REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
08-05-2020	Master of Military Studies (MMS) thesis	AY 2019-2020

4. TITLE AND SUBTITLE
SPMAGTF: Sustaining the ACE

5a. CONTRACT NUMBER
N/A

5b. GRANT NUMBER
N/A

5c. PROGRAM ELEMENT NUMBER
N/A

6. AUTHOR(S)
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5d. PROJECT NUMBER
N/A

5e. TASK NUMBER
N/A

5f. WORK UNIT NUMBER
N/A

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
USMC Command and Staff College
Marine Corps University
2076 South Street
Quantico, VA 22134-5068

8. PERFORMING ORGANIZATION REPORT NUMBER
N/A

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
N/A

10. SPONSOR/MONITOR'S ACRONYM(S)
Dr. Jill Goldenziel

11. SPONSOR/MONITOR'S REPORT NUMBER(S)
N/A

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT

To sustain Special Purpose Marine Air Ground Task Force–Crisis Response–Central Command (SPMAGTF-CR-CC) aircraft readiness, flight operations, and support for ongoing operations in the United States Central Command (USCENTCOM) the Marine Corps must improve Aviation Logistics (AVLOG) support. The SPMAGTF-CR-CC 18.2 Aviation Combat Element (ACE) was a critical enabler to support operations in the USCENTCOM Area of Responsibility (AOR) during the author's recent nine-month deployment. The Ready Basic Aircraft (RBA) material condition was the primary metric used to provide readiness statuses and determined available aircraft to support operations and missions. The impacts of aircraft maintenance processes, aviation supply chain management, infrastructure, and weather on aircraft readiness specific to the Marine Medium Lift Tilt-rotor Squadron (VMM) and its 12 MV-22B Osprey aircraft fluctuated during the deployment and highlighted the need for improved AVLOG support.

15. SUBJECT TERMS
Aviation Logistics; Sustainment; SPMAGTF-CR-CC,

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			USMC Command and Staff College
Unclass	Unclass	Unclass	UU	38	19b. TELEPHONE NUMBER *(Include area code)* (703) 784-3330 (Admin Office)

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MASTER OF MILITARY STUDIES

TITLE:

SPMAGTF: Sustaining the ACE

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

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Executive Summary

Title: SPMAGTF: Sustaining the ACE

Author: Major Christopher J. Alfaro, United States Marine Corps

Thesis: To sustain Special Purpose Marine Air Ground Task Force–Crisis Response–Central Command (SPMAGTF-CR-CC) aircraft readiness, flight operations, and support for ongoing operations in the United States Central Command (USCENTCOM) the Marine Corps must improve Aviation Logistics (AVLOG) support.

Discussion: The SPMAGTF-CR-CC 18.2 Aviation Combat Element (ACE) was a critical enabler to support operations in the USCENTCOM Area of Responsibility (AOR) during the author's recent nine-month deployment. The Ready Basic Aircraft (RBA) material condition was the primary metric used to provide readiness statuses and determined available aircraft to support operations and missions. The impacts of aircraft maintenance processes, aviation supply chain management, infrastructure, and weather on aircraft readiness specific to the Marine Medium Lift Tilt-rotor Squadron (VMM) and its 12 MV-22B Osprey aircraft fluctuated during the deployment and highlighted the need for improved AVLOG support.

Conclusion: The following recommendations are the initial steps to improve AVLOG support and overall aircraft readiness for the MV-22B squadrons deploying to the USCENTCOM Theater.

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Preface

Marine Corps Doctrinal Publication (MCDP) 3, *Expeditionary* Operations, defines a Special Purpose Marine Air Ground Task Force (SPMAGTF) as a task organized unit with narrowly focused capabilities formed to accomplish a specific mission that is limited in scope, focus, and duration.[1] However, the SPMAGTF deployed to the United States Central Command (USCENTOM) has executed operations since 2014, with a limited concept of aviation logistics (AVLOG) support designed originally for a short duration. In 2020, the mission remains the same, and SPMAGTF provides the USCENTCOM Commander with a tasked organized, trained, and equipped expeditionary force capable of responding to a broad range of crises and contingencies. The SPMAGTF Aviation Combat Element (ACE) is a critical enabler to support crisis response missions and all ground operations. Thus a validated and robust concept of AVLOG support is necessary to increase aircraft readiness. Aircraft readiness determines aircraft availability, which is a factor in crisis action planning and daily ongoing operations.

Though SPMAGTF remains operationally and tactical competent, its concept of AVLOG support and methods for sustainability have not changed in six years and as a result aircraft readiness remains below readiness goals established by the Commander of Naval Air Forces (CNAF). SPMAGTF will remain one of the Marine Corps's enduring expeditionary forces in USCENTCOM for the foreseeable future. Therefore, this thesis examines the SPMAGTF concept of AVLOG support and based on the author's observations as the Aviation Logistics Department (ALD) Planner for the SPMAGTF 18.2 deployment, the Marine Corps should improve AVLOG support to increase aircraft readiness.

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[1] Headquarters US Marine Corps, *Expeditionary Logistics*, MCDP 3 (Washington, DC: Headquarters US Marine Corps, April 4, 2018), 3-15.

I would like to express my gratitude to Dr. Jill Goldenziel, LtCol Eduardo Bitanga, and LtCol Zachariah Anthony for their mentorship and patience, and ensuring I cross the finish line to complete this thesis. Lastly, I would like to thank my wife Nicole and son Liam for their encouragement and support during this academic year.

Introduction

The Commandants Planning Guidance (CPG) asserts the Marine Corps will continue to advocate to forward deploy units globally, but also recognizes that current deployed units such as Special Purpose Marine Air Ground Task Force (SPMAGTF) lack the requisite capabilities to compete against the malign activities of Russia, China, Iran and their proxies.[2] The CPG further states that SPMAGTFs are a core tenet of the Commandant's Force Design focus area. Through Naval Integration the SPMAGTFs will serve as extensions of the greater naval force, but first must be fully resourced, equipped, trained, and manned units capable of self-sustainment.[3] Special Purpose Marine Air Ground Task Force-Crisis Response-Central Command (SPMAGTF-CR-CC) has remained forward deployed in the United States Central Command (USCENTCOM) since 2014, and though the unit is operationally and tactically proficient, it exceeded its intended duration and suffers from outdated sustainability.

Over the course of the last six years little has changed to SPMAGTF's aviation logistics (AVLOG) support to the Aviation Combat Element (ACE), and as a result the ACE's Marine Medium Tiltrotor squadron (VMM) and its 12 MV-22B aircraft averaged below 60% readiness since its initial deployment. This aircraft readiness threshold has become the new norm and is important to note because further decrease in aircraft readiness will reduce the ACE's operational tempo and significantly impact all other operations. SPMAGTF operations rely heavily on aviation assets, and in most cases the aircraft are the only means to support distributed operations. The concept of SPMAGTF AVLOG support for aircraft readiness lacks resources and needs updating. In order to improve the concept of AVLOG support, increase aircraft

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[2] Commandant of the Marine Corps. 38th Commandants Planning Guidance, July 16 2019. https://www.hqmc.marines.mil/Portals/142/Docs/%2038th%20Commandant%27s%20Planning%20Guidance_2019.pdf?ver=2019-07-16-200152-700

[3] 38th Commandants Planning Guidance, July 16 2019.

readiness, and sustain flight operations for SPMAGTF, the Marine Corps must address flaws in equipment, training, and manpower, which not only benefit the MV-22B squadrons, but also other Type/Model/Series aircraft deployed to USCENTCOM.

The following methodology, background information, and analysis were derived from empirical data collected from aircraft readiness reports, after action reports, and observations compiled from my deployment as the 3d Marine Aircraft Wing (MAW) Aviation Logistics Department (ALD) planner in support of the SPMAGTF-CR-CC 18.2 deployment. The recommendations provided are a combination of input from the 3d MAW Aviation Logistics Maintenance Team (ALMAT) VMM-164 readiness review and a site visit conducted at the Task Force 51 / 5th Marine Expeditionary Brigade (CTF-51/5) logistics directorate. They are compiled here in the hope that this paper will reach those decision-makers who can make a difference in SPMAGTFs AVLOG support.

Methodology

Analysis of the SPMAGTF aircraft readiness data, principally RBA percentages, reveals how the concept of AVLOG support could only sustain an average below 60% readiness, and identified areas for AVLOG improvement. MCDP 3, *Expeditionary Operations*, informs the reader that an expeditionary mindset is necessary for operations and that Marines will accomplish the mission with the resources they possess. This statement underlies a widely held attitude within the Marine Corps that Marines do more with less. As such, the SPMAGTF has become accustomed to operating without the robust logistical support that one would expect after operating from the same location for roughly six years. A review of VMM-164's) 18.1 deployment reveals that an outdated concept of AVLOG support negatively impacted the

squadron's aircraft readiness. Although VMM-164 flew all of its assigned missions—the accepted standard of a successful deployment—it suffered degraded maintenance operations, and low aircraft readiness. The primary goal of reviewing this squadron's readiness is to identify and highlight resource shortfalls and bring awareness to the degraded and outdated AVLOG support the squadron endured for six months.

The research methodology used in this thesis included aircraft readiness data and recommendations from the 3d MAW ALMAT VMM-164 readiness review, the CTF-51/5 logistics directorate site visit, and a SPMAGTF aircraft readiness study completed by the Marine Corps Combat Development Command's (MCCDC) Operation and Analysis Division (OAD). The data reviewed aircraft readiness, in particular the Ready Basic Aircraft (RBA) metric for the 15.1, 15.2, 16.1, 18.1, 18.2, and 19.1 VMM deployments. Table 1 on page 21 depicts a combination of RBA data from a case study for the first three VMM rotations and RBA data populated from the Aviation Maintenance Supply Readiness Reporting (AMSRR) system for the last three. The 16.2, 17.1, and 17.2 rotations were squadrons comprised of six aircraft vice the full complement of 12 and were not listed due to research limitations.

To understand the following discussion on aircraft readiness, one must first understand the terms used to describe variations of readiness. Aircraft readiness is measured using several metrics. These metrics include the following aircraft material conditions and statuses: Non Mission Capable (NMC), Partial Mission Capable (PMC), Full Mission Capable (FMC), and Ready Basic Aircraft. The OAD study in conjunction with the Naval Aviation Maintenance Program (NAMP), 4790.2c, define the following aircraft readiness statuses and provide the reader with a basic understanding of aircraft readiness terminology.

- NMC is a "material condition of an aircraft that is not capable of performing any of its missions" and is not flyable.

- PMC is a "material condition of an aircraft that can perform at least one but not all of its missions."
- FMC is a "material condition of an aircraft that can perform all of its missions."[4]
- RBA is "a mission capable aircraft (PMC or FMC), that is FCF complete, capable of day or night Instrument Meteorological Conditions (IMC) field operations, and has the necessary operational communications, Identification Friend or Foe (IFF), Navigation, flight and safety systems required. [5]

Due to the complexities associated to aircraft material condition and aircraft readiness reporting, the RBA metric was primarily used to brief current statuses to the SPMAGTF CO and the planning staff. In this instance, RBA vice mission capable statuses was used because it was the general term used for non-aviation personnel, and in plain language provided the exact number of aircraft available and ready for tasking. Only ALD and squadron maintenance personnel were privy to mission capable statuses and therefore ensured the appropriate aircraft was tasked for missions and operations.

Study of VMM-164's low readiness identified flaws in equipment, training, and manpower, and resulted in recommendations for improving the concept of AVLOG support for the ACE. The goal of these recommendations are to improve the concept of AVLOG support, increase aircraft readiness, and sustain flight operations for all MAGTFs, by providing lessons learned during the author's deployment for deploying units to ensure they are resourced, equipped, trained, and manned according to their assigned mission.

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[4] Commander Naval Air Forces Instruction 4790.2C, *Naval Aviation Maintenance Program.* Department of the Navy, January 15, 2017, Appendix A.
[5] Headquarters US Marine Corps, *Analyzing Aviation Readiness of the Crisis Response SPMAGTFs (Central and Africa Commands*, Operational Analysis Directorate, Marine Corps Combat Development Command, 2017, 2.

Background

SPMAGTFs aircraft readiness is contingent on the relationship between flight and maintenance operations and in order to understand the problems that the unit faces, one must first understand how its task organization, table of equipment, and concept of AVLOG support interact.

Task Organization & Table of Equipment

SPMAGTF's task organization (T/O) and table of equipment (T/E) negatively impacted command and control (C2), and the concept of AVLOG support. In October of 2014, the Marine Corps deployed an SPMAGTF to the CENTCOM AOR, splitting components of its ACE between Ahmed Al Jaber Airbase in the Kingdom of Kuwait and Sheik Isa Airbase in the Kingdom of Bahrain. According to the SPMAGTF-CR-CC 18.2 Commanding Officer, George C. Scheffler III, Colonel USMC, the mission states: "SPMAGTF-CR-CC conducts crisis response operations, provides forces, and performs other missions as directed by Commander, US Central Command in order to support theater objectives."[6] To meet the demands for crisis response SPMAGTF is T/O with a Command Element (CE) and three Major Subordinate Elements (MSE); the Ground Combat Element (GCE), Logistics Combat Element (LCE), and the Aviation Combat Element (ACE). Unlike the nine-month CE deployment, each MSE executes a six-month deployment. This rotation cycle provides continuity between MSEs, and ensures the execution of proper Relief in Place / Transfer of Authority operations (RIP/TOA). Over the course of the 18.2 CE deployment, the T/O changed twice. Figure 1 depicts the T/O changes from April to December 2018 and highlights the change over from VMM-164 to VMM-

[6] Mitch Borley, *Special Purpose Marine Air Ground Task Force, Central Command 18.2: OPR – Deputy Commandant of Installations & Logistics* (SPMAGTF-CR-CC 18.2 S-4, January 24, 2018), PowerPoint presentation.

165 during a seasonal climate change in Kuwait, which affected aircraft readiness. The disparity in aircraft readiness between the two VMM squadrons will be addressed later in this paper.

Figure 1: SPMAGTF-CR-CC 18.2 Task Organization April to December 2018
Source: Special Purpose Marine Air Ground Task Force Crisis Response, Central Command 18.2: OPR – Deputy Commandant of Installations & Logistics. PowerPoint presentation. SPMAGTF-CR-CC 18.2 S-4, January 24, 2018.

The T/O and T/E for the SPMAGTF ACE is different from that of a composited MEU ACE, and due to this C2 structure and assigned bed-down locations, SPMAGTF squadrons suffered low readiness as they further exacerbated an already degraded concept of AVLOG support by competing for resources. While the MEU ACE is commanded by one O-5, Lieutenant Colonel, which is structured under one composited VMM squadron, and reinforced with a complement of other aircraft platforms and support detachments, the SPMAGTF ACE is not a composited squadron, but instead made of two separate squadrons with O-5 commanders and one aviation detachment commanded by an O-4, Major. The initial MV-22B T/E deployed with 12 aircraft, but after two rotations, six aircraft were rotated back to the Continental United States

(CONUS) in 2016. After three rotations, in April of 2018, six additional aircraft were augmented to SPMAGTF and arrived via black-bottom shipping, from the Port of San Diego – Naval Air Station North Island, to the Port of Ash Shuaibah, Kuwait. The T/E changes in 2016 and again in 2018, never updated the concept of AVLOG support. The logistics support package should have undergone review and revalidation to account for the decrease of aircraft and flight operations in 2016 and the increase in 2018. However, the concept of AVLOG support did not get revalidated during the numerous T/O and T/E changes over the last six years and as a result aircraft readiness decreased the most with the the increase of six aircraft during the VMM-164 deployment

Concept of AVLOG Support

In this paper's discussion of how to improve aircraft readiness for SPMAGTF, one must understand some of the basic tenets of aviation logistics, and how deficits in the SPMAGTF concept of AVLOG support led to suboptimal maintenance and supply operations, which resulted in decreased aircraft readiness. Marine Corps Training Publication 3-20A, *Aviation Logistics*, states "the AVLOG mission of the Marine Corps, at all command and support levels, is to assist in generating ACEs that are rapidly deployable, self-reliant, self-sustaining, and flexible."[7] Prior to a deployment, squadrons are identified and planners begin to plan and compose a concept of AVLOG support utilizing the following overarching principles.

- *Responsiveness:* Providing the right support at the right time and at the right place.
- *Flexibility:* Adapting logistic support to changing conditions.
- *Attainability:* Acquiring the minimum essential logistic support to begin operations.
- *Survivability:* Ensuring the functional effectiveness of the logistic infrastructure in spite of degradation and damage.
- *Sustainability:* Ensuring adequate logistic support or the duration of the operation.

[7] Headquarters US Marine Corps, *Aviation Logistics*, MCTP 3-20A (Washington, DC: Headquarters US Marine Corps, April 4, 2018), 1.

- *Economy:* Employing logistic support assets effectively.
- *Simplicity:* Avoiding unnecessary complexity in preparing, planning, and conducting logistics operations.[8]

These principles serve to validate a support package based on the number and mix of T/M/S aircraft from a given Marine Aircraft Group (MAG). In turn the parent MALS of the deploying unit(s) will build a support package utilizing a building block method, which remains fundamental to providing support to maintain aircraft and to sustain aviation operations for a given period of time. These building blocks contain elements for aviation operations and elements specific to a T/M/S platform. They include; aircraft spare parts allowances, Ground Support Equipment (GSE), Hazardous Materials (HAZMAT), Individual Material Readiness List (IMRL) items, Mobile Facilities, and specific Intermediate Level (I-Level) capabilities, maintainers, and aviation supply personnel.[9] The SPMAGTF AVLOG support package suffers degradation in each building block area, which further emphasizes the requirement to validate the concept of AVLOG support with every T/O change. The following findings and recommendations utilize the same overarching principles and building blocks to identify areas of improvement and make recommendations to bolster AVLOG support for the ACE.

Analysis

An analysis of the AVLOG support package and SPMAGTF aircraft readiness; based on RBA data collected from an OAD case study, the author's observations while deployed with SPMAGTF, and suggestions from the VMM-164 readiness review, reveal that the VMM is meeting mission with the resources and support package its possess regardless of shortfalls.

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[8] Headquarters US Marine Corps, *Aviation Logistics*, MCTP 3-20A (Washington, DC: Headquarters US Marine Corps, April 4, 2018), 5-1.
[9] Headquarters US Marine Corps, *Aviation Logistics*, MCTP 3-20A (Washington, DC: Headquarters US Marine Corps, April 4, 2018), 1-6.

However, an RBA average below 60% is not conducive to sustaining consistent flight operations, and the squadron increases risk of long-term degradation of aircraft readiness.

AVLOG Support Package – Supply Chain

The MALS detachment for the VMM squadron continues to support flight operations at the cost of overly taxing the supply chain causing delays in aircraft maintenance operations. The MALS detachment serves as the primary source of aviation supply within theater and provides an expeditionary supply chain at the point of need. The supply section utilizes an Expeditionary Pack-Up Kit (EPUK) to digitally manage an effective and responsive supply chain.[10] Physically, two support allowances have been allocated to the MALS detachment: a Fly-In Support Allowance (FSA) and Supplemental Aviation Spares Support Allowance (SASS). Both combined form the Pack Up Kit (PUK) and provide enough aircraft parts for approximately 12 aircraft for a 30 day period at combat utilization rates.[11] As noted in the turnover between ALD staffs, "the supply portion of the concept of AVLOG support was designed to be expeditionary, employing a minimal footprint within theater and heavily reliant on a responsive supply chain from the parent MALS."[12] However, this concept of AVLOG support was intended for a one to two rotations and not the extended duration it has endured. At the current rate, the parent MALS struggles to fill the demand signal for ordered aircraft parts, thus affecting supply effectiveness and efficiency. Figure 2 visually depicts the logistics flow of aircraft parts shipping from CONUS to the MALS detachment to fill orders and PUK replenishments.

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[10] Aviation Logistics Department, "SPMAGTF-CR-CC 18.2 ALD Turn-over" (unpublished paper, December 1, 2018), Microsoft Word file.
[11] Naval Air Systems Command, *Marine Aviation Logistics Support Program (MALSP)* Modernization (Unmanned Aviation & Strike Weapons, PMA-242, 2017), PowerPoint presentation.
[12] Aviation Logistics Department, "SPMAGTF-CR-CC 18.2 ALD Turn-over" (unpublished paper, December 1, 2018), Microsoft Word file.

SPMAGTF-CC VMM/MALS Aviation Parts Logistics Flowchart (CONUS/Worldwide to Al Jaber Air Base, Kuwait)

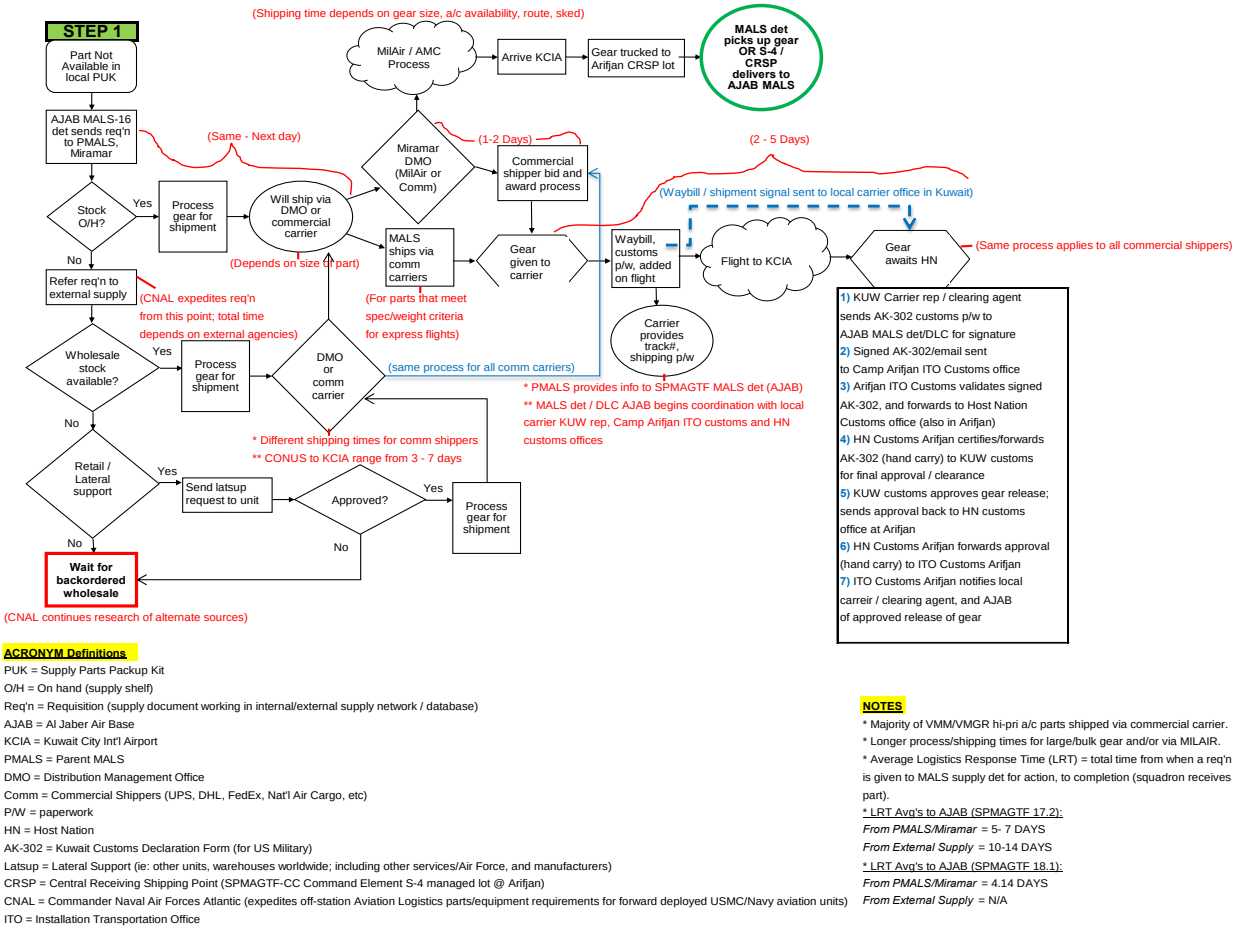

Figure 2: SPMAGTF-CR-CC VMM Aviation Logistics Flowchart
Source: MALS Detachment Shipping. *AVLOG Operations.* PowerPoint presentation. SPMAGTF-CR-CC 17.2 ALD, 2018.

Figure 2's significance shows the amount of touch points encountered during shipment and notes the Logistics Response Time, later referred to as Customer Wait Time, which measured the average shipping times for the 17.2 and the beginning of the 18.1 VMM deployments. Figure 3 depicts the average Customer Wait Time for the remaining18.1 and 18.2 VMM deployments combined.

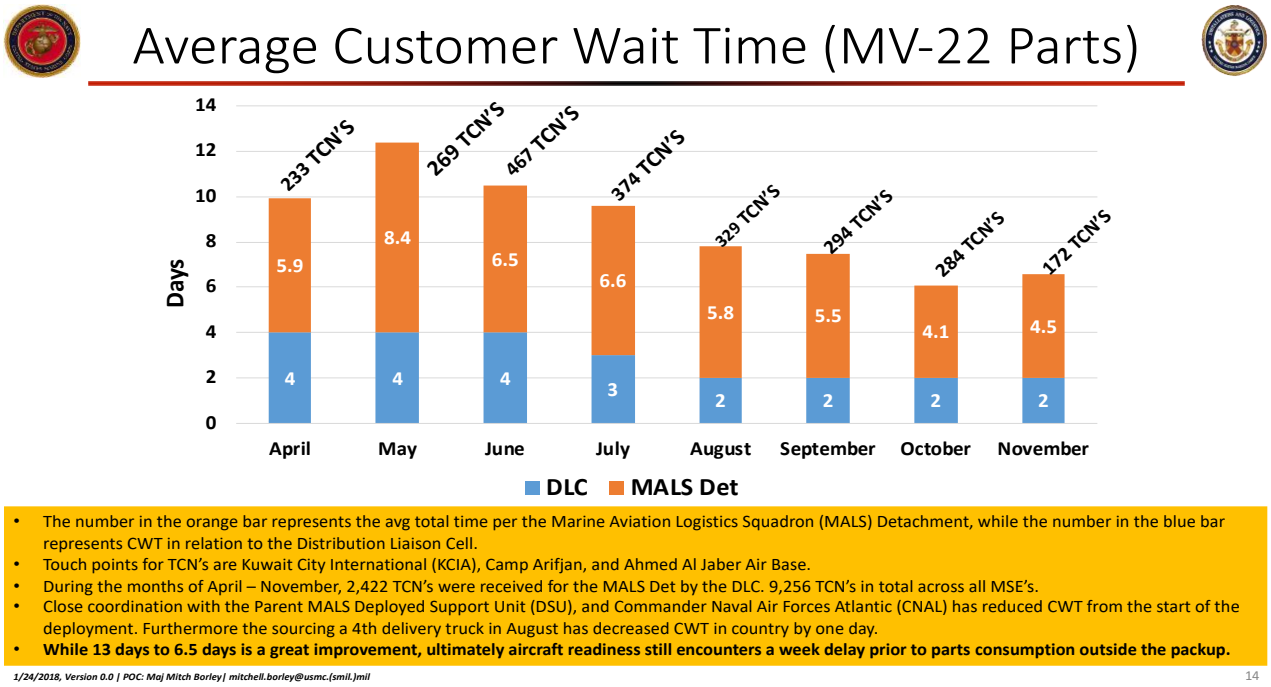

Figure 3: SPMAGTF-CR-CC 18.2 Average Customer Wait Time (MV-22 Parts)
Source: Special Purpose Marine Air Ground Task Force Crisis Response, Central Command 18.2: OPR – Deputy Commandant of Installations & Logistics. SPMAGTF-CR-CC 18.2 S-4, January 24, 2018.

Both figures underscore an important part of the concept of AVLOG support as shipping aircraft parts and the time associated impacts aircraft readiness. It is important to note that while the MALS detachment made significant gains in reducing CWT across two deployments by establishing a close relationship with the parent MALS Deployed Support Unit, Commander Naval Air Force Atlantic and the Distribution Liaison Cell, it still consistently generated readiness below 60%. Acceptance of this readiness standard goes against the CPG's commitment to ensuring forward deployed units are resourced, trained, equipped, and manned to compete against malign activities. An allowance review and validation would provide enough aircraft parts to meet current maintenance trends, and reduce such a heavy reliance on the supply chain.

SPMAGTF Aircraft Readiness

Throughout the deployment a combination of extreme temperatures, lack of proper maintenance facilities, ill-maintained support equipment, high aircraft utilization, poor maintenance procedures, and overtaxed supply chain degraded VMM-164's aircraft readiness. Amidst these constraints though, the squadron's resilience and professionalism accomplished every mission tasked. However, out of all the VMM rotations it suffered the lowest aircraft readiness in part due to the aforementioned external and internal factors. It was the first squadron to receive the six additional aircraft in 2018 after the reduction in 2016. An initial indicator of aircraft readiness issues within the first month of the deployment involved: establishing a full VMM squadron worth of aircraft, equipment, and personnel aboard the air station; receiving the aircraft from the port; and establishing flight operations. The squadron was not afforded the time to establish working routines before executing day and night flight operations. Simply taking time to acclimatize the squadron to the AOR, to include the MALS detachment, would have provided sufficient review of the concept of AVLOG support package and identified deficiencies. Table 1 depicts the VMM RBA data for SPMAGTF since 2014. This is important because it shows that the total average RBA for deployments combined is still below established readiness goals.

Deployment	Squadron	# of A/C Assigned	Average RBA
15.1	VMM-363	12	57%
15.2	VMM-165	12	49%
16.1	VMM-268	6	63%
16.2	VMM-363	6	N/A
17.1	VMM-165	6	N/A
17.2	VMM-364	6	N/A
18.1	VMM-363	6	62%
18.2	VMM-164	12	45%
19.1	VMM-165	12	72%

Table 1: Average Ready Basic Aircraft for SPMAGTF-CR-CC VMM Deployments
Source: Data received from the Operational Analysis Directorate, Marine Corps Combat Development Command study "*Analyzing Aviation Readiness of the Crisis Response SPMAGTFs (Central and Africa Commands)*", 2017, and the Aviation Maintenance and Supply Readiness Reporting database.

An aircraft readiness study conducted by the Marine Corps Combat Development Command (MCCDC), Operations Analysis Directorate (OAD) in 2017 analyzed the first three VMM rotations; 15.1, 15.2, and 16.1. The study determined an average RBA percentage of 56% and concluded "that operational tempo, maintenance capability, and logistics systems have significant impacts on readiness for SPMAGTF."[13] The next three rotations we not accounted for, and data not captured due to research limitation. RBA data for the 18.1, 18.2, and 19.1, pulled from the Aviation Maintenance Supply and Readiness Reporting (AMSRR) system shows an average of 59%. There are no significant deviations in the overall average RBA for the VMM

[13] Headquarters US Marine Corps, *Analyzing Aviation Readiness of the Crisis Response SPMAGTFs (Central and Africa Commands*, Operational Analysis Directorate, Marine Corps Combat Development Command, 2017, 10, 27.

since the MAGTF's inception. As a result of the VMM-164 low readiness, 3d MAW sent a team of subject matter experts (SMEs) to conduct a readiness review of the maintenance department and MALS detachment.

3d MAWs review took place in the heart of the region's summer, when extreme weather conditions make the routine tasks of maintenance uncommonly difficult and aircraft readiness faces more challenges than normal. VMM-164 suffered the brunt of this extreme weather, which affected aircraft readiness and flight operations severely. During the summer months, Kuwait is subject to weather conditions of extreme temperatures that consistently exceed 110 degrees Fahrenheit and sun exposure, which affect aircraft and maintenance personnel during the day maintenance shift. Furthermore, June and July are the windiest months, sustaining average wind gusts between 8-14 knots. An estimated six to eight days of maintenance operations were lost due to heat or wind exposure beyond the ability to safely conduct aircraft maintenance. [14] Plainly stated, under these extreme conditions, Marines do not have the opportunity to fix aircraft. Figure 4 depicts temperature readings in Fahrenheit taken at 1200 on July 25, 2018 of a MV-22B aircraft parked on the maintenance spot.

[14] Thomas Fowler. "Marine Medium Tiltrotor Squadron (VMM) 164 Special Purpose Marine Air Ground Task Force (SPMAGTF) Readiness Review." (unpublished report, July 28, 2018). Microsoft Word file.

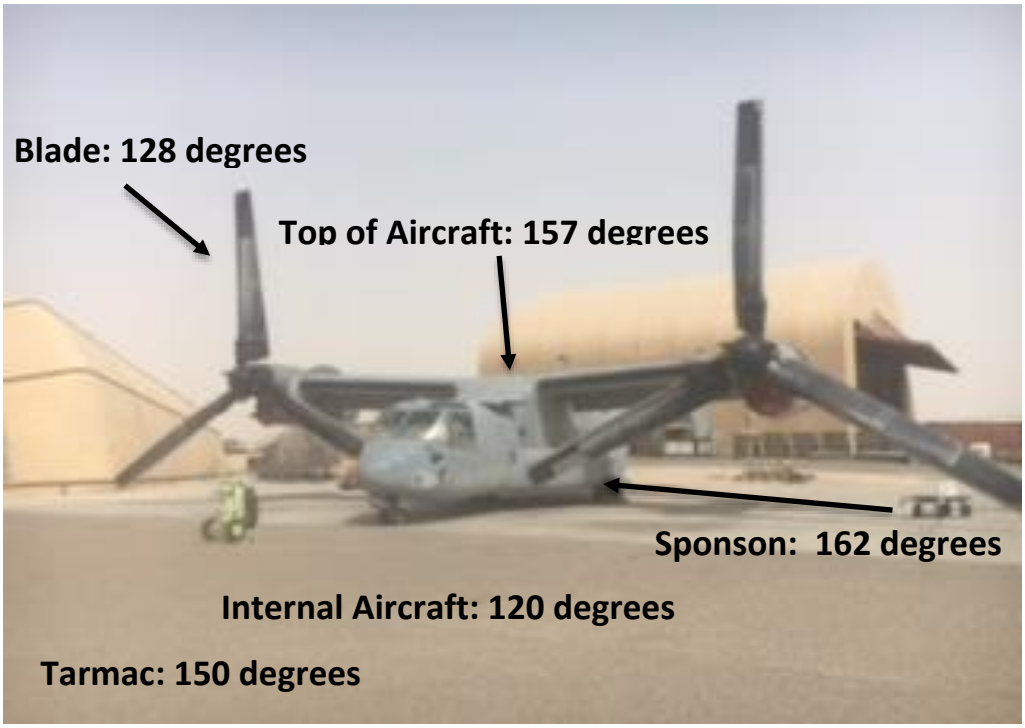

Figure 4: SPMAGTF-CR-CC 18.2 VMM-164 MV-22B on Maintenance Spot
Source: VMM-164 SPMAGTF Readiness Review. July 28, 2018.

A simple fix for this problem is the procurement of a new hangar and sunshades. A new hangar safeguards and protects aircraft and maintainers from the external elements, while also providing space for IMRL and GSE storage. For example, figure 5 depicts uncovered and ill-maintained support equipment that could be stored in the hangar. Inoperable IMRL and GSE are major contributors to decreased maintenance capabilities and, as a result, reduce aircraft readiness.

Figure 5: SPMAGTF-CR-CC 18.2 IMRL and GSE
Source: VMM-164 SPMAGTF Readiness Review. July 28, 2018.

Furthermore, the team evaluated the maintenance material management (3M) data for ten of VMM-164s aircraft during a three-month period to determine any internal deficiencies. Figure 6 provides a snapshot of the accumulated data.

BUNO	FLTHRS	DMMH	UTIL	MC%	NMCS%	NMCM%	TOTAL SCIR HRS	RBA	A799 WOs	A799 MHRS TOTAL	BEFORE FLT ABORTS	IN-FLT ABORTS	120	200	310	NMC UNSCHED	POST FLT DOWNER
00 / 168640	88.5	1655.3	29.5	45.1	7.8	47.1	10838.2	79.16%	4	7.7	1	1	346.8	525.4	574.8	836	50.00%
01 / 168637	70.7	1984.9	23.6	45.2	2.6	52.2	12570.7	86.11%	7	24.0	3	3	370.1	716.9	797.2	903	71.42%
02 / 168635	84.7	780.6	28.2	76.2	1.4	22.3	3634	48.61%	7	25.5	1	1	124.3	180.1	357.0	390	40.00%
03 / 168639	68.4	1835.8	22.8	60.7	5.1	34.2	17037.9	54.16%	7	36.1	0	0	443.4	476.9	720.5	327	73.33%
04 / 168629	121.8	1451.9	40.6	73.5	2.3	24.2	12522.4	59.72%	7	39.5	0	0	361.7	375.8	581.5	423	53.84%
05 / 168336	98.4	2256.2	32.8	41.3	8.5	50.3	12926.9	50.00%	9	46.2	0	2	282.3	748.8	895.3	880	53.84%
06 / 168296	57.4	2304.3	19.1	31.7	10.6	57.7	9105.2	27.77%	13	104.6	1	2	361.7	618.6	764.2	1002	77.27%
08 / 165847	60.7	1488.9	20.2	61.9	4.7	33.4	9352.2	61.11%	14	19.3	1	0	320.2	462.8	506.6	584	77.27%
09 / 166495	41	1581.4	13.7	56.5	4.1	39.4	7756.0	56.93%	17	46.6	1	0	348.7	768.0	305.3	689	72.72%
10 / 166734	18.4	1943.5	6.1	18.2	11.7	70.1	12676.0	19.44%	4	6.9	0	0	532.8	644.1	643.6	1229	62.50%

Figure 6: SPMAGTF-CR-CC 18.2 VMM-164's Maintenance Data
Source: VMM-164 SPMAGTF Readiness Review. July 28, 2018.

The significance of figure 6 data shows that RBA percentages fluctuated among the ten aircraft, and indicates aircraft with higher RBA rates were utilized more. The maintenance department strived to manage the assigned aircraft and balance all inspection cycles but due to extensive flight operations was forced to over utilize and induct aircraft into phase maintenance sooner than planned and consecutively. A phase inspection is the most disruptive scheduled maintenance action because it is a detailed inspection that normally keeps an aircraft in a NMC status for extended periods of time because of the number of maintenance actions required and or awaiting ordered parts. In comparison to figure 6, figure 7 below depicts the phase maintenance tree, which is based on a 280 flight hour cycle for the MV-22B. An ideal phase tree resembles that of a staircase, which allows for time to plan between inspection cycles, keeps more aircraft

flying, and spread-loads aircraft utilization across the squadron's fleet. VMM-164's phase tree had several plateaus, which caused back-to-back phase maintenance cycles, resulting in significant maintenance delays and reducing aircraft readiness. Though this was an internal maintenance department issue, it was worth noting because VMM-164 ran the risk of inducting multiple aircraft into phase maintenance at the same time, which constrains maintenance manpower, stresses the supply chain, and decreases aircraft availability.

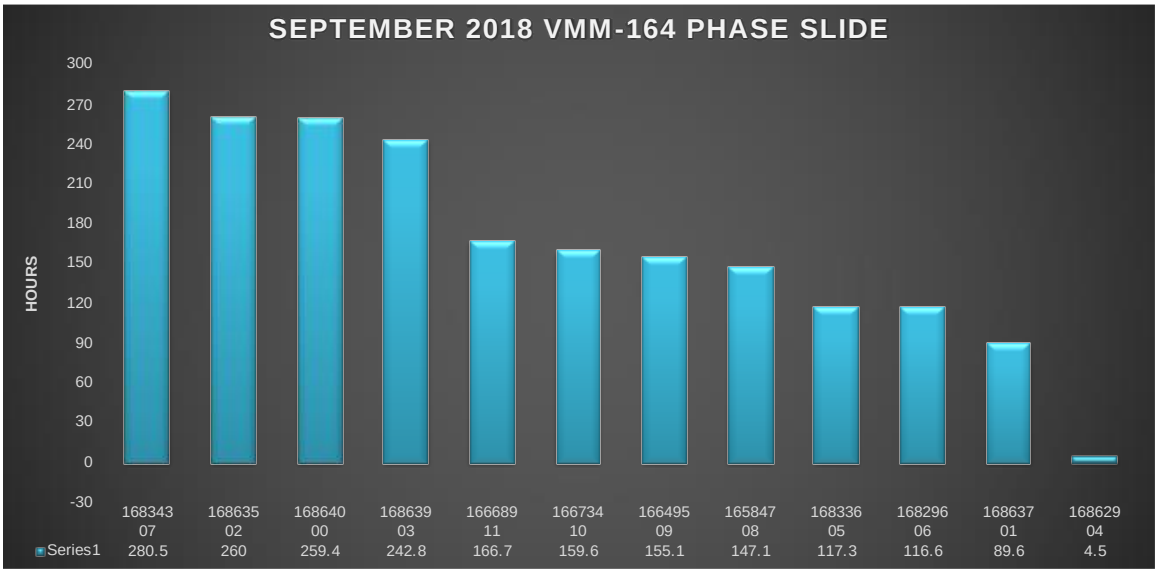

Figure 7: SPMAGTF-CR-CC 18.2 VMM-164's Phase Tree
Source: VMM-164 SPMAGTF Readiness Review. July 28, 2018.

Findings/Recommendations

Findings

First and foremost, improving the concept of AVLOG support will increase aircraft readiness, and sustain flight operations for SPMAGTF. The VMM-164 readiness review revealed external and internal factors that affected aircraft readiness and ultimately aircraft availability. While it appears impressive that, despite these factors, the squadron still executed all missions without failure, this selective data hides the reality that total missions flown would have

been much higher had aircraft readiness been higher. Simply put, squadrons schedule fewer missions when they face lower levels of readiness in order to ensure that they are capable of executing what is expected of them.

Secondly, though the squadron maintained a high operational tempo, its support package, including the PUK, IMRL, and GSE, was intended to provide sufficient sustainment for a pre-determined duration and aircraft utilization rate that ended up being far less than what the squadron actually flew. This logistics flow is not uncommon. Most support packages for a deployed ACE have only enough parts and capabilities to sustain flight operations for a short duration, with the caveat of establishing a logistics chain with home station and external support. While this support package was sufficient for the initial deployment, the increase in current operational demands for TSC, crises response, and other contingency operations exceed the capabilities of the current AVLOG posture.

Thirdly, in addition to the readiness review, the SPMAGTF ALD conducted a site visit to regional logistics facilities and discovered several missed opportunities to capitalize on joint logistics capabilities that could ease the burden on the SPMAGTF's AVLOG system. During a visit to Aviation Intermediate Maintenance Department (AIMD) Bahrain and CTF-51 Logistics Directorate aboard Naval Support Activity (NSA) Bahrain, SPMAGTF ALD discovered several key areas for improved AVLOG support and coordination between these regional logistics entities, which included GSE maintenance, oil analysis, and HAZMAT storage and replenishment—simple improvements that could have an large impact on reducing the strain on an already overtaxed system.

Recommendations

The following recommendations are a combination of the VMM-164 readiness review and the SPMAGTF ALD site visit observations. They address the flaws in concept of AVLOG support and provide simple fixes to improve the AVLOG support package with the goal of increasing aircraft readiness, and sustaining flight operations. Additionally, these recommendations not only benefit the VMM, but also other T/M/S aircraft deploying to the CENTCOM AOR.

First, the squadron has one soft-skinned hangar with a door that retains the ability to accommodate two aircraft; one spread and one in a folded configuration. This is an example of logistical support decisions that did not account for prolonged operations in the CENTCOM environment. See figure 8 for a photo of the MV-22B hangar.

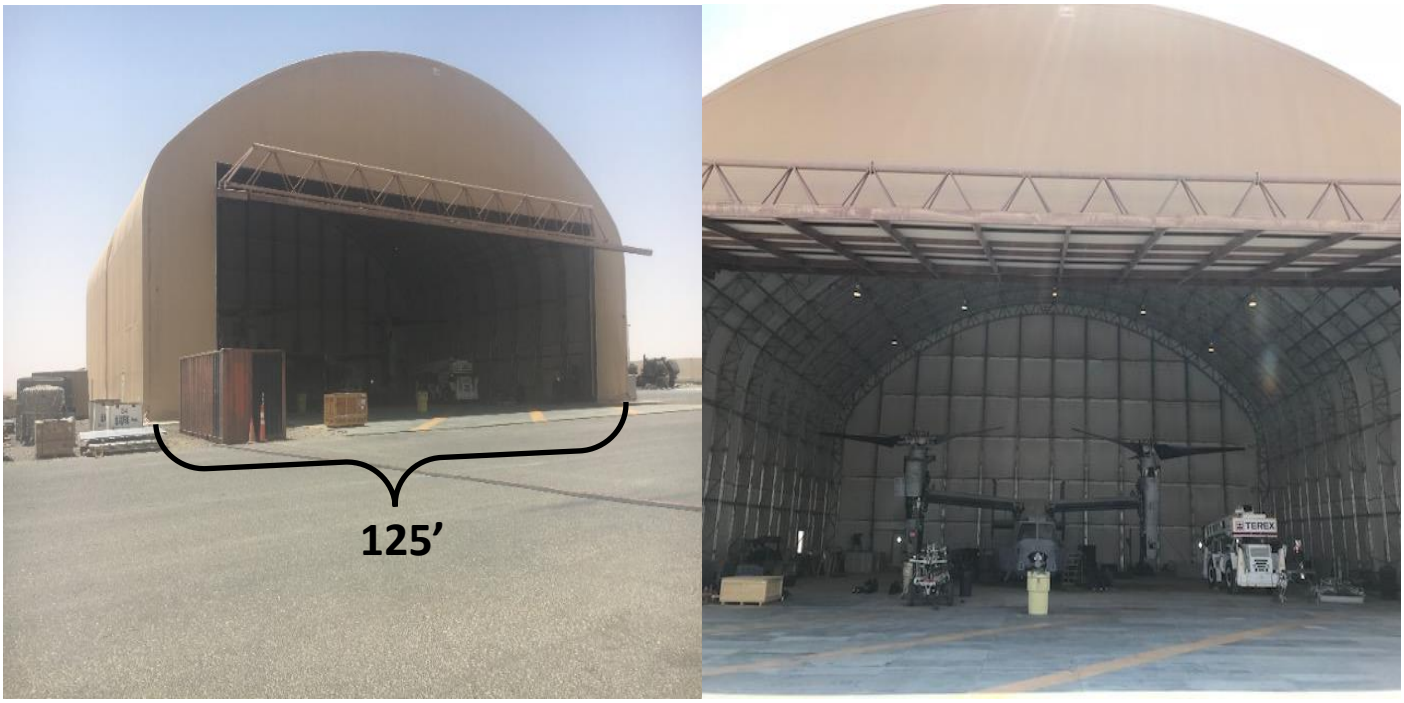

Figure 8: SPMAGTF-CR-CC MV-22B Hangar
Source: VMM-164 SPMAGTF Readiness Review. July 28, 2018.

As a result of the weather conditions during the summer months, the VMM is in need of an additional hangar and sunshades. A new hangar and sunshades will provide additional coverage for maintenance personnel, aircraft, and storage of IMRL and GSE. Reducing heat and sun exposure allows maintenance operations during extreme weather condition and prevents work stoppages. The squadron could regain a portion of the day maintenance shift normally lost to the heat and sun, thereby increasing maintenance hours and, as a result, aircraft readiness.

Second, the VMM and MALS detachment should replace degraded IMRL and GSE that has been in theater since the initial deployment. The original requirement did not anticipate for the extended duration of these assets in theater, and over time the climate and external elements eroded gear. Equipment identified and prioritized by the team were the degraded beyond repair, they include: a tow tractor, large corrosion control cart, mobile electric power plant, a portable hydraulic test stand, and an AM32C-23 air conditioning unit. Exchanging these assets for operable equipment significantly increase maintenance operations, especially when there is only one or two assigned to the MALS detachment. Of note, the VMM shares three of the six A/M32C-23 air conditioning units with the VMGR detachment and uses them to cool the aircraft avionics closets prior to launch. The though the A/M32C-23 air condition unit is a KC-130J specific support equipment item, the VMM has relied on them to cool aircraft during the summer months. AIMD Bahrain utilizes the new 802 air recommends this unit for the SPMAGTF ACE. A distinct difference between the two units is the 802's easy maintenance serviceability and reliability, while the A/MC32C-23 serviceability requires additional training due to its extensive electrical panel.

Third, squadron maintenance training should incorporate formalizing a pre-deployment milestones tracker similar to that of MEU ACE in order to ensure squadrons arrive fully trained

and equipped for the CENTCOM AOR.[15] An established tracker will facilitate proper pre-deployment maintenance tasks and training for deploying SPMAGTF units. Furthermore, a milestone tracker places the ownness on the MALS, MAW ALD, and MARCENT to ensure deploying squadrons are in compliance with deployment directives and are sufficiently prepared to self-sustain until a supply chain is established. Furthermore it ensures the AVLOG support package is validated.

Fourth, AIMD Bahrain offers adequate space and capacity to support SPMAGTF aviation GSE requirements, calibration, and oil analysis, and should be incorporated into the concept f AVLOG support in order to reduce the reliance placed on the supply chain and parent MALS. ALD to include the squadrons should coordinate and exercise naval integration with AIMD to the max extent possible. Leveraging the existing I-level capabilities at AIMD where applicable, vice relying on home station, will reduce significant turnaround time for items shipped. To support GSE maintenance, ALD should request a Naval Aviation Technical (NATEC) Representatives permanently stationed in Bahrain. The NATEC representatives would provide load testing for cranes, training for the 802 air conditioning unit too includes the AM32C-23s and all other GSE used by SPMAGTF aviation. In addition to hosting the NATEC representative, AIMD Bahrain could send GSE mechanics every quarter to Al Jaber Air Base to support the MALS detachment onsite. Due to the wide variety of support, AIMD Bahrain can conduct tire build-ups, Non-Destructive Inspection, proof-loading, air conditioning servicing and brazing, calibration, and oil analysis. Additionally, AIMD Bahrain uses the calibration work center aboard Naval Air Station Sigonella, Italy for all calibration requirements. The MALS detachments should establish procedures to send equipment in conjunction with the AIMD

[15] Thomas Fowler. “Marine Medium Tiltrotor Squadron (VMM) 164 Special Purpose Marine Air Ground Task Force (SPMAGTF) Readiness Review.” (unpublished report, July 28, 2018). Microsoft Word file.

Bahrain shipment for calibration. Furthermore, AIMD Bahrain has a fully functioning oil analysis laboratory that is able to process aircraft oil samples. ALD should coordinate oil analysis of all oil samples.

Fifth, due to the complexities associated with hazardous material (HAZMAT) shipping, the VMM should pre-stage HAZMAT at the Fleet Logistics Center (FLC) Naval Base Bahrain by utilizing the Consolidated Hazardous Material Reutilization and Inventory Management Program (CHRIMP), this will result in reduced shipping times and maintenance operations delays, and increase aircraft readiness. NAVSUP FLC Bahrain has the ability to pre-position hazardous materials in a climate-controlled, regulated area with oversight and inventory management. The CHRIMP will provide inventory accountability, monthly inspections, and reconciliation reports to the MALS. Inventory levels can provide on-demand or scheduled dependent HAZMAT based on the needs of the customer. Storage limits are not defined, but the main consideration is stocking hazmat based on shelf-life limits. Pre-staging HAZMAT reduces CWT to approximately two to four days from the time HAZMAT is requisitioned to the time it arrives.

Lastly, manpower needs to be reviewed for high demand low-density military occupational specialties (MOS) in order to increase I-level capacity, which will result a reduction in I-Level maintenance backlog. Furthermore, the MALS detachment should send its one Aviation Life Support System (ALSS) technician with work requests to AIMD Bahrain to work with the two Collateral Duty Quality Assurance Representatives and execute all ALSS inspections and maintenance. Ultimately, this will drastically decrease the turnaround time needed to repair and make ALSS equipment Ready For Issue (RFI). In addition, to the above manpower coordination, the squadron maintenance department requested, an additional IMRL

Staff Non-Commissioned Officer (SNCO), one GSE mechanic, E-4 or below, and one Dynamic Component mechanic, E-4 or below, to increase the MALS detachment from a single shift to a dual maintenance shift.[16]

Conclusion

The nine-month SPMAGTF 18.2 deployment revealed several flaws in concept of AVLOG support that contributed to decreased aircraft readiness for the VMM. First, though the unit has endured the last six years the ACE's sustained low aircraft readiness will not increase without a significant AVLOG support revision. The current mission and operational demand for SPMAGTF show no sign of decreasing, and operating at low levels of readiness will only continue to strain maintenance and supply operations, potentially resulting in long-term degraded aircraft readiness. Second, the seasonal weather conditions will not change, all squadrons should tailor their flight and maintenance operations to account for extreme weather and exposure of personnel to the elements by training, and operations, especially during the summer months. Third, improving the concept of AVLOG support for SPMAGTF requires a two-fold approach, one from the squadron and the other from the Parent MALS, to ensure all requirements are accounted and/or requested from higher headquarters.

Lastly, heeding the above recommendations are necessary for the VMM, but also for the other squadrons, and ALD in order to increase aircraft readiness. Moreover, acquiring a new hangar and sunshades, training maintenance and supply personnel properly, and investing in additional I-Level capabilities not only benefits the SPMAGTF, but also executes the CPG's naval integration initiative with AIMD. VMM-164 was subjected to the same concept of

[16] Thomas Fowler. "Marine Medium Tiltrotor Squadron (VMM) 164 Special Purpose Marine Air Ground Task Force (SPMAGTF) Readiness Review." (unpublished report, July 28, 2018). Microsoft Word file.

AVLOG support established in 2015 and though the squadron executed all major operations, a heavy burden was placed on the maintenance department, and thus aircraft readiness suffered. These recommendations are rather simple, but very important as they operationalize the CPG's advocacy and support for forward deployed units.

Glossary

ACE	AVIATION COMBAT ELEMENT
AIMD	AVIATION INTERMEDIATE MAINTENANCE DEPARTMENT
AMSRR	AVIATION MAINTENANCE AND SUPPLY READINESS REPORTING
ALD	AVIATION LOGISTICS DEPARTMENT
ALMAT	AVIATION LOGISTICS MAINTENANCE ASSESSMENT TEAM
AMO	AIRCRAFT MAINTENANCE OFFICER
AOR	AREA OF RESPONSIBILITY
ASR	ASSAULT SUPPORT REQUEST
AVLOG	AVIATION LOGISTICS
CE	COMMAND ELEMENT
CHRIMP	CONSOLIDATED HAZARDOUS MATERIAL REUTILIZATION AND INVENTORY MANAGEMENT PROGRAM
CNAF	COMMANDER OF NAVAL AIR FORCES
CNAL	COMMANDER NAVAL AIR FORCE ATLANTIC
CONUS	CONTINENTAL UNITED STATES
CWT	CUSTOMER WAIT TIME
DOD	DEPARTMENT OF DEFENSE
DLC	DISTRIBUTION LIAISON CELL
EPUK	EXPEDITIONARY PACK-UP KIT
FCF	FUNCTIONAL CHECK FLIGHT
FMC	FULL MISSION CAPABLE
FOC	FULL OPERATIONAL CAPABILITY
FSA	FLY-IN SUPPORT ALLOWANCE

GCE	GROUND COMBAT ELEMENT
GSE	GROUND SUPPORT EQUIPMENT
HAZDEC	HAZARDOUS MATERIAL DECLARATION
HAZMAT	HAZARDOUS MATERIAL
HMLA	MARINE LIGHT ATTACK HELICOPTER SQUADRON
HMH	MARINE HEAVY HELICOPTER SQUADRON
I-LEVEL	INTERMEDIATE LEVEL
IMRL	INDIVIDUAL MATERIAL READINESS LIST
LCE	LOGISTICS COMBAT ELEMENT
MAG	MARINE AIR GROUP
MALS	MARINE AVIATION LOGISTICS SQUADRON
MAGTF	MARINE AIR GROUND TASK FORCE
MAW	MARINE AIRCRAFT WING
MC	MISSION CAPABLE
MCDP	MARINE CORPS DOCTRINAL PUBLICATION
MCTP	MARINE CORPS TRAINING PUBLICATION
MEF	MARINE EXPEDITIONARY FORE
MEU	MARINE EXPEDITIONARY UNIT
MLG	MARINE LOGISTICS GROUP
MSE	MAJOR SUBORDINATE ELEMENT
MWSS	MARINE WING SUPPORT SQUADRON
NAMP	NAVAL AVIATION MAINTENANCE PROGRAM
NAVAIR	NAVAL AIR FORCES

NMC	NON MISSION CAPABLE
O-LEVEL	ORGANIZATIONAL LEVEL
OPCON	OPERATIONAL CONTROL
PAX	PERSONNEL
PMC	PARTIAL MISSION CAPABLE
RBA	READY BASIC AIRCRAFT
RIP/TOA	REMAIN IN PLACE/TRANSFER OF AUTHORITY
SASS	SUPPLEMENTAL AVIATION SPARES SUPPORT ALLOWANCE
SPMAGTF-CR-CC	SPECIAL PURPOSE MARINE AIR GROUND TASK FORCE-CRISIS RESPONSE-CENTRAL COMMAND
TACON	TACTICAL CONTROL
T/O	TASK ORGANIZATION
T/E	TABLE OF EQUIPMENT
T/M/S	TYPE/MODEL/SERIES
USCENTCOM	UNITED STATES CENTRAL COMMAND
VMA	MARINE ATTACK SQUADRON
VMFA	MARINE FIGHTER ATTACK SQUADRON
VMM	MARINE MEDIUM TILTROTOR SQUADRON
VMGR	MARINE AERIAL REFUELER TRANSPORT SQUADRON

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