its publication, the threat environment has already shifted, and should the Marine Corps maintain this vision for the next five years, we risk negative gains in our competitive advantage as potential adversaries find inventive ways to iterate capabilities inside our acquisition cycles. The Marine Corps must evolve in stride and adjust our concepts and capabilities in order to regain the advantage across the range of military operations, and meet the challenges of today and the future.

The Threat Has Evolved

Existing and emerging technologies are fueling an explosion in commercially available robotics and autonomous systems (RAS). This has created an environment in which states and non-state actors alike have gained access to tools which provide potential adversaries the ability to offset both current and future MAGTF capabilities and disrupt our operational concepts.[3] Many of the advertised capabilities envisioned in *EF 21* are either delayed or aspirational, exposing a gap that has provided a sanctuary for prospective enemies. Left uncorrected, this poses a severe threat to MAGTF operations.[4]

Rand senior analyst, David Ochmanek, said this regarding the growing capabilities of the near-peer threat:

> Of particular concern for future U.S. power projection operations is the accelerating proliferation of systems and concepts aimed at impeding U.S. forces' access to key regions in Eurasia and dramatically raising the risks and

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The winner of the robotics revolution will not be who develops this technology first or even who has the best technology, but who figures out how best to use it.

–Paul Scharre, Center for New American Security, 2014

*Authors' Note on the subtitle: an unexpected power or event saving a seemingly hopeless situation, especially as a contrived plot device in a play or novel.

> suppressing the operating tempo of those forces that do deploy forward. Key elements of these anti-access/area denial (A2/AD) strategies are: accurate ballistic and cruise missiles; dense, integrated surface-to air defenses; large numbers of modern 4th generation fighter aircraft and capable air-to-air missiles; near-real time surveillance and reconnaissance systems; hardened, redundant command and control networks; electronic warfare (jamming) systems; anti-satellite weapons; and cyber weapons.[5]

The rise of advanced capabilities designed to negate our current operational concepts is disconcerting but well known. More troubling is the threat of extremely inexpensive, commercially available communications tools and RAS. These types of systems create parity for state and non-state actors alike, and provide the means to affect the battlespace over large distances with little chance of detection and interdiction[6]—one only has to look at ISIL's (Islamic State of Syria and the Levant) rapid spread and many tactical successes across the Middle East to see how commercial off-the-shelf (COTS) technology is changing the modern battlefield.[7]

The time has come to re-envision our MAGTF concepts of operation and to adjust to the threats as the threats have adjusted to us. Once again, adaptation and innovation must become the hallmarks of the Marine Corps as we leverage technology at the tactical edge and enable our Marines to be successful on the modern battlefield. The currency of warfare is the 0311 rifleman, and we must focus on innovative ways to team RAS with the individual Marine rifleman in an integrated fashion that takes the best of man *and* machine to create a more effective asset. Ultimately, this seamless manned-unmanned teaming (MUM-T) will provide our MAGTF the means to obtain and maintain a new competitive advantage.

Evolution vs. Revolution

> A study of modern warfare suggests that whoever is first to combine new technologies with disruptive doctrine can gain a decisive advantage. Conversely, a military that is slow to adapt new ways of fighting to technological advance opens itself to catastrophic defeat.[8]

Many contend that innovative platforms, like unmanned aircraft systems (UAS), the MV-22 Osprey, and the F-35 Lightning II, are "revolutionary." In truth, they are merely evolutionary advances in existing technology, as doctrine has yet to change dramatically because of the introduction of these capabilities. The "drone" was invented in order to more effectively conduct persistent surveillance and reconnaissance than existing platforms, yet does so in much the same fashion as manned aircraft. Indeed, the Marine Corps focus on small tactical UASs—at the expense of more capable platforms[9]—has left an enormous gap in ability to provide persistent battlespace awareness, long-range command and control, and precision fires to the MAGTF commander. The MV-22 was created as a means to project forces farther and faster than the conventional helicopter, with little regard to other aspects of MAGTF operations, outstripping the capabilities of the majority of the ACE to provide escort. Even the F-35, with its superior sensor fusion and situational awareness, will be operationally employed in much the same manner as its fourth predecessors, providing little improvements in speed, range, or persistence. Further, if a MAGTF commander seeks to employ the F-35 to execute distributed STOVL operations, he will be extremely challenged by the capability gaps described above. Thus, while these systems have all been significant steps forward in capability, they have not lead to a dramatic revolution in military technology on par with the development of the tank or the aircraft carrier.[10]

In the meantime, the DOD has spent billions in research and development on programs that were touted as "revolutionary," but fallen well short of desired results and/or resulted in dramatic cost overruns.[11] Senator John McCain stated the following regarding our current acquisition methodology:

> [Let me] …describe root causes of why big programs fail: aggressive promises for "revolutionary" capability; poorly understood or fluid requirements; unrealistic initial cost estimates; overly optimistic schedules and assumptions; unreliable manufacturing and integration risk assessments; starting major production with an immature design or unproven critical technologies; and poorly performing government and industry teams.[12]

The DOD has a terrible track record when it comes to acquiring viable, cost-effective, military capabilities in a timely manner. And, when a new capability is fielded, it is rarely revolutionary. Worse, with the rate of advancing technology and long time lag for fielding new programs of record, any advantage gained is often negated by time, during which potential adversaries can develop countermeasures.[13]

To counter this trend, future Marine Corps acquisition strategy should augment established programs of record with readily available, rapidly fielded RAS solutions to increase the individual capabilities of our advanced, but limited, manned systems. The inclusion of RAS, as a series of "stepping stones," will compensate for gaps in manned systems' capabilities and capacity. The Marine Corps should look to field and integrate affordable, high technology readiness level RAS while simultaneously developing an effective MUM-T concept of employment. Acknowledging existing gaps within our manned systems capacity and capability legitimizes an increased investment of science and technology dollars toward the integration of RAS capabilities to fill these shortfalls. By adopting this strategy, the Marine Corps could expedite an increase in fleet capabilities in a timelier manner than the legacy method of spiral upgrades—that take years to materialize—while also increasing capacity for global engagement.

Karl Lautenschlager draws the crucial distinction between how we have operated in the past and how we should adjust for the future:

> Significant changes in the military and political capabilities of naval forces have come when long-existing technologies were eventually refined and integrated. It is the final integration of several technologies that came quickly in some cases. In other cases

an essential component was lacking from the ensemble, but by itself would have been useless. Certainly, no single technological "breakthrough" has brought immediate change in naval capability.[14]

To be clear, a deliberate and workable integration of RAS into our scheme of maneuver is required to achieve the vision laid out in our capstone concept. Applied properly, an effective MUM-T concept of operations would prove disruptive to the point of initiating a revolution in military affairs. However, to jump to this conclusion without looking at the situation as an evolutionary process would be to ignore years of historical experience in introducing other technologies, such as the tank, helicopter, and aircraft carrier. As before, the innovative application of technological advancements must strengthen our currency—that 0311 rifleman—and provide better ways to accomplish the mission. An accelerated development and *integration* of RAS can not only mitigate identified capability gaps of some of our manned platforms but also ultimately enhance the effectiveness of our Marines.

Should the Marine Corps attempt to abruptly supplant existing capabilities with RAS, as a standalone innovation, we are likely to fail.[15] At the same time, we cannot continue to pursue programs that take a decade-plus to field—with the guarantee that the technology will change every five to ten years—and with ever increasing costs. A logical compromise is a measured integration of RAS, through rapid acquisition programs, and an aggressive embrace of MUM-T. Only then, will the MAGTF truly derive a set of capabilities to effectively meet the complete spectrum of future conflict.

Envisioning Employment: MUM-T in Practice

As previously highlighted, introducing RAS into Marine Corps concept of operations is not the panacea to address the diversity of threats across the operating environment. Just as no one will argue that victory against a counterinsurgency can be achieved solely through employment of stealth fighters and bombers, it is equally unreasonable to propose that a fleet of UAS alone is the answer to the A2/AD threat. However, the Marine Corps could quickly invest in multimission UAS that could—through effective MUM-T—greatly complement stealth fighters and bombers,[16] allowing manned assets to become significantly more survivable in an A2/AD environment. In the same vein, long-range, long-persistence UAS, configured with appropriate sensors and digital datalink interfaces, could increase situational awareness in an asymmetric operating environment and act as battlespace manager for any number of manned platforms. This increased awareness would effectively minimize the amount of time manned assets would be required in the objective area, reducing risk to aircrew, while increasing efficiency by minimizing the amount of flight hours required. The second order effect becomes an overall reduction in the need for additional airborne refueling capacity. In total, this would result in significant cost reduction and an increase in efficiency for the entire MAGTF.

The Marine Corps must shed the preconception that RAS are (a) purely intelligence assets and (b) tools limited to the three "D" missions—dull, dirty, and dangerous; and (c) a threat to existing programs of record and manned aviation writ large. Those are artificial assumptions. They limit any potential for innovative applications in the context of MUM-T and retard the growth of what could be a cornerstone of future Marine Corps operational concepts.

F-35 Lightning II. The F-35, while incredibly capable, is not yet fully integrated into our concepts of operations. In order to maximize the effectiveness of the Lightning II, while minimizing the cost to upgrade key components, the Marine Corps should consider the implementation of MUM-T with a low-observable UAS (equipped to offset capability gaps within the F-35) employed in cooperation with the F-35. A four-ship of aircraft—one Lightning II and three UAS—in a defensive counterair (DCA) scenario, for example, becomes an extremely efficient, yet very potent, management of resources. A mission that once required four legacy manned aircraft now requires one fifth generation F-35, freeing others for simultaneous or complimentary missions.

If the F-35 are conducting distributed STOVL operations, the unmanned assets could provide mission essential aerial reconnaissance of the 3,000-foot mobile forward aerial refueling and rearming points, provide critical digital command and control, and serve in an on-call fire support role—while also, if

We need to take advantage of the manned and unmanned technology to develop a more effective force. *(Photo by LCpl Clayton Filipowicz.)*

necessary, leveraging these same 3,000 foot runways to rapidly refuel and rearm before lifting again for another 24 hour or longer, multithousand nautical mile mission. Ultimately, combining the persistence and battlespace awareness of UAS, with the deliberate, focused efficiency and lethality of the F-35, increases the survivability and effectiveness of precious resources and, most importantly, gives that 0311 the protective blanket of situational awareness and responsive fires.

Another F-35 consideration is the limitations of translating all the information its sensor fusion suite provides and distributing that data across the MAGTF for increased situational awareness. Using UAS as a "tactical satellite" and a "tactical gateway," the F-35 data could be properly sanitized of source information and then incorporated into a larger fused common intelligence picture, in near-real time. This sharing of data would significantly enhance MAGTF integration and give the commander actionable intelligence quickly versus waiting for the data to be processed at the ground station post mission.

MV-22 Osprey. Without question, the advent of the MV-22 has increased the reach of the MAGTF by a factor of 10. This has facilitated an expansion of the MAGTF commander's area of responsibility, and combatant commanders recognize this. Senior Marine Corps leadership has found creative ways to keep Marines engaged with the resources available.[17] However, our special purpose MAGTFs, and MEUs alike, are lacking an accessible and responsive asset that can penetrate threat airspace ahead of the MV-22, and provide greater awareness of the operating environment.[18] The need for critical intelligence preparation of the operating environment and the battlespace awareness necessary to provide critical information necessary to make informed decisions is more acute than ever.[19] Presently, emergent and crisis response missions are reliant on joint assets for support. Aside from the critical shortage of such assets, our reliance on Joint and theater resources is a complicated endeavor, as they are rarely integrated into the MAGTF scheme of maneuver and lack adequate levels of interoperability (many times due to Marine Corps shortfalls) to be effective. The teaming of the MV-22—and the raid force in the back—with a long-range, long-persistence, electronic warfare equipped UAS would enable a greater awareness, while also introducing the ability to deny and degrade the threat's ability to detect our forces. Without this integration, our commanders incur unnecessary risks in making assumptions about the threat environment, the landing zones, and the nature of the enemy itself.

Maritime domain awareness. Within an A2/AD environment, the ARG-MEU team is also extremely vulnerable to the latest generation of cruise missiles.[20] The defense of the ARG-MEU from this threat is missing a critical persistent airborne detection system to provide ample advance warning of inbound missiles. However, a long endurance UAS, with the appropriate size, weight, and power, could digitally link with other surface assets of the ARG to act as that over the horizon detect and track system, much in the same manner as an E-2D works with the carrier strike group. If the UAS were to be equipped with an effective kinetic kill system, such as General Atomics' 150 kW laser system designed for the Predator C Avenger UAS, then the UAS could become the persistent, over the horizon, protector of the ARG-MEU team.[21] This frees up the F-35 to focus on the more traditional DCA missions—as previously highlighted—as well as close air support and electronic warfare support for long-range raids or assaults.

Distributed operations. While examples of the benefits of MUM-T with respect to aviation functions are sufficiently compelling, there are also efficiencies that can be gained from incorporation within the land domain, specifically distributed operations.

At the squad level, robotic followers can carry provisions, ammunition, and provide detection to protect and inform the individual Marine. Our Corps' explosive ordnance disposal (EOD) community has extensive experience with MUM-T. Armored unmanned ground vehicle (UGV) scouts can be networked and controlled to provide increased fire support.[22] Further incorporation of UGVs will enable mission accomplishment and save lives, as any EOD Marine with Iraq or Afghanistan experience will state without hesitation. Unlike current engagements where a Marine is required to physically breach a door or clear a building, the robotic system would incur the risk, allowing the infantry Marine increased situational awareness and a safer position from which to act. The same could be stated for our reconnaissance units, who would benefit greatly from a mix of locally employed and networked small tactical UASs and UGVs, employed around the perimeter of vulnerable, small unit positions. These systems could provide early warning of an attack to inform leaders as to the nature and intent of the enemy, while also providing a critical, real-time network bridge between ground forces and higher headquarters. Depending on the system, they could also absorb the attack prior to effects on friendly forces.

The benefits of MUM-T extend to the artillery as well. Currently, our supporting artillery and mortar forces lack precision situational awareness in the impact area and have an inability to strike moving targets. Efforts by the Office of Naval Research (ONR) have demonstrated "swarms" of small, tube launched UAS, called "LOCUST," which could enhance current 155 millimeter howitzer and 81 millimeter mortar fires significantly by launching persistent small tactical UASs over the target area and then using that real-time imagery to conduct precision corrections without the need of a traditional forward observer.[23] Conceptually, artillery launched LOCUST will mitigate the challenges of operations in an urban environment, as swarms of small kinetic UASs could loiter in the objective area for several hours, providing immediate responsive fires to the MAGTF.[24]

The execution of logistics presents one of the greatest challenges to distributed operations, and MAGTF operations writ large. Through the implementation of MUM-T, manpower intensive convoy operations can be transitioned to a "pack" of manned platforms with

unmanned leader/follower ground vehicles. This concept has recently been demonstrated by the U.S. Army and operationally employed by Israel in their latest conflict in Gaza.[25] What used to take scores of personnel to accomplish is completed with a mere handful of personnel and with a significantly lower level of risk. This reduction in risk is compelling considering improvised explosive device employment, which claimed the lives of so many Marines during our most recent conflicts. Eventually, with improvements in autonomy and the development of concept of operations based upon integrated manned-unmanned experience, whole logistics systems could become fully autonomous, monitored by humans "on the loop" instead of detailed human involvement at each level. Additionally, similar efficiencies are found in commercial warehousing today. Tools such as the Kiva robotic system, working with their human counterparts, have transformed the way we catalog, store, and access spare parts and supplies.[26]

Command and control. Any discussion that leads to the creation of a more effective MAGTF through the integration of RAS would not be complete without discussing the benefits in terms of revolutionizing the Marine Corps command and control system, which is yet another gap in the current vision. This is the greatest vulnerability within the MAGTF and requires the most amount of attention. Future engagements will forever necessitate a continuation of the Marine Corps' hallmark close integration of air, ground, and logistics, but will also require integration with cyber and electronic warfare in order to truly employ 21st century combined arms. Our aging, legacy command and control architecture is vulnerable to modern threats that exist within the A2/AD environment. The reliance upon single channel UHF and VHF communications is a shortfall easily exploited by a modern adversary, as demonstrated by the Russians in eastern Ukraine.[27] Additionally, the large infrastructure required to enable a MAGTF's command and control network is susceptible to individual failures, which cascade to disable the greater network as whole.

Logistics systems could become fully autonomous. *(Photo by LCpl Charles Santamaria.)*

Integrating digitally networked RAS would reduce these complicated—and at times cumbersome—systems to manageable, agile networks that provide seamless and survivable connectivity across the MAGTF, leading to higher levels of shared awareness. As an example, existing plans call for less than 10 percent of the MAGTF's MV-22s to have "tactical satellite" and "tactical gateway" capabilities beginning in 2018 and will steadily increase across the MV-22 fleet by 2031.[28] We can bridge this gap, as early as 2018, incorporating a cloud of highly-persistent, low-cost, long-endurance UAS as network relay nodes, in conjunction with individual UASs and UGVs that provide network connectivity down to the squad level. Leveraging this digitally interoperable, extended range network would transform the GCE in much the same way as sensor fusion has transformed the ACE from a fourth generation to a fifth generation level of awareness. This "balancing" of awareness is the critical lynch-pin in the evolution of the MAGTF and is ultimately the capability that will transform our foundational operational construct from merely a cooperative air, ground, and sea capability, into to a fully integrated and efficient 21st century combined arms force.

Significant enhancements will be found within the sea as well. Today, there are efforts by the ONR to develop unmanned surface vehicles (USVs), which defend larger manned assets, such as destroyers and carriers.[29] This benefits the Marine Corps, as part of an integrated naval force. USV arsenal ships, sailing in formation with their manned counterparts in the ARG, would increase its overall lethality and effectiveness and provide a critical defensive edge against advanced enemy missile systems. These arsenal USVs would also provide enhanced, long-range call-for-fire capabilities for expeditionary forces with ship-to-shore fires the likes of which have not been seen since the days of the Iowa class battleship. Meanwhile, unmanned undersea vehicles (UUVs) would be capable of autonomously tracking enemy submarines and ships, creating "hunter-killer" teams between the ARG and an unmanned subsurface force. They could also be used as a means to deliver reconnaissance and Marine special operations teams to the shore, undetected. This cumulative capability equates to exponential increases in lethality and survivability of the ARG-MEU and enhances the ability to maneuver within the littorals to deliver forces ashore more efficiently.

The critical need for high-speed ship-to-shore connectors to rapidly phase equipment and personnel ashore is fundamental to our capstone concept. Through effective MUM-T, the introduction of hybrid ship-to-shore connectors—enabled for remote control from the amphibious combat vehicle but also

capable of autonomous positioning as a maritime staging platform—would reduce the manpower requirements and vulnerabilities of traditional connectors. Additionally, prior to inserting waves of infantrymen in an amphibious assault, USV ship-to-shore connectors could deliver UGVs to clear the beachhead, determine the best approaches, test surface and undersea conditions, effectively reducing friction and minimizing vulnerabilities during the landing process and dramatically increasing situational awareness for the MEU commander.

Conclusion

Ultimately, the rapid introduction and eventual evolution of MUM-T will dramatically enhance the Marine Corps ability to influence and engage on the world stage. With the growing, multi-axis threats that face our Nation today, it is imperative that we find the means to be present in more places than ever before, with capabilities that far outmatch our enemies. It is equally important, given the reduction in defense spending, that our Corps find a more economical approach to the sustained conflict against global extremism, while preventing the overuse of capabilities designed to deter and defeat a near-peer threat. The effective integration of RAS with manned platforms, through MUM-T, and the development of concepts of operations, which supports and embraces RAS as a critical enabler, will create the conditions for our future success, and will ultimately prove essential to realizing both *EF 21* and The Cooperative Strategy for 21st Century Seapower.[30]

Notes

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