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The current construct of an ACE centered on a Medium Lift Tilt Rotor Squadron does not make efficient use of the advanced MV-22 technology, and would be more lethal with an increased ratio of rotary wing to tiltrotor transport aircraft. The growing size and weight of Ground Combat Element Equipment and vehicles, gaps in Type/Model/Series (T/M/S) capability, changes in the future amphibious operational environment justify a shift towards a more rotary wing and fewer tilt rotor aircraft.The preceding thirty years shows a technological evolution that results in the lethal force that the Marine Corps is today. The improvements in lethality and survivability is an abject positive improvement, but it comes with negatives for which have yet to be completely compensated, specifically the vast advantage in range and airspeed the MV-22 has over the rest of the rotary wing component of the ACE. Improvements in technology are improving the range, speed and endurance of traditional rotary wing assets, but the gap remains. Rather than constraining the majority of a MEU's assault support assets and treating the MV-22 as a fast helicopter, a shift in airframe asset allocation would impve performance across the board. With more CH-53s and fewer MV-22s embarked aboard U.S. Naval shipping, the ability to gain tempo and mass while maintaining dispersion is improved, while also maximizing the use of the MV-22's strengths. There is no doctrinal or recommended exact number of each airframe, just the recommendation to exercise a scalable and tailorable ACE. Maintaining at least a minimum number of each airframe will allow to reinforce some capacities while still retaining all capabilities, albeit at a reduced rate. The potential benefits of this shift are maximized when embarked aboard America Class shipping, but there are advantages to employing this construct while aboard Wasp Class amphibious ships as well.

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MASTER OF MILITARY STUDIES

A NEW ACE FOR THE MEU: ROTARY WING FOCUS FOR OPTIMAL SYNERGY AND EFFICIENCY

SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF MILITARY STUDIES

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DISCLAIMER

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EXECUTIVE SUMMARY

Title: A New ACE for the MEU: Rotary Wing Focus For Optimal Synergy and Efficiency

Author: Major William J. Majeski, United States Marine Corps

Thesis: The current construct of an ACE centered on a Medium Lift Tilt Rotor Squadron does not make efficient use of the advanced MV-22 technology, and would be more lethal with an increased ratio of rotary wing to tiltrotor transport aircraft. The growing size and weight of Ground Combat Element Equipment and vehicles, gaps in Type/Model/Series (T/M/S) capability, changes in the future amphibious operational environment justify a shift towards a more rotary wing and fewer tilt rotor aircraft.

Background: The preceding thirty years shows a technological evolution that results in the lethal force that the Marine Corps is today. The improvements in lethality and survivability is an abject positive improvement, but it comes with negatives for which have yet to be completely compensated, specifically the vast advantage in range and airspeed the MV-22 has over the rest of the rotary wing component of the ACE. Improvements in technology are improving the range, speed and endurance of traditional rotary wing assets, but the gap remains.

Recommendation: Rather than constraining the majority of a MEU's assault support assets and treating the MV-22 as a fast helicopter, a shift in airframe asset allocation would improve performance across the board. With more CH-53s and fewer MV-22s embarked aboard U.S. Naval shipping, the ability to gain tempo and mass while maintaining dispersion is improved, while also maximizing the use of the MV-22's strengths. There is no doctrinal or recommended exact number of each airframe, just the recommendation to exercise a scalable and tailorable ACE. Maintaining at least a minimum number of each airframe will allow to reinforce some capacities while still retaining all capabilities, albeit at a reduced rate. The potential benefits of this shift are maximized when embarked aboard America Class shipping, but there are advantages to employing this construct while aboard Wasp Class amphibious ships as well.

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PREFACE

The Marine Corps is the United States' Expeditionary Force in Readiness and historically has leveraged evolving and emergent technologies in order to execute this mission more effectively. History provides many examples of fighting forces employing revolutionary technology in arcane techniques, tactics and procedures (TTP). The use and employment of these revolutionary weapons became more efficient, effective and lethal with time and additional exposure to the weapons resulting in a better understanding in capabilities and limitations. The Marine Corps is not an exception to this.

I became interested in the optimization of the Marine Expeditionary Unit (MEU), specifically the Air Combat Element (ACE), due to personal experience in support of one. Over seven years serving in Marine Corps operational squadrons, I was a part of four separate MEUs, as well as embarked aboard amphibious shipping for three additional multinational training exercises. My capacity for participation spanned the gamut, as did my level of tactical proficiency. I have been part of a MEU or MEU-like entity for each level of flight qualification and designation from Helicopter Second Pilot to Weapons and Tactics Instructor and CH-53E Detachment Officer in Charge. During that time I have seen changes in the equipment used, as well as an evolution in TTPs. Though much has changed, there is still much to be done to optimize the ACE.

The preceding thirty years shows a technological evolution that results in the lethal force that the Marine Corps is today. The improvements in lethality and survivability is an abject positive improvement, but it comes with negatives for which have yet to be completely compensated. A core tenet of the Marine Air Ground Task Force (MAGTF) is its ability to be scaled and tailored dependent on mission requirements. The size of the MAGTF has no bearing on the applicability of this; as such the Marine Expeditionary Unit (MEU) will be the focus of this paper. The current construct of an ACE centered on a Medium Lift Tilt Rotor Squadron does not make efficient use of the advanced MV-22 technology, and would be more lethal and effective with an increased ratio of rotary wing to tiltrotor transport aircraft. The growing size and weight of Ground Combat Element Equipment and vehicles, gaps in Type/Model/Series (T/M/S) capability, changes in the future amphibious operational environment justify a shift towards a more rotary wing and fewer tilt rotor aircraft.

MEU EQUIPMENT AND LIFT REQUIREMENT EVOLUTION

"Marines are America...the history of America is the history of the Marine Corps."
~ Tom Clancy

The term "Marine" is ubiquitous with amphibious and expeditionary operations. This core concept is best seen in the persistent, forward deployed and afloat MEUs. A MEU is a highly mobile, rapid response force consisting of a relatively standard allocation of both ground and air equipment, as well as personnel. Though a core attribute of a MAGTF is being scalable and tailorable dependent on an analysis of the likely mission set required and commander's disposition, a MEU's wide scope of mission sets trained to and proficiency in result in a relatively standard composition.[1] This composition is standard throughout a short term period, but undergoes long term changes due to emergent technology and acquisition cycles. This long term change and ability to be scalable and tailorable has not been applied with the transition from the CH-46 to the MV-22. The current construct of an ACE centered on a Medium Lift Tilt Rotor Squadron does not make efficient use of the advanced MV-22 technology, and would be more lethal with an increased ratio of rotary wing to tiltrotor transport aircraft. The growing size and weight of Ground Combat Element Equipment and vehicles, gaps in Type/Model/Series (T/M/S) capability, changes in the future amphibious operational environment justify a shift towards a more rotary wing and fewer tilt rotor aircraft.

The period between 1980 and present day have yielded tremendous change throughout the MEU's Ground Combat Element (GCE). During this period, the GCE's artillery batteries have seen the arrival and departure of the M101A, M198, and M777 Howitzers. Increasing technology brought increased capability, but also increased the logistical transport support requirement. The M101A 105mm Howitzer has a max weight of 4,980 pounds; this weight requirement increased up to 11,580 pounds if operations dictated three A-22 Cargo Bags.[2] At this relatively light weight, the MEU's Air Combat Element (ACE) was able to use either the CH-46 Sea Knight or CH-53D/E Sea/Super Stallions for transport.[3] This artillery piece was augmented, and later replaced by, the M198 Howitzer.

In 1984, the M198 155mm Howitzer was employed by the Marine Corps to augment, and ultimately replace the M101A.[4] The increased projectile size increased the effective range and capability of the GCE's artillery batteries with increased weight. The size of the M198 ballooned to 15,740 pounds, putting it outside the transport capabilities of the CH-46 and the yet to be introduced MV-22 Osprey[5]. The CH-53 was the sole ACE airframe able to externally transport the M198, resulting in reduced capability for the MEU as a whole and a call for a lightweight artillery piece to replace the M198.

The calls for a new lightweight indirect fire artillery piece were answered in the form of the M777 155mm Lightweight Howitzer, which was introduced to the Marine Corps in 2005.[6] Dependent on variant, the M777 gross weight fluctuated from 9,300 to 9,920 pounds.[7] The reduction in weight seemed to accomplish all requirements to diversify available transport, enabling it to be lifted by both the CH-53 and the MV-22 Osprey, albeit close to the operational limits of the Osprey.[8] To further improve the lethality of the M777A2, artillery Marines are able to equip the weapon system with a Digital Fire Control System, Enhanced Portable Inductive Artillery Fuse Setter, and a Muzzle Velocity System, as described in an email conversation with United States Marine Corps Artillery Officer Major Jared Streeter on January 13, 2020.[9] These accessories come at the cost of additional weight that places it outside of the transport envelop for an MV-22.[10]

Further improving upon the capabilities of the M777 and its traditional munitions is the High-Mobility Artillery Rocket System (HIMARS). General David Berger mentions the possibility of leveraging HIMARS in INDOPACOM in order to operate in a contested sea environment.[11] It is logical to infer that a counter Anti-Access/Area Denial (A2AD) strategy would include long range shipboard transit into theatre, terminating with a ship to shore movement via air or surface. While a HIMARS system has yet to be externally transported via CH-53E, the system components are well within the capability of the CH-53E.[12]

Indirect fire assets were not the only pieces of equipment that grew overtime. Traditional ground mobility is provided by High Mobility Multipurpose Wheeled Vehicles (HMMWV), and it has been a staple of battlefield circulation since its inception in the eighties. As evident in the name, being designed for a multitude of purposes results in a variety of variants, none of which are able to be transported internally by any shipboard aviation asset. This leaves the commander with two choices when trying to employ these assets ashore; either they will go ashore via Landing Craft Air Cushion (LCAC) or Landing Craft Utility (LCU), or they will be taken ashore via MV-22 or CH-53 sling load. Of the many variants, the M998 is proliferated throughout the MAGTF, and serves as a good base weight for estimates of supportability. At an empty weight of 7,700 pounds, it can be transported flown ashore one at a time via V-22 or two side-by-side under a CH-53.[13]

As a result of enemy employment of Improvised Explosive Devises (IED) during Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF), the M1114 Up Armored HMMWV became more commonplace. This new up armored HMMWV variant increased the survivability of GCE Marines against the IED threat at the cost of increased weight, ballooning to an empty weight of 12,100 pounds.[14] This increased weight cuts the air delivery capability by half, increasing reliance on surface transport or sacrificing tempo and speed of the operation. While not a critical shortfall of emergent technology, but part of a give and take that results in sub optimal operations.

Survivability while mounted is not the only improvement that came from lessons learned during OEF and OIF. In the last thirty years, personal protective and individually issued equipment technology improved and increased survivability, resulting in a greater size and weight burden that infantry Marines must shoulder. A 2005 study "Estimation of Marine Infantry Rifle Squad Load Weight" concluded that a combat loaded concluded that a Company Reinforced (55 Marines) of Riflemen with a twenty-four to thirty-six hours of sustainment is a load of 15890.9 pounds.[15] The issued equipment with which Marines deploy and operate has not only gotten heavier over the last 3 decades, but also larger and bulker. While this weight in and of itself is not prohibitive to either assault support airframe currently employed aboard a standard MEU, the space available becomes an issue, and doctrinal planning factors for personnel movement start to decrease, increasing the aircraft requirement, resulting in a detriment to capability or mission tempo.

Improved technology that results in the increased lethality of the warfighter will inevitably, and rightfully should, continue. Along with that trend of increased lethality will likely come a corresponding weight and size increase, as has been seen historically? Should this trend line continue, the weight and size of a Marine infantry rifle squad will quickly outpace and over encumber the capacity of an MV-22. This increased encumbrance will result in a reduction in passenger capacity, which leads to loss in tempo and slower massing of forces ashore. This can be mitigated with limited costs by shifting the ratio of rotary wing to tilt rotor in the favor of more heavy lift assets.

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[1]*22d Marine Expeditionary Unit Command Chronology for the Period of 14 Feb to 28 Oct 04*, Headquarters, United States Marine Corps, Archives Branch, History Division, Library of the Marine Corps, Quantico, VA; *13th Marine*

Expeditionary Unit Command Chronology for the Period of 1 Jul to 29 Oct 2011, Headquarters, United States Marine Corps, Archives Branch, History Division, Library of the Marine Corps, Quantico, VA; *24th Marine Expeditionary Unit Command Chronology for the Period of 1 Nov 2016 to 28 May 2017*, Headquarters, United States Marine Corps, Archives Branch, History Division, Library of the Marine Corps, Quantico, VA.

[2]United States Army Training and Doctrine Command. *MCRP 4-11.3E, Vol III* [Multiservice Helicopter Sling Load: Dual Point Rigging Procedures]. 2009. 6-1.

[3]William J. Anderson, "Filling the Capability Gap: Making Tough Choices Until the MV-22" (Master's thesis, Command and Staff College,1995), 4, Defense Technical Information Center. http://www.dtic.mil/dtic

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[9]Major Jared Streeter, email message to author, January 13, 2020.

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ACE EVOLUTION, CAPABILITIES, AND GAPS

"We are stuck with technology when what we really want is just stuff that works."
~ Douglas Adams

Technological advancements in the last three decades have helped the Marine Corps continued service as the country's expeditionary force in readiness, increasingly extending the reach of American influence worldwide. This emergent technology is seen through each of the ACE's aviation platforms at different times on a rotational basis, resulting in a constantly incongruent evolution of TTPs to best accomplish the mission at hand. With this ever changing set of TTPs and leaps in technological capabilities, planners will need to restrain more capable airframes in order to continue to employ the less capable, technologically inferior airframes.

An ACE in the nineties and early 2000s was a Marine Medium Lift Helicopter Squadron (HMM) reinforced by personnel and equipment detachments from Light Attack Squadrons (HMLA), Heavy Lift Squadrons (HMH), and Fixed Wing Attack Squadrons (VMA). This reinforced squadron (HMM [REIN]) brought the capabilities of the CH-46, AH-1W, UH-1N, CH-53D/E and AV-8B to the MEU.[16] Over three decades time, each of these airframes will be replaced for modern day MEU operations.

The CH-46 Medium Lift Assault Helicopter comprised the core of the ACE, and therefore accounted for the majority of the airframes. As GCE combat equipment grew in size and weight, discussed earlier, the capability of the CH-46 declined inversely. A single CH-46 originally was capable of transporting sixteen Combat Loaded Marines with a range of 155 nautical miles while cruising at 120 knots. These capabilities gradually decreased as aircraft engine performance degraded and infantry combat equipment grew in size.[17] These characteristics were the low end of the ACE capabilities spectrum, and the capabilities gap would grow as time went on.

For the time in service, the CH-46's range and cruise speed worked well to compliment other assault support airframes and escorts. The CH-53E, due to its sheer size, was capable of more; more combat loaded Marines (30), faster cruise speed (130 knots) and longer range (110 nautical mile radius with 9,600 pound external load).[18] While the range may look similar to the CH-46, there is some nuance in the comparison. As its primary mission is to move heavy equipment and supplies, the CH-53E's advertised combat radius takes that in mind.[19] When planning for the secondary mission of assault support transport of combat troops, that combat radius increases to nearly 200 nautical miles. Air assault planning leverages the mutual supportability of the ACE, and as such required planners to constrain the CH-53E if planning a large scale, mixed T/M/S operation in a contested environment.

Inserting Marines via air within a contested environment requires sufficient, if not persistent escort aircraft to protect the assault aircraft package. The capabilities of the nineties' AH-1W and UH-1N are well suited to support these missions. Though the light attack combat radii is slightly less than that of the CH-53E, as depicted in Figure 1, the rotary wing ACE element compliments each other synergistically.[20] This synergy comes by sacrificing some capability. By reducing the range of the ACE as a whole, light attack aircraft are able to provide more time on time on station to prosecute enemy targets and CH-53E airframes are able to provide post insert contingency support. A second choice is to sacrifice available seats in the CH-53E for combat forces in exchange for additional internal fuel cells, allowing the conduct of Forward Arming and Refueling Point (FARP) operations to extend the CH-46 and H-1 range, and still remaining mutually supportive. This synergistic and efficient operation is possible because the majority of the aircraft are operating on fairly level playing fields, capability-wise. Constraining one airframe, which makes up a minority of the aviation assets aboard a MEU, is slightly detrimental, but that self-imposed reduction in capability is outweighed by the benefits of mass.

The CH-46's capability degradation added to the calls for a replacement medium-lift aircraft. The replacement airframe criteria for the CH-46 was extremely broad, and not restricted to conventional rotary wing technology. The 1994 "Medium Lift Replacement Helicopter Program Concept Exploration Study" delved into the requirements, mission need, threats, and shortcomings currently in existence across the potential contenders, both rotary and tiltrotor.[21] The resultant airframe is the V-22 tiltrotor, the finished product introduced initially as the XV-15 Tiltrotor Concept in 1981.[22] Very much in line with the 1986 Goldwater –Nichols Act, the acquisition of the V-22 was conducted jointly, though it included slight variations for differing service requirements. During a 2000 Operational Evaluation, the V-22 Program Office had achieved speeds of three hundred forty two knots, altitudes of twenty five thousand feet, and a ten thousand pound external load transport at two hundred thirty knots.[23] A CRS Report to Congress bluntly stated the V-22 will transport three times the cargo, fly five times the range twice as fast, twenty one percent less vulnerable to small arms fire, and seventy five percent quieter than helicopters.[24]

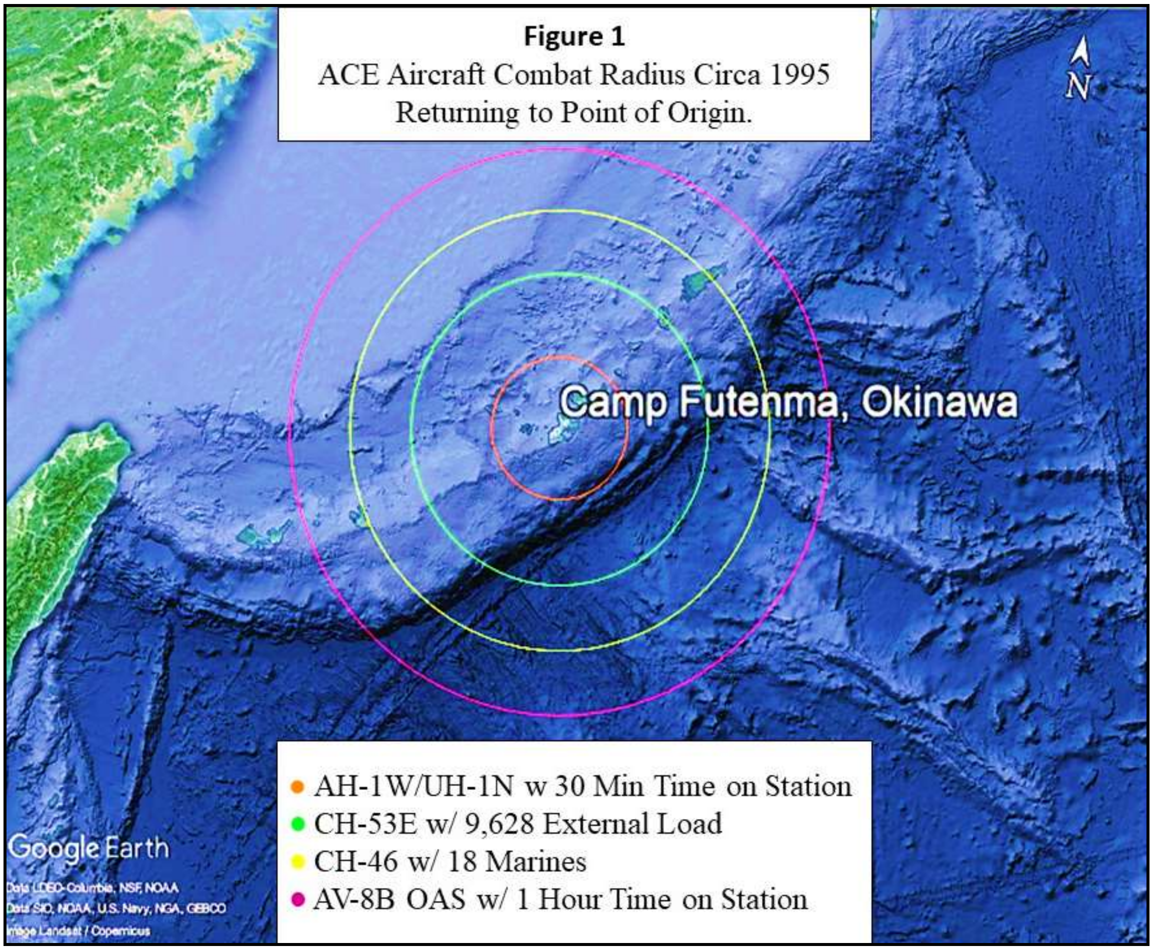

Figure 1: ACE Combat Radius Circa 1995
Source: Derived from Headquarters, Marine Corps. *2019 Marine Corps Aviation Plan*. Deputy Commandant for Aviation, Washington, DC, 2019 and Jane's All the World's Aircraft CH-46.

While the 1997 Quadrennial Defense Review recommended accelerated procurement of the V-22, some Congressional Legislators were still not convinced in the airframe.[25] The need to replace the aging fleet of Marine Corps CH-46 medium lift aircraft was not disputed. The path to replacement was. Proponents of the Tilt Rotor Program identified the increasing cost to maintain the CH-46, both in fiscal and force protection lenses, as well as the operational flexibility a Tilt Rotor provides over all pure rotary wing assets in existence at the time.[26]

Opponents to the program also cite the economics of the airframe, but in the context of the present budgetary environment. These opponents argued that the ship to shore requirements that the Marine Corps, the planned recipient of the majority of V-22s, has presented can be performed by less expensive helicopters, as greater speed and range are not likely to be needed.[27] These Congressional Members also assert that the likely situations in which a contested amphibious assault would be conducted would require coordination between the V-22 and less capable aircraft.[28]

Ultimately, the V-22 Tilt Rotor program was approved and funded. In 2007, the MV-22 was introduced to the Marine Corps, and Marine Medium Lift Tiltrotor Squadrons (VMM) began to replace HMMs. The MV-22 fuses helicopter amphibious capability and fixed wing aeronautical ranges that result in an expanded Area of Influence for any supported MEU. With a combat radius of 420 nautical miles and a cruise airspeed of 240 knots, the MV-22 easily becomes the most capable embarked aircraft, in terms of airspeed and operational range.[29] The folded and stowed footprint is no larger when compared with a CH-46, so a VMM (REIN) will not sacrifice any capacity once embarked, maintaining the same amount of medium lift platforms once transitioned from HMM to VMM. In fact, the MV-22's more powerful engines allow for a greater number of passengers, improving to 24 combat loaded Marines from a ship.[30]

This net increase in lift capacity does come with a cost. Previously, the CH-46 was the airframe that restricted the operations of the ACE. Now, the majority of the airframes that comprise the ACE are able to outpace and out range every rotary wing counterpart. The Marine Corps continues acquisitions for improved Light Attack and Heavy Lift assets. A severe gap between rotary wing and tilt rotor capabilities will remain despite those improvements, as this is a physical limitation to the physics of rotary wing flight.[31] As depicted in Figure 2, even with AH/UH combat radius improved to 50 nautical miles with thirty minutes time on station at 139 knots cruise speed, and CH-53K upgraded to 110 nautical miles with 27,000 pounds of cargo and 150 knots respectively, the capability gap has closed, but is still relevant.[32]

The relevance of the capability gap is seen across the MAGTF, and has been noted in numerous after action interviews conducted by the Marine Corps Center for Lessons Learned. Infantry officers and highly qualified naval aviators have identified this as an assumed risk when the MV-22 out ranges the rotary wing assets that are capable of persistent close air support coverage.[33] While the ability to insert a platoon of Marines hundreds of miles inland is a capability to leverage, doing so leaves that same platoon of Marines at risk without "responsive immediate fires at its disposal."[34] Fixed wing fires are a way to reduce or mitigate this risk, but this also comes at a reduction in responsiveness and on station time when compared to traditional rotary wing close air support assets.

A deployed MEU is required to be certified for and capable of executing fifteen distinct missions.[35] Baring involvement in OEF and OIF operations, the majority of real world application MEUs have been involved in are non-kinetic, Humanitarian Assistance/Disaster Relief (HA/DR) missions. In the case of these missions, response time and range are paramount, while an armed escort is less important due to the permissive environment.[36] It is human nature to try to anticipate future tasking and requirements by studying past operations and occurrences. This may come an urge to pivot from potential combat operations, making a MEU a more capable HA/DR response unit at the sacrifice of combat effectiveness.

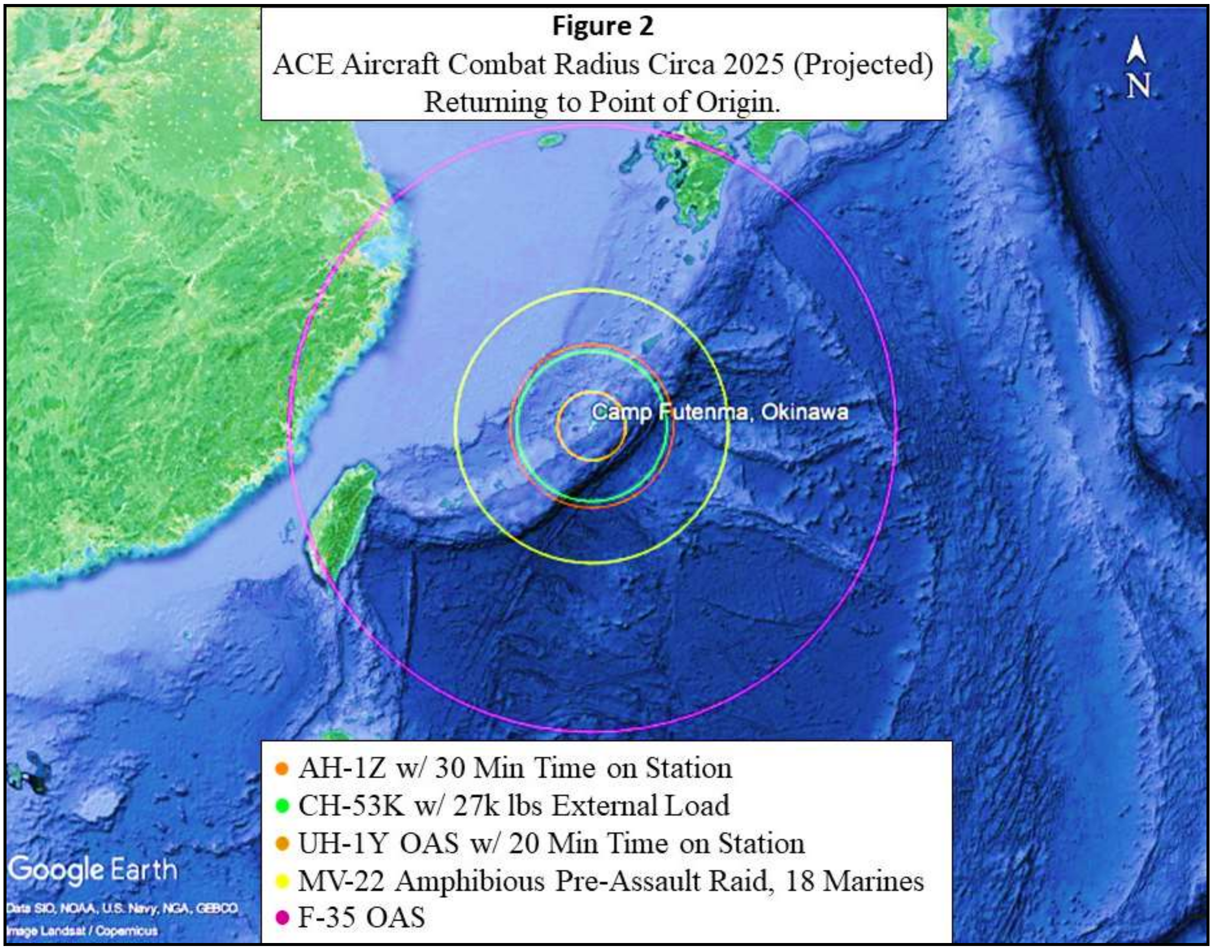

Figure 2: ACE Combat Radius Circa 2025 (Projected)
Source: Derived from Headquarters, Marine Corps. *2019 Marine Corps Aviation Plan*. Deputy Commandant for Aviation, Washington, DC, 2019.

The ACE, similar to the MAGTF as a whole, is best when employed together. Its sum is greater than the parts. The ability for a MEU Commander to extend influence nearly one thousand miles with MV-22s is a great capability, one suited for HA/DR missions requiring near immediate response. This long reach is not always necessary, as the ability to mass personnel and fires by leveraging the combined might of the ACE is a more effective means to accomplishing a mission when the ARG is closer to the objective. This combined effort increases Force Protection, leading the commander to assume less risk to mission and force.

The transition from CH-46 to MV-22 brought with it improved technology and increased capability to the individual airframe. Looking at the holistic impact that this technological transition has had on the ACE as a whole, this increase in capability has not been recognized across the span of ACE operations. While the MV-22 brings with it increased speed and range that precludes most of the remainder of the ACE unable to render mutual support. A composite unit that is unable to mutually support the airframe on which it is centered is inherently less efficient and effective. In order to lessen the amount of operational dependence on a single T/M/S, a shift in the core construct of the ACE may be necessary.

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[16]*22d Marine Expeditionary Unit Command Chronology for the Period of 14 Feb to 28 Oct 04*, Headquarters, United States Marine Corps, Archives Branch, History Division, Library of the Marine Corps, Quantico, VA; *13th Marine Expeditionary Unit Command Chronology for the Period of 1 Jul to 29 Oct 201*1, Headquarters, United States Marine Corps, Archives Branch, History Division, Library of the Marine Corps, Quantico, VA; *24th Marine Expeditionary Unit Command Chronology for the Period of 1 Nov 2016 to 28 May 2017*, Headquarters, United States Marine Corps, Archives Branch, History Division, Library of the Marine Corps, Quantico, VA.
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[34]Eric Piper. "An Interview with Captain Eric Piper, II MEF SOTG Air Officer," interview by Chris Wilk, 2009. 3-4. http://dtic.mil/dtic.
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CURRENT AND FUTURE AMPHIBIOUS OPERATIONS

"The outstanding achievement of this war in the field of joint undertakings was the perfection of amphibious operations, the most difficult of all operations in modern warfare."
~ Fleet Admiral Ernest J. King
Commander-in-Chief, US Fleet and Chief of Naval Operations (1947).

Marines are known as the soldiers from the sea, an idiom that dates to the Revolutionary War period, and still holds true today. A MEU deploys today aboard and with an Amphibious Ready Group (ARG), typically consisting of three amphibious ships; a big deck Amphibious Assault Class (LHD/LHA), a smaller Amphibious Transport Dock (LPD), and a smaller still Dock Landing Ship (LSD). These platforms represent a litany challenge for the MEU Commander, as well as all Major Subordinate Element (MSE) Commanders; how to distribute manpower and equipment throughout the ARG, and how, when and in what order to embark/debark each asset. At the onset of a deployment, the process of embarkation is relatively simple; the entirety of the ARG is moored pier side, enabling all of the equipment to be lifted aboard via shipboard crane, or rolled/driven on. The difficulty and tempo of this action increases exponentially when debarking while the ships are underway, and more so if doing so in a non-permissive or uncertain environment.

An estimate of logistical transport requirement can be made using the afloat force laydown of the 15th MEU from 2015, an ARG centered on the LHD-2 Essex. Figure 3 is a graphical representation of that force laydown and distribution of resources and equipment.[37] After action reports from that same MEU deployment do not indicate that this laydown was atypical from previous deployments.[38] The implication being an estimate of this MEU would be applicable to typical MEU force laydowns aboard an LHD-centric ARG.

Figure 3: Example MEU Force and Equipment Laydown

Source: Cryer, Vance L. and Chad A. Dodd. *15th Marine Expeditionary Unit USS Essex ARG Logistics Post-Deployment Brief*, 2016. https://www2.mccll.usmc.mil/

The embarkation and debarkation of an entire MEU is a lengthy and complicated maneuver to accomplish in a timely manner, regardless of environment. The Marine Corps has refined this process from decades of close work and planning aboard surface transport capable LHDs and the sailors that are intimately familiar with well deck operations. Wasp Class LHD centered MEUs are able to leverage the well deck and surface connectors to move very large and very heavy equipment ashore. An LHD has the capacity for 125,000 cubic feet of cargo with 20,000 cubic feet for rolling stock vehicles.[39] This amounts to five M1A1 Abrams tanks, twenty-five Light Armored Vehicles (LAV), sixty-eight HMMWVs and ten logistical trucks. Facilitating the movement of this equipment from ship to shore via surface are the LCACs, of which a Wasp Class LHD has storage capacity for three.[40] While this is not a fast process by any means, surface connectors, such as the LCAC or LCU, are the only way to get an M1A1 ashore.

The three LCACs that a Wasp Class is able to transport in its well deck also provide logistical support capacity for the other ships in the ARG. Both the San Antonio Class LPD and

Whidbey Island Class LSD have a well deck, allowing for surface transport. This capacity for mutual logistical supportability increases the flexibility of the ARG/MEU commanders and planners alike, increasing lethality, resilience, tempo, and massing of forces ashore.

This equation changes drastically once the well deck capability is removed. The newest addition to the Navy's Amphibious fighting fleet, the America Class LHA-6, does not have a well deck. The loss of well deck allows that space to be reallocated for other purposes, in this case increasing cargo capacity to 160,000 cubic feet.[41] The loss of the well deck removes distance requirement for surface connectors, allowing the ship to operate further from shore, and theoretically allows uninterrupted flight operations. A negative aspect to losing surface logistical capability is the inability to project heavy fire power from the LHA. Common sense implies in order to make up for that loss in heavy fires that the M1A1 provides, a MEU aboard an America Class LHA will see an increased number of lighter trucks, allowing for a greater dispersion of fires. This will result in a greater need for heavy lift air operations to mass this equipment ashore in a contested environment when an administrative port debarkation is out of the question.

The LHA-6 America is currently the only operational large deck amphibious ship without well deck capability, soon to be joined by the LHA-7 Tripoli. The majority of deployed MEUs will continue to conduct operations afloat with the legacy construct of well deck capabilities. This does not absolve the Marine Corps from identifying and planning to mitigate the shortfalls presented by America Class shipping. Operating aboard an America Class LHA presents a unique problem set of increased cargo capacity for equipment and vehicles, while also removing capacity to off load them expeditiously. America Class ships have space for 28% more cargo and equipment, but that comes with a tradeoff of surface connector capabilities. A Wasp Class LHD has the capacity for, and typically deploys with, three LCACs. The loss of the well deck also loses the surface payload capacity of 1,809 square feet (vertical dimension is undefined, as it is an open cargo area transport), or a single M1A1 Abrams Main Battle Tank.[42] Using the dimensions of the M1A1 as a guide, a safe assumption is a single LCAC provides 3,096 cubic feet of space.

A standard compliment of twelve MV-22Bs and four CH-53E are able to transport 13,793 cubic feet of volume in a single wave.[43] Aboard a Wasp Class LHD, with a full complement of three LCACs, a single wave of air and surface movement provides capacity for 23,081 cubic feet of cargo. A completely full Wasp Class LHD of 125,000 cubic feet would be offloaded in six combined waves. Well deck and flight deck operations cannot be conducted simultaneously, so additional planning in terms of timing and phasing is necessary to optimize the offload ashore. Though time consuming, the surface connectors provide substantial lift capacity. Moving to an America Class LHA increases the cargo capacity by 28%, while loss of a well deck equates to a 40% loss in logistical capability, a tradeoff that equates to increased time to mass fires and forces ashore.

A MEU embarked aboard the USS America transiting ashore with all equipment and cargo, lacking surface transit capability, an offload would entail twelve waves of assault support aircraft. With an adjusted laydown of ten CH-53Es and four MV-22B, the capacity for cargo movement in a single wave increases by nearly 34% to 18,445 cubic feet of cargo space, and reducing the waves required to nine. Taking into consideration the requirement to move personnel, and the fact that not all equipment and cargo will maximize each aircraft perfectly, one can extrapolate the tremendous burden this places on the ACE. The requirement for the MEU to actually be scaled and tailored to fit the America Class construct is clear.

In 2014, Marine Corps Combat Development Command analyzed the requirements to conduct an amphibious assault to seize an island. In the scenario studied, the assault force is comprised of two vertical assault rifle companies inserted by the ACE, with a third rifle company inserted via surface connector.[44] The analysis assumes an ACE with twelve MV-22 and four CH-53K assigned operating off a well deck capable LHD, conducted once at an aircraft maintenance readiness rate of 82%, and a second time at 62%. These rates equate to eight/three and six/two airframes available for tasking, respectively. Time to secure the objective with companies equipped with Joint Light Tactical Vehicles (JLTV) was nine hours at 82% aircraft readiness, and just over twelve hours at 62% readiness.[45] With one-third of the force moving via surface, it is easy to infer that the loss of a well deck and the resultant loss of surface connectors would increase that time by a third as well. With the mission times growing to twelve and sixteen hours at the respective aircraft readiness rates, a commander must assume more risk somewhere; either increased risk to force by extending aircrew members acceptable crew day limitations, or increasing risk to mission success by conducting said mission with a smaller, possibly less capable force.

The need to consistently self-reevaluate and optimize for the MEU ACE is paralleled across the Fleet Marine Force. The pace of technological advancements enjoyed by the United States Military is still ahead of the other global great powers, but that capability gap is narrowing every day. The dominant position the Unites States Military enjoys today is not as it was thirty, twenty, or even ten years ago. This tremendous military advantage was due much in part to the technological advantage that the United States enjoyed relative to the rest of the world, beginning at the conclusion of World War II. That technological advantage is narrowing. In future conflict, the United States Military, Marine Corps included, will not have the luxury of de facto overwhelming technological dominance. With friendly and enemy forces' capabilities changing due to the proliferation of technology, the only way to maintain this advantage is to change the way the Marine Corps operates.

General Berger identified this period of revolutionary technological proliferation in the 2019 Commandant's Planning Guidance (CPG), and offers:

> …we must acknowledge that different approaches are required given the proliferation of anti-access/area denial (A2AD) threat capabilities in mutually contested spaces. Visions of a massed naval armada nine nautical miles off-shore in the South China Sea preparing to launch the landing force in swarms of ACVs, LCUs, and LCACs are impractical and unreasonable. We must accept the realities created by the proliferation of precision long-range fires, mines, and other smart-weapons, and seek innovative ways to overcome those threat capabilities.[46]

Later in the CPG, General Berger expands on concepts recently developed and beginning implementation as a way to mitigate an enemy's ability to employ A2AD operations. These two operations impact the operations of all members of the MEU/ARG team: Composite Warfare (CW) primarily effecting the ARG's operations, and Expeditionary Advance Base Operations (EABO) focusing mainly on the MEU.[47] The conduct of either operation will have huge implications on both Navy and Marine Corps personnel embarked.

CW, Distributed Maritime Operations (DMO), and Distributed Lethality (DL) will require the MEU Commander to separate forces and capabilities as the ARG disaggregates, potentially over thousands of miles. While it is not atypical for an ARG to split within the Area of Operations, the DL concept will likely result in a different distribution of Marine Corps forces aboard each ship in order to distribute offensive capability across the ARG.[48] With these Marine forces split amongst the three ships within the ARG, assault support aircraft will need to be distributed as well.

In previous MEUs, a general distribution of airframes is the entire Light Attack AH/UH detachment embarked aboard the LPD, with all other ACE assets aboard the LHD/A. This results in a few problems when conducting operations while the ARG is dispersed. The forces employed off of the LHD/A must rely on fixed wing escort security and close air support (CAS) for aviation delivered fires. Though this is only an issue when conducting operations in a non-permissive environment, it has the potential to become a grave issue. While the technology and capability of the F-35 make it far and away most lethal platform in the Marine Corps inventory, it lacks the persistence and responsiveness that rotary wing attack aircraft provide in a CAS role.

With the light attack aircraft sequestered aboard the LPD, the vast majority of GCE forces and equipment must rely on surface ship-to-shore transport. The limitations of transit via LCAC, LCU or Amphibious Assault Vehicle (AAV) are numerous. The range of these craft render over the horizon operations nearly impossible if working in concert, sacrificing any element of surprise, as well as spoiling the tempo of the operations as follow on waves will take significant time.[49] The proximity to shore also puts the host LPD and LSD well within the range of enemy A2AD weapon systems, increasing the risk of a portion of the ARG suffering a catastrophic attack. The low speed of these surface connectors make themselves, and the ship from which it originated, vulnerable to enemy attack for sustained periods of time.[50]

A solution to the response time and tempo conundrum is be a better construct and distribution of ACE assets, a distribution that spreads the strengths and capabilities of the ACE throughout the distributed ARG. A traditional ACE construct aboard the LHD/A maximizes the space available for aircraft. Typically, at the conclusion of flight operations, the twelve MV-22Bs are folded and secured on the starboard side of the ship, forward of the superstructure and perpendicular to the length of the flight deck (see Figure 4). Both MV-22Bs and CH-53Es are able to be parked clear of the fixed wing parking line, avoiding interference with fixed wing flight deck operations. That said, the length of the assault support aircraft will not be considered a factor, only the folded width. When folded and stowed, these twelve Osprey fit within the space of Spots 1 and 3 (Forward Slash), requiring a footprint of 256 feet. The four CH-53Es are traditionally secured directly aft of the super structure (Aft Slash), in vicinity of Spot 8, requiring a footprint of 113 feet.

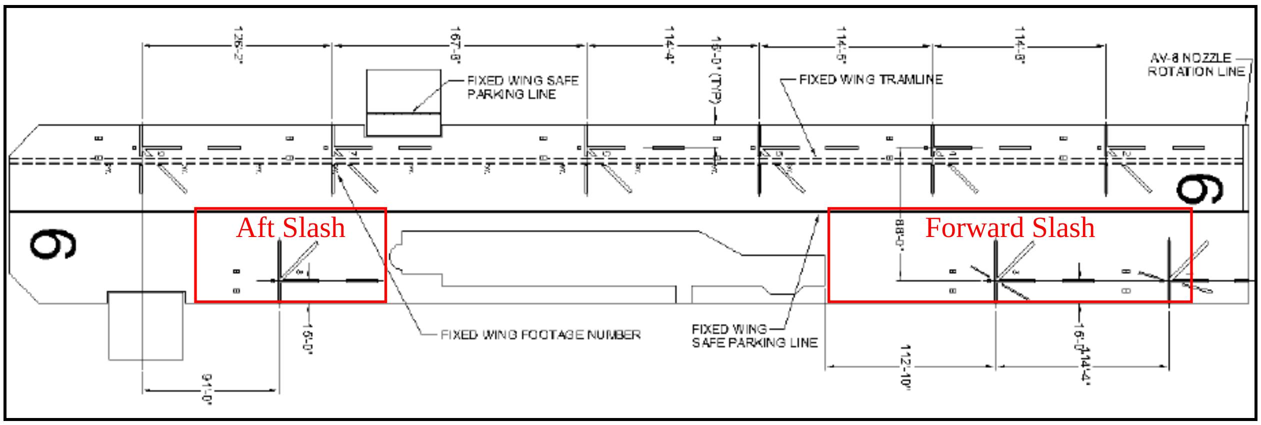

Figure 4: LHD/A Aircraft Parking Locations
Source: Naval Air Warfare Center. *Shipboard Aviation Facilities Resume*. Lakehurst, NJ: Naval Air Warfare Center, 2019.

Shifting to paradigm of ten CH-53E and four MV-22s complicates the parking problem, but only slightly. When taking the scheduled maintenance cycles of each T/M/S, it is likely that the ship's Aircraft Handling Officer would only need to park nine CH-53Es and three MV-22s on the flight deck at one time. The remaining aircraft would be moved on to the Hangar Deck while undergoing scheduled hourly maintenance inspection (e.g. Phase Inspection). Not only does this allow the CH-53Es to be parked forward of the superstructure and the MV-22Bs aft, requiring 257.4 feet and 55.8 feet each airframe respectively, but would also allow more space on the flight deck to maneuver and secure F-53Bs and AH/UH aircraft.

The positives for a shift to a CH-53 heavy ACE aboard the LHD/A become more apparent with the introduction of CH-53K deployments. The CH-53K retains the same footprint of the CH-53E, but increases the cargo and troop capacity tremendously. This increased ability to transport combat troops and cargo falls in line with the CPG and EABO concepts, and increased heavy lift transport ability is a requirement that will be more and more in demand with the proliferation of EABO. The ramifications of issues discussed earlier justify a shift the airframe allocation. Potential alternatives to aircraft allocation are discussed in later pages.

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[37]Vance L, Cryer and Chad A. Dodd. *15th Marine Expeditionary Unit USS Essex ARG Logistics Post-Deployment Brief*, 2016. https://www2.mccll.usmc.mil/
[38]Ibid.
[39]*Nick Brown, Alex Pape, Michael Fabey, Ridzwan Rahmat. Jane's Fighting Ships, 2018-2019*. Jane's by IHS Markit, 968.
[40]Ibid.
[41]Ibid, 966.
[42]Ibid, 972.
[43]NAVAIR. *A1-V22AB-NFM-000*, 1-6; *NTTP 3-22.5-CH53 TACTICAL POCKET GUIDE*. NAVAIR, Patuxent River, MD: Naval Air Systems Command, 2019. 28.
[44]Marine Corps Combat Development Command. *Heavy Lift Helicopter Requirements Analysis*. Quantico, VA, 2014. Received as email attachment from Major Scott Stafford, Adobe Portable Document Format (PDF). 30-31.
[45]Ibid, 31.
[46]David H. Berger. *Commandant's Planning Guidance: 38th Commandant of the Marine Corps*. 5.
[47]Ibid, 10.
[48]T. S. Rowden. "Surface Force Strategy; Return to Sea Control." Commander, Naval Surface Forces, Washington, D.C. January 2017.
[49]Mark W. Beddoes "Logistical Implications of Operational Maneuver from the Sea." Naval War College Review 50, no. 4 (Autumn, 1997): 32-48. https://search-proquest-com.lomc.idm.oclc.org/docview/205922530?accountid=14746.
[50]Ibid.

OBSTACLES, RECOMMENDATIONS AND CONCLUSIONS

"Patience and perseverance have a magical effect before which difficulties disappear and obstacles vanish."
~ *John Quincy Adams*

Further complicating logistical ship to shore movements is the ongoing learning curve of MV-22 shipboard aerodynamics. Recent shipboard aircraft mishaps involving MV-22s have resulted in Headquarters Marine Corps limiting the Osprey's allowable Max Gross Weight when operating aboard air capable ships.[51] Since this gross weight limitation has been enacted, representatives from Naval Air Systems Command (NAVAIR) have conducted tests and certifications to remove the gross weight limitation and replaced it with a safety margin dependent on landing spot location, wind speed and relative direction.[52] This safety margin has large implications to operational capability, ranging from a loss of range, to time on station, to lift capacity. Though this restriction is likely temporary on the larger LHD/A ships due to the interaction of the deck height and aerodynamic down wash, the restriction is likely to remain on the smaller LSD/LPD ships.

The strength of the MV-22 Osprey is not its capacity as a troop transport. As VMMs have replaced HMMs throughout the Marine Corps, it seems as if the de facto view is to treat this revolutionary tiltrotor platform as a CH-46 that can fly much faster and further. Its strengths are the fixed wing abilities to an amphibious platform. Employing the MV-22 in similar fashion to the CH-46 ultimately negates these improvements. In past MEU deployments, Battalion Landing Team (BLT) Marines' preferred COA was to insert via rotary wing, with the MV-22 as the contingency platform.[53] The pure speed of the MV-22 provides an extremely fast platform in which to reinforce forces or conduct a CASEVAC well within the Golden Hour, a non-doctrinal term signifying the first hour after the occurrence of a traumatic injury which is considered the most critical for emergency treatment.

Marine Corps Combat Development Command recently conducted a study on Heavy Lift requirements with regards to CH-53K acquisitions. The analysis concluded that the currently acceptable mix of twelve MV-22s and four CH-53K yield similar results to a ten and six airframe construct, respectively, for most cases.[54] The latter construct is preferred and recommended as it "provided (sic) improved performance for lifting JLTVs and provided the farthest operational reach."[55] This ACE construct change requires minimal changes on the currently existing infrastructure of the VMM and HMH squadrons. The VMM would remain the core of the ACE in its entirety and the HMH detachment would remain a detachment, albeit one that grows by half the legacy size. Increasing the number of CH-53s is an option that has been applied by on a recent deployment by the 22 MEU.

When looking for solutions to better man, train and equip the MEU ACE, one must take adjacent units' operations into consideration as well. Though a MEU's missions are various and the Area of Operations is vast, the likely area of conflict is in vicinity of emergent nations referred to as the "Arc of Instability."[56] In addition to the MEU that is currently in the area, there are two standing Special Purpose Marine Air Ground Task Forces (SP-MAGTF) focused on Crisis Response; SP-MAGTF Crisis Response Africa (SP-MAGTF-CR-AF) in Moron, Spain and SP-MAGTF-CR Central Command (SP-MAGTF-CR-CC) stretched throughout CENTCOM's Area of Operations. [57] Each of these SP-MAGTF-CRs are capable of similar missions as a MEU, and in fact have been employed due to a lack of a geographically relevant ARG/MEU team.[58]

While similarly manned with two thousand Marines, the SP-MAGTF-CRs are allocated four to six MV-22s, half of what a standard MEU is allocated (SP-MAGTF-CR is considered a temporary organization, and as such does not have a standard table of organization).[59] But being strictly land based, the SP-MAGTF-CR Commander is not limited in terms of potentially available fixed wing aircraft. Rather than the 7 currently deployable squadrons of F-35Bs or AV-8B, there are 9 Marine Fighter Attack (VMFA) squadrons throughout the Marine Corps.[60] A greater pool of available squadrons to select from would provide a greater amount of escort capability to any MV-22 assault package, an escort capability that is more compatible with the flight characteristics of an MV-22. The addition of KC-130 aircraft would further extend the range of the SP-MAGTF-CR, as the MV-22, F-35B and F/A-18 both use the same equipment for Aerial Refueling.

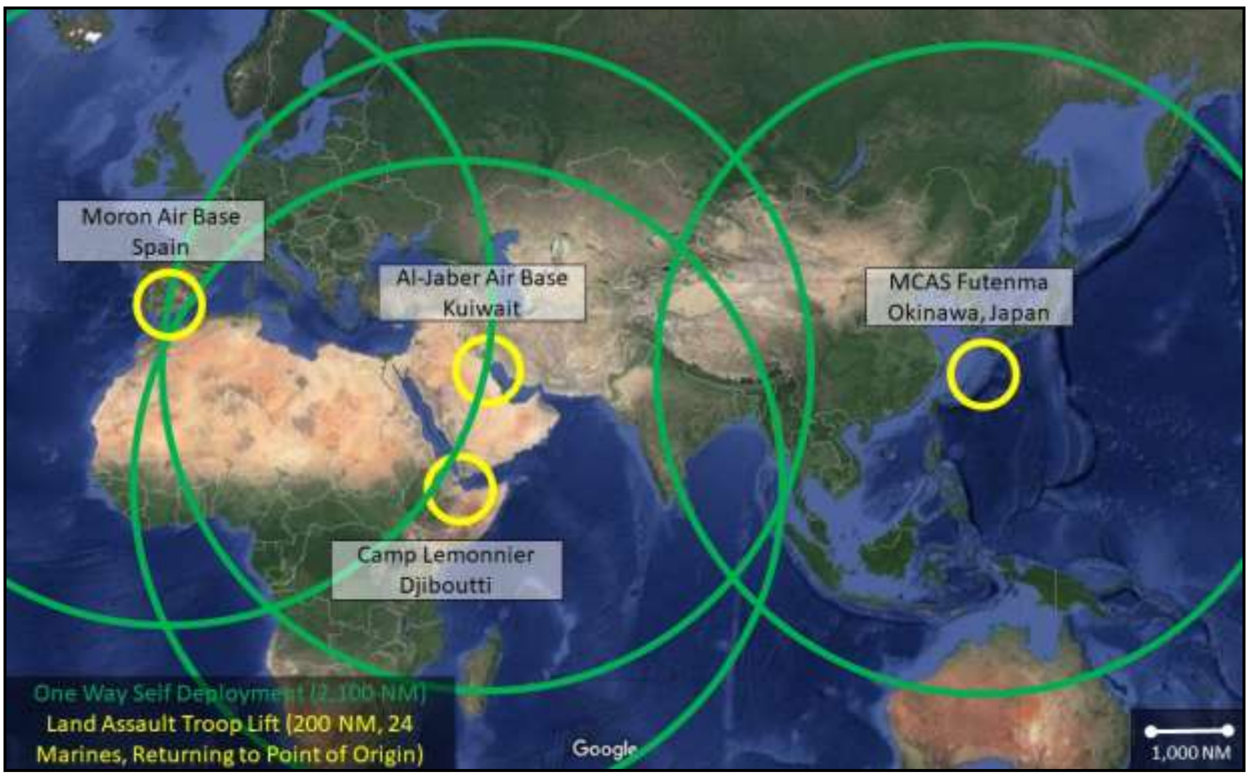

Figure 5: MV-22 Area of Influence
Source: Derived from Headquarters, Marine Corps. *2019 Marine Corps Aviation Plan*. Deputy Commandant for Aviation, Washington, DC, 2019. 39.

This nearly redundant capability over a vast area shared between the MEU and SP-MAGTF-CR provides a more flexible response option for Geographic Combatant Commanders. Figure 5 shows a graphical depiction of the area that the Marine Corps is able to physically influence with SP-MAGTF-CRs operating at existing locations in which United States Military are currently, or have historically, operated. Relying on MV-22 Crisis Response from the above bases falls in line with the path laid out in the CPG. A SP-MAGTF-CR brings dispersion of forces while still allowing influence throughout multiple theatres with a light weight force of infantry Marines not relying on exquisite equipment and materials, or other high payoff targets such as Naval Shipping.[61]

The increased range and response time that SP-MAGTF-CRs operating out of multiple locations throughout AFRICOM and CENTCOM also allow more options when organizing a MEU ACE. Fewer MV-22s aboard the ARG would equate to a reduction in aviation range as a whole, that is mitigated by the range of the land based MV-22s discussed above, and the mobility of the ARG itself. While the reliance on large amphibious platforms does not coincide with the end state presented in the CPG, a shift in aircraft allocation aboard would serve as a transition tactic until this “once in a generation” transition is complete and implemented.[62]

The possibility of a four MV-22 / ten CH-53 ACE aboard an LHD/A was explored earlier. The shift to heavier lift rotary wing platforms provide the capacity to disperse Marine Corps forces from embarked shipping to Expeditionary Advanced Bases (EAB) astride straits or on islands in fewer waves of aircraft. Heavier lift capacity also results in that EAB employing heavier fires. A CH-53K will have the capability to externally transport an M142 HIMARS. This aerial delivery capacity will provide advanced rocket artillery capability to be distributed throughout the Area of Operations. In INDOPACOM, this is would equate to near simultaneous delivery throughout the first island chain, and a rapid implementation of Area Denial operations. An example of this is depicted in Figure 6, where “Advance Naval Logistical Bases” would coincide with HIMARS batteries.

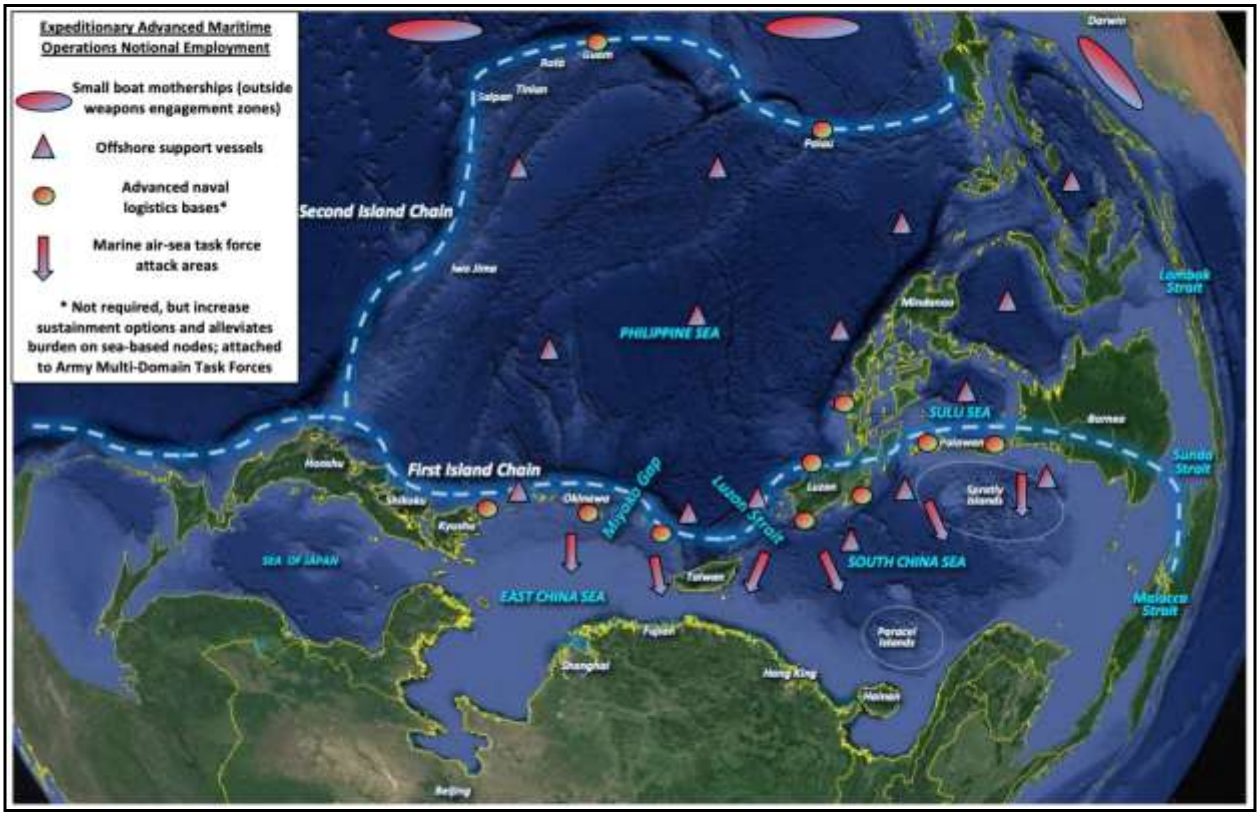

Figure 6: Expeditionary Advanced Base Operations Notional Employment
Source: Jake Yeager. "Expeditionary Advanced Maritime Operations: How the Marine Corps can Avoid Becoming a Second Land Army in the Pacific." Accessed February 20, 2020
https://warontherocks.com/2019/12/expeditionary-advanced-maritime-operations-how-the-marine-corps-can-avoid-becoming-a-second-land-army-in-the-pacific/

The Navy Marine Corps team will also employ smaller A2AD assets to compliment the HIMARS batteries along the island chain. This increased capability and capacity comes in the form of JLTV mounted anti-ship missiles, currently the Naval Strike Missile, with future potential of Maritime Strike Tomahawk missiles being employed.[63] The employment of JLTVs will still restrict the transport to strictly CH-53s, but the lighter weight of the JLTV respective to a HIMARS has multiple positive results. The JLTVs lighter weight allow a higher beginning fuel state for a CH-53, allowing for a larger delivery radius and increasing the overall engagement area for the MEU as a whole. This same lighter weight allows for a greater operational power margin when transporting the vehicle. This larger power margin equates to a lower level of risk assumption for the commander, and a higher likelihood of actual employment in theater.

In the construct explored above, MV-22s should be used more in a battle management capacity than traditional assault support roles. Plans and trials for broadening the scope of MV-22 capabilities are currently under evaluation by Marine Operational Test and Evaluation Squadron 1 (VMX-1). VMX-1 is evaluating various technologies that would facilitate a shift away from the assault support troop transport mission and more towards a command and control platform. The F-35 sensor suite is able to share information throughout the MAGTF through its organic technology. In an effort to spread this ability to other airframes, the Marine Corps is testing a suite of technology to implement "Digital Interoperability," a line of effort that seeks to increase the situational awareness across the MAGTF and over the horizon.[64] This increased command and control ability, while very useful, does come at the expense of seats and space available in aircraft.

An MV-22, equipped with the Digital Interoperability suite and range extension tanks, provide an optimal command and control platform. The Digital Interoperability suite allows for increased situational awareness for the Mission Commander and the Air Mission Commander, the range extension tanks increase the time on station, and the sheer altitude capability increases the range of line of sight communications. These improved capabilities result in increased Situational Awareness for these key billet holders, effectively decreasing the size of the friendly OODA Loop, and increasing tempo for Marine Operations.

Restructuring the ACE towards more CH-53 Heavy Lift platforms and fewer MV-22s would require changes in TTPs and a shift away from the traditional through process used during MEU planning. Though on the surface, it seems as if the MEU would lose capability and become slower. This is true while looking purely at a statistical representation, the MEU would gain the ability to mass fires and forces quickly. Fewer aircraft to deliver the same size force also allows for simultaneous operations in multiple objective areas, bringing dispersion and lower signatures.

Some may counter this shift in tactics with the thought that rising technological abilities across the global community will soon make near instantaneous situational awareness a possibility. The race towards countries establishing proliferated satellite constellations of sensors with the ability to monitor the entirety of the usable electromagnetic spectrum is underway. With this ability, competitor great power states will be able to identify any and all units that are emitting any electromagnetic signatures.

This thought that future technology rendering dispersion and EABO irrelevant prior to its employment is overblown and alarmist. While some peer countries have this capacity with satellites in orbit, the communication chain is not optimized to negate dispersed fighting EABs immediately. EABO is not a cure all to counter space based sensors, it is a transitionary tactic until competitors are able to leverage their sensors for near immediate neutralization of EABs. Until that time, spreading forces and capabilities across the globe, on land and sea based platforms is the ideal technique to maintain operational effectiveness.

Challenges to employing an ACE with a greater number of CH-53s and fewer MV-22 are not insurmountable. HMH squadrons are currently maned, trained and equipped to source two detachments equal to a quarter of the squadron, and a remain-behind element of the remaining half.[65] Increasing ACE manning to six CH-53s as suggested in the 2014 MCCDC report would require a change to the current allocation of personnel, equipment, and funding to HMH squadrons. The Marine Corps would have to either increase how an HMH squadron is constructed, or change the expectation in the number and size of disparate detachments feasibly supportable.

Going even further and centering the ACE on an HMH would go against the current norms. This challenge is much easier to mitigate, as large scale exercises in recent history have shown. Every two years, the Navy-Marine team hosts a large scale, multi-national training exercise called Rim of the Pacific. The last three iterations of the Rim of the Pacific Exercise have been supported by HMH-463 as the core squadron. HMH-463 was reinforced with detachments from VMM, HMLA, VMFA, and KC-130 squadrons. While this was not perfectly executed, that is to be expected by exercising an ability that is rarely employed.

A third challenge is the current status of CH-53 material readiness across the Fleet Marine Force. This poor material readiness is due to the nearly two decades of operational deployments in support of OEF, OIF, and other conflicts in the Middle East. Headquarters, Marine Corps recently addressed this with the CH-53E Reset Program.[66] This program has lofty goals, and will take time to remedy the readiness issue. While it is underway, HMH squadrons see a decrease in the number of usable aircraft, with the usable aircraft waiting to undergo Reset Maintenance. Placing the requirement for an HMH to source more personnel, aircraft and equipment to support a MEU would be to the further detriment to the remain-behind element. A solution to this would be a change to the number of HMH squadrons across the Marine Corps. Consolidating personnel, equipment and aircraft across fewer squadrons would account for this increased requirement.

The reduction in MV-22 requirement aboard the MEU would increase the capability of the SP-MAGTF-CRs. Fewer aircraft required aboard the ARG allows increased allocation for land based MAGTF operations. This increased dispersion of forces throughout multiple theatres also increases resiliency and survivability. Although it is doing so in counter to the CPG in a large signature immobile land base, this is merely a transition TTP until the “once in a generation transformation” is completed.[67] These forces are also outside of the A2AD Weapon Engagement Zones of competitor Great Powers in INDOPACOM.

The true solution is not a single, hard and fast prescription for aircraft allocation. To borrow a term from former President Kennedy, the Marine Corps needs to develop a flexible response. A key aspect of the MAGTF is that is it inherently scalable and tailorable in response to any problem or mission set. Today’s MEU speaks to that, but does not actively practice the tenet. Every ACE assigned to deploy in support of MEU operations is a VMM (REIN) with a similar allocation of aircraft as the one prior to it, without much analysis of likely missions within the area. This lack of analysis is a trend that is repeated often in the Marine Corps, with one relevant example being the transition from CH-46 to MV-22; the only reason that a VMM is assigned 12 MV-22s is because an HMM was assigned 12 CH-46s.

A major constraint in aircraft quantity afloat is space. Referencing the deck space in the forward and aft slashes in Figure 4, 369 feet are available for securing assault support aircraft laterally and clear fixed wing flight operations. Within the confines of this space, the MEU and ACE commander should be able to adjust the amount of MV-22s and CH-53s aboard the ship. Doing an analysis of likely mission sets, the allocation of GCE heavy equipment, and shortcomings of naval surface connector assets will influence the capabilities required, and by extension, the aircraft numbers and types.

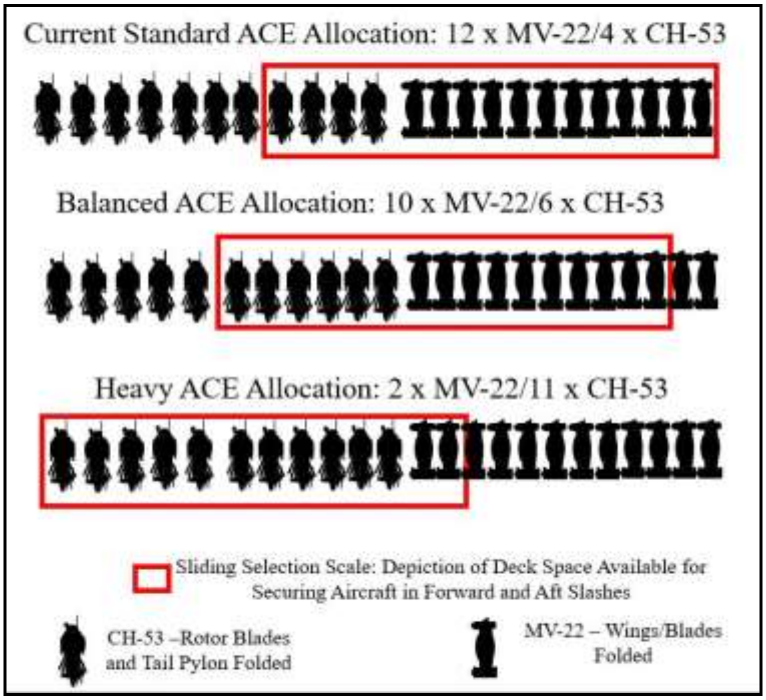

Figure 7: ACE Assault Support Aircraft Allocation Sliding Scale
Source: Naval Air Systems Command. A1-H53BE-NFM-000 [NATOPS Flight Manual Navy Model CH-53E Helicopter]. Patuxent River, MD: Naval Air Systems Command, 2019 and Naval Air Systems Command 00-80t-106 [LHA/LHD NATOPS Manual]. Patuxent River, MD: Naval Air Systems Command, 2019 and Naval Air Systems Command. A1-V22AB-NFM-000 [NATOPS Flight Manual Navy Model MV-22B Tiltrotor]. Patuxent River, MD: Naval Air Systems Command, 2019.

In an effort to avoid a capability gap, and deploy merely with a degradation in one aspect, the assault support allocation sliding scale should require no less than two of each T/M/S, regardless of decision to deploy a primarily MV-22, CH-53 or balanced ACE. Moving this sliding scale that is constrained to the available deck space and no less than two of each T/M/S ensures that MEU retains core capabilities provided by each airframe, albeit at a reduced capacity.

An inherent problem of this construct is the existing lack of knowledge on the MEU's capability amongst the Geographic Combatant Commander's (GCC) staff and planners. This lack of knowledge is already detrimental to the employment of a MEU afloat within the GCC's area of responsibility. Taking a composite unit that is already nebulous to many in the Joint world and inserting variables and changes in capacity will amplify that confusion. This confusion is easily avoided through increased and timely communication, and may very well require additional Marine Liaison Officers to be placed with GCC staffs.

Shifting a construct that has been actively employed with success for decades is not an easy task. It requires a change to subordinate constructs and funding, and a change in thinking by the men and women employing it ideologically. While it is easy to remain static and comfortable with the status quo, the changes going on around the ACE necessitate a change. The increasing size in GCE equipment, employment of amphibious ships without a well deck, and increasing inequalities of aircraft capabilities are resulting in a loss of efficient operations. This loss of efficiency has an inverse correlation to the lethality of a MEU itself. It is not necessary to completely overhaul the ACE with a "one size fits all" construct to be employed all the time. It is, however, more and more apparent the Marine Corps exercise the ability of the MEU MAGTF to be "scalable and tailorable." Changes need to happen for the sake of optimization, and more Heavy Lift is the path for that change.

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