

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

The public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.
PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.

1. REPORT DATE (DD-MM-YYYY) 06-05-2015		2. REPORT TYPE Masters of Operational Studies - Future War Paper		3. DATES COVERED (From - To) August 2014-April 2015	
4. TITLE AND SUBTITLE The Implications of Tiltrotor Mobile Formations on Future War				5a. CONTRACT NUMBER NA	
				5b. GRANT NUMBER NA	
				5c. PROGRAM ELEMENT NUMBER NA	
				6. AUTHOR(S) Hill, Nathan J., Major, USMC	
				5d. PROJECT NUMBER NA	
				5e. TASK NUMBER NA	
				5f. WORK UNIT NUMBER NA	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) School of Advanced Warfighting, Marine Corps University 3070 Moreel Avenue Quantico, VA 22134-5068				8. PERFORMING ORGANIZATION REPORT NUMBER NA	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) NA				10. SPONSOR/MONITOR'S ACRONYM(S) NA	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S) NA	
12. DISTRIBUTION/AVAILABILITY STATEMENT Unlimited					
13. SUPPLEMENTARY NOTES NA					
14. ABSTRACT Tiltrotor mobile formations provide decisive, asymmetric mobility advantages to the GCE and increase the MAGTF's forcible entry options at reduced response times. Leveraging the mobility advantage of the MV-22B, the USMC can develop a tiltrotor mobile force which provides an unparalleled crisis response force, flexible defensive options, and a decisive offensive formation. This paper develops operational concepts for the tiltrotor beyond a replacement for the CH-46E and examines the implications of formations which can move quickly around the battlefield.					
15. SUBJECT TERMS MV-22B, future conventional warfare, tiltrotor, tiltrotor mobile combat formations, offense, defense, tiltrotor fire brigades, crackback tactics, forcible entry, MEB operations, MEF operations					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT U/U	18. NUMBER OF PAGES 28	19a. NAME OF RESPONSIBLE PERSON Marine Corps University/SAW
a. REPORT UNCLASS	b. ABSTRACT UNCLASS	c. THIS PAGE UNCLASS			19b. TELEPHONE NUMBER (Include area code) 703-432-5318 (Admin Office)

*United States Marine Corps
School of Advanced Warfighting
Marine Corps University
3070 Moreell Avenue
Marine Corps Combat Development Command
Quantico VA 22134*

FUTURE WAR PAPER

The Implications of Tiltrotor Mobile Combat Formations on Future War

**SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF OPERATIONAL STUDIES**

AUTHOR: Major Nathan J. Hill, USMC

AY 2014-15

Mentor: Dr. Bradley Meyer

Approved: *Bradley J. Meyer*

Date: *21 April 2015*

DISCLAIMER

THE OPINIONS AND CONCLUSIONS EXPRESSED HEREIN ARE THOSE OF THE INDIVIDUAL STUDENT AUTHOR AND DO NOT NECESSARILY REPRESENT THE VIEWS OF EITHER THE SCHOOL OF ADVANCED WARFIGHTING OR ANY OTHER GOVERNMENTAL AGENCY. REFERENCES TO THIS STUDY SHOULD INCLUDE THE FOREGOING STATEMENT.

EXECUTIVE SUMMARY

Title: The Implications of Tiltrotor Mobile Combat Formations on Future War

Author: Major Nathan J. Hill, United States Marine Corps

Thesis: Tiltrotor mobile formations provide decisive, asymmetric mobility advantages to the Ground Combat Element (GCE) and increase the Marine Air Ground Task Force's (MAGTF) forcible entry options at reduced response times. Leveraging the mobility advantage of the MV-22B, the Marine Corps can develop a tiltrotor mobile force that provides an unparalleled crisis response force, flexible defensive options, and a decisive offensive formation.

Discussion: The MV-22B is a revolutionary aircraft, but the doctrine for its employment remains rooted in helicopter capabilities. Thinking about the range and speed advantage that the MV-22B provides a combat formation reveals conventional capabilities that provide an asymmetric advantage to the US DOD, and the USMC in particular, while it remains the only operator of tiltrotor technology as a major assault support asset. The MV-22B is an operational connector that has the potential to move large combat formations around the battlefield at speeds previously impossible. Such movements create options for operational artists during crisis response, during conventional offensive operations and during conventional defensive operations - specifically in the establishment and the destruction of a defense in depth.

Conclusion: The MV-22B represents a technological breakthrough. Operational concepts maximizing the mobility advantage of the MV-22B focus the Marine Corps on projecting combat power quickly in support of a coalition or joint force. Whether employed in conventional or unconventional warfare, MEF and/or MEB tiltrotor mobility formations provide the Marine Corps with a capability to respond with speed and overwhelming tempo in any clime or place.

Introduction

The MV-22B is a unique mobility platform with unexplored potential. Tiltrotor technology may be as revolutionary as the shift from horses to motor vehicles nearly a century ago, but its potential in conventional warfare has largely been unrecognized. The Marine Corps is currently the only force in the world capable of projecting large combat formations with the tiltrotor. The MV-22B can quickly deliver light infantry, ready to fight, at unprecedented ranges. Organized, trained, and equipped tiltrotor mobile forces can mass quickly from disaggregated locations, projecting combat formations long distances in a relatively short period. Such forces are useful as a crisis response force, in the defense, and in the offense, creating battlefield asymmetries heavily favoring the military with tiltrotor mobility formations.

Examined as a component of the joint force, USMC tiltrotor capability is exclusive – underscoring the Marine Corps' role in forcible entry. Tiltrotor mobile formations "ensure[s] we are prepared to fight with what we have today...and to improve our ability to advocate for the development of critical Navy and joint capabilities."¹ Tiltrotor mobile formations provide decisive, asymmetric mobility advantages to the Ground Combat Element (GCE) and increase the Marine Air Ground Task Force's (MAGTF) forcible entry options at reduced response times. Leveraging the mobility advantage of the MV-22B, the Marine Corps can develop a tiltrotor mobile force that provides an unparalleled crisis response force, flexible defensive options, and a decisive offensive formation.

The Problem

The MV-22B is not a helicopter. A flight of eight MV-22Bs can move 192 Marines 390 miles in approximately one hour and forty minutes. The same flight could refuel and subsequently deliver 192 more Marines about three and a half hours later. The helicopter that the

MV-22B replaced, the CH-46E, would require a Forward Arming and Refueling Point (FARP) to range the objective. Further, the CH-46E requires two to three times the number of aircraft to lift the same number of troops.² Finally, it would take the CH-46E two hours and fifty minutes, plus time in the FARP, to get to its objective, while the MV-22B is already returning for its second trip through the pickup zone (PZ). The tiltrotor does not replace the helicopter; it upgrades the Aviation Combat Element (ACE) just as the helicopter upgraded the all-fixed wing ACE after WWII.

The MV-22B is an operational connector. The evolution of the ACE to a tiltrotor based assault support force enables the other elements of the ACE. The ACE possesses other assault support assets capable of lifting light infantry; however, the operational effect of troops moved solely by MV-22B, due to its speed and range advantage is significant. With the exception of the KC-130, other USMC assault support aircraft are not capable of reaching a combat radius of 390 NM without refueling at some point along the route, slowing tempo and requiring ships to move closer to shore.

Current concepts use the helicopter as the final stroke in operational exploitation. In spite of the tiltrotor's dominance in speed and range, no concept exists for employment of tiltrotor mobile forces during large-scale conventional combat operations. Richard Simpkin notes in *Race to the Swift*, "exploitation of the dynamics of manoeuvre theory calls for rare excellence in training and the exercise of command."³ Currently, the Marine Corps has exceptional pilots with excellent equipment, but today's ACE is not trained to move any formation larger than a battalion, for any purpose.

The missing element required to harness tiltrotor mobility exists in training the Marine Expeditionary Brigade (MEB), Marine Expeditionary Force (MEF), Marine Aircraft Group

(MAG), and Marine Aircraft Wing (MAW), and the repeated practice of this promising capability by these formations. Marine Medium Tiltrotor squadrons (VMM) are skilled movers of Marines, but ensuring that higher-level commands have the appropriate standard operating procedures and practice for such a mission are prospective training objectives with a substantial return on investment.

Presently, the largest lift conducted by MV-22Bs are long-range raids, employing Company Landing Teams (CLTs) and a combined helicopter/tiltrotor battalion lift during semi-annual Weapons and Tactics Instructor courses in Yuma, AZ. According to *Expeditionary Force 21*, the MEB is the USMC's "main effort in force development;"⁴ however, if called upon in a heavy, conventional fight, the Corps' concept for moving a brigade would look much the same as it did in the later portion of the last century. The Marine Corps has the opportunity to develop *revolutionary* mobility on the battlefield by creating a tiltrotor mobile, light infantry brigade and division combat formations.

The Capacity

Troops ideally suited for use as a tiltrotor mobile force are light - moving without any heavy equipment or fire support larger than 120mm mortars. The MV-22B is capable of cruising at 240 knots while carrying 24 combat loaded Marines a distance of 390 nautical miles.⁵ Currently, the Marine Corps has 15 operational squadrons of 12 MV-22Bs; by 2018, the Corps will have 18 operational squadrons of 12 airframes.⁶

A regimental-, brigade-, or division-sized movement includes the fighting formations and the senior headquarters. For example, 7200 is the number of Marines in a MEB derived from the GCE number of 6072 and MEB Command Element (CE) number of 1125, rounded up. At the sustained sortie rate, in one 20-hour period, a squadron of 12 aircraft is capable of moving a

Marine infantry battalion 390 miles. Based on these planning factors, a MAG assigned six VMMS could move an entire regiment in eight hours and a two-regiment MEB in approximately 23 hours.⁷ Further, the same MAG could move an entire division in 29.3 hours at the sustained sortie rate.⁸ Using only MV-22Bs to accomplish this movement frees other assault support aircraft to conduct supporting or parallel missions requiring less speed or range.

Except for the KC-130 and the MV-22B, Marine assault support aircraft are not capable of reaching a combat radius of 390 NM without refueling at some point along the route, slowing tempo. Although the ACE possesses other assets capable of lifting light infantry the MV-22B's speed and range advantage is asymmetric when compared to a force that moves solely by helicopter.⁹ Investigating possible applications for tiltrotor mobile forces underscores their potential.

The USMC has developed no new concept for employing the aircraft in conventional military operations, yet an organized, trained, equipped and ready tiltrotor mobile force provides strategic leaders with combat formations of Marines ready to act as a fire brigade in support of national objectives. Further, the aircraft's capability in the offense and defense is pioneering.

Fire Brigade Capability

In 1950, the First Marine Provisional Brigade was “forced by a shortage of shipping to leave all their heavy equipment in the United States.”¹⁰ While it took several weeks for the First Provisional Marine Brigade to arrive in Pusan, a similar Provisional Marine Brigade using MV-22Bs from Okinawa could be in Pusan within a day of their deployment order. Marine light infantry, trained and equipped to deploy quickly, and ready to fight, could secure perimeters or key logistical nodes while the heavier, but slower, combat power marshals and deploys via traditional means. The following scenario illustrates such a capability.

On 1 June 2021, North Korea crossed the 38th parallel into South Korea. Within a week, Seoul fell and the United Nations’ coalition was in retreat toward the southern quarter of the Korean peninsula. During that week, First Marine Aircraft Wing (1MAW), as the ACE for III MEF, was allocated three CONUS-based VMMS and 2d MEB was attached to III MEF. CONUS-based tiltrotors self-deployed to Okinawa. Joining the two squadrons already at Futenma, III MEF now wielded the fastest and longest reaching aviation force the world had ever known – eight VMMS.¹¹

2d MEB increased III MEF CG’s response options. Recently deployed as a deterrent option, before hostilities started, the MEB is positioned 135 miles southeast of Pohang on the evening of 9 June, maximizing the defensive advantage provided by allied Japanese air defense systems. III MEF ACE supported 3d MARDIV¹² with five VMMS.

Eighth US Army requested III MEF in Korea on June 10. The MEF CG moved his 3d MARDIV Marines decisively, maximizing the mobility and flexibility advantage afforded by his tiltrotor mobile formations. He assigned three objectives on the peninsula: 3d MARDIV objectives were Saechon and Pusan in the south; II MEB objective was Pohang in the east.

Marines staged for combat at camps and airfields all over Okinawa, loaded onto MV-22Bs and started the Korean buildup.

Surging to complete their mission, 2d MEB ACE inserted a battalion in Korea in slightly less than three hours. Four hours later, 2d MEB had a regiment on the ground in Pohang. Meanwhile 3d MARDIV Marines were moving from Okinawa to their peninsular objectives. Within 31 hours of the execute order, all 10,000 Division Marines were in Korea, assembled for combat.

Coalition naval and air power shaped the battle space. Supremacy at sea was crucial, but the only thing required for entry into these coastal objectives was local air supremacy around the objectives and heavy coalition tanker support. 100 miles after the Okinawa-based VMMS left their insert LZ, each flight rendezvoused with tankers that dragged them back to toward Okinawa; there, aircraft topped off fuel while embarking troops, then launched the next wave for insert.

Concurrently, ACE helicopters were the first to move to Korea, providing fires, mobility, and prepositioned sustainment for the Fire Brigade. Following the divisions' movement to the peninsula two VMMS on Okinawa moved to Korea to continue support. There the tiltrotor force was just as responsive, with fewer assets. Due to shorter distances, the two VMMS on the peninsula are capable of moving an entire battalion two and a half hours and a regiment in 7.5 hours.

If the MEF CG assigned 2d MEB to lift a regiment, the ACE could move that regiment anywhere on the peninsula in under 8 hours.¹³ Although the MEF would not anticipate fighting as a full MAGTF for more than a week, the 3d MARDIV is positioned to reinforce the line or fill

a gap. The support of the ACE, combined with the geography of the Korean peninsula also facilitates the use of each regiment separately, or as an operational reserve.

An often-mentioned shortfall of the current ACE is the so-called “gap” between the range of helicopters and the range of tiltrotors. While this shortfall exists when supporting a long-range raid, the above vignette illustrates that the gap is less evident in heavy, conventional conflict. Once the division is ashore, the distances on the peninsula are supportable by helicopter. Thus, the F-35B, legacy TACAIR assets, the AH-1W/Z, and the UH-1Y provide aviation fire support until the MEF's artillery and tank assets are ashore.

This vignette illustrates the role of the MV-22 as an operational connector and the relevance of today's ACE to future war. The aircraft's ability to take disaggregated combat formations from shore and/or sea-based sites and quickly concentrate them on an objective, ready to fight, is unprecedented. Opponents of this concept may attack this plan as vulnerable to poor weather, but the operational design mitigates this detractor when used as a fire brigade and in the defense.

Weather is unpredictable and could potentially cause havoc with a force moving by air to a tactical zone; however, this operation is not an insert into direct enemy contact. Rather, the MV-22B repositions large numbers of troops from a position of relative safety in the rear (in this case in a separate country and the Sea of Japan) and moves them to an airfield (Busan, Saechon, and Pohang) for movement. Thus, the MV-22B serves as an operational asset, rather than a tactical asset. Each of the airfields identified above is capable of recovering and launching aircraft in all but the worst weather conditions. After arrival at the airfield, there are several options for moving the troops to their tactical areas of responsibility. Worst case, subsequent movement could be executed via foot or whatever transportation was available (cabs, civilian

vehicles and buses); best case, these forces could be moved via Korean or Eighth Army vehicles from the assembly area to their line of departure. Thus, all but the worst weather patterns do not inhibit this operationally significant movement. Once III MEF deploys its tiltrotor mobile forces, the operational artist - the III MEF CG - now has more combat power to employ in the defense. This combat power is impossible without tiltrotor mobile formations.

Defensive Capability

In the defense, the tiltrotor provides the commander with flexibility and speed from long distances. Compared to the enemy, a reserve with such vast range and speed advantage is decisive in action and asymmetric in combat power. In WWI, divisions were designated as a reserve and positioned near the front, outside of the enemy's artillery range, ready to occupy the second or third line defenses. Operational reserves supported armies with troops who used trains for operational movement, then marched to the sound of guns. Thus, the speed and concentration of train movement paired with subsequent short marching distances allowed the appropriate reserves to reinforce formations reeling from an enemy's attack, preventing the breakthrough.

Arguably, German breakthroughs during the Spring 1918 offensives were less of a German success and more of an Allied failure because the Allied units were too far back and could not reach the point of penetration.¹⁴ The responsiveness of the operational reserve is crucial to the health of the defense. Granted a tiltrotor mobile formation, the operational commander's capability to deploy his reserve quickly and over a comparatively long distance creates a combat asymmetry.

Contrasting with WWI reserves, WWII commanders placed reserve echelons further back due to the truck mobility of the reserve force and the air threat. However, the concept of "two up, one back" prevailed. Tiltrotor mobile formations break this paradigm. Tiltrotor mobile

formations conceivably only require a reserve at the division or army level, increasing economy of force while simultaneously increasing the speed at which the reserve moves into position to counter attack. The response time for most reserves, generally division elements, was several days until the combat formation was fighting in formation. The tiltrotor mobile formation has the capability to maneuver a division in about a day.

Belarus, Eastern Front, 2022: I MEF is the US 3rd Army's operational reserve. From their position outside of Brest, I MEF ACE, with six VMMS, is ready to move Marines to the front, which stretches from Riga in the north, to Odessa in the south. Each of the Second Marine Division's regiments stages east of Brest oriented north, south, and east. Overall, division response time to a penetration near Riga, Latvia is 22 hours; response to eastern Belarus, near Kursk, is under 35 hours; finally, response time to Odessa, in southern Ukraine, is 33 hours.¹⁵

Such a scenario is interesting from several perspectives. First, tiltrotor mobility covers ranges that in WWII sheltered several army fronts. Second, tiltrotor mobile forces respond more quickly than WWII reserve divisions even though the distance is vastly larger than its historical counterpart is. Third, this unique capability supplies the resource needed most during a conventional defense, the fighting manpower of a division, quickly; its guns and heavy equipment can move to the defensive position later. While blunting the enemy's tempo and freeing up reserves at lower levels the reserve formation with tiltrotor mobility provides two more advantages to the defense - increased operational security and tempo.

Conceivably, an operational reserve might be able to support more than one army, although the wisdom of this would be dependent on the situation and a thorough cost-benefit analysis. Reducing reserve requirements because of increased flexibility and responsiveness frees formations to fight creating an additional combat asymmetry allowing a smaller defending

force to be employed more economically. Further, tiltrotor mobile formations allow the operational commander to use his forces more efficiently - centralizing his reserve elements location, or dispersing them, or concentrating dispersed elements later, while simultaneously reducing their response time.

Historically, the desired response time for operational reserves is about 24 hours.¹⁶ A tiltrotor mobile brigade assigned as the operational reserve can move 390 nm in 22.8 hours. This formation is not tied to roads, and can arrive at an assembly area or can be inserted close to the decisive point, in combat formation.

Comparatively, according to the MAGTF Planner's Reference Manual, an armored or mechanized brigade reserve transits an average of 31.7 km (17.1 nm) per hour during a tactical road march.¹⁷ From 390 NM, the motorized reserve's lead trace, not the entire combat formation, would just reach the battle in 22.8 hours. While most armored or mechanized operational reserves are closer, closer proximity requires more brigades assigned as operational reserves, underscoring the economy of force created by tiltrotor mobile capability. The tiltrotor mobile combat formation responds quickly, at greater distances, without being tied to the road network.

While the US and the Marine Corps, in particular, maintain a monopoly on tiltrotor mobility the use of tiltrotor mobile forces as a reserve strengthen the defense simply based on their battlefield presence. *The advantage that they promise is theoretical prior to their employment and overwhelming after their employment.* Because the tiltrotor mobile force's speed provides quick reinforcement anywhere on the line, theoretically, the defending commander's army is stronger at all points along the line, making it difficult for the offense to gain the 3:1 force ratio historically necessary to penetrate and operationally exploit the defense.¹⁸

If two divisions face each other in conventional combat and one side is not required to provide a reserve due to the availability of a tiltrotor mobile reserve, then the side with tiltrotor mobile formations is at a 3:2 advantage, measured in battalions. But the tiltrotor mobile force's advantage grows after the less mobile enemy attacks. A reserve tiltrotor mobile division reinforcing at the point of attack, increases the defender's advantage is 9:1, discouraging attack. *Thus, operational reserves with tiltrotor mobile capability require the attacker to gather even more combat power to penetrate the defense in depth and still risking stalemate after the attack.* Meanwhile, the attacking force must mass via foot, truck, or helicopter - requiring more time, congesting the road networks, and tipping their hand to the enemy.

Historically operational reserves occupy second and third lines of defense; however, these lines usually remained unmanned because the forces are not available or the time to move and employ the reserve is too short. Tiltrotor mobile forces' responsiveness promises to strengthen the defense with the capability to man and defend second and third lines of a defense in depth. If the corps or army combat formation provides the reserve, divisions need not provide their own reserves. Thus, divisions freed from supplying their own reserves can occupy the second and third lines of defense, further reinforcing the defense in depth. This asymmetric capability maximizes the army commander's forces, especially when the enemy force does not have a tiltrotor mobile capability.

Defensive tiltrotor mobile forces mitigate common sustainability issues associated with moving large combat formations long distances. Employed in the defense as an operational reserve, the tiltrotor mobile force falls in on an existing joint or coalition defensive system. Artillery and air support are previously established, thus a tiltrotor mobile force is simply using

its speed and range to support more of the battlefield while remaining dispersed and ready for combat.

Due to its distance from the front and its capability to quickly aggregate from dispersed locations, the enemy will have a hard time "seeing" a tiltrotor mobile reserve's movement.

When the enemy does see decisive movement, it is too late. The enemy cannot mass against the reserve without knowledge of its employment. On the other hand, the employment of a tiltrotor mobile reserve happens too quickly for the enemy to mass effectively.

A final advantage to tiltrotor mobile formations is the reduced requirement on the road network. During periods of heavy combat, refugee populations trying to leave the area saturate road networks near the front. A motorized operational reserve requires the same roads for movement toward the front, but the tiltrotor mobile operational reserve does not. In poor weather, the tiltrotor mobile force can use local airfields to move close to the objective before marching cross country to their defensive or counter attack positions. In good weather, the tiltrotor mobile division can land at points advantageous to the commander's scheme of maneuver, further increasing the speed of deployment for a tiltrotor mobile operational reserve. This key advantage also translates to an asymmetric offensive capability for the side wielding a tiltrotor mobile force.

Offensive Capability

Race to the Swift notes that helicopters "can move dispersed and fight concentrated."¹⁹ The MV-22B is not a helicopter, but the concept holds. Tiltrotors "can move dispersed and fight concentrated" at greater distances from the Forward Edge of the Battle Area (FEBA), and the dispersion of combat formations make tiltrotor mobile forces difficult to observe until they mass decisively. Consider the use of tiltrotor mobile forces on the Mediterranean battle space in

WWII. Tunis, Sicily, Corsica, Sardinia, and Malta are five viable options for staging combat divisions, which are easily within MV-22B range of central Italy. Malta and Tunis, the most distant points are less than 1.5 hours of tiltrotor flight from central Italy.

Historically, air delivered forces have some drawbacks. Dispersion during the drop encumbers airborne troops, short ranges hinder helicopter troops, the requirement to use roads and trafficable terrain impedes motorized troops. Tiltrotor formations harbor an inherent time advantage over other truck or airborne troops, as they do not have to load trucks and convoy to an assembly area on roads and over terrain. Moreover, the tiltrotor mobile forces inherently reduce and avoid the congestion on the road network that is historically prevalent during operational movements. While refugees, casualty trains, and defeated formations are typical problems for motorized troops moving into the attack, tiltrotor mobile formations do not have to fight through this chaos to bring their combat power to bear. Tiltrotor mobile forces can land at airfields or roads, railroads, or in any area where the commander wishes it to assemble. Motorized troops, on the other hand, are bound to the road network - narrow, poorly engineered, or missing.

The MV-22B allows dispersed troops to conduct a bold move on the enemy's flank or rear, pressuring the enemy *from behind while attacking back toward the FEBA*, a "crackback" attack. The *crackback* concept envisages a tiltrotor mobile force attacking enemy formations in conventional defensive positions. The *crackback* force inserts between the defense's operational reserve and the defensive front line attacking back toward a friendly holding force that is attacking simultaneously. The tiltrotor mobile force is the hammer; the holding force is the anvil.

The defense in depth is viable because of the operational reserve. A *crackback* is a concept of attack that defeats the operational reserve simultaneous with an attempt to penetrate

the defense. There are several methods of employing a tiltrotor mobile division in such an attack. In channelized terrain, the division could designate two regiments as the assault element while a regiment delays the arrival of the defense's operational reserve. A regiment defending defiles that are avenues of approach to the main defensive line could hold up a division for a decisive period with only Javelin missiles and air support.

In open terrain, the tiltrotor mobile division has two options for conducting the *crackback* attack. If the enemy's operational reserve is in close proximity to the defensive line, the tiltrotor mobile force could simply assault the operational reserves in bivouac or column, before they can interfere with the breakthrough. The tiltrotor mobile division fixes the operational reserve while the breakthrough force flanks the operational reserve, fundamentally defeating the defense in depth. Alternatively, if time was on the side of the attacker, the tiltrotor mobile force could assault the enemy's rear area fast enough that the breakthrough occurs before the operational reserve can react; the breakthrough force deals with an off-balance operational reserve after it has conducted a passage of lines with the breakthrough force.

The *crackback* attack creates a combat asymmetry due to the attack's geometry and the character of the forces pitted in the fight - light infantry attacking service support positions from behind or light infantry attacking an operational reserve in bivouac or column on the road. Even if the operational reserve is able to deploy and fight, the tiltrotor mobile force engages them and the defense in depth is at least degraded, if not defeated. The movement of a division into a proximate position behind enemy lines will require the defense to turn, *but if the enemy turns, they face defeat from the FEBA force - enabling the breakthrough.*

Artillery positions are also vulnerable to this method of attack, as they have limited capability against closing infantry when unsupported by infantry units of their own – especially

if they are engaged while facing the wrong direction. The artillery focused on supporting the fighting divisions is surprised and at a positional disadvantage.

The *crackback* attack has cascading effects for the breakthrough. A *crackback* operation facilitates breakthrough operations and employs infantry at an advantage over their enemy while they need minimal fire support. Largely ignored throughout history, the *crackback* attack is feasible for an amphibious force attacking an enemy flank tied to a coast. The sea is maneuver space for friendly forces, enabling forcible entry. The MV-22B adds speed, surprise, and shock to the *crackback* attack, facilitating an asymmetric employment of combat power – infantry against artillery.

Joint operational commanders looking for a forcible entry capability to break an enemy's defense would greatly benefit from a MEB capable of conducting tiltrotor mobile assaults with Marine infantry. After coalition naval assets establish local sea superiority, the MEB could conduct amphibious operations in the breakthrough area. An amphibious assault originating from 225 NM southwest of Inchon is a two-hour round trip for the MV-22B. Thus, a tiltrotor mobile MEB could move its infantry ashore in approximately 24 hours. The enemy is reacting to the attack at the front, and to the attack on his operational reserves. Conversely, the operational artist wielding the tiltrotor mobile force chooses the timing and place of the attack.

The tiltrotor mobile formation promises other advantages in the offense. Following a breakthrough, tiltrotor mobile forces provide the commander a fresh means for conducting an operational exploitation. Richard Simpkin uses the analogy of a nutcracker to describe operational exploitation.²⁰ The conceptual nutcracker begins with a breakthrough, develops with an armored penetration, followed by a light armor thrust, and finally, a rotary wing thrust.²¹ However, the MV-22B has a capability vastly different from rotary wing platforms. Tiltrotor

mobile forces can also engage reserve echelons of the enemy force or seize secondary defensive lines, key lines of communication, bridges, railroad junctions, or airfields. The conceptual nutcracker is intact; however, tiltrotor mobile forces simultaneously disrupt enemy combat power and hasten his defeat.

Rotary wing platforms are not obsolete; they complement the tiltrotor's capability to go even deeper, making the problem more complex for the enemy by cutting lines of communication and decapitating command and control (C2) structures at several echelons with aerial assault forces. Operational exploitation with tiltrotors is both sustainable and decisive when a combat formation has seized an advanced airfield, opening an air hub for sustainment of the exploitation.

A tiltrotor mobile force is particularly capable of seizing airfields, forcing the enemy to attack a light infantry formation with a strong defensive capability in Javelin missiles, 120mm mortars, and the lifeline inherent to their geographic position - the airfield. Similarly, the tiltrotor mobile forces could seize rail junctions or bridges, denying the enemy critical mobility links, or preserving them for use by friendly mechanized or motorized forces conducting the operational exploitation.

A final offensive capability of tiltrotor mobile forces is their capability in pursuit. Tiltrotor mobile forces provide the commander a means for even the most exhausted combat formation to move long distances, quickly. Alternatively, tiltrotor mobility provides a formation formerly in reserve as a fresh formation in pursuit of the enemy. For the first time in the history of warfare, pursuit may involve fresh troops at the decisive point, due to their rapid movement in the MV-22B and the range from which the formation embarks. The combination of fresh troops with MV-22Bs may be decisive in cutting off the enemy's retreat and their final destruction.

Conclusions

A trained and equipped tiltrotor mobile force is a revolutionary capability on the battlefield. Once developed, a trained and equipped tiltrotor mobile force provides strategic leaders a responsive deterrent option when conflict is likely or imminent. Additionally, the tiltrotor mobile force can provide flexibility in the defense with unprecedented speed and range. During decisive offensive operations, tiltrotor mobile forces can attack the enemy in the most advantageous way possible, employing strength on weakness with shocking speed. A tiltrotor mobile force can conduct forcible entry from the sea provided only local air superiority or attack an enemy's rear echelons or reserves facilitating a breakthrough.

Reconsidering the battlespace in light of tiltrotor aircraft increases the Corps' relevance in forcible entry and underscores the Corps' position as the most responsive member of the joint force. Remarkably, this capability only requires a change in thinking and focused training. None of these concepts requires an airframe that is not in the current ACE inventory. Streamlined aviation command and control systems emphasizing seamless, selectable data between the squad leader and the division commander and regular training for the MEB and the MEF develop this latent capability.

The MV-22B is a technological breakthrough. Operational concepts maximizing the mobility advantage of the MV-22B focus the Marine Corps on projecting combat power quickly in support of a coalition or joint force. Whether employed in conventional or unconventional warfare, MEF and MEB tiltrotor mobility forces provide the Marine Corps with a capability to respond with speed and overwhelming tempo in any clime or place.

Appendix A - General MV-22B capacity for large formation lift

Formation+	Miles	Unit assigned	Aircraft sorties to move formation*	Aircraft assigned	Surge rate	Sustained rate	Miles	Airspeed	Hours per wave \$	Minutes per wave	Total number of waves at the surge rate^	Hours to complete movement @ surge &	Total number of waves at the sustained rate ^	Hours to complete movement @ sustained &
Generic squadron	390													
Battalion	1000	VMM	42	12	10	8	390	240	3.3	195.00	5	16.3	6	19.5
Regiment	3200	MAG	133	72	58	48	390	240	3.3	195.00	3	9.8	3	9.8
Brigade	7200	MAG	300	72	58	48	390	240	3.3	195.00	6	19.5	7	22.8
Division	10000	MAG	417	72	58	48	390	240	3.3	195.00	8	26.0	9	29.3
Marines														
\$ This number is miles/airspeed doubled (to get the aircraft to the zone and back to its origination). + Formation strength is derived from MSTP's 5-0.3 MAGTF Planner's Reference Manual. The author added numbers from the notional MEB, Division, Battalions and rounded up. * This is determined by dividing the number of Marines by the number of seats in the aircraft ^ This is determined by multiplying the sortie rate by the number of squadrons in the MAG, rounded up. & This number indicates the number of hours that will be required to lift the entire formation to their intended destination.														

Appendix B - RW TR Comparison

Air Frame	Airspeed (Knots)	Passengers	Distance (NM)	Time (hours)
Helicopters				
CH-46E	140	12	390	2.8
CH-47D/F	130	36-55	390	3.0
CH-53E	150	36-55	390	2.6
UH-1Y	130	8	390	3.0
UH-60	130	11	390	3.0
Tiltrotors				
MV-22B	240	24	390	1.6
Fixed Wing aircraft				
KC-130J*	340	92	390	1.1

* The KC-130J has a real advantage in terms of moving troops quickly in a permissive environment; however, in a medium to high threat environment, the flight profiles required for the KC-130J make it much more vulnerable than a tiltrotor aircraft, which can fly much lower.

Appendix C - MEB Fire Brigade vignette

Formation+	Miles	Unit Assigned	Aircraft sorties to move formation*	Aircraft assigned	Surge rate	Sustained rate	Miles	Airspeed	Hours per wave \$	Minutes per wave	Total number of waves at the surge rate^	Hours to complete movement @ surge &	Total number of waves at the sustained rate ^	Hours to complete movement @ sustained &
Generic squadron														
	<u>100</u>													
Battalion	1000	VMM	42	24	19	16	100	240	0.8	50.00	3	2.5	3	2.5
Regiment	3200	MAG	133	24	19	16	100	240	0.8	50.00	7	5.8	9	7.5
Marines														
Camp Courtney to Pusan														
	<u>525</u>													
Battalion	1000	VMM	42	30	24	20	525	240	4.4	262.50	2	8.8	3	13.1
Regiment	3200	MAG	133	30	24	20	525	240	4.4	262.50	6	26.3	7	30.6
Futenma to Saechon														
	<u>530</u>													
Battalion	1000	VMM	42	30	24	20	530	240	4.4	265.00	2	8.83	3	13.25
Regiment	3200	MAG	133	30	24	20	530	240	4.4	265.00	6	26.50	7	30.92
MEB afloat to Pohang														
	<u>135</u>													
Battalion	1000	VMM	42	36	29	24	135	240	1.1	67.50	2	2.25	2	2.25
Regiment	3200	MAG	133	36	29	24	135	240	1.1	67.50	5	5.63	6	6.75
<p>\$ This number is miles/airspeed doubled (to get the aircraft to the zone and back to its origination).</p> <p>+ Formation strength is derived from MSTP's 5-0.3 MAGTF Planner's Reference Manual. The author added numbers from the notional MEB, Division, Battalions and rounded up.F10</p> <p>* This is determined by dividing the number of Marines by the number of seats in the aircraft</p> <p>^ This is determined by multiplying the sortie rate by the number of squadrons in the MAG, rounded up.</p> <p>& This number indicates the number of hours that will be required to lift the entire formation to their intended destination.</p>														

Appendix D - Defense vignette

Formation+	Miles	Unit Assigned	Aircraft sorties to move formation*	Aircraft assigned	Surge rate	Sustained rate	Miles	Airspeed	Hours per wave \$	Minutes per wave	Total number of waves at the surge rate^	Hours to complete movement @ surge &	Number of waves @ Sustained +	Total number of waves at the sustained rate ^	Hours to complete movement @ sustained &
Generic															
squadron	390														
Battalion	1000	VMM	42	12	10	8	390	240	3.3	195.00	5	16.3	5.18	6	19.5
Regiment	3200	MAG	133	72	58	48	390	240	3.3	195.00	3	9.8	2.76	3	9.8
Brigade	7200	MAG	300	72	58	48	390	240	3.3	195.00	6	19.5	6.22	7	22.8
Division	10000	MAG	417	72	58	48	390	240	3.3	195.00	8	26.0	8.64	9	29.3
Marines															
Brest to Riga 290															
Battalion	1000	VMM	42	12	10	8	290	240	2.4	145.00	5	12.1	5.18	6	14.5
Regiment	3200	MAG	133	72	58	48	290	240	2.4	145.00	3	7.3	2.76	3	7.3
Brigade	7200	MAG	300	72	58	48	290	240	2.4	145.00	6	14.5	6.22	7	16.9
Division	10000	MAG	417	72	58	48	290	240	2.4	145.00	8	19.3	8.64	9	21.8
Marines															
Brest to Kursk 460															
Battalion	1000	VMM	42	12	10	8	460	240	3.8	230.00	5	19.2	5.18	6	23.0
Regiment	3200	MAG	133	72	58	48	460	240	3.8	230.00	3	11.5	2.76	3	11.5
Brigade	7200	MAG	300	72	58	48	460	240	3.8	230.00	6	23.0	6.22	7	26.8
Division	10000	MAG	417	72	58	48	460	240	3.8	230.00	8	30.7	8.64	9	34.5
Marines															
Brest to Odessa 430															
Battalion	1000	VMM	42	12	10	8	430	240	3.6	215.00	5	17.92	5.18	6	21.50
Regiment	3200	MAG	133	72	58	48	430	240	3.6	215.00	3	10.75	2.76	3	10.75
Brigade	7200	MAG	300	72	58	48	430	240	3.6	215.00	6	21.50	6.22	7	25.08
Division	10000	MAG	417	72	58	48	430	240	3.6	215.00	8	28.67	8.64	9	32.25
Marines															
\$ This number is miles/airspeed doubled (to get the aircraft to the zone and back to its origination).															
+ Formation strength is derived from MSTP's 5-0.3 MAGTF Planner's Reference Manual. The author added numbers from the notional MEB, Division, Battalions and rounded up.F10															
* This is determined by dividing the number of Marines by the number of seats in the aircraft															
^ This is determined by multiplying the sortie rate by the number of squadrons in the MAG, rounded up.															
& This number indicates the number of hours that will be required to lift the entire formation to their intended destination.															

Appendix E - Comparison of 8 versus 6 VMM ACE

Formation+	Miles	Unit Assigned	Aircraft sorties to move formation*	Aircraft assigned	Surge rate	Sustained rate	Miles	Airspeed	Hours per wave \$	Minutes per wave	Total number of waves at the surge rate^	Hours to complete movement @ surge &	Total number of waves at the sustained rate ^	Hours to complete movement @ sustained &	
6 VMM MAG		<u>390</u>													
Battalion	1000	VMM	42	12	10	8	390	240	3.3	195.00	5	16.3	6	19.5	
Regiment	3200	MAG	133	72	58	48	390	240	3.3	195.00	3	9.8	3	9.8	
Brigade	7200	MAG	300	72	58	48	390	240	3.3	195.00	6	19.5	7	22.8	
Division	10000	MAG	417	72	58	48	390	240	3.3	195.00	8	26.0	9	29.3	
Marines															
8 VMM MAG		<u>390</u>													
Battalion	1000	VMM	42	12	10	8	390	240	3.3	195.00	5	16.3	6	19.5	
Regiment	3200	MAG	133	96	77	64	390	240	3.3	195.00	2	6.5	3	9.8	
Brigade	7200	MAG	300	96	77	64	390	240	3.3	195.00	4	13.0	5	16.3	
Division	10000	MAG	417	96	77	64	390	240	3.3	195.00	6	19.5	7	22.8	
Marines															
\$ This number is miles/airspeed doubled (to get the aircraft to the zone and back to its origination). + Formation strength is derived from MSTP's 5-0.3 MAGTF Planner's Reference Manual. The author added numbers from the notional MEB, Division, Battalions and rounded up. * This is determined by dividing the number of Marines by the number of seats in the aircraft ^ This is determined by multiplying the sortie rate by the number of squadrons in the MAG, rounded up. & This number indicates the number of hours that will be required to lift the entire formation to their intended destination.															

Bibliography

- Barksdale, Captain Travis. "CAS: KILSWITCH and the Way Ahead." *Marine Corps Gazette*, July 2014.
- Bell Helicopter. "MV-22 Guidebook." The Bell Boeing V-22. December 2014.
<http://www.bellhelicopter.com/MungoBlobs/126/268/V-22%20Guidebook%202013_update_PREVIEW_LR2.pdf> (accessed December 24, 2014).
- Chapin, John C. *Fire Brigade: U.S. Marines in the Pusan Perimeter*. Washington, DC: History and Museums Division, Headquarters U.S. Marine Corps, 2000.
- Commandant of the Marine Corps. *Expeditionary Force 21 Forward and Ready: Now and in the Future*. Washington, DC: Department of the Navy. 2014.
- Commandant of the Marine Corps. *36th Commandant's Planning Guidance: Innovate, Adapt, Win*. Washington, DC: Department of the Navy. 2015.
- Deane, Captain Jason N. "Night Raid: A 500-Mile MAGTF experiment." *Marine Corps Gazette*, January 2014.
- Glanzt, David M. *Soviet Military Operational Art: In Pursuit of Deep Battle*, London: Frank Cass, 1991.
- Headquarters U.S. Marine Corps Aviation. "2015 Marine Corps Aviation Plan." *marinecorpsconceptsandprograms.com*. <<https://marinecorpsconceptsandprograms.com/sites/default/files/files/2015%20Marine%20Aviation%20Plan.pdf>> (accessed December 24, 2014).
- Headquarters U. S. Marine Corps. *Expeditionary Operations*. MCDP 3. Washington, DC: Headquarters U.S. Marine Corps, 1998.
- Isley, Jeter A. and Philip A. Crowl. *The U.S. Marines and Amphibious War: Its Theory, and Its Practice in the Pacific*. Princeton, NJ: Princeton University Press, 1951.
- Leonhard, Robert R. *Fighting by Minutes*. Wesport, CT: Praeger, 1994.
- Meyer, Bradley J. *The Breakthrough Battle*. Unpublished paper, Aug 2008.
- . *Conclusion*. Unpublished paper, Aug 2008.
- . *The Development of the Defense in Depth*. Unpublished paper, Aug 2008.
- . *The Spring 1918 Offensives*. Unpublished paper, Aug 2008.

—. *Storm Troop Tactics*. Unpublished paper, Aug 2008.

—. *WWI as a Revolution in Military Affairs*. Unpublished paper, Aug 2008.

Simpkin, Richard. *Race to the Swift: Thoughts on Twenty-first Century Warfare*. London: Brassey's Defence, 2000.

—. *Deep Battle: The Brainchild of Marshal Tukhachevsky*. Washington, DC: Pergamon-Brassey's, 1987.

RAND. *Rapid Force Projection Technologies*. Documented Briefing, Washington, DC: RAND, 1996.

—. *Rapid Force Projection: Exploring New Technology Concepts for Light Airborne Forces*. Documented Briefing, Washington, DC: RAND, 1996.

Steeb, Randall. *Turning Light Forces into Heavy Hitters*. Research brief, Washington, DC: RAND, 1996.

Wynne, G.C. *If Germany Attacks: the Battle in Depth in the West*. London: Faber, 1940.

End Notes

- ¹ Commandant of the Marine Corps. *36th Commandant's Planning Guidance: Innovate, Adapt, Win*, 2015, 10.
- ² Originally, the CH-46E advertised the capacity to carry 17 Marines; however, during its last several operational deployments the CH-46E often was limited to 8-12 passengers due to age-induced engine and airframe limitations.
- ³ Richard E. Simpkin, *Race to the Swift* (London: Brassey's, 2000), 57.
- ⁴ Headquarters U.S. Marine Corps Aviation, *2015 Marine Corps Aviation Plan*, 2014, <<https://marinecorpsconceptsandprograms.com/sites/default/files/files/2015%20Marine%20Aviation%20Plan.pdf>>, 13.
- ⁵ Bell Helicopter, MV-22 Guidebook, 2014, 58, <http://www.bellhelicopter.com/MungoBlobs/126/268/V-22%20Guidebook%202013_update_PREVIEW_LR2.pdf>.
- ⁶ Headquarters U.S. Marine Corps Aviation, *2015 Marine Corps Aviation Plan*, 2014, <<https://marinecorpsconceptsandprograms.com/sites/default/files/files/2015%20Marine%20Aviation%20Plan.pdf>>, 2.5.7.
- ⁷ See Appendix A for the general capabilities of a six VMM ACE.
- ⁸ See Appendix E for a comparison of the 8 VMM versus the 6 VMM ACE.
- ⁹ See Appendix B for a general summary of helicopter vs. tiltrotor capabilities and limitations.
- ¹⁰ John C. Chapin, *Fire Bridgade: U.S. Marines in the Pusan Perimeter* (Washington, DC: History and Museums Division HQMC, 2000), 12.
- ¹¹ 3 MEB VMMs plus 2 Okinawa VMMs plus 3 CONUS VMMs = 8 VMMs total for III MEF.
- ¹² Using MSTP Pamphlet 5-0.3, 3d MarDiv consists of only 2 infantry regiments, the third is LAR and are not considered for tiltrotor mobility in this paper. This paper does consider the Hawaii-based 3d Marine Regiment as deployed to Okinawa and ready for combat operations.
- ¹³ See Appendix C for detailed calculations supporting these movements.
- ¹⁴ Meyer, Bradley J. *The Spring 1918 Offensives*. Unpublished paper, Aug 2008. page *passim*.
- ¹⁵ See Appendix D for detailed calculations supporting these movements.
- ¹⁶ Wynne, G.C. *If Germany Attacks: the Battle in Depth in the West*, London: Faber, 1940, *passim*.
- ¹⁷ MSTP Pamphlet 5-0.3, page IV-47-48. This number is an extrapolation based on 12 hours of daylight, and 6.5 hours of nighttime.
- ¹⁸ Meyer, Bradley J. *The Breakthrough Battle*. Unpublished paper, Aug 2008. page *passim*.
- ¹⁹ Richard E. Simpkin, *Race to the Swift* (London: Brassey's, 2000), 120.
- ²⁰ Richard E. Simpkin, *Deep Battle: The Brainchild of Marshal Tukhachevskii* (Washington, DC: Pergamon-Brassey's, 1987), 55.
- ²¹ Richard E. Simpkin, *Race to the Swift* (London: Brassey's, 2000), 100-102.