

Space Operations for the Warfighter

Do we have to have one?

by Maj Joseph Horvath & Angela Hatch

The Marine Corps consumes products and services enabled by space-based capabilities every day. Imagine any operation, from full division level to a single squadron or company, and it is virtually guaranteed that they are using space capabilities such as GPS, satellite communications (SATCOM), and space-based intelligence, surveillance, and reconnaissance (ISR) products in order to plan and execute their mission. While certainly capable of operating without these enablers (for instance, every Marine should know how to use a map and compass), space capabilities provide a significant advantage that allow us to maintain the tempo, agility, and the distributed nature we require of today's force. As noted in the *Marine Corps Space Operating Concept*, "Space-based capabilities enable the MAGTF to gain and maintain initiative across the spectrum of conflict."¹

However, as space has become more contested and competitive, it has also become more vulnerable to threats. Taken from the Senate Select Committee on Intelligence testimony by the Director of National Intelligence:

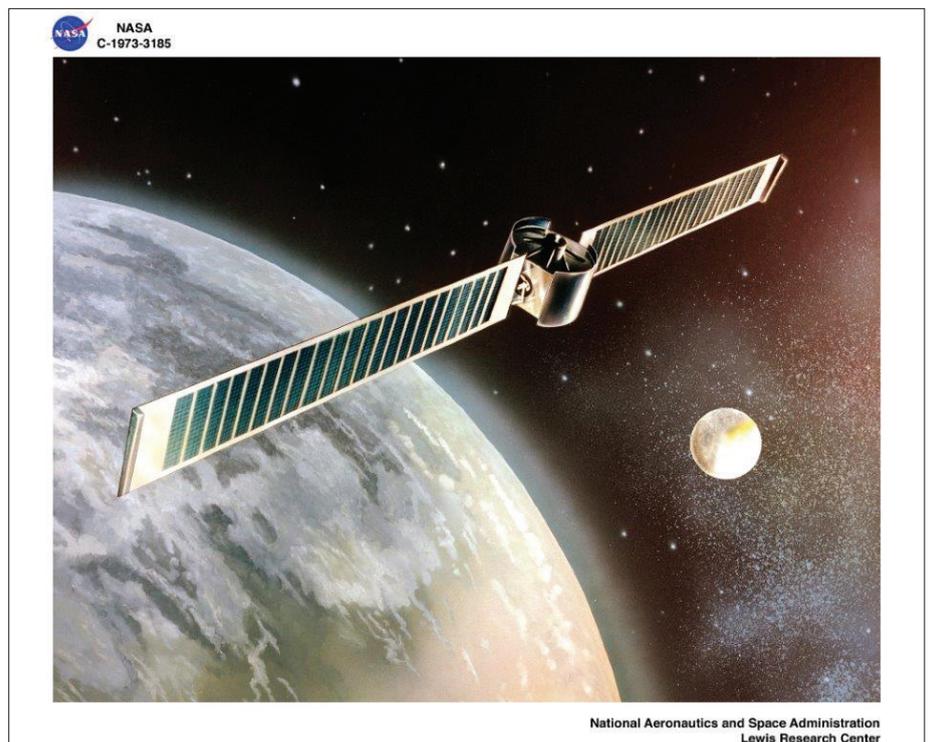
Threats to US space services will increase during 2014 and beyond as potential adversaries pursue disruptive and destructive counterspace capabilities. Chinese and Russian military leaders understand the unique information advantages afforded by space systems and are developing capabilities to disrupt US use of space in a conflict. For example, Chinese military writings highlight the need to interfere with, damage, and destroy reconnaissance, navigation, and communication satellites. China has satellite jamming

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capabilities and is pursuing antisatellite systems.²

Our adversaries understand the U.S. military dependence on space capabili-



Regardless of the size of the operations, we can pretty much guarantee that SATCOM are being used. (Photo courtesy of NASA; ID C-1973-3185.)

ties and will use this to their advantage. As highlighted in *Expeditionary Force 21*, “Forward-deployed crisis response forces most often operate within the threat of A2/AD systems daily and must be equipped, trained, and practiced to accomplish power projection under varied degrees of that threat.”³ The threat of adversary antiaccess/area denial (A2/AD) systems being used against our Nation’s space assets requires that the Marine Corps take full advantage of the existing and future capabilities afforded by the national space community, while also preparing to fight with these systems degraded or denied.

Doctrine

There exists a common misperception that the Marine Corps is not involved in the space domain. Although it is true that the Marine Corps does not own nor operate its own space-based systems, the Service is a significant end user of space capabilities, and the MAGTF is only expected to become more dependent on these in the future. For instance, the Marine Corps is reliant on GPS satellites for precise navigation, network timing, and precision-guided munitions. SATCOM is a significant enabler for communications while conducting distributed operations in austere environments. Space-based ISR provides imagery that otherwise would be unavailable in denied areas, and space-based environmental monitoring is useful for weather prediction (METOC) and characterization of beaches and landing zones. It should also be noted that space operations is not a new discipline; in fact, space operations for the U.S. military began in 1958 when the Explorer I was launched, beginning the United States’ entry into the “space race.” Space-based communications, ISR, and missile warning were significant components of the Cold War military strategy and have been developing and improving ever since.

Current doctrine divides space operations into five different mission areas, which include space situational awareness, space force enhancement, space support, space control, and space force application. While each of these areas plays a role in enabling the force as a

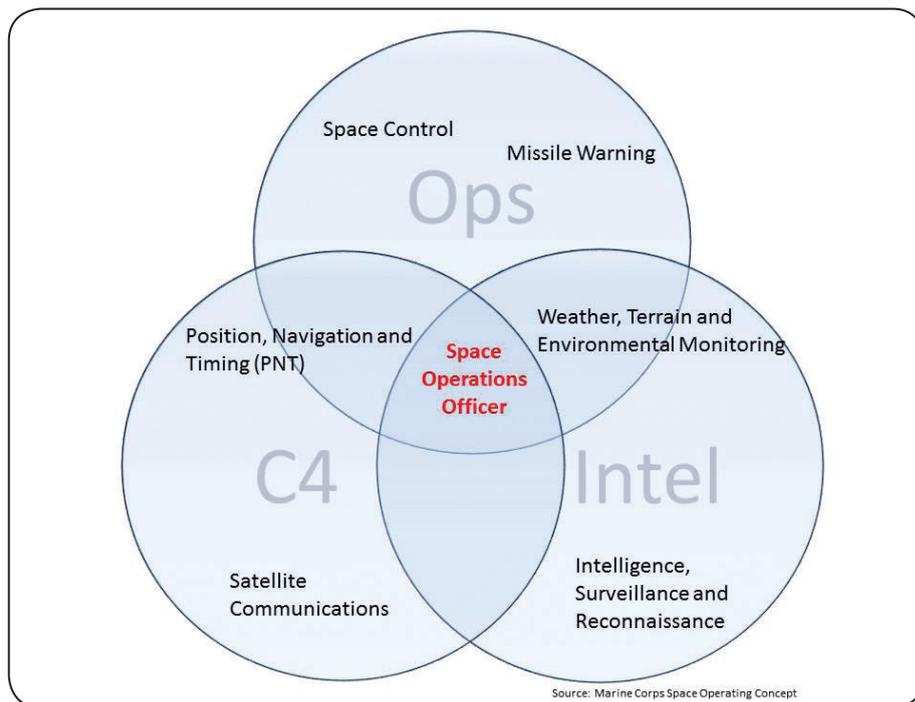


Figure 1.

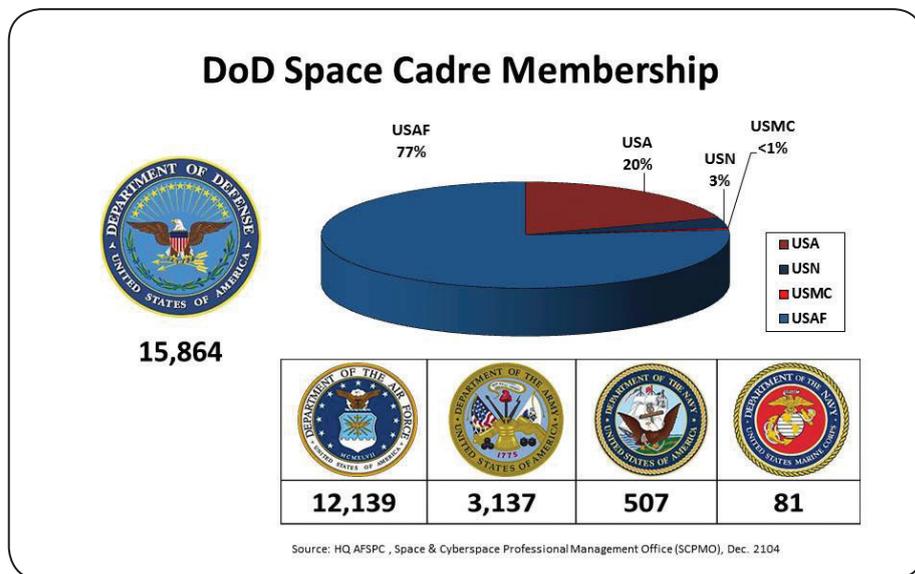


Table 1.

whole, the mission area of most direct utility to the Marine Corps is space force enhancements, or SFEs. SFEs increase effectiveness by “increasing the combat potential of the force, enhancing operational awareness, and providing critical joint force support.”⁴ Components of SFEs include ISR, missile warning, environmental monitoring, SATCOM, and positioning, navigation, and timing (PNT).

Space-based ISR. Space-based ISR is advantageous to the MAGTF due to its global nature and the spacecraft’s ability to overfly and image denied areas without airspace restrictions. Space-based assets have the benefit of longevity (lifetimes typically span several years), and they are difficult for our adversaries to target. Due to orbital mechanics, these satellites cannot generally remain fixed over a spot, but as a constellation

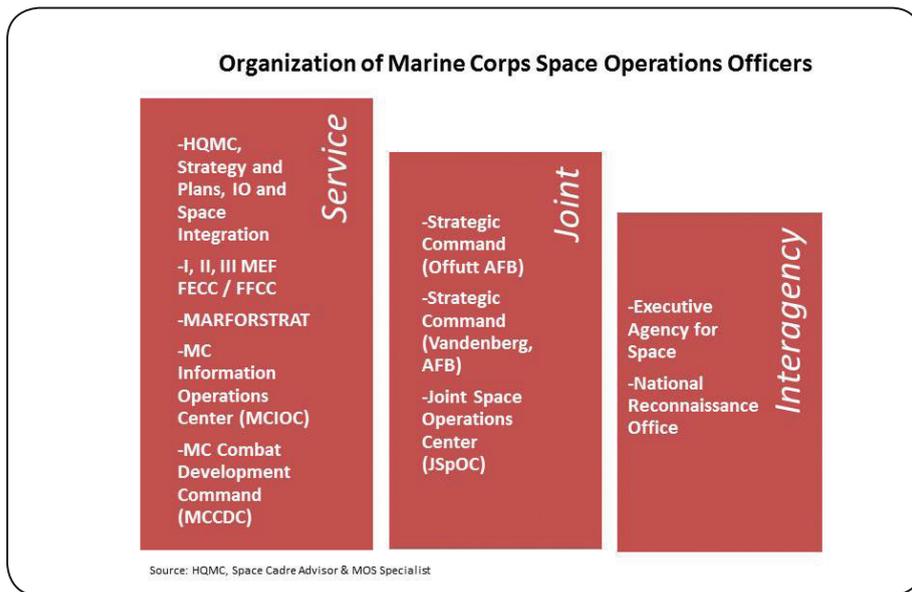


Table 2.

of assets they provide a regular revisit cycle without the same logistical tail as airborne ISR. Space-based ISR from national, commercial, and allied satellites can provide information on diverse topics such as indications and warnings, targeting analysis, friendly course of action development, adversary capability assessment, battle damage assessment, or characterization of the operating environment.⁵

Missile warning. Missile warning is accomplished through both space-based and terrestrial sensors, which work together to provide warning of ballistic missile launches at both the strategic and tactical levels. The first level of detection is typically provided from space systems, such as space-based infrared systems and the Defense Support Program. Timely and accurate missile warning is crucial to support timely decision making and to counter the threat to both military and civilian populations.

Environmental monitoring. Environmental monitoring satellites provide terrestrial and space environmental monitoring data that is analyzed by METOC SMEs to produce environmental intelligence for the MAGTF. Aside from the obvious weather monitoring, examples of terrestrial monitoring data provided by satellites that are useful to amphibious operations includes beach or landing zone condi-

tions, vegetation, and land use. Space environmental data is used to predict and mitigate the effects of space weather on satellites and for anomaly resolution. This is important due to the fact that degradation of SATCOM and PNT signals can have a direct impact on mission accomplishment if not planned for in advance.

Solar flares can also have a significant effect on satellite operations and can even affect ground operations. For example, in 1859, a coronal mass ejection from the sun caused a major disruption in telegraph lines, in some cases giving an electrical shock to operators. The next time an event this size occurs could be disastrous based on the current interdependent communications networks and computer chip-enabled force but can be largely mitigated if detected in advance.⁶

Satellite communications. SATCOM provides a “beyond line of sight (BLOS) information transport capability.”⁷ Advantages of SATCOM include global coverage, real time over-the-horizon transmission of voice and data, data relay, and flexibility. SATCOM also enables survivable communications in austere areas where the MAGTF is expected to operate. These capabilities are provided by both military and commercial assets with the majority of bandwidth traveling through commercial satellite providers.

Positioning, navigation, and timing. Space-based PNT systems, for which GPS is the primary source for the DOD, provide precision navigation and a highly accurate time reference. This capability has become an integral part of operations, enabling increased tempo and accuracy. The common precise time provided by GPS enables communications capabilities such as frequency hopping and cryptological synchronization. Space-based PNT enables precision attack from stand-off distances with reduced collateral damage. Some benefits of GPS include accuracy of artillery fire, friendly force tracking, surveying of coastlines, and expediting logistics resupply efforts.

Due to the overlapping nature of these disciplines, space operations and its practitioners must have thorough understanding of the interrelationships between functional areas. Figure 1 depicts how the SFEs correlate toward traditional functional areas and yet still provide significant applicability to others. For instance, PNT largely falls under the C⁴ (command, control, communications, and computers) Department and is necessary to provide accurate timing to networks and devices. It also is important to operations with respect to mission execution and blue force tracking, as the blue force tracking architecture requires the GPS signal in order to determine location.

USMC Space Cadre

In 2003, the Secretary of Defense directed all Services to build a cadre of military and civilian space professionals in order to support their components in space planning, programming, acquisition, and operations.⁸ The Marine Corps space cadre was thus established and composed of space operations officers (8866 MOS) and space operations staff officers (0540 MOS). The space cadre is managed by the Information Operations and Space Integration Branch of Strategy and Plans within HQMC, which also acts as the MOS occupational field manager and specialist. Compared to the other Services, the Marine Corps space cadre is relatively small, with only 13 space operations officer billets and 50 space operations staff



Satellites assist Marine meteorology/oceanography specialists deployed with MEUs. (Photo by Cpl Joshua W. Brown.)

officer billets throughout the Marine Corps. Marine Corps space professionals represent a very small community, making up less than one percent of the total DOD space cadre. (See Table 1.)

In order to become an 8866, an officer must earn a master's degree in either space operations or spacecraft systems engineering from either the Naval Postgraduate School (NPS) or the Air Force Institute of Technology (AFIT).⁹ The 13 space operations officer billets are located throughout the Marine Corps, Joint agencies, and interagency (see Table 2).

Space operations staff officer billets are typically billets in the G/S-2/6 (intelligence/communications) that have been identified as having desired space skill sets. These officers utilize this space background in order to add value to their current billet, usually within intelligence or C4 career fields. In order to earn the 0540 MOS, the Marine is required to attend Space 200, a three-week course at the National Security Space Institute (NSSI). Training and Education Command funding will be available for Marines in 0540 billets to attend Space 200 starting in FY16.

MAGTF Space Operations

During OIF/Operation Enduring Freedom, Army space support teams

(ARSSTs) supported I and II MEF. The ARRST's capabilities were a force multiplier to the MEFs and their functions included coordinating space effects, enabling inter-Service space requests, and providing space products and services to the commander. ARRSTs are typically used to support Corps-level and above sized units. As the Marine Corps

The 13 space operations officer billets are located throughout the Marine Corps, Joint agencies, and interagency.

returns to its amphibious roots with smaller MAGTFs, the ARSSTs should not be expected to support MEU-sized units conducting short-term expeditionary operations. Based on recent combat experiences of the past decade, the MEFs identified a requirement for this support, and in 2012, three space operations officer billets were realigned to the MEFs in order to provide organic space support capability. The realign-

ment directly affects tactical operations by allowing space operations officers to integrate space-based capabilities and effects into all phases of operational planning and execution.

The following is an example of the MEF space operations officers functions:

- Coordinate across staff and major subordinate commands to integrate space capabilities into operations, exercises, and contingency plans.
- Develop courses of action and recommendations for operating environments where space capabilities have been denied. Write/review operation plans and operation orders Annex N (Space Annex).
- Provide navigation warfare planning, implementation, and remediation.
- Deconflict/troubleshoot SATCOM problems attributed to spacecraft issues in coordination with communications section.
- Obtain GPS accuracy prediction models in support of precision-guided munitions.
- Alert space service users of upcoming detrimental space weather events impacting tactical communications, satellite imagery, terrestrial communications, and power distribution.
- Lead the 0540s, space operations staff officers, who are embedded in the MEF and major subordinate commands staffs and supervise their annual training requirements.
- Coordinate and support staff and major subordinate commands in developing requirements for space-based sensors and supporting space capabilities.
- Integrate special technical operations into the Marine Corps Planning Process in support of operations, exercises, and contingency plans.
- Coordinate and manage space-related requests for forces and prepare for their integration into the MEF, including the ARSSTs.
- Develop space-related universal needs statements for MEF submission.¹⁰

I and III MEF received their space operations officers in 2013, and II MEF is slated to receive their space operations

officer in 2015. The space operations officer at I MEF was reassigned into other billets and thus was unable to accomplish the above duties. However, the space operations officer at III MEF was able to fulfill the space operations duties and his after-action report identified several key takeaways. First, placement in the fires and effects coordination cell enables the space operations officer to integrate with the S-2, S-3 (operations), and S-6. The space operations officer is also well positioned to assist with coordinating and integrating special technical operations into the planning process due to the clearances they already have to access the space enterprise. Additionally, the space operations officer can assist with coordinating space education and training for the MEF and is crucial for integrating space capabilities and effects into training and exercises.

Way Ahead

As the DOD has become more reliant on space, it has created vulnerabilities that our adversaries can exploit. Critical steps need to be taken in order to ensure that the Marine Corps can continue to fight in a denied or degraded space environment. One on-going initiative is a study being completed by the Operational Analysis Division to examine the effects of GPS and SATCOM jamming on the MAGTF. Once the effects to the MAGTF have been analyzed, it will be possible to develop tactics, techniques, and procedures to mitigate GPS and SATCOM jamming. For instance, if planners expect the adversary to use GPS jammers, then they could plan to use laser-guided munitions instead of precision-guided munitions. If SATCOM jamming is expected, then the planners could recommend backup communications capabilities such as high frequency radios.

It is also necessary to insert space capabilities into training and exercises, as directed by *DoDD 3100.10, Space Policy* (Washington, DC: Department of Defense, October 2012). Inserting simulated GPS or SATCOM jamming into exercises will be a forcing function that will teach Marines how to work through degraded GPS and/or SATCOM and still complete the mission.

The lessons learned from the training and exercises will provide a force that is better prepared for the inevitable degradation of space capabilities during a conflict.

The issue of preparing to fight in a degraded or denied technical environment is not unique to space operations. There are numerous shared implications that relate to cyberspace operations, information operations, and electromagnetic spectrum operations. It will be important going forward for the Marine Corps to retain the expertise of those with these skills sets and ensure they are properly employed to support the Operating Forces.

Conclusion

Today and into the future, military operations will continue to be reliant on the space domain and its enhancements. Space-based capabilities provide a significant advantage to the MAGTF, and the addition of the space operations officers to the MEFs will further assist the Marine Corps with integrating space force enhancements into planning, training, and operations. Marines with these skill sets should be identified within their commands and utilized to increase our combat potential in today's complicated operating environment. Space-force enhancements are a force multiplier, and a well-educated and trained Marine Corps force that understands space capabilities and vulnerabilities will ensure that we are able to counter the 21st century threat.

Notes

1. Headquarters Marine Corps, *Marine Corps Space Operating Concept*, (Washington, DC: 2012).
2. Director of National Intelligence, *Worldwide Threat Assessment of the US Intelligence Community, Counterspace*, (Washington, DC: 29 January 2014).
3. Headquarters Marine Corps, *Expeditionary Force 21*, (Washington, DC: 2014).
4. *Joint Staff, Joint Publication 3-14 (JP 3-14), Space Operations*, (Washington, DC: 29 May 2003), II-4.

5. *Ibid.*, A-1.

6. Tony Philips, (January 21, 2009). "Severe Space Weather—Social and Economic Impacts," NASA Science News, (Cape Canaveral, FL: 21 January 2009).

7. JP 3-14, D-1.

8. Department of Defense, Department of Defense Directive 5101.2, DOD Executive Agent for Space, (Washington, DC: 3 June 2003).

9. Headquarters Marine Corps, Navy Marine Corps 1200.1, MOS Manual, (Washington, DC: August 2013).

10. III MEF, III MEF Space Operations Officer, 100 Day After-Action Report, (Okinawa, Japan: 2014).



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