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“Back to the Future:” The UH-1Y Utility Helicopter; A Multi-Role Solution for a Changing Security Environment

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Executive Summary

Title: “Back to the Future.” The UH-1Y Utility Helicopter; A Multi-Role Solution for a Changing Security Environment.

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Thesis: Due to the capability shortfalls associated with the transformation of the Marine Corps aviation force structure and the challenges associated with a changing security environment, the role of the utility helicopter must evolve to achieve a true multi-mission capability. Through a change in paradigm, the Marine Corps must properly equip the UH-1Y to meet these challenges.

Discussion: In the 4th quarter of FY08 the Marine Corps anticipates the Initial Operational Capability (IOC) of the upgraded UH-1Y “Venom” Utility helicopter, the third generation helicopter in the Marine Corps UH-1 family. While this aircraft offers significant potential and greatly enhances the performance over the current utility helicopter capabilities, the strategic landscape has changed considerably from the time of its conception. With the emergence of a changing security environment, the prolonged operational tempo associated with the “Long War,”¹ and potential asset shortfalls due to the transition or conversion of several aircraft in the Fleet inventory, The Marine Corps will face an increasing number of operational capability gaps within the aviation force structure. Traditionally, the utility helicopter has and will continue to fill these mission gaps; however, due to the complexity of the changing security environment, the utility helicopter must evolve into a true multi-role aircraft that possesses the capability, equipment, and versatility to meet these challenges.

Conclusion: The current composition of the Marine Corps aviation force structure will remain constant for the next 25 years. The transition of upgraded type model series aircraft within the existing force structure coupled with the constraints of a bureaucratic acquisitions process and the security challenges associated with irregular warfare, security cooperation initiatives and the long war have generated significant capabilities gaps within its operational requirements. The solution will therefore require a timely and fiscally responsible alternative that will involve a paradigm change within existing helicopter doctrine and employment. That solution is the evolution of the utility helicopter into a true multi-role aircraft that possesses the capability, equipment, and versatility to meet the challenges of a changing security environment.

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Recent military operations, particularly those in Afghanistan and Iraq, have brought to the fore a number of outstanding questions concerning helicopters in the U.S. armed forces, including deployability, safety, survivability, affordability, and operational effectiveness. These concerns are especially relevant, and made more complicated, in an age of “military transformation,” the “global war on terrorism,” and increasing pressure to rein in funding for the military, all of which provide contradictory pressures with regard to DOD’s large, and often complicated, military helicopter modernization efforts.²

CRS Report to Congress: Military Helicopter Modernization:
Background and issues for Congress

INTRODUCTION

In the 4th quarter of Fiscal Year (FY) 08 the Marine Corps anticipates the Initial Operational Capability (IOC) of the upgraded UH-1Y “Venom” Utility helicopter. The third generation helicopter in the Marine Corps UH-1 family, the UH-1Y will replace “the current U.S. Marine Corps utility helicopter, the UH-1N Huey which was initially fielded in 1970.”³ While this aircraft provides a significant increase in range, speed, and payload in comparison to its predecessor, the operational requirements have changed considerably since the time of its conception. As such, the capabilities of the UH-1Y must evolve to meet the broad spectrum of challenges facing the Marine Corps in the changing security environment.

The utility helicopter has been an essential element of Marine aviation for more than forty years. Tasked to “conduct other missions as may be required within capabilities,”⁴ the utility helicopter has become the quintessential “jack of all trades,” providing mission support for whatever requirement or capability gap that exists to satisfy the needs of the supported commander. While this mission still holds significant relevance in future operations, the strategic landscape has changed significantly and so must the role of the utility helicopter.

Threat estimates for the first quarter of the 21st century predict a shift in operational requirements from traditional to irregular forms of warfare. In order to meet these challenges the

Department of Defense is “continuing to reorient its capabilities and forces to be more agile in this time of war, preparing for wider asymmetric challenges and hedging against uncertainty over the next 20 years.”⁵

This situation is further complicated as the Marine Corps transforms its aviation force structure to replace its aging and outdated airframes. As this transition occurs, significant operational capability gaps will develop. The lion’s share of these shortfalls will fall on the capabilities of the UH-1Y. Therefore, it must be equipped appropriately to fulfill these mission requirements.

Recently, the Marine Corps Combat Development Command (MCCDC) assessed that “the current size, shape and posture of our forces are not optimized to provide sufficient forward presence and conduct the diverse array of security cooperation and counter-terrorism tasks required in this changing security environment.”⁶ Based on the current operational tempo associated with the “long war” and bounded by the protracted challenges of the acquisitions process the solution must be readily available. Therefore, the need for an agile platform capable of performing a multitude of missions, often simultaneously, has never been greater. In order to fulfill this role, the paradigm associated with the utility helicopter missions and capability requirements must change. The role of the utility helicopter must evolve to a true multi-role aircraft that possesses the capability, equipment, and versatility to meet the challenges of a changing security environment.

In building the case for the evolution of the utility helicopter, this paper will:

1. Review the history of the UH-1E within the Vietnam conflict to highlight the lessons learned in the development of the Huey due to their inherent similarities to the circumstances faced today.

2. Explore the role of the UH-1 by addressing the challenges of understanding the utility mission and reviewing its assigned mission essential tasking.
3. Discuss the current capability shortfalls associated with the UH-1Y and the impact these shortfalls will have on future operational requirements.
4. Define the requirements associated with the current operational situation and the challenges the Marine Corps faces in equipping the force to support the diversity of future operations.
5. Delve into the evolution of the Marine Corps rotary wing force structure and the impact it will have on operational requirements within the first quarter of the 21st Century.
6. Discuss the concept of a multi-role platform in future operations and provide recommendations for the development of an advanced armament system for the UH-1Y that optimizes its increased capabilities and appropriately equips the aircraft to meet emerging requirements.

SECTION ONE: BACKGROUND

Vietnam has proven that we do not have enough small helicopters for all the tasks that Marine ingenuity can devise.⁷

General McCutcheon, Deputy Chief of Staff (Air), 1967

The Rise of the UH-1

In 1960, the Marine Corps was urgently seeking the replacement for two deteriorating observation platforms; the OH-43 and the O-1 "Bird Dog."⁸ There was a difference of opinion as to whether a replacement aircraft should be specialized to fulfill the observation role of the O-1 or if the missions of both aircraft could be combined in a single Assault Support Helicopter (ASH).

Conveniently, the U.S. Army was pursuing "a requirement for a Light Observation Aircraft (LOA)"⁹ that outlined similar requirements to those identified for the ASH. This provided an opportunity "for the Marine Corps to establish a joint services procurement program which would greatly reduce the cost per unit."¹⁰ The Deputy Chief of Naval Operations (CNO) (air), Vice Admiral Robert B. Pirie, reinforced these benefits by highlighting the importance of accepting perhaps a less suitable, operationally tested aircraft over the possibility of a "protracted and costly developmental program."¹¹ The Marine Corps identified some minor modifications required to enhance the UH-1B to meet maritime operational requirements and the UH-1E emerged to replace both the O-1's and the OH-43.¹²

Before the first UH-1E (commonly referred to as the "Huey") was delivered an additional requirement for an armed helicopter variant to escort the UH-34's performing the troop transport mission.

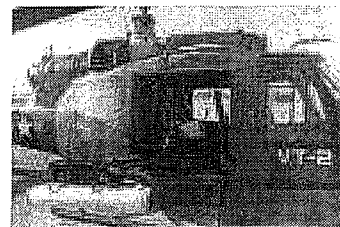


Figure 1. UH-1E

Due to the environmental constraints of the jungles of Vietnam and the near "surgical precision" required to support helicopterborne operations in close proximity to "densely populated areas,"

fixed-wing jets simply could not adequately support the helicopters.¹³ Transport helicopters, lacking their fixed wing escorts, were becoming extremely vulnerable to Viet Cong (VC) small arms attacks. Initial armament concepts were developed for use on the UH-34's, but each proved ineffective due to reduced payload capacity, inherent instability of the aircraft, and difficulty in achieving weapons employment parameters. Conveniently, the Army had developed an armament system for the UH-1B/D that was successfully employed in Vietnam, and Bell Helicopter decided that it would be "cheaper and more advantageous to assemble the UH-1E with the same modifications as those required on the armed version (the UH-1B/D) of the Army Helicopters"¹⁴ rather than re-tool the assembly line.

The prospect of arming the Huey's came with great controversy. First, the idea itself conflicted with the current "tactical doctrine, practice and equipment... and would require a major change in concept."¹⁵ Second, it would affect the total number of aircraft within the inventory and the Marine Corps would need to reduce the number of fixed wing aircraft by an equal number. Finally, its roles would overlap into the Light Armed Reconnaissance Aircraft (LARA) mission "and could potentially jeopardize OSD and Congressional support"¹⁶ for the program. Ultimately, operational necessity prevailed and the Hueys were armed to support mission requirements with the caveat that specific instruction would be included to address the difference of opinion stating that the "armament was to be used only for self defense."¹⁷

The subsequent utilization of the Huey was a tremendous success as stated by the Deputy Chief of Staff (DC/S) (air) General McCutcheon in July 1967, "If there is anything that we have learned in Vietnam, it is that we need light helicopters and many of them."¹⁸ The Huey was extremely adept at performing a multitude of missions and often diverted in flight to perform various additional tasks in conjunction with its assigned mission. The Huey had been so

successful that there were not enough available to accomplish all of its assigned missions. The preponderance of missions flown were Attack/Escort missions and the roles which it was designed to perform (Observation and Administration-liaison-utility missions)¹⁹ were secondary by comparison. To right-size the force, General McCutcheon devised a solution “to strengthen the UH-1E program which involved two plans.”²⁰ The first was to grow the force and add two new “Light Helicopter Squadrons” (HML), which would employ the UH-1E’s as the Marine Corps light or utility helicopter. The second was to rebuild the Marine Observation Squadrons (VMO’s) with the newly acquired OV-10, fulfilling the dedicated Observation role, and add a dedicated Attack helicopter, the Huey-Cobra later designated the AH-1J specifically developed to perform the Attack/Escort mission.

The evolution of the UH-1E in Vietnam highlights some specific insights that have particular relevance to the circumstances facing Marine aviation today. Challenged with replacing or upgrading the majority of an aging aviation force structure in the midst of a protracted insurgency, the decision to purchase the UH-1 emerged as the most reasonable solution amid competing budgetary requirements and significant fiscal concerns. Providing a low cost and timely solution, the UH-1 was acquired as a multi-role solution to fulfill both the observation and assault support role. The Marine Corps armed the aircraft to support emergent operational requirements despite a significant controversy concerning a change in the doctrinal paradigm. Due to the diverse nature of the conflict in Vietnam and the agility afforded by the UH-1E, the Huey performed a myriad of missions that spanned the breadth of heliborne operations. The versatility provided by the UH-1E subsequently defined the role of the utility helicopter and shaped the development of Marine Aviation as we know it today.

SECTION TWO: THE ROLE OF THE UH-1

The "utility" role is widely misunderstood within the Marine Corps, both internal and external to the community. Fears of a utility aircraft encroaching on the missions of other aircraft are at odds with the basic concept. Instead of enhancing the multi-mission aspects of the airframe, to augment firepower or lift shortages, attempts have been made to narrowly define its role.²¹

Major S.R. McGowan, CSC, 1999

Defining the Utility Mission

The UH-1N is currently employed within the Marine Light Attack Helicopter Squadrons (HMLA), operating in concert with the AH-1W. The mission of the HMLA is to support the MAGTF Commander by providing offensive air support, utility support, armed escort, and airborne supporting arms coordination, day or night, under all weather conditions during expeditionary, joint or combined operations.²² The HMLA consists of eighteen AH-1W's performing the attack helicopter role and nine UH-1N's fulfilling the utility helicopter role.

The challenge of understanding the utility mission is akin to understanding versatility of the aircraft itself. Simply stated the utility role means different things to different people, and the experience of the commander combined with the presence or availability of additional Type Model Series (T/M/S) aircraft to perform dedicated missions guides its employment. For some commanders the mission of the UH-1 is to provide Command and Control, VIP transport, or perhaps to be a light assault support vehicle or casualty evacuation (CASEVAC) platform. Others use the Huey in conjunction with the AH-1Ws to assist in the role of Close Air Support (CAS), or simply to fulfill whatever mission essential shortfall exists regardless of perception of appropriate mission tasking. The diversity associated with this sort of mission tasking is indicative of the utility role and has led to the perception of the UH-1 as a "Jack of all Trades, Master of None" platform. (See figure 2, UH-1N)

Since its introduction in 1971, the Mission Essential Tasking List (METL) for the UH-1N has grown considerably. (See Table 1 (USMC UH-1 Mission Tasking 1966-2008) Initially, the UH-1N simply filled the light assault role due largely to the significant growth



Figure 2. UH-1N

of mission specific aircraft that emerged from the Vietnam conflict. Since that time, utility helicopter mission tasking has grown considerably while the aviation force structure has remained constant. Appendix A, lists the current METL for each T/M/S as assigned by the Marine Corps Combat Development Command (MCCDC). When comparing the HMLA METL with the remainder of the T/M/S aircraft, the list for the HMLA is considerably larger due to the multitude of tasks assigned to the UH-1. In fact there are only three tasks that are not assigned to the UH-1 of all the missions listed for MV-22's, CH-46's, CH-53's and AH-1's (these missions require specific equipment to be accomplished) and two additional tasks that are uniquely assigned to the UH-1, indicative of the agility the UH-1 provides.

Ironically, as the mission tasking broadened, the capabilities of the UH-1N were simultaneously deteriorating due to an aging airframe and its limited performance capabilities.

Twenty-two years of mission system growth has resulted in almost 1000 pounds of lost payload. Operations at maximum gross weight with little-to-no...power margins have been commonplace. Improved performance is critical to meeting required mission profiles for safe/successful completion of current and future missions.²³ (August 1994)

The limitations associated with the UH-1N have been evident for several years yet the Huey continues to perform its assigned missions. Forced to balance time-on-station requirements with the necessity to carry ordnance, passengers, or equipment, the Huey has

persevered despite its performance limitations. While the Marines continue to utilize the Huey extensively throughout its life cycle, a true utility capability has not been realized for more than fifteen years due to the current performance limitations of the UH-1N. The question arises, what capabilities will the UH-1Y provide when the aircraft actually possesses the performance necessary to accomplish its assigned missions?

Mission Tasking

Despite its current performance limitations, the role of the UH-1N is still relevant in the scope of Marine Corps operations as evidenced by its performance in Operation Iraqi Freedom (OIF) I. During initial planning, the role of the Huey was in question as to how best employ the aircraft. Incapable of performing dedicated assault support due to performance limitations, not suitably equipped to perform dedicated Close Air Support (CAS), too few aircraft to fulfill the Casualty Evacuation CASEVAC mission, and only a single command and control mission identified for the initial assault onto the Al Faw Peninsula, the UH-1 had no dedicated mission requirement. Capitalizing on the flexibility afforded by the aircraft, a unique mission was developed in which each of the three supporting HMLA's were tasked to provide two dedicated sections (a section is the smallest employment component in Marine aviation and consists of two aircraft) of UH-1Ns in Direct Support (DS) to the Regimental, Division, and MEF Commanders.²⁴ The UH-1Ns provided continuous utility support and were at the disposal of the respective commanders to conduct leaders' reconnaissance, VIP transport, CASEVAC, Visual Reconnaissance (VR), limited Close Air Support (CAS) and Spotter/Observer missions at a moments notice. The missions proved very successful and provided commanders considerable flexibility to address time critical requirements or augment mission specific aircraft shortfalls.

The Hueys remained in direct support until I Marine Expeditionary Force (MEF) approached Baghdad during the first week of April 2003. By this time, several AH-1s had received excessive battle damage as the enemy began to adapt to the tactics employed by these aircraft. The AH-1s were tasked with screening forward of the lead trace of Marine Forces. In doing so, provided the Iraqis an opportunity to exploit a vulnerability in the AH-1. Namely, the Pilot's inability to see aft of the aircraft which allowed the Iraqis to utilize cover and concealment until the AH-1s flew past and then engage the aircraft from the rear, dispersing before the aircraft could reverse its direction to engage. In order to counter these tactics, then Major General Amos, the Commanding General of the 3rd Marine aircraft Wing (MAW), directed that the DS mission be dissolved and each flight of AH-1's would have a UH-1 attached for rear area security. The addition of the Hueys provided the flight with persistent 360-degree security due to the visibility afforded by the Crew Chiefs and the expansive weapons engagement zones of the UH-1 door guns.

While this solution greatly reduced the battle damage received by the AH-1's, it presented additional challenges based on the performance and capability limitations of the UH-1N. Most notable was the difference in speed and range between the AH-1W's and the UH-1N's as the AH-1's cruise airspeed exceeded the UH-1Ns by at least 20 knots. The second was the increased threat associated with attaching a UH-1 with limited ordnance capabilities. Typically carrying only its door guns for security this reduced the overall amount of ordnance carried within the flight as the Hueys lacked any additional ordnance payload or guided munitions capability. Despite these limitations, the ability of the UH-1's to engage pop-up targets without having to reverse the flight significantly reduced the overall threat and has become the preferred

employment within the HMLA community due to the imbedded security and operational flexibility the mixed section of aircraft provide.

SECTION THREE: EQUIPPING THE UH-1Y

Capabilities and Limitations

The introduction of the UH-1Y will provide much needed relief to the utility helicopter community. Appendix C, H-1 Missions and Performance Specifications, provides a simple comparison of the capabilities of the UH-1N and the UH-1Y. It is evident that the UH-1Y (See Figure 3



Figure 3. UH-1Y

UH-1Y) provides a significant increase in capabilities over its predecessor, the UH-1N . The increase in speed, range, payload, and situational awareness gained will greatly enhance the utility mission. Table 1 (UH-1 Standard Mission Configurations) displays the standard configurations for the UH-1Y in comparison to the UH-1N. As depicted, the UH-1N must choose to either carry ordnance or personnel but does not have the performance to carry both simultaneously. Conversely, the increase in performance of the UH-1Y can accommodate twice the number of troops in addition to a considerably larger ordnance payload. While the UH-1Y provides a tremendous advantage over the UH-1N it falls short of maximizing the

Table 1 UH 1 Standard Mission Configurations

capabilities of the airframe, namely its ability to carry troops in

	UH-1N	UH-1Y
Ordnance	(7) 2.75 inch rockets (300) rounds of .50 caliber ammunition (400) rounds of 7.62 ammunition	(14) 2.75 inch rockets (500) rounds of .50 caliber ammunition (500) rounds of 7.62 ammunition
Personnel	* or (4) combat loaded troops	*with (8) combat loaded troops

conjunction with an adequate conventional ordnance load-out. Currently, the Marine Corps will field the UH-1Y with the same Defensive Armament System (DAS) and unguided weapons capability of its predecessor. While these weapons have been utilized to the best of their ability, the prudence of continuing to employ unguided munitions designed to be defensive in nature in the current operational environment is questionable. Equipped with the same weapons capability employed on the Vietnam era UH-1E the versatility and increased capabilities afforded by the upgraded UH-1Y lack any complementary improvements to upgrade its weapons systems.

Defensive Armament System (DAS)

The DAS on the UH-1 is designed to carry both off-axis machine gun systems and forward firing rockets. (see figure 4, Defensive Armament System) The DAS was primarily designed to support the UH-1Ns weapons capability and subsequently carried forward to the UH-1Y. While the UH-1N did

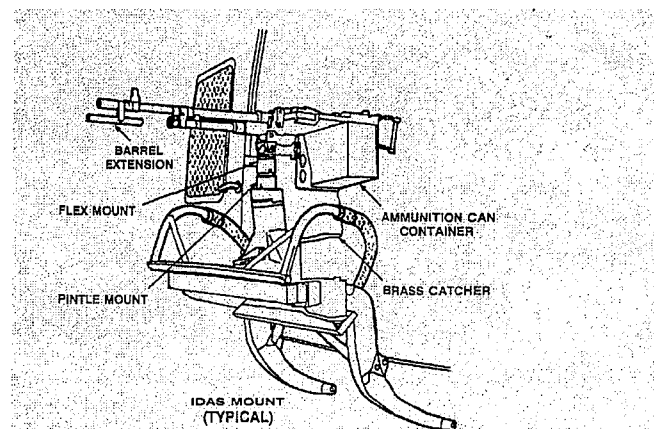


Figure 4, Defensive Armament System

not possess the ability to optimize the full compliment of the system, the potential capability of the UH-1Y far exceeds the weight restrictions imposed due to structural failure of the mounting attachments in a crash scenario. Currently, the weight capacity of the DAS is limited to 571 lbs, with 411lbs of the total weight able to rest on the top of the mount in a machine gun pintle. These structural limitations will severely restrict the total amount of ordnance and external fuel that could be carried by the UH-1Y, limiting its overall capabilities. The requirement to improve the DAS system and update the current weapon systems were identified numerous times during the development of the aircraft. Namely in the initial Concept of Employment (COE) published

by Marine Corps Combat Development Command in 2001, the UH-1Y Capabilities Procurement Document (CPD), in the weapons test firing and separation flight test evaluation of the UH-1Y helicopter report, and during the 2007 Assault Support Operational Advisory Group conference. (See Appendix D, Assault Support Operational Advisory Group, H-1 Top Ten Items) To date, any solutions proposed by Bell Helicopter to modify the aircraft and accommodate improvements to the DAS have been cost prohibitive. Bounded by a finite budget, current solutions increase the total cost of each aircraft which results in a reduction of aircraft purchased to mitigate the cost increase in addition to significantly delaying the introduction of the aircraft to the fleet Marine forces.

Implications for Future Requirements

The impact on future requirements associated with the current DAS weapon system will affect both its ability to carry ordnance and its flexibility in conducting long-range missions utilizing external fuel systems. Currently, aircrews must account for the limitations of the DAS by choosing weapon systems and payload based not on their effectiveness but by on their cumulative weight to remain within the imposed restrictions. This results in unnecessarily sacrificing either rate of fire, range, penetration capability or time on station. With the enhanced capability of the UH-1Y, the aircraft is capable of carrying its maximum number of eight troops in addition to a fully loaded DAS with ordnance and weapons within limitations and still have approximately 1,300 pounds of payload available for additional fuel or ordnance. Improvements in the weapon system capability of the UH-1Y could capitalize on this payload surplus increasing lethality and time on station.

Impact on Weapons Systems for the UH-1Y

The UH-1Y is scheduled to employ a new variant of the 2.75 Folding Fin Aerial Rockets (FFAR) referred to as the Advanced Precision Kill Weapon System (APKWS). This system incorporates a laser-guided seeker on each rocket to provide a precision fire capability. Scheduled for arrival in FY 10, this system will greatly enhance the weapons capability of the UH-1Y, however, the trade off is a heavier payload due to the addition of the laser-guided seeker. The current limitations of the DAS preclude the UH-1Y from being able to carry the full compliment of rockets within a LAU-61 rocket pod. Instead of holding its total capacity of nineteen 2.75-inch rockets, the restrictions of the DAS limit the total ordnance payload to no more than 13 or 14 rockets, depending on the warhead variant. With the heavier payload associated with the APKWS this will further restrict the total amount of ordnance carried by the UH-1Y reducing its lethality and collective ability to support the warfighter.

Impact on Extended Range Fuel Capability for the UH-1Y

When tasked to conduct longer-range missions the UH-1Y will utilize the same 77-gallon auxiliary fuel system employed on the AH-1W, which will be mounted on one of the two weapons stations of the DAS. Based on the average fuel consumption of the UH-1Y, this capability will provide approximately 30 to 40 minutes of additional flight time. However, due to the weight limitations of the DAS system, the capacity of the fuel tanks is limited to no greater than 66 gallons of fuel, provided the crew utilizes the M240 machine to reduce the total weight on the DAS. When refueling this system, the crew must completely de-fuel and subsequently re-fuel the fuel tank utilizing the fuel capacity indicator on the fueling vehicle to ensure adherence to the 66-gallon limitation. This results in a significant increase in man-hours for a resultant 20

minutes of additional flight time. In addition, it occupies one of the two existing weapons stations further limiting the over all capability of the aircraft.

SECTION FOUR: THE OPERATIONAL REQUIREMENT

Since the World War there has been a flood of literature dealing with the old principles illustrated and the new technique developed in that war: but there always have been and ever will be other wars of an altogether different kind, undertaken in very different theaters of operations and requiring entirely different methods from those of the World War. Such are the small wars...²⁵

FMFRP 12-15, Small Wars Manual

Defining the Changing Security Environment

Recent operations in Iraq and Afghanistan have brought to the fore those conflicts that do not fit in the traditional construct of state on state warfare and considerable attention has been generated to define them. Military intellectuals have utilize such terms as insurgencies and counterinsurgencies (COIN), wars amongst the people²⁶, irregular warfare²⁷, and the long war²⁸ to identify a change in the operational culture of warfare in the 21st century. While no one can predict with absolute certainty what the character of the next conflict may be, most agree that military organizations must be prepared to conduct a diverse set of operations. These operations range from humanitarian assistance, to nation building, participation in low intensity conflicts, in addition to full scale, conventional maneuver warfare collectively known as the “full spectrum” of operations. For the purpose of clarity, this paper will address the breadth of these operations based on two specific terms; that of traditional and irregular warfare.

Traditional warfare is characterized by state on state conflict where wars are fought with decisive results, utilizing conventional weapons to impose or influence political objectives upon another state actor. These wars are typically fought symmetrically between military forces where the local populace are typically bystanders or considered non-combatants.

Conversely, irregular warfare “is broadly used to refer to all types of unconventional methods of violence employed to counter the traditional capabilities of the military forces of a nation-state.”²⁹ Typical operations include insurgencies and counterinsurgencies, stabilization, security, transition, and reconstruction operations (SSTRO), among others. Irregular operations typically occur within urban sprawls, amongst the people, where the distinction between combatants and non-combatants is blurred and the threat is elusive.

Historically, operations in urban terrain have proved to be some of the most challenging among the scope of military operations. The inability to maneuver freely, canalizing terrain, the expanse of concealment within structures and communications limitations are a significant departure from the traditional forms of maneuver and present unique challenges. Often coupled with the simultaneous operations of nation building or humanitarian assistance intermingled amongst the local populace, the use of urban terrain provides non-state actors the benefit of effectively neutralizing the technological disadvantage they may face against superbly equipped conventional forces. These operations are now and will likely continue to be the preeminent challenge facing the Marine Corps.

The vulnerabilities associated with conducting heliborne operations in this environment are considerable. The need to conduct CASEVAC missions or CAS within the urban canyons, typically dangerously close to friendly forces, has necessitated the development of unique tactics and requirements in order to mitigate the threat. Currently, commanders exclude larger aircraft from conducting operations within these areas due to their increased vulnerability and difficulty in accessing the confined landing zones within the urban landscape. The mixed section, employment of the AH and UH-1s, has evolved because of the rear area security provided by the UH-1N to mitigate the threat and compensate for the lack of rear visibility in the AH-1. With the

increased risk of fratricide or collateral damage, the reliance on Precision Guided Munitions (PGMs) and modern weapons integration has become paramount. As the Marine Corps looks to operate predominately within this environment, the UH-1Y will play a significant role due to its smaller profile, ability to employ small teams in confined spaces, and if properly equipped, will provide the additional imbedded offensive capability to support the diverse mission requirements of this challenging environment with fewer assets.

Equipping the Force

Countering Irregular threats: A new Approach to Counterinsurgency....From a capability development perspective, however, these ideas are new in that they break the focus of combined arms maneuver of mechanized forces that has predominated since the Vietnam War. This conventional focus often assumed that forces designed, trained and equipped for major combat operations against a peer competitor would be equally adept at operations to counter insurgents, guerilla forces, and other irregular threats. Recent experience has revealed the fallacy of such assumptions.³⁰

FMFM 5-1, Organization and Function of Marine Aviation, 1991

The success of helicopter aviation in Vietnam provided the foundation of current Marine Corps helicopter doctrine, and employment, providing the genesis of the operational force structure as we know it today. From 1963 to 1967 the Marine Corps acquired the UH-1 Utility helicopter, the AH-1 Attack helicopter, the CH-46 Medium lift helicopter and the CH-53 Heavy lift helicopter, each of which remains in service today in one form or another. Currently the Marine Corps is in the process of replacing each of these aircraft and validating the existing roles of each platform in support of emergent requirements. In doing so the challenge lies in whether to continue to equip in support of conventional requirements or in support of emerging concepts, particularly those of irregular warfare.

Traditionally, military leaders base their decisions on established doctrine from which armed forces are primarily organized, trained, and equipped. Based largely on historical

reference and the operational theory of future or emergent requirements, doctrine is the guiding vision that shapes these decisions.³¹ Often the decision is a function not only of established doctrine but also in gaining the technological advantage as expressed by General Sir Rupert Smith:

The process is founded upon the logic of industrial war: that there must be an identifiable threat, in terms of an enemy and his weapons, which must be matched by weaponry operated and organized in such a way to defeat it. The key is to gain the technological advantage over the threat.³²

This highlights the overarching concept of the cold war approach in which Nations equip their forces to achieve a quantifiable advantage in numbers and technology to act as a deterrent against competing nation states. While this serves its purpose in conventional warfare practices, it provides little applicability within irregular operational concepts. By virtue of the specific mission requirements associated with conventional operations, the process results in equipment specialization. As such, when equipment is specialized to support a particular mission task, it provides little utility in tasks other than that for which it was originally designed.³³

A key example lies in the concept of the MV-22 Osprey. The Marine Corps developed the aircraft to support the concept of Operational Maneuver from the Sea (OMFTS), providing a significant advantage in an over the horizon capability. Currently, the MV-22 is deployed to Iraq where there is no significant advantage in the extended range provided by its unique capability and the aircraft is challenged to fulfill the mission requirement of its predecessor, the CH-46 in an irregular warfare scenario. Another by-product of this quest for technology is the divergence the Marine Corps is currently facing within its force structure. Considerable time and effort went into the procurement of the MV-22 and due to budgetary constraints its complementary platforms have yet to be developed. Therefore, the exceptional capability provided by the MV-22 is unique to itself and lacks a complementary force structure to provide mutual support.

As the Marine Corps diverges from conducting conventional type operations, the question of whether we continue to utilize systems that were designed for another purpose or develop capabilities to support emergent requirements becomes increasingly important. The solution is that we must prepare and equip for both. For the foreseeable future, the ability for the United States to maintain its status as a superpower and equip its force structure as a deterrent remains a requirement. However, the need to adapt existing capabilities to support irregular operations has become equally important. Similar to the experience in Vietnam the optimum solution for augmenting the heliborne force lies in utilizing an existing capability that is fiscally responsible and fills this operational capability gap through a versatile multi-role platform in the UH-1Y.

SECTION FIVE: THE TRANSFORMATION EFFECT

The purpose of transformation is to extend key advantages and reduce vulnerabilities. We are now in a long-term struggle against persistent, adaptive adversaries, and must transform to prevail.³⁴

National Defense Strategy, 2005

The Neck Down Strategy; the Heart of the Issue

In the mid 1980's the Marine Corps began to revise its aviation strategy and in an attempt to reduce cost and manpower requirements the Marine Helicopter Light (HML) and the Marine Helicopter Attack Squadrons(HMA) equipped with UH-1Ns and AH-1Ts, respectively, were combined to form the common HMLA. Concurrently, the Marine Corps Aviation Master Plan began to focus on a "long range" strategy for the future of rotary-wing aviation. In an attempt to "neck down" the number of aging aircraft a new plan, titled VMAO (Marine Attack Observation), envisioned the missions of the HMLA and the OV-10 merging into a single platform, possibly of tilt-rotor design, to be implemented in the 2010 timeframe.³⁵ Due to budgetary constraints the program, though meant to be complementary, came into direct

competition with a higher priority requirement to replace the aging CH-46 assault support helicopter with the MV-22 Osprey.

By the early 1990's, the MV-22 program had been cancelled (temporarily) while the VMAO concept lacked any credible direction due to the uncertainty of the Osprey and budgetary constraints. The AH-1 was in the process of upgrading from the "T" to the "W" model, which completely upgraded the engines, rotor blades, and drive train. The UH-1N, now twenty years from its last significant upgrade, was still in need of an upgrade. The concept of a Mid Life Upgrade (MLU) program was proposed in an attempt to provide some relief for the UH-1N, but the program never gained ground due to minimal operational benefits and further dissimilarity from the upgraded AH-1Ws. Subsequently a comprehensive plan promised to solve the HMLA dilemma by concurrently upgrading both the AH and UH aircraft in order to restore the commonality of HMLA. Titled the 4BN/4BW (also referred to as the H-1 upgrades) program, it outlined a plan to upgrade the two airframes with sufficient capability to keep them in service through the year 2020. "The new proposal would restore commonality between the two airframes using common rotor blades, engines, and drive trains."³⁶ The H-1 upgrades program was developed as a capability bridge to support the existing Neck-Down strategy of the Marine Corps Aviation Master Plan until the Joint Replacement Aircraft (JRA, Joint program developed to support the evolution of heliborne forces within the DOD which incorporated the requirements previously referred to as the VMAO concept)³⁷ arrived in 2020. The 4BN/4BW (later labeled the UH-1Y/AH-1Z) contract was awarded in late 1996 anticipating fleet introduction in 2002-2004 timeframe.

Currently the H-1upgrades program has revised its delivery dates due to cost and schedule overruns. The programmed delivery for the UH-1Y is scheduled for the 2008-2014

timeframe and 2011-2019 for the AH-1Z. Additionally, based on current projections and the lack of any budgetary appropriations, the JRA program has been delayed indefinitely. If the need arose and appropriations were committed during this FY budget cycle (FY 11), based on the cost and complexity of this requirement, the earliest this aircraft could be in service would be no sooner than FY 2025-2030.³⁸ Therefore, the AH-1Z and UH-1Y will be in service until at least 2030 and beyond. The complications associated with the UH-1Y/AH-1Z programs coupled with the delay of the JRA program have resulted in significant challenges in the evolution of the aviation force structure. Based on the protracted nature of these programs and that of the MV-22 Osprey, the Marine Corps must rely on the capabilities of the current aircraft inventory for a considerable amount of time. As a result, the Marine Corps must acquire the capabilities needed to meet emergent operational requirements through adapting current assets vice engaging in another budgetary conflict.

The Evolving Force Structure

As careful stewards of our Nation's resources, we must decide the most effective way to modernize the Total Force. We must make tough decisions: whether to replace aging equipment with similar platforms or to procure next generation capabilities.³⁹

General James T. Conway

Within the next ten years not only will the UH-1N and AH-1W transition to the UH-1Y and AH-1Z, respectively, the CH-53E will transition to the CH-53K, and the CH-46 and the CH-53D will continue to transition to the MV-22 Osprey. These transitions will produce significant challenges and equipment shortfalls in the midst of current mission requirements. The transitions will also broaden the existing capability gaps and increase the operational tempo of fleet Marine units as identified in the 2007 aviation campaign plan.

Over the next several years, Marine Aviation will transition from 13 to 7 type/model/series aircraft, with a peak of 18 type/model/series. These are manpower and training intensive transitions that temporarily take units out of the operating force.

2007 Aviation Campaign Plan.

Of specific concern is the transition from the AH-1W to the AH-1Z. Currently there are not enough AH-1s in the inventory to support 202K (the current Marine Corps Objective to “grow the force” to 202,000 Marines) requirements. The current strategy to “right-size” the force as outlined in the 2007 Aviation Campaign Plan will activate three new active duty HMLAs while de-activating one reserve component HMLA over the course of the next 5 years.⁴⁰ (see appendix E, Marine Light Attack Helicopter Plan) To accomplish these initiatives the current aircraft allocation plan will distribute AH-1’s to an increased number of operational squadrons temporarily reducing the total number of AH-1s in each squadron until the appropriate number of AH-1Z’s are produced. To complicate matters there will be a requirement to “turn in” AH-1W aircraft to support the re-manufacturing process to AH-1Zs vice building entirely new airframes. The resultant AH-1 shortfall is referred to as “the bathtub,” which is the graphic depiction of the aircraft inventory shortfalls in relation to the required number of aircraft within each fiscal year. (See Appendix F. 202K AH-1 Aircraft Inventories (Transition to Zulu Build New). The “bathtub” highlights an eight-year deficit beginning in FY08 where the Primary Aircraft Assigned (PAA) will fall below the standard Table of Equipment (T/E) of eighteen aircraft. Beginning in FY 09 those numbers will drop as low as twelve aircraft per squadron and remain below thirteen until FY12. The HMLA’s will not possess their full compliment of eighteen Attack Helicopters until FY 16. This will result in a peak shortage in PAA of sixty-one AH-1Ws in FY 11, producing a significant shortfall in attack/escort capability.

Historically, the Marine Corps has mitigated these operational shortfalls by the augmentation of the Huey. However, based on the limitations associated with the DAS weapons

system the UH-1Y does not possess any enhanced weapons capability or Precision Guided Munitions (PGMs) that are the current operational standard of employment within an urban environment. This lack of attack helicopter capability will present a significant capability shortfall for the near future, amidst one of the most challenging times in Marine Corps History. The current operational tempo associated with the “long war” and the protracted conflicts of Iraq and Afghanistan will exponentially increase the effects of this shortfall in future operations.

Ironically, the most viable suitable solution to compensate for this shortfall was the genesis of the Attack helicopter mission requirement more than 40 years ago. Currently the capability and availability of the UH-1Y (see appendix G, UH-1 Aircraft Inventories (Yankee Build New)) can support an initiative to “arm the Hueys.” The introduction of a Commercial off the Shelf (COTS) advanced modular weapon system would provide a timely and affordable solution to meet the operational requirements associated with the AH-1W “bathtub” effect and capitalize on the increase in performance capabilities of the UH-1Y.

SECTION SIX: CHANGING THE PARADIGM: THE MULTI-ROLE SOLUTION OF THE 21st CENTURY

The Marine Corps, as the nation’s force in readiness, must have the versatility and flexibility to deal with a situation at any intensity across the entire spectrum of conflict.⁴¹

MCDP-1, Warfighting

The Multi-Role Mission

The distinction between a multi-role helicopter and the utility helicopter may appear to be a matter of semantics. However, it is important in two critical areas, each of which has proved to be a challenge for the UH-1. The first is that of developing the requirements to effectively equip the aircraft. By definition, a multi-role platform is one that can perform two or more missions equally as well. Utility, by definition, is simply useful. The UH-1 has been an extremely useful

platform for more than 40 years. However, developing a capability requirement for a useful helicopter would rarely achieve optimal results. Developing the requirements for a helicopter that is tasked to perform multiple missions equally well (i.e., Assault Support and CAS) would achieve significantly differing results. The second critical area is the paradigm associated with the operational mindset of utility helicopter employment. The predisposition toward appropriate UH-1 tasking and its associated mission capabilities have influenced the development of the Huey for many years. In fact, it was at the heart of the debate as to whether the UH-1 should be armed, despite the operational necessity more than 40 years ago. Currently, the capability enhancements provided by the UH-1Y sufficiently restore the performance necessary to accomplish the utility mission that was neglected for many years. However, to achieve a true multi-role capability the paradigm associated with the utility helicopter must change and the UH-1Y must be equipped with a modular armament weapons capability sufficient to meet the operational requirements and capability shortfalls outlined in this text.

Developing an Advanced Modular Weapons System

Ideally our equipment or materiel will be simple, easy to maintain, capable of withstanding the rigors of a long campaign, and adaptable to the unique requirements of various missions and operating environments.⁴²

Marine Corps Operating Concepts for a Changing Security Environment, 2007

The principles associated with the multi-role concept form the basis of the requirements associated with the development of a modular armament system. The design would incorporate a

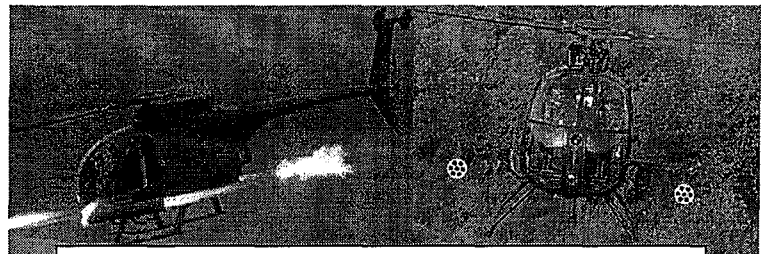


Figure 5, Plank System (Contract Fabrication)

modular capability to support mission specific situations while still maintaining the utility of the aircraft. Based on a plank system concept (See Figure 5, Plank System (Contract Fabrication))

similar to the one shown here, it would utilize a support structure that traversed the cabin of the aircraft, capable of four universal hard points (weapons stations). This would alleviate the requirement to mount the system on external points of the aircraft and facilitate a more robust payload. In addition, the system would incorporate two pintle mounts (one on each side of the aircraft) that would be utilized for crew served weapons in the same manner they are currently employed. The central strength of this concept would be its modularity and mission flexibility since it would be capable of configuring for specific mission sets by detaching weapons stations as required. (see Figure 6, Modular Armament System (Dillon Aero Concept)).⁴³

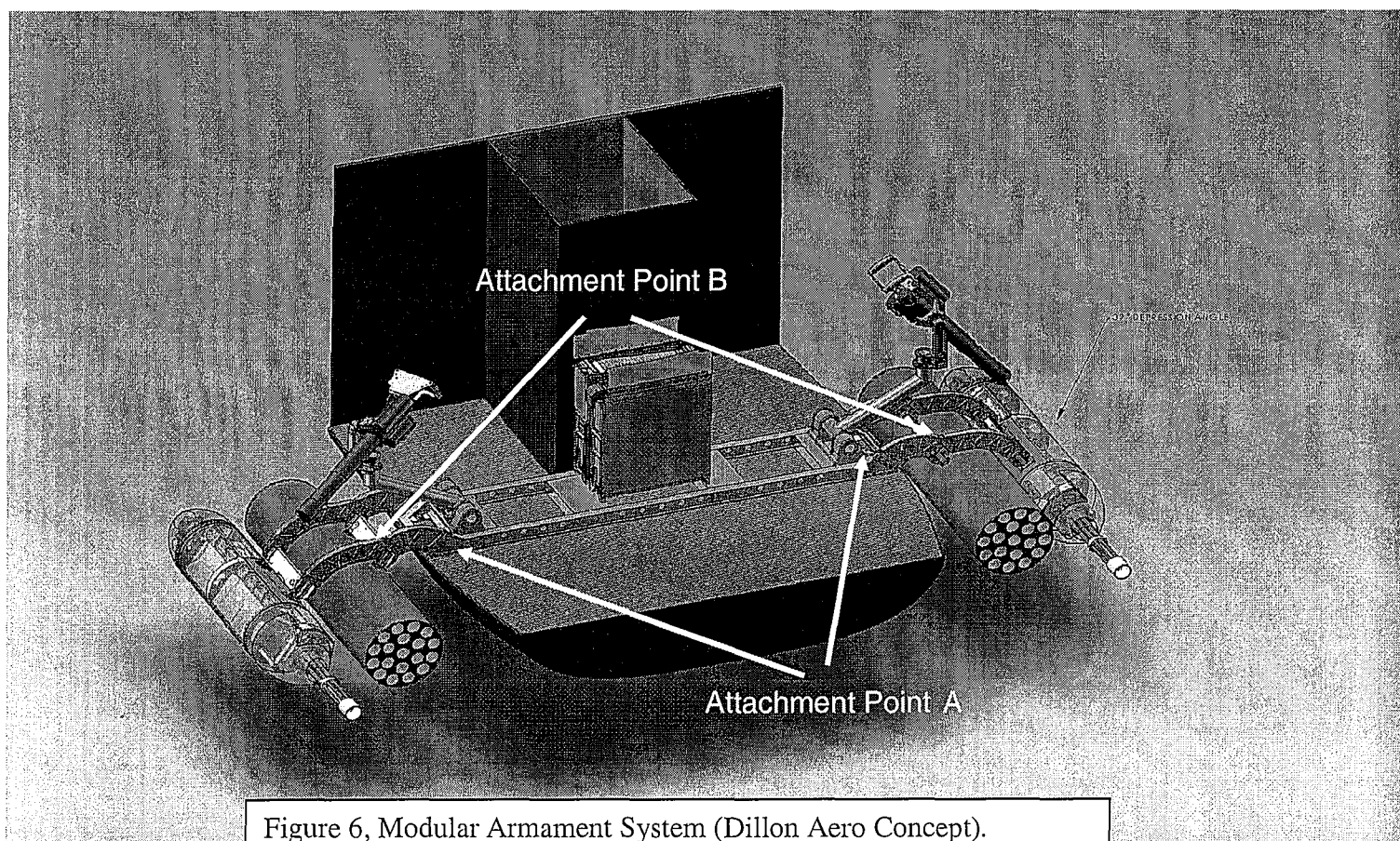


Figure 6, Modular Armament System (Dillon Aero Concept).

Referring to the figure, the system can be adapted to suit particular mission requirements by attaching or detaching weapons stations at attachment points A and B. For example, when conducting an Assault Support mission, attachment points A and B would be detached and the

aircraft would carry only the door guns for defensive purposes. Adding two additional weapons stations at attachment point A would facilitate the use of external fuel tanks, for a longer-range mission, a LAU-61 rocket pod as depicted or integrate a fixed forward machine gun for a more offensive capability depending on the mission requirements. For the more complex missions, crews could utilize attachment points B and the system would possess all four hard points to provide multiple combinations of fixed forward machine guns, rocket pods, or external fuel systems to meet a diverse set of mission specific requirements and extended range operations. Within each of these configurations, the aircraft would maintain its defensive capability with the 360-degree suppression provided by the crew served door guns. However, if required the unique capability of this system can be adapted to support humanitarian operations or other operations involving diplomatic sensitivities, where the crew could remove the entire system to facilitate a greater payload and minimize its offensive posture.

Based on current operational concepts the system depicted could significantly expand the capabilities of the UH-1Y. Depending on mission requirements, this system could increase the auxiliary fuel capacity to beyond three hours of flight time, double the conventional load-out of 2.75-inch rockets, and provide an expansive capability to incorporate a multitude of future weapons systems upgrades. The addition of an appropriate weapons data bus or universal weapons mounting points could increase the ability to deliver guided munitions and significantly increase lethality while reducing the risks associated with urban operations. In addition to affording an increased capability the MAS provides a potentially off-the-shelf solution that would provide a timely and fiscally responsible solution similar to the experience of the UH-1E in Vietnam.

Scalable Options

A significant benefit of a modular armament system employed on the UH-1Y is that it would significantly enhance the concepts of Distributed Operations, Marine Expeditionary Unit (MEU's) missions, Crisis Response, Security Cooperation and other Special Purpose MAGTF's. This system would provide the flexibility to change the aircraft from an unarmed platform in humanitarian operations, to an offensive weapon system capable of suppressing large scale riots or other low intensity conflict contingencies. This modularity would significantly increase the capabilities associated with each of these operations and provide an unprecedented level of agility and adaptability to supported commanders while providing an economy of force with an aircraft that can perform multiple missions per sortie. This capability could result in a reduced operational tempo and a smaller T/M/S footprint within certain operational scenarios.

The Modern HMLA

The introduction of the UH-1Y has reduced the performance discrepancies that previously existed between the UH and AH-1 helicopters. Possessing similar flight performance characteristics, residing in the same squadron, and performing the preponderance of its missions similarly, the intangible benefits of the modern HMLA have great potential. Provided the UH-1Y acquires an improved modular armament system that facilitates a guided weapons capability, the UH-1Y could potentially dominate the low intensity spectrum of operations. Coupled with the AH-1 the employment considerations associated with the HMLA will increase exponentially. Utilizing the mixed light division concept (three aircraft in a flight), often employed within the squadrons, will afford a multitude of options spanning the spectrum of mission tasking. For example, using three UH-1Ys, the flight would have the capability to insert 24 Marines while still carrying enough ordnance to provide imbedded, on station CAS after the insert capable of

addressing a wide array of threats. Employing a single UH-1Y and two AH-1s the flight could be tasked as a Tactical Recovery of Aircraft and Personnel (TRAP) force, as a long-range small team insert/extract force or a multitude of other options. Within each mission set, the HMLA will possess the imbedded capability to accomplish the full spectrum of operations and provide commanders with an adaptive, scalable solution to meet the challenges of a changing security environment.

Conclusion

The success of the Marine Corps lies in its utility as a scalable, general-purpose force. Central to this strength is the comprehensive MAGTF concept that provides an autonomous capability to meet the unique challenges or mission requirements associated with the “full spectrum” of operations. As the nation’s smallest military force, the Marine Corps is routinely challenged with equipping its force structure within budgetary constraints. The Marine Corps must therefore make prudent decisions in transitioning its force structure to meet the challenges of the 21st century.

The insights derived from the procurement of the MV-22 and the now defunct JRA program to acquire “leap ahead” technology have painted the Marine Corps aviation force structure into the proverbial “box.” While these platforms provide a significant increase in capability, the specialization of these aircraft is at odds with the fundamental strengths of the MAGTF concept. As a general-purpose force, the challenge of developing an aviation force structure to meet the diverse requirements associated with Marine Corps operational tasking is significant and involves a certain degree of specialization to support traditional warfare concepts. However, with the emergence of the changing security environment and a shift in the operational mindset of irregular warfare equal attention must be given to equipping the force to support these

“other” operations. This paper does not propose that the Marine Corps purchase a fleet of UH-1Y’s equipped with a modular armament system to solve the problems associated with aviation support in a changing security environment and the long war, but that it must address the problem through a balanced approach.

Understanding the limitations associated with the evolution of the current force structure and the impact aircraft specialization has on the ability to support the warfighter across the “full spectrum” of operations, if properly equipped, the UH-1Y provides a scalable and versatile platform capable augmenting the current force structure to meet these challenges. To date the utility mission has provided support based on “performing missions within the capabilities of the aircraft,” and in doing so lacks any dedicated requirement for equipping the aircraft. A change must occur not simply in the employment considerations of the aircraft as a multi-role platform but in the means by which the aircraft is equipped. A change in the operational mindset to codify the operational requirements associated with a multi-role platform capable of equally performing CAS and assault support within the context of the changing security environment will produce a definitive requirement in appropriately equipping the aircraft. Similar to the experience of the UH-1E in Vietnam the solution afforded by equipping the UH-1Y with a modular armament system will provide a timely and fiscally responsible alternative that will greatly enhance the capabilities of the UH-1Y and afford the versatility necessary to meet the challenges outlined within this text.

HMM

Draft Core METL

MCT 1.3.3.3.1	Conduct Aviation Operations From Expeditionary Sea-Based Sites
MCT 1.3.3.3.2	Conduct Aviation Operations From Expeditionary Shore-Based Sites
MCT 1.3.4.1	Conduct Combat Assault Transport
MCT 4.3.4	Conduct Air Delivery
MCT 6.2.1.1	Conduct Aviation Support of Tactical Recovery of Aircraft and Personnel (TRAP)
MCT 6.2.2	Conduct Air Evacuation

Core Plus

MCT 1.3.4.1.1	Conduct Airborne Rapid Insertion/Extraction
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VMM

Draft Core METL

MCT 1.3.3.3.1	Conduct Aviation Operations From Expeditionary Sea-Based Sites
MCT 1.3.3.3.2	Conduct Aviation Operations From Expeditionary Shore-Based Sites
MCT 1.3.4.1	Conduct Combat Assault Transport
MCT 4.3.4	Conduct Air Delivery
MCT 6.2.1.1	Conduct Aviation Support of Tactical Recovery of Aircraft and Personnel (TRAP)
MCT 6.2.2	Conduct Air Evacuation

Core Plus

MCT 1.3.4.1.1	Conduct Airborne Rapid Insertion/Extraction operations
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HMH (CH-53E)

Draft Core METL

MCT 1.3.3.3.2	Conduct Aviation Operations From Expeditionary Shore-Based Sites
MCT 1.3.4.1	Conduct Combat Assault Transport
MCT 4.3.4	Conduct Air Delivery
MCT 6.2.1.1	Conduct Aviation Support of Tactical Recovery of Aircraft and Personnel (TRAP)
MCT 6.2.2	Conduct Air Evacuation

Core Plus

MCT 1.3.3.3.1	Conduct Aviation Operations From Expeditionary Sea-Based Sites
MCT 1.3.4.1.1	Conduct Airborne Rapid Insertion/Extraction
MCT 1.3.4.2.1	Provide Aviation-Delivered Ground Refueling

HMH (CH-53D)

Draft Core METL

MCT 1.3.3.3.2	Conduct Aviation Operations From Expeditionary Shore-Based Sites
MCT 1.3.4.1	Conduct Combat Assault Transport
MCT 4.3.4	Conduct Air Delivery
MCT 6.2.1.1	Conduct Aviation Support of Tactical Recovery of Aircraft and Personnel (TRAP)
MCT 6.2.2	Conduct Air Evacuation

Core Plus

- MCT 1.3.3.3.1 Conduct Aviation Operations From Expeditionary Sea-Based Sites
- MCT 1.3.4.1.1 Conduct Airborne Rapid Insertion/Extraction
- MCT 1.3.4.2.1 Provide Aviation-Delivered Ground Refueling

HML/A

Draft Core METL

- MCT 1.3.3.3.1 Conduct Aviation Operations From Expeditionary Sea-Based Sites
- MCT 1.3.3.3.2 Conduct Aviation Operations From Expeditionary Shore-Based Sites
- MCT 1.3.4.1 Conduct Combat Assault Transport
- MCT 3.2.3.1.1 Conduct Close Air Support (CAS)
- MCT 3.2.3.1.2.1 Conduct Air Interdiction
- MCT 3.2.3.1.2.2 Conduct Armed Reconnaissance
- MCT 3.2.3.1.2.3 Conduct Strike Coordination and Reconnaissance (SCAR)
- MCT 3.2.5.4 Conduct Forward Air Control (Airborne) [FAC(A)]
- MCT 4.3.4 Conduct Air Delivery
- MCT 5.3.2.11 Provide an Airborne Command and Control Platform for Command Elements
- MCT 6.2.1.1 Conduct Aviation Support of Tactical Recovery of Aircraft and Personnel (TRAP)
- MCT 6.1.1.11 Conduct Aerial Escort
- MCT 6.2.2 Conduct Air Evacuation

Core Plus

- MCT 1.3.4.1.1 Conduct Airborne Rapid Insertion/Extraction
- MCT 3.2.3.2 Conduct Offensive Anti-air Warfare (OAAW)
- MCT 5.3.2.7.3 Conduct Tactical Air Coordination (Airborne) [TAC(A)]
- MCT 6.1.1.8 Conduct Active Air Defense

Unique AH-1 METs

- MCT 3.2.3.1.2.1 Conduct Air Interdiction

Core Plus

- MCT 3.2.3.2 Conduct Offensive Anti-air Warfare (OAAW)

Unique UH-1 METs

- MCT 1.3.4.1 Conduct Combat Assault Transport
- 4.3.4 Conduct Air Delivery
- MCT 5.3.2.11 Provide an Airborne Command and Control Platform for Command Elements
- MCT 6.2.2 Conduct Air Evacuation
- Core Plus**
- MCT 1.3.4.1.1 Conduct Airborne Rapid Insertion/Extraction
- MCT 5.3.2.7.3 Conduct Tactical Air Coordination (Airborne) [TAC(A)]

USMC UH-1 MISSION TASKING 1966-2008

	1966 VMO (UH-1E)	1970 HML(UH-1E)	1973 HML (UH-1N)	1979 HML (UH-1N)	1991 HMLA (UH-1N)	2003 HMLA (UH-1N)	2008 HMLA (UH-1Y)
Squadron Mission	The mission of the VMO is to provide air support for the Fleet Marine Force by conducting visual aerial reconnaissance and observation tasks and such other air operations as may be directed.	The primary mission of the HML is to provide utility combat helicopter support to the landing force.	Provide utility combat helicopter support to the landing force in the ship-to-shore movement and in subsequent operations ashore.	The Mission of the HML is to provide utility combat helicopter support to the landing force in the ship-to-shore movement and in subsequent operations ashore.	Provide combat utility helicopter support, attack helicopter fire support and fire support coordination, during amphibious operations and subsequent operations ashore.	Support the MAGTF Commander by providing offensive air support, utility support, armed escort and airborne supporting arms coordination, day or night under all weather conditions during expeditionary, joint or combined operations.	Support the MAGTF Commander by providing offensive air support, utility support, armed escort and airborne supporting arms coordination, day or night under all weather conditions during expeditionary, joint or combined operations.
Mission Tasks	<ol style="list-style-type: none"> 1) Conduct aerial reconnaissance and observation operations in support of ground units to include flight operation to provide ground commanders and staff officers with the means to accomplish personal flights for observation purposes. 2) Provide aircraft support for radiological reconnaissance. 3) Provide aircraft support for tactical air observation and for artillery and naval gunfire spotting. 4) Conduct emergency aerial supply and resupply. 5) Assist in local search and rescue operations within the capabilities of the assigned aircraft. 6) Provide airborne command and control of tactical air support operations when required. 7) Provide aircraft for liaison and courier service. 8) Provide aircraft to conduct frontline, low level aerial photography. 9) Provide frontline casualty evacuation. 10) Conduct aerial spraying of insecticides. 11) Conduct aerial wire laying. 	<ol style="list-style-type: none"> 1) Conduct medical evacuation operations. 2) Augment local search and rescue operations. 3) Provide aircraft for radiological operations. 4) Conduct airborne command and control operations. 5) Provide liaison and courier services. 6) Conduct aerial wire laying and dispensing of chemical agents. 7) Conduct other missions as may be required within capabilities. 	<ol style="list-style-type: none"> 1) Conduct airborne command and control operations. 2) Conduct casualty evacuation operations. 3) Provide liaison and courier services. 4) Augment local search and rescue facilities. 5) Conduct aerial wire laying and dispensing of chemical agents. 6) Conduct airborne radiological reconnaissance survey. 7) Conduct other such operations as may be required within capabilities. 	<ol style="list-style-type: none"> 1) Conduct emergency aerial supply and resupply. 2) Conduct frontline casualty evacuation. 3) Conduct airborne command and control operations of tactical air support operations as required for command and control. 3) Conduct liaison and courier services. 4) Augment local search and rescue facilities within the capabilities of the assigned aircraft. 5) Conduct aerial spraying of insecticides. 6) Conduct aerial wire laying. 7) Provide second echelon maintenance for organic motor transport equipment. 	<ol style="list-style-type: none"> 1) Provide an airborne command and control platform for command elements. 2) Provide armed escort for assault support operations. 3) Provide combat assault transport of troops, supplies and equipment. 4) Provide airborne control and coordination for assault support operations. 5) Augment local search and rescue assets and provide aeromedical evacuation of casualties from the field to suitable medical facilities or other aeromedical aircraft. 6) Conduct combat assault and assault support for evacuation operations and other maritime special operations. 7) Control, coordinate and provide terminal guidance for supporting arms to include CAS, artillery, mortars, and naval gunfire. 8) Provide fire support and security for forward and rear area forces. 9) Maintain a self defense capability from ground-to-air and air-to-air threats. 	<ol style="list-style-type: none"> 1) Conduct air assault operations and air assault. 2) Conduct amphibious assault and raid operations. 3) Conduct fire support. 4) Conduct Close air support 5) Conduct interdiction operations 6) Conduct Air-to-Air operations. 7) Conduct battlespace maneuver and integrate with firepower. 8) Conduct Joint personnel recovery. 9) Conduct rear area security. 10) Conduct non-combatant operations. 	<ol style="list-style-type: none"> 1) Provided assault support transport of combat troops. 2) Provide support for casualty evacuation operations. 3) Provide armed escort for assault helicopters and tilt rotor aircraft. 4) Conduct assault support for maritime special operations. 5) Provide armed escort for airborne and surface forces. 6) Provide fire support for forward and rear area forces against point and area targets. 7) Conduct Close Air Support. 8) Conduct armed reconnaissance. 9) Maintain self-defense capability from air-to-air threats. 10) Provide control, coordination, target acquisition, and terminal guidance for supporting arms. 11) Provide airborne command, control and coordination for assault support operations. 12) Conduct multi-sensor imagery, visual reconnaissance, and provide Battle Damage Assessment(BDA). 13) Conduct Tactical Recovery of Aircraft and Personnel (TRAP) operations. 14) Augment local Search and Rescue (SAR) assets. 15) Provide fire support and security for rear area forces. 16) Provide Fire Support and escort for evacuation operations. 17) Provide support for evacuation operations.

H-1 Missions & Performance Specifications

<p>AH-1W Mission Description:</p> <ul style="list-style-type: none"> - Ground Force Fire Support - Transport Helo Escort - Convoy Escort - Anti-Armor Ops - Visual and Armed Recce - TRAP - Night and Adverse Wx Ops - Control of Supporting Arms - Anti-Air Ops 	<p style="text-align: center;">AH-1W Spec's</p> <p>Max Gross Wt. 14750 lbs Max Internal Fuel 2100 lbs HOGE, SL/Hot 3986 lbs Cruise (3K ft/Hot/KTAS) 131 Mission R w/ attk payload 58 NM Maneuverability +.5 to +2.4 g</p>	<p>UH-1N Mission Description:</p> <ul style="list-style-type: none"> - Command and Control - Combat Assault Support - Convoy Escort - Control of Supporting Arms - Special Ops Support - Reconnaissance - CASEVAC - SAR augment - TRAP 	<p style="text-align: center;">UH-1N Spec's</p> <p>Max Gross Wt. 10500 lbs Max Internal Fuel 1360 lbs HOGE, SL/Hot 3532 lbs Cruise (3K ft/Hot/KTAS) 107 Mission R w/ payload* 63 NM Maneuverability +.5 to +2.27 g *4 fully loaded combat troops</p>
<p>AH-1Z Mission Description:</p> <ul style="list-style-type: none"> - Close Air Support - Armed Escort - Armed Recce - Anti-Armor Ops - Control of Supporting Arms - Anti-Air Ops 	<p style="text-align: center;">AH-1Z Spec's</p> <p>Max Gross Wt. 18,500 lbs Max Internal Fuel 2768 lbs HOGE, SL/Hot 5558 lbs Cruise (3K ft/Hot/KTAS) 138 Mission R w/ attk payload* 139 NM Maneuverability -0.5 to +2.8 g *8 x HF, 14 x 2.75" HE rockets, 650 rds, 30 min TOS, 20 min fuel rsv.</p> <p style="text-align: center;">Survivability enhancements Airframe Ballistic Hardening Turned Exhaust (IR Suppression) Nitrogen Inerting (Fuel System)</p>	<p>UH-1Y Mission Description:</p> <ul style="list-style-type: none"> - Command and Control - Armed Escort - Armed Recce - Control of Supporting Arms - Special Ops Support - CASEVAC - SAR augment 	<p style="text-align: center;">UH-1Y Spec's</p> <p>Max Gross Wt. 18500 lbs Max Internal Fuel 2584 lbs HOGE, SL/Hot 5930 lbs Cruise (3K ft/Hot/KTAS) 153 Mission R w/ payload* 129 NM Maneuverability -0.5 to +2.8 g *8 combat loaded troops, GAU-16 w/ 500 rds, M240 w/ 500 rds, 5 min mid-mission HOGE, 10 min TOS, 20 min fuel rsv.</p> <p style="text-align: center;">Survivability enhancements Airframe Ballistic Hardening Turned Exhaust (IR Suppression) Nitrogen Inerting (Fuel System)</p>

2007 Assault Support Operational Advisory Group H-1 Top Ten Items

ASOAG, May 2007

OAG Top Nine (AH-1Z)	OAG Top Ten (AH-1W)	OAG Top Ten (UH-1Y)	OAG Top Ten (UH-1N)
<ol style="list-style-type: none"> 1) Continue programmed FRP of full mission capable AH-1Z, fund "Build New" initiative, accelerate production rate beyond current POR IOT support 50% increase in AC HMLAs. 2) Procure and field advanced integrated avionics and digital / real-time uplink/downlink systems to enhance situational awareness, joint connectivity and interoperability. 3) Procure and field enhanced ASE to defeat current & emerging IR and RF threats. 4) Fund, develop, and accelerate fielding of Advanced Weapons to include PGMs, enhanced rockets, and associated systems. 5) Ensure funding for AH-1Z OFP development. Ensure that PRL/PRE is fully funded to provide effective life cycle support. 6) Ensure the fidelity and functionality of simulators and part task trainers match fleet aircraft characteristics in all aspects and meets T&R requirements. 7) Ensure ordnance availability O/H IOT meet NCEA levels and T&R requirements. 8) Establish Technical pub validation and verification site and resources. 9) Continue to pursue ballistically tolerant cockpit protection. 	<ol style="list-style-type: none"> 1) Ensure programmed FRP of full mission capable AH-1Z, fund "Build New" initiative, and accelerate production rate beyond current POR. 2) Correct Night Targeting System sensor deficiencies as soon as possible. 3) Procure and field advanced integrated avionics and digital / real-time uplink/downlink systems to enhance situational awareness, joint connectivity and interoperability. 4) Procure & field enhanced ASE for AH-1 (Radar Warning System, Missile Warning System, Laser Detection System, IR Suppressors, Jammers, Active IR Countermeasures (IRCM)) suite to defeat current & emerging IR / RF threats. 5) Ensure ordnance availability O/H IOT meet NCEA levels and T&R requirements. 6) Procure and field next generation, WFOV NVGs at earliest opportunity. 7) Fund, develop, and accelerate fielding of Advanced Weapons to include PGMs, enhanced rockets, and associated systems. 8) Improve accuracy, reliability and maintainability of 20mm weapon system. 9) Ensure life cycle funding to correct logistics and software/OFP deficiencies. 10) Ensure the fidelity and functionality of simulators and part task trainers match fleet aircraft characteristics in all aspects and meets T&R requirements. 	<ol style="list-style-type: none"> 1) Continue to fund UH-1Y to meet PAA requirements and accelerate full rate production quantities beyond current POR IOT support 50% increase in AC HMLAs. 2) Procure and field advanced integrated avionics and digital / real-time uplink/downlink systems to enhance situational awareness, joint connectivity and interoperability and provide an assault support common airborne command and control platform for command elements. 3) Procure and field enhanced ASE to defeat current and emerging threats. 4) Procure and field sensor upgrades that support the HML/A mission/task list. 5) Procure and field advanced weapons, associated systems and the integrated capability to employ them IOT support HMLA METLs. 6) Ensure funding for UH-1Y operational flight program (OFP) development. Ensure that PRL/PRE is fully funded to provide effective life cycle support. 7) Ensure the fidelity and functionality of simulators and part task trainers match fleet aircraft characteristics in all aspects and meets T&R requirements. 8) Procure and field a crash-worthy hot-refuel capable auxiliary fuel system. 9) Increase the external stores weight capacity w/o delaying UH-1Y production. 10) Continue to pursue ballistically tolerant cockpit and cabin protection. 	<ol style="list-style-type: none"> 1) Continue to fund UH-1Y to meet PAA requirements and accelerate full rate production quantities beyond current POR IOT support 50% increase in AC HMLAs. 2) Procure and field enhanced ASE to defeat current and emerging threats. 3) Procure and field sensor upgrades that support the HML/A mission/task list accelerate procurement of BRITE Star Block II. 4) Procure and field advanced integrated avionics and digital / real-time uplink/downlink systems to enhance situational awareness, joint connectivity and interoperability. 5) Ensure life cycle funding to correct logistics and software/OFP deficiencies. 6) Ensure the fidelity and functionality of simulators and part task trainers match fleet aircraft characteristics in all aspects and meets T&R requirements. 7) Procure and field next generation, WFOV NVGs at earliest opportunity. 8) Improve reliability and safety of current auxiliary fuel system. 9) Fund, develop, and accelerate fielding of Advanced Weapons to include PGMs, enhanced rockets, and associated systems. 10) Explore other initiatives to make the UH-1N capable of supporting the HML/A mission/task list.

MARINE LIGHT / ATTACK HELICOPTER (HMLA) PLAN

CURRENT FORCE:

6 AC SQDN X 18 AH-1W/9 UH-1N
 2 RC SQDN X 18 AH-1W/9 UH-1N
 1 FRS X 20 AH-1W/10 UH-1N

FORCE GOAL:

9 AC SQDN X 18 AH-1Z/9 UH-1Y
 1 RC SQDN X 18 AH-1Z/9 UH-1Y
 1 FRS X 18 AH-1Z/10 UH-1Y

UNIT/LOCATION	PMAA	FY07				FY08				FY09				FY10				FY11				FY12				FY13				FY14				FY15				FY16				FY17				FY18			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4				
3rd MAW																																																	
HMLA-169	18 AH-1/9 UH-1						Y		V								Z				V																												
HMLA-367	18 AH-1/9 UH-1							Y				V									Z				V																								
HMLA-369	18 AH-1/9 UH-1								Y			V									Z				V																								
HMLA-267	18 AH-1/9 UH-1											Y				V									Z				V																				
HMLA/T-303 (1/2)	18 AH-1/10 UH-1	Y			V				Z			V																																					
2nd MAW																																																	
HMLA-167	18 AH-1/9 UH-1											Y				V									Z				V																				
HMLA-269	18 AH-1/9 UH-1												Y			V									Z				V																				
HML/A-467 (3)	18 AH-1/9 UH-1							N/W								Y					V																Z				V								
HML/A-567 (5)	18 AH-1/9 UH-1											Y				V									Z				V																				
1st MAW																																																	
HMLA-469 (4)	18 AH-1/9 UH-1							N/W								Y					V																												
4th MAW																																																	
HMLA-773	18 AH-1/9 UH-1																				Y				V																								
HMLA-775	18 AH-1/9 UH-1																																																

Y = YANKEE TRANSITION BEGINS
 Z = ZULU TRANSITION BEGINS
 B = SIMULTANEOUS TRANSITION
 V = TRANSITION COMPLETE
 N/W = UH-1N / AH-1W

AvPlan pg. 5-7.

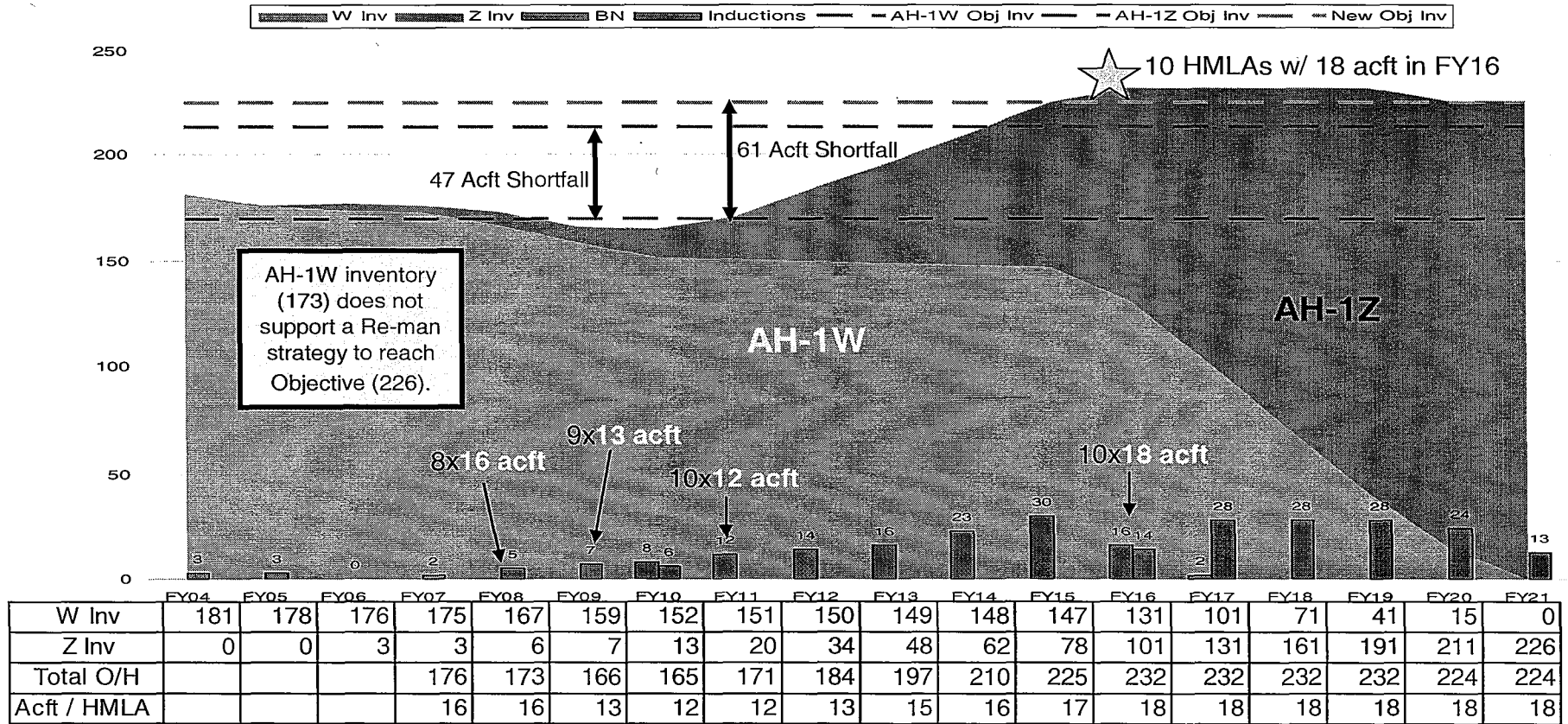
GENERAL NOTES:

- ~ TRANSITION PLAN REFLECTS INCREASE IN PROCUREMENT OBJECTIVE (137UH-1Y AND 250 AH-1Z) TO SUPPORT 9 AC AND 1 RC HMLAS BY FY11.
- ~ TRANSITION PLAN AS DEPICTED IS DC(A) APPROVED BY LOCATION. INDIVIDUAL UNITS ARE NOTIONAL PENDING MARFOR/MAW INPUT.

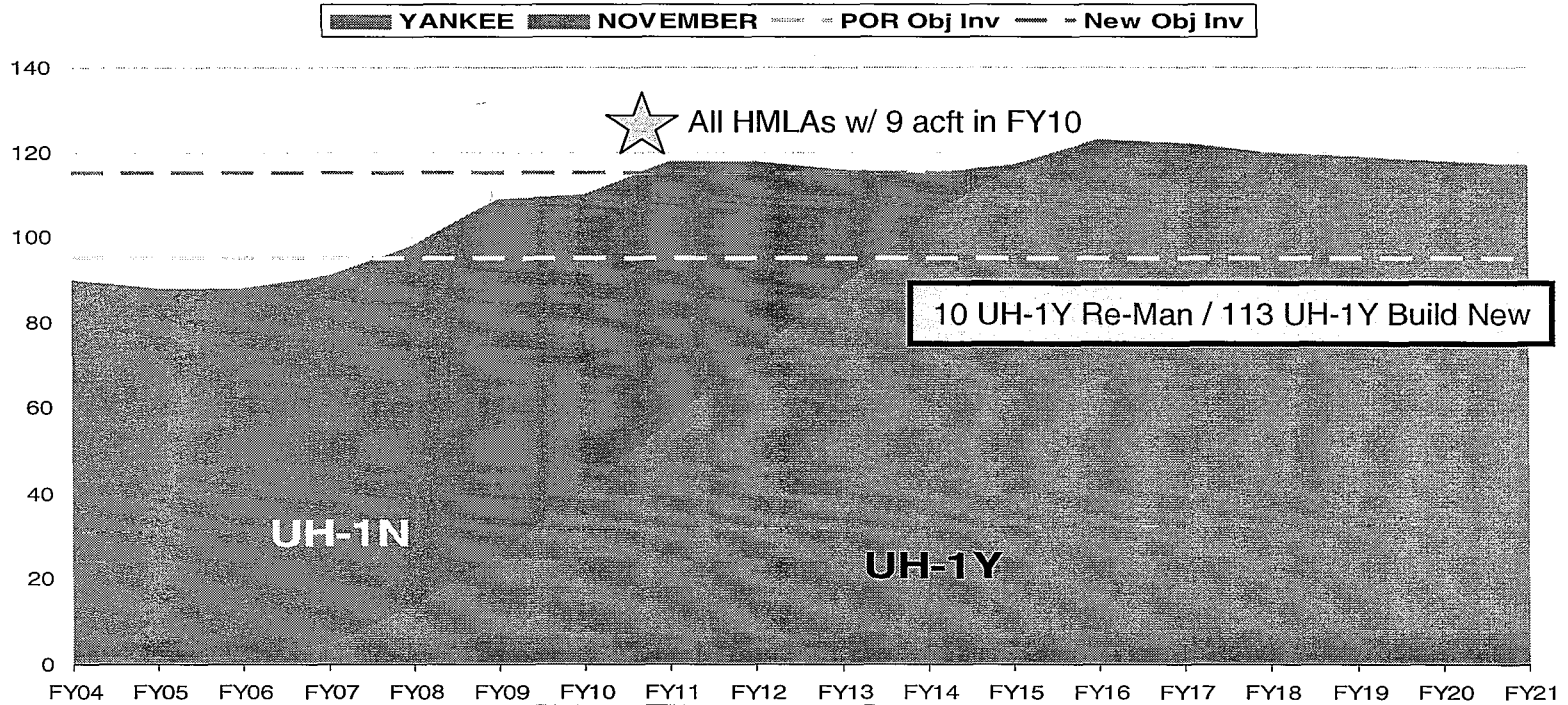
SPECIFIC NOTES:

1. HMLA/T-303 UH-1Y RFT 2ND QTR FY08, AH-1Z RFT 3RD QTR FY10.
2. ANTICIPATE HMLA/T-303 PTAA: ~FY10 FOR UH-1Y AND ~FY16 FOR AH-1Z.
3. ONE RC HMLA SQDN (HMLA-775) WILL TRANSITION TO AN AC HMLA SQDN (HMLA-467) IN FY08. 1 YEAR PERIOD IOC TO FOC. FY08 PMAA 12 AH-1W / 6 UH-1N. FY10 PMAA 18 AH-1W / 9 UH-1N.
4. HMLA-469 STAND-UP AS AC HMLA IN FY09. 2 YEAR PERIOD IOC TO FOC.
5. HMLA-567 STAND-UP AS AC HMLA IN FY11. 2 YEAR PERIOD IOC TO FOC.

202K AH-1 Aircraft Inventories (Transition to Zulu Build New)



202K UH-1 Aircraft Inventories (Yankee Build New)



	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21
Y Inv	2	2	5	14	26	41	57	73	89	105	116	123	122	121	120	119	118	117
N Inv	88	86	86	86	83	69	61	45	27	10	0	0	0	0	0	0	0	0
Total Inv	90	88	91	98	109	110	118	118	116	115	115	122	121	120	119	118	117	116

- All West Coast HMLAs will have 9 UH-1Ys by FY11
- All East Coast HML/As will have 9 UH-1Ys by FY13

Notes

1 The Long War is a concept of employment developed to provide a vision for Marine force employment that seeks to provide a persistent, forward deployed Marine presence, in keeping with the previously identified COCOM requirements, across key regions in the world while still providing the nation the ability to concentrate and deploy Marine forces to fight and win our nation's battles across the full spectrum of potential conflicts. This concept fulfills OSD's requirement that we "accept risk in the traditional to address the irregular" while capitalizing on the naval and expeditionary nature of our Corps in a manner that best meets OSD's needs. U.S.M.C., Plans Policies, and Operation, "Long War Concept" (H.Q. U.S.M.C. 2008).

2 Christopher Bolkcom, and Christian Liles. CRS Report for Congress "Military Helicopter Modernization: Background and Issues for Congress." Congressional Research Service. 24 June, 2004.

3 Alan W. Meyers and Paul Davidovich., "The H-1 Update Program: Affordable War Fighting Capability for the U.S. Marines." Bell Helicopter Textron Inc. Fort Worth Tx, April 01, 2000. A2-1.

4 U.S.M.C., Marine Aircraft Wing (FMFM 5-1), 1970 (Washington D.C: GPO 1970), 30.

5 U.S. Department of Defense. Quadrennial Defense Review Report (Washington, D.C. GPO 2006), 1.

6 U.S.M.C., Marine Corps Operating Concepts for a Changing Security Environment, 2007, 2d ed. (Washington D.C.: GPO, 2007), 15.

7 William R. Fails. Marines and Helicopters, 1962-1973. Washington, D.C.: History And Museums Division Headquarters, U.S. Marine Corps, U.S. Govt. Print. Off, 1978. Pg 112.

8 Fails, pg 44.

9 William R. Fails. Marines and Helicopters, 1946-1962. Washington, D.C.: History And Museums Division Headquarters, U.S. Marine Corps, U.S. Govt. Print. Off, 1976, 85.

10 William R. Fails. Marines and Helicopters, 1962-1973. Washington, D.C.: History And Museums Division Headquarters, U.S. Marine Corps, U.S. Govt. Print. Off, 1978., 85.

11 Fails, 86.

12 Fails, 46.

13 Fails, 86.

14 Fails, 88.

15 Fails, 86.

16 Fails, 86.

17 William R. Fails. Marines and Helicopters, 1946-1962. Washington, D.C.: History And Museums Division Headquarters, U.S. Marine Corps, U.S. Govt. Print. Off, 1976., 89.

18 Fails 112.

19 Fails 112.

20 Fails 113.

21 Major S.R. McGowan, "The Case for a Single Multi-Mission HMLA Platform." Quantico, VA: Marine Corps Command and Staff College MMS Paper, 1999. 32.

22 U.S.M.C.. "UH-1Y Training & Readiness Manual." (NAVMC 3500-20) (Washington D.C. GPO, 2007). pg. 3.

23 Commanding General, 2d Marine Aircraft Wing message to Commandant of the Marine Corp (Aviation), subject: "Report of HMLA Commander's Symposium, 24-26 May 94," 081355Z August 1994.

24 3rd MAW TACC, Future Operations RW CAS Planner.

25 Small Wars Manual pg. 8.

26 Rupert Smith, The Utility of Force: The Art of War in the Modern World. New York: Knopf, 2007.

27 Irregular warfare (IW) is defined as "a violent struggle among state and non-state actors for legitimacy and influence over the relevant populations. IW favors indirect and asymmetric approaches, though it may employ the full range of military and other capabilities, in order to erode an adversary's influence and will."²⁷ Typical forms of IW include insurgencies, counterinsurgencies (COIN), counterterrorism, foreign internal defense (FID) and stabilization, security, transition, and reconstruction operations (SSTRO) to name a few. Taken from U.S. Department of Defense, Irregular Warfare, Joint Operating Concept, 2007 (Washington D.C.: GPO, 2007), 6.

28 The Long War is a concept of employment developed to provide a vision for Marine force employment that seeks to provide a persistent, forward deployed Marine presence, in keeping with the previously identified COCOM requirements, across key regions in the world while still providing the nation the ability to concentrate and

deploy Marine forces to fight and win our nation's battles across the full spectrum of potential conflicts. This concept fulfills OSD's requirement that we "accept risk in the traditional to address the irregular" while capitalizing on the naval and expeditionary nature of our Corps in a manner that best meets OSD's needs. Taken from U.S.M.C., Plans Policies, and Operation, "Long War Concept" (H.Q. U.S.M.C. 2008).

²⁹ U.S.M.C., Organization and Function of Marine Aviation (FMFM 5-1), 1991 (Washington D.C: GPO 1991), 58.

³⁰ U.S.M.C., Organization and Function of Marine Aviation (FMFM 5-1), 1991 (Washington D.C: GPO 1991), 55.

³¹ Wray Johnson, "Teaching Irregular Warfare; Déjà vu All Over Again?" a paper presented to the Joint conference Pedagogy for the Long War: Teaching Irregular Warfare, General Alfred M. Grey Marine Corps research Center, Quantico, VA, 29 Oct-1 Nov 2007.

³² Rupert Smith, The Utility of Force: The Art of War in the Modern World. New York: Knopf, 2007, 300.

³³ Smith, 299.

³⁴ U.S. Department of Defense. National Defense Strategy (Washington, D.C. GPO 2005), 12.

³⁵ Major Michael Leuck, "The Marine Light Attack Helicopter Paradigm, Upgrade, Replace or Invest in the Future." Quantico, VA: Marine Corps Command and Staff College MMS Paper, 1996. 2-3.

³⁶ Lueck, 3..

³⁷ Previously referred to as the VMAO concept.

³⁸ LtCol Streeter, APW-53, Personal Interview. 26 Jan 2008.

³⁹ ³⁴ Commandant's planning guidance, U.S.M.C., Organization and Function of Marine Aviation (FMFM 5-1), 1991 (Washington D.C: GPO 1991), Pg xii.

⁴⁰ U.S.M.C., Deputy Commandant for Aviation. "2007 Marine Aviation Campaign Plan." (H.Q. U.S.M.C. 2007), pg. 2-2.

⁴¹ U.S.M.C.. Warfighting (MCDP 1) (Washington D.C. GPO, 1997), 27.

⁴² U.S.M.C., Marine Corps Operating Concepts for a Changing Security Environment, 2007, 2d ed. (Washington D.C.: GPO, 2007), 52.

⁴³ Current Modular Armament System concept is proprietary in nature and used under expressed permission provided by Chris Dillion.

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- LtCol T.P Dolan, Future Commanding Officer, HMLA-169. Personal Interview November 2007.
- LtCol W.R. Dunn, Commanding Officer HMLA-369. Personal Interview November 2007.
- LtCol Steve Girard, Deputy Program Manager H-1 programs PMA-276, NAS Patuxent River. Personal Interview November 2007.
- LtCol K.M. Hudson, Commanding Officer, HMLA-267. Personal Interview November 2007.
- LtCol M.A. Moore, Future Commanding Officer HMLA-369. Personal Interview November 2007.
- LtCol B.K. McCrary, Commanding Officer, HMLAT-303. Personal Interview November 2007.

LtCol John Mitchell former Command and Staff faculty Advisor and MAWTS-1 UH-1N instructor. Phone Interview December 2007.

LtCol W.A. Randall, OIC UH-1Y Fleet Introduction Team (FIT), Operational test pilot. Personal Interview November 2007.

LtCol Craig Streeter, APW-53 Attack/Utility Coordinator. Personal Interview November 2007.

LtCol W.L. Wade, Executive Officer HMLAT-303. Personal Interview November 2007.

LtCol W.E. Zamagni, Future Commanding Officer HMLA-369. Personal Interview November 2007.

Maj C.M. Chown, HMLAT-303 UH-1Y Instructor Pilot. Personal Interview November 2007.

Maj J. Coker, UH-1Y Operational Test Director. Personal Interview November 2007.

Maj A.D. Dyer, UH-1Y FIT Instructor, Operational Test Pilot. Personal Interview November 2007.

Maj S.P. Suckow, UH-1Y FIT Instructor, Operational Test Pilot. Personal Interview November 2007.