

The FUTURE OF ARMY SPACE FORCES

A Vision to Optimize Tactical and Operational Space Support

By LTC Bob Guerriero,
LTC Tom James and LTC Jim Rozzi

This vision paper is intended to encourage debate and discussion regarding the future evolution of Army Space Forces. The statements and recommendations contained in this paper are solely the opinions of the authors, and do not represent official positions of the Future Warfare Center, U.S. Army Space & Missile Defense Command/U.S. Army Forces Strategic Command, or the United States Army.

Space support to Land Component formations continues to evolve as the requirements for Space support change and grow. This evolution is apparent in the methods and procedures used to deliver Space support, as well as in the organizational structure that is developing and expanding to provide this support. The Army's current organizational structure for Space is largely a result of the confluence of the Global War on Terror and the effects of Army Transformation. Specifically, Army Space Support Teams and Space Support Elements have been modified in terms of both organization and function even as we work to complete the fielding of these Teams and Elements across the Modular Army. Today's structure, including both personnel and equipment, is not optimized to deliver Space support for current operations and will not be adequate in the future without additional evolution. This paper will address Land Component Space support needs, the organizations designed to deliver this support, the roles and functions of those organizations, and recommendations for optimizing the quality and effectiveness of Space support.

SPACE SUPPORT NEEDS FOR LAND COMPONENT FORCES

The United States is becoming increasingly reliant on Space-based capabilities for military operations. Space assets have revolutionized communications, navigation, intelligence collection, ballistic missile warning, environmental monitoring and precision targeting. The effective application of Space-based capabilities is mis-

sion essential for the Land Component Command, even as their requirements for Space support change across the spectrum of operations and from region to region.

Space Force Enhancement Needs

Space Force Enhancement functions are similar to combat support operations in that they improve the effectiveness of forces by providing operational assistance to combat forces. FM 3-14 (Space Support to Army Operations, May 2005) lists five Space Force Enhancement functions: communications; position, navigation and timing; environmental monitoring; intelligence, surveillance and reconnaissance; and theater missile warning.

Satellite Communications (SATCOM) Army and Marine Corps units rely heavily on Department of Defense, civil and commercial communications satellites. Units must monitor the health and status of on-orbit assets, and occasionally request the reallocation or movement of Space vehicles to meet critical communications needs. Land Component Command staffs must understand the impacts of any interruptions of SATCOM service to the command operations and develop courses of action to mitigate these impacts. Space-based blue force tracking has also become a critical enabler for military operations, and Land Component Command staffs must develop architectures to support operations and resolve Space-based blue force tracking problems when they occur. Additionally, Land Component Command staffs must be capable of integrating emerging Defensive Space Control capabilities in order to ensure SATCOM access.

Position, Navigation, and Timing Navigation through

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the 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 this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 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 a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE 2007		2. REPORT TYPE		3. DATES COVERED 00-00-2007 to 00-00-2007	
4. TITLE AND SUBTITLE The Future of Army Space Forces. A Vision to Optimize Tactical and Operational Space Support				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Army Space & Missile Defense Command, Army Forces Strategic Command, Redstone Arsenal, AL, 35809				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 12	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			



Space Soldiers deploy in small units and are attached to larger elements. They provide a huge return for the size of the element because, on the modern battlefield, knowledge is power and timely and accurate knowledge is supreme power. *Photograph courtesy of SMDC/ARSTRAT*

the use of satellites allows for extremely accurate maneuver and targeting. Many systems also depend on Global Positioning System (GPS) timing for the synchronization of communications. The number of land force systems that have an integrated GPS receiver is large and growing, to the point that numerous missions are dependent on it. Widespread use of GPS in military operations in the last few years has uncovered unforeseen problems, and Army and Marine unit staffs are now routinely required to resolve complex, technical anomalies with GPS in support of operations. Furthermore, staff members must monitor the accuracy of GPS and the effect this accuracy may have on current and planned operations.

Environmental Monitoring Terrestrial and Space weather can have substantial impacts on the Space-based capabilities used by Land Component units. The Land Component Command staff must understand these impacts and their effects on current and planned operations.

Intelligence, Surveillance, and Reconnaissance Space-based intelligence, surveillance and reconnaissance assets have always been a key component of strategic indications and warnings, but are becoming increasingly important in their support to tactical operations. Land Component Command staffs must have a thorough understanding of the technical capabilities of a wide variety of national and commercial on-orbit assets, and must remain aware of emerging capabilities in order to be prepared to effectively integrate them when available.

Theater Missile Warning Space-based assets are a critical component of our Theater Missile Warning architecture. Technical expertise of satellite systems and associated architectures is required to effectively integrate these assets for accurate and timely Theater Missile Warning.

Battle Space Characterization Battle Space Characterization, although not doctrinally a separate Space Force Enhancement function, is the use of satellite products to better understand the events in the commander's Operational Environment. Much of the work in this area focuses on integrating existing and developing capabilities in non-traditional methods. Overhead non-imaging infrared systems are a primary contributor to Battle Space Characterization.

Space Control Needs

Space control operations ensure freedom of action in Space for the United States and its allies and, when directed, deny an adversary freedom of action in Space. Defensive Space Control ensures friendly access to satellite capabilities while Offensive Space Control denies the enemy use of these assets to gain advantage over U.S. and coalition forces. Neither Defensive nor Offensive Space Control is possible without sufficient Space Situational Awareness that provides a detailed understanding of the technical parameters and status of pertinent satellites, and how all forces (enemy, neutral and friendly) are integrating capabilities from these systems.

The Land Component Command staff must have a thorough knowledge of any national or commercial Space capabilities available to the enemy, and the techniques and procedures used to employ those capabilities. The staff must also provide targeting recommendations (lethal and non-lethal) aimed at mitigating advantages that an adversary may gain from leveraging satellite technologies.

Prior to the integration of Army Space Professionals into Army units, no single staff element of these organizations examined Space integration in a comprehensive manner. Army



Currently capabilities like the Space Support Elements and Army Space Support Teams support a variety of commands at all levels along the chain. These resources greatly expand capabilities when they are utilized correctly. *Photograph courtesy of SMDC/ARSTRAT*

Space Professionals bring this comprehensive approach to Space integration, and provide a body of experts focused on understanding the Land Component formation mission as well as methods to innovatively integrate satellite technologies into operations. These technologies include legacy systems designed primarily for strategic purposes during the Cold War, as well as emerging research and development satellite technologies as they become operational.

ARMY SPACE SUPPORT TEAMS AND SPACE SUPPORT ELEMENTS

Army Space Support Teams and Space Support Elements have been developed primarily to provide Space support to operational and tactical Army forces. Although similar in some respects, Army Space Support Teams and Space Support Elements have important differences that enable them to perform their respective functions.

Doctrinal Background Information

According to FM 3-14, *“The mission of the ARSST is to deploy worldwide to provide force enhanced Space support during operations and exercises. The ARSST brings with it a comprehensive variety of capabilities and products The strength of the support team concept is in its forward presence, which gives a front-line awareness of Army warfighter needs and the ability to provide fast, tailored solutions [to the supported unit].”*

Army Theater Space Support in Joint Operations — Today, July 26, 2006, provides a succinct but detailed description of the Space Support Element mission:

The Space Support Element provides organic space operations planning and support to the commander,

staff, and subordinate organizations and understands the force’s inherent reliance on Space in all areas. The senior Space Operations Officer advises the commander and staff on capabilities, limitations and availability of Space assets (blue/grey/red). The Space Support Element is first and foremost a planning agent providing recommendations, coordinating Space-based products and services, and preparing Space input to plans and orders. The Element assists the G2 with space IPB, the G6 with SATCOM resource planning and allocation, the G3 with the integration/fusion of Space-based blue force tracking and the entire staff with non-tactical imagery and products such as GPS predictions/assessments and force protection through missile warning. The Element is active in the targeting process, to include the Space portion of Information Operation/non-lethal effects of planning. The Element at the Joint Forces Land Component Command will be capable, when augmented, to provide manning at the Space Coordinating Authority at the Joint Forces Air Component Command or if the Joint Forces Land Component Command is designated as the Space Coordinating Authority, perform this function as well.

Manning

The Army Space Support Team comprises a team leader, FA40 MAJ; a deputy team leader, branch immaterial CPT; an enlisted 35F Intelligence Analyst; an enlisted 25S Satellite Communications Systems Operator-Maintainer; an enlisted 25B Information Technology Specialist; and an enlisted 21U Topographic Analyst. Of 27 projected Army Space Support Teams, 18 have been fielded.

The Division Space Support Element comprises

Space control operations ensure freedom of action in Space for the United States and its allies and, when directed, deny an adversary freedom of action in Space. Defensive Space Control ensures friendly access to satellite capabilities while Offensive Space Control denies the enemy use of these assets to gain advantage over U.S. and coalition forces.

a section chief, FA40 LTC; a Space Operations Officer, FA40 MAJ; and two SSG 25D Satellite Communications Systems Operator-Maintainers. Space Support Elements have been fielded to eight Active Divisions and partially fielded to two National Guard Divisions. The Corps element will be comprised of a section chief, FA40 LTC; two Space Operations Officers, FA40 MAJ; and two SSG 25D Satellite Communications Systems Operator-Maintainers. The Army Headquarter element comprises a chief, FA40 COL; four Space Operations Officers, two FA40 LTC and two FA40 MAJ; and one SSG 25D Satellite Communications Systems Operator-Maintainer. Currently, 3rd Army is the only Army Headquarter with a Space Support Element; four Army Space Support Elements remain to be fielded.

Expertise

Division, Corps, and Army Headquarter Space Support Elements possess two, three and four times the number of FA40s respectively as an Army Space Support Team, and the chiefs are LTCs (Division and Corps) and COL (Army). A Space Support Element possesses both a greater level of Space expertise and a greater level of experience and military education than does an Army Space Support Team. A Space Support Element chief at the LTC or COL rank may have had several tactical and strategic level Space assignments prior to reporting to his element assignment, and may have served as an Army Space Support Team leader as well. Because of its organic nature, rank structure and the level of military education and experience, the Space Support Element is organized to be comparatively more able to participate in planning and to manage integration of Space forces, especially at Corps and Army levels, than is the Army Space Support Team. The Army Space Support Teams are better manned, trained, and equipped to rapidly create a large quantity of specialty Space products without relying on the Operational Control headquarters' constrained bandwidth.

Space Support Enhancement Toolset

The Space and Missile Defense Battle Lab produced Space Support Enhancement Toolset prototype was developed to enable deployed Army Space Support Teams and Space Support Elements to execute their required Space tasks while remaining self-sufficient. The Space Support Element Toolset includes a commercial SATCOM capability, currently the Segovia-based Space Application Technology User Reachback Node (SATURN) that provides both secure and non-secure two-way dedicated bandwidth. The Space Support Element Toolset also includes four Space Operations System Computers that provide Space-specific software and hardware for Space Support Elements, Army Space Support Teams, and stand-alone Space Operations Officers. In addition, the Space Support Element Toolset contains an INMARSAT (International Marine/Maritime Satellite) terminal, Iridium satellite phone, and an imagery and map plotter.

Space Analysis Tools on the Space Operations System consist of several Space-specific software packages, including the Space Common Operating Picture and Exploitation System, Space Battle Management Core System and Satellite Tool Kit. Together, these software provide Space estimates and analysis, satellite SATRAN (Satellite Reconnaissance Advanced Notice) reports with visual representation, some missile launch analysis capability, GPS navigational accuracy reports and modeling, satellite-to-ground look angle calculations, analysis of Space weather effects on terrestrial and satellite radio communications, orbital estimations, satellite overflight data, quick access to Space Tasking Orders, and three-dimensional (3D) visualization of satellite constellations and their orbits. The Space Battle Management Core System software will eventually be phased out and replaced by Single Integrated Space Picture (SISP v1.0). Space Support

(See The Future, page 40)

Elements, Army Space Support Teams and Space Operations Officers use this Space software to varying but similar degrees based on the factors of METT-TC (Mission, Enemy, Terrain and weather, Time, Troops available and Civilian) to accomplish their specific tasks.

Initially, the Space Support Element Toolset was intended to be the equipment set for Army Space Support Teams. The acceleration of Army Transformation, which included the assignments of Space Support Elements to the division level much earlier than anticipated, led to the decision to also equip the Elements with the toolsets. While this decision seemed prudent at the time, experience has shown that Elements do not require a full toolset to accomplish their planning and integration functions. Recently, it was decided that Army Space Support Teams will continue to be equipped with toolsets, while Space Support Elements will be equipped with Space Operation System computers only.

ROLES AND FUNCTIONS OF ARMY SPACE FORCES

The two basic elements designed to meet tactical Space support requirements, the Space Support Elements and the Army Space Support Teams, are similar in some respects but each has a critical yet differing role in the delivery of operational and tactical Space support. The differences between the two lie in the functions that they are best-suited to perform and their relationships with other Joint and Service organizations. There are strengths and weaknesses inherent in both Army Space Support Teams and Space Support Elements, but when properly employed, both support and complement each other.

In general, Army Space Support Teams support Corps, Marine Expeditionary Forces, Combined Force

Land Component Commands, and Combined Joint Task Forces. Space Support Elements are organic to Division, Corps, and Army Headquarters, and are usually organized within the G3 Section as G3 — Space. Space Support Elements may request Army Space Support Teams to complement them based on mission requirements. This need is identified during mission planning and requires the Space Support Element to generate a Request for Forces.

Space Support Elements plan, integrate, and coordinate global and theater Space capabilities to support their unit's plans and operations. Space Support Elements are the commander's primary advisor on capabilities, limitations, and availability of friendly, enemy, and neutral Space assets, and they regularly provide Space support to coordinating and special staff. The organic relationship with the staff allows the Space Support Element to establish working relationships and to understand the strengths and weaknesses of their particular staff in any Space-related areas. This gives the Space Support Element the ability to focus its efforts in the areas where it can make the greatest contribution in maximizing Space support. The Element, as an integral part of the staff, is also directly involved in the staff planning process from the very beginning. During mission analysis the Space Support Element identifies all Space support requirements and initiates the necessary planning, including any requests for Army Space Support Team support that might be needed. The Space Support Element, with its heavy complement of field grade FA40s, is ideally suited to serve as the Space planning element on the staff, and to anticipate, integrate, synchronize and assess Space requirements.

Having a Space Support Element as an organic part of unit staffs also leads to a disadvantage,

however. Unit staffs naturally reallocate personnel from lower priority tasks to higher priority tasks, and individuals within the element have become prime candidates for other duties and responsibilities, some of which take FA40s out of their roles as Space Operations Officers completely. This has turned out to be even more prevalent during operations in the Central Command area of responsibility, where unforeseen requirements for field grade officers have increased significantly. When considered on an individual basis, the practice of assigning FA40s to other duties is not necessarily a negative or a reflection on the value of the Space Support Element, as many other staff sections and subordinate units also reallocate personnel to other pressing requirements. The risk in the area of Space support is that with so few Space experts on a staff, the reallocation of even one or two FA40s causes many of the Space functions to not be performed. The impact of this is that units often learn to accept and get by with less-than-optimal Space support instead of maximizing Space support, and the Space Support Element can be quickly perceived as a non-essential staff element. Many Space Support Elements have sought to mitigate this by becoming heavily involved in other staff functions, such as Special Technical Operations (STO). This is a good use of an FA40's technical skills, and a benefit to the staff in an area that requires technical expertise. Some of the STO functions may be related to Space support, depending on the particular operation. Space Support Elements must be careful that they are not so consumed by STO functions that Space functions are neglected, and therefore must effectively manage the Space mission areas as well as the STO requirements to ensure that the command is well supported in both functions.

Army Space Support Teams, organized within the 1st (Active and Army Reserve) and 117th (Colorado Army National Guard) Space Battalions, deploy in support of units requiring tactical Space support. They bring a variety of capabilities to provide Space support to operations. Army Space Support Teams are often attached to units with an organic Space Operations Officer, and conceptually may be attached to a unit with a Space Support Element, although the latter has not yet occurred. The composition of Army Space Support Teams makes them ideally suited to execute Space support tasks and produce Space support products on a daily basis. An Army Space Support Team is designed to complement a Space Support Element, and both together have all of the tools and expertise necessary to deliver tactical Space support, from initial planning through execution. An Army Space Support Team may partially fulfill Space planning and integration functions in a headquarters without organic Space expertise.

The inherent disadvantage of an Army Space Support Team is the same disadvantage for any attached element, which is that it arrives as a largely unknown component and must rapidly integrate into the staff. Much of this disadvantage is mitigated if the Team integrates into a Space Cell with an organic Space Operations Officer or Space Support Element. Army Space Support Teams have their own support requirements that must be planned for by the gaining unit in terms of physical space, power, communications and life support. Most of these issues are overcome in advance by integrating a deploying Army Space Support Team into the pre-deployment training of the gaining unit, such as Mission Rehearsal Exercises.

One of the great advantages of an Army Space Support Team is that it is part of a Space unit, with specific Space expertise and Space-oriented mission essential tasks. This allows the team to be reconfigured if necessary to provide specialized Space support, such as an Intelligence, Surveillance and Reconnaissance-heavy team to help integrate new



Space technology has brought a whole new set of capabilities and strategies to the modern battlefield. As time goes on and Space capabilities develop, mature and evolve, the battlefield will change even more and the military must be ready to define and implement these changes. *Photograph courtesy of SMDC/ARSTRAT*

Space sensors or an officer-heavy team to support Space planning. This also gives Army Space Support Soldiers better unit training opportunities and serves as the natural place to field and test new Space support capabilities. In principle, the unit training opportunities in a Space Battalion should produce Space Operations Officers and Soldiers who are unparalleled experts in their field.

Due to the different composition of the two components, Space Support Elements are best suited for the planning and integration of Space support, while Army Space Support Teams are best suited for delivery of Space capabilities, production and execution. For every operation, the decisions have to be made as to how many Army Space Support Teams will deploy and at which echelon they will be attached. For example, some operations may require a team at the Division level, while others could require one at the Corps level in general support of subor-

dinate echelons.

Space Force Enhancement — Roles and Functions

In the Space Force Enhancement Mission Area, the Space Support Element responsibilities lie mainly in identifying the areas where Space Force Enhancements could be applied, and then coordinating for that support. As part of the staff planning process, the Space Support Element conducts mission analysis to determine which of the Space Force Enhancement functions are applicable to an upcoming operation. For example, if the Space Support Element determines that additional Space-based Blue Force Tracking devices are required, they then coordinate for the allocation and use of those devices. An operation relying heavily on precision engagement in restricted or urban terrain will necessitate additional monitoring of GPS accuracy. The Space Support Element has the expertise to de-

Space Support Elements and Army Space Support Teams have similar skills and expertise, but when employed properly these units are not redundant but in fact are complementary and mutually supporting. The perception of any unnecessary overlap in the roles and functions of Army Space Support Teams and Space Support Elements is due primarily to one underlying issue — the lack of unique Space capabilities.

velop innovative methods of using Space-based intelligence, surveillance and reconnaissance sensors or novel means to combine multiple sources of Space-based data, and works with the G2 staff and collection manager to request the collection and exploitation. Finally, the Space Support Element considers any Space or terrestrial weather impacts to operations from a Space perspective, the impacts of any potential enemy use of Space-based assets, and any friendly Space vulnerabilities, and keeps the commander and the rest of the staff informed.

The output of the Space Support Element's mission analysis becomes the Space Running Staff Estimate and Annex N (Space Operations) for all Fragmentary Orders, Operational Orders, Operational Plans, or Concept Plans. The Space Support Element also provides input appropriate to other staff sections for inclusion in their own annexes, especially the G2 or G6 sections. If any production is required for Space Force Enhance-

ment mission areas, the element determines whether that production can be done internally or must be passed to an Army Space Support Team. If no Team is attached at that echelon, the request should go to an Army Space Support Team in general support.

While the functions of the Space Support Element are almost entirely staff functions, the Army Space Support Team responsibilities for Space Force Enhancement are primarily those of execution and production. The Army Space Support Team should take its guidance from the unit's Space Support Element, based on the Element's mission analysis and participation in the staff planning process. If additional monitoring and reporting of GPS accuracy is required, the Army Space Support Team would perform this function. The Team has the ability to produce Space products such as imagery maps, 3-D visualizations, satellite overflight reports or SATCOM scintillation reports. They are involved in the dissemi-

nation of these products, as well as, the posting and dissemination of specialized Space-based Battle Space Characterization products. The Army Space Support Team is also responsible for the continuous monitoring of the Space environment, including the operational status of Space vehicles, Space weather and any other Space events. In some cases, Army Space Support Teams serve as Tier 1 missile warning nodes. Since not every Space Support Element has an attached Army Space Support Team, some of an Army Space Support Team's production work may be in support of a subordinate unit's Space Support Element.

Space Control — Roles and Functions

The Space Support Element is the primary element responsible for Space control planning. During mission analysis, the element determines if offensive or defensive Space control could contribute to the success of the operation, and

must then initiate any requests for forces, intelligence assessments or approval processes that might be required. Space Control planning is closely coordinated with the G2, G3, and G6, and synchronized with other operations. The Army Space Support Team has the ability to assist with the integration and synchronization of Space control assets.

Redundant Roles and Functions

Space Support Elements and Army Space Support Teams have similar skills and expertise, but when employed properly these units are not redundant but in fact are complementary and mutually supporting. The perception of any unnecessary overlap in the roles and functions of Army Space Support Teams and Space Support Elements is due primarily to one underlying issue — the lack of unique Space capabilities. The Space Support Element, as the primary Space planning element, should be planning for the employment of unique Space capabilities. Since there are very few such capabilities, the Element is left to plan for the improved employment of capabilities that other staff sections have primary responsibility for. The Army Space Support Team, the primary element for the execution of Space tasks, should be executing unique tasks that no other staff element has the capability or expertise to execute. Since there are very few of these tasks, Army Space Support Teams often find themselves helping other staff sections manage their workloads of Space-related tasks.

FINDINGS AND RECOMMENDATIONS

Space support to Army operations must continue to evolve in order to support changing Army organizations, missions and requirements. Our existing capabilities, structures, and procedures, developed prior to the Global War on Terror and Army Transformation, are inadequate to meet today's and tomorrow's Land Component operational requirements. In order to meet these increased demands, Army Space Forces must evolve in four distinct ways: develop and field

unique Space capabilities, improve Space technical expertise, reallocate Space Operations Officer assignments, and develop and equip Army Space Support Teams and Space Support Elements with improved equipment and Space tools. Lastly, we should consider expanding Army Space Support Team capabilities and missions in order to provide Space support to units without organic Space expertise.

1. Unique Space Capabilities. For our Space support model — a Space Support Element planning element and an Army Space Support Team execution element — to be viable, there must be a set of capabilities to plan for and execute. This is currently limited to a set of Space-based capabilities that other staff sections already have responsibility for, with few exceptions. As Space functions become more normalized across the staffs, and as Web-based services become more prevalent and accessible, staff sections are becoming increasingly comfortable performing these functions without the help of FA40s. This has been one of the successes and the expected outcome of Space education, so we must now migrate our own functions into other areas where emerging areas of Space support can be applied. We must develop new and unique Space capabilities that will use innovative means to deliver tactical and operational Space support while remaining outside of the functions of other staff sections. These Space capabilities should be fielded to Army Space Support Teams, where they can be adequately tested and where the Teams can maintain proficiency in the operation of the equipment. These capabilities will give Space Support Elements something to plan for, and Army Space Support Teams something to deliver and operate. These capabilities should be outside of the traditional areas of intelligence, surveillance and reconnaissance, communications, and topography, and should be designed to support existing requirements. We should consider some or all of the following for immediate development and fielding:

Global Positioning System Interference Detector — A handheld detector that can acquire all GPS signals in an area, and

identify, characterize, and locate any additional signals within the GPS frequency bands. The detector should indicate anomalous signal frequency and strength. This capability supports existing requirements for accurate positioning, navigation and timing information.

Laser Dazzler — A ground-based, low-power laser dazzler designed to saturate the optics of any overhead imagers without causing damage. These could be positioned in fixed locations to prevent imaging of sensitive sites such as forward operating bases, or employed in a mounted version to mask unit movement. This capability provides ground-based, reversible, offensive Space control, and supports existing force protection requirements.

Global Positioning System Augmentation — A GPS pseudolite transmitter that provides an additional ground-based signal for GPS receivers. This would be particularly useful in urban environments or deep valleys where GPS signals may be obscured. It allows Army Space Forces to offer a solution when GPS navigational accuracy reports indicate an unacceptable error probability. This capability supports existing requirements for accurate positioning, navigation and timing information.

Radar Imagery Detector — A detector that detects radar imaging occurring at the location of the detector by identifying the unique waveform emitted by radar imagers. Combined with SATRAN information, it would allow Army Space Forces to identify the radar satellite imaging U.S. Forces. This capability provides ground-based Space Situational Awareness and supports its existing requirements.

Optical Augmentation Scanner — A detector that uses optical augmentation techniques to identify Space-based EO imagers oriented at the detector. Combined with SATRAN information, it allows Army Space Forces to determine which foreign or commercial imager is oriented toward U.S. Forces. This detector could not determine whether or not an image was actually taken. This capability provides ground-based Space Situational Awareness and supports its exist-

ing requirements.

Global Positioning System Jammer — A device that interferes with civil GPS signals in an area to prevent use of commercial Global Positioning System receivers. It would deny an adversary use of GPS while preserving U.S. military use. A potential issue would arise for military receivers that rely on the C/A signal to acquire the military signal. This capability supports ground-based Space control by denying an adversary use of Space-based capabilities.

Mobile VSAT Studio — An equipment suite consisting of a laptop computer with Digital Versatile Disk (DVD) writer, digital video camera, and VSAT (Very Small Aperture Terminal) transmitter. By using previously leased channels on commercial broadcast satellites, Army Space Forces could facilitate widespread dissemination of psychological operation products over one of the fastest growing media forms worldwide. This would represent a vast improvement over current practices of contracting with local broadcast studios. This capability supports psychological operations and information operations.

When our Army Space Forces are equipped with such capabilities then our roles fundamentally change from enhancing capabilities already resident in other staff sections to delivering our own valuable capabilities. When GPS interference is reported in an area, a commander can turn to an attached Army Space Support Team to quickly move to the affected area to confirm the interference and determine the frequency and source. Space Support Elements will have the ability to plan for the appropriate placement of laser dazzlers, to be emplaced, monitored and maintained by Army Space Support Teams. When predicting poor GPS accuracy in an area for a particular operation, a Space Support Element will be able

to offer a means to improve that accuracy, with an Army Space Support Team emplacing and operating an augmentation device. Army Space Support Teams will have the means to provide local Space Situational Awareness by employing both radar and electro-optical detectors, and correlating any detection with satellite overflight reports. Army Space Support Teams or Space Support Elements can also employ their mobile VSAT studios to record either a psychological operation message or a commander's message and immediately broadcast it directly to a large regional audience by uplink to a commercial broadcast satellite.

Along with these Space capabilities, there is value in developing specialized Army Space Support Teams to support them. One Army Space Support Team should be configured around GPS capabilities, including interference detection, GPS augmentation and jamming. Another Army Space Support Team should specialize in local Space Situational Awareness, employing various ground-based detectors. Yet another Army Space Support Team can concentrate on the emplacement and operation of ground-based Space control capabilities such as laser dazzlers. Space Support Elements will be responsible for requesting the appropriate Army Space Support Team and their capabilities, based on mission requirements.

Capabilities like this would be unique to Army Space Forces, would be planned for and executed by Space Support Elements and Army Space Support Teams respectively, and would provide immediate value to supported units. U.S. Army Space and Missile Defense Command/U.S. Army Forces Strategic Command (SMDC/ARSTRAT) must take the lead in developing these capabilities for Army Space Forces with a goal of delivering at least two new capabilities within

two years.

New and innovative Space capabilities planned and executed by Army Space Forces, can provide direct Space support to tactical operations.

2. Improve Space Technical Expertise. Providing innovative and effective Space support requires a thorough understanding of the technical capabilities of Space systems. Feedback indicates that many of our Army Space Professionals do not possess the level of technical understanding of satellite systems and architectures that they could or should have in order to deliver effective tactical and operational Space support. Having a general awareness of the functions of Space systems is not sufficient in today's complex and dynamic operating environment. There is clearly a need to increase the level of technical instruction in the Space Operations Officer Qualification Course and other training venues for Army Space professionals. There is also a need to develop new courses that focus on the technical aspects of satellite capabilities and the tactical integration of these capabilities into military plans and operations for Army Space professionals preparing to deploy in support of Land Component formations. However, this level of expertise cannot be obtained through these courses alone — it is a long-term process that encompasses formal education, collective training and experience.

An advanced degree in a technical area, especially science or engineering, is probably the best preparation for a Space technical expert. The majority of FA40s should have advanced degrees in a technical field. We should aggressively recruit officers finishing a teaching assignment at West Point who already have an

advanced technical degree. As the Army increases graduate school opportunities for company-grade officers, we must capitalize on this program as a means to provide formal education for newly designated FA40s. In addition, a significant portion of FA40 positions should be tied to the Army Education Requirements Board requirements. This will provide two years of advanced civil schooling for those FA40s, followed by a three-year utilization tour where that advanced degree can be leveraged. There is a centralized pool of funding that is available to support advanced civil schooling for Army Education Requirements Board-coded positions. Finally, utilization of FA40s must be closely tied to education so that FA40s are assigned to positions where expertise in their particular field is required. This will provide maximum benefit of that education both to the individual and to the Army.

We also require an ongoing technical training program at the unit level. This can be done on a small-scale with Space Support Elements at the Division through Army level, but is best accomplished within a Space unit. The 1st and 117th Space Battalions are the only places in the Army that are organized to keep Army Space Forces technically and tactically proficient in Space operations. These personnel will continue to be challenged to maintain their currency in a field that changes as rapidly as Space operations. Despite the challenges, our Space units should make the technical Space training of Space officers and Soldiers their top training priority. Army Space Support Teams that deploy to provide tactical Space support must be subject matter experts on all Space systems, and must be armed with the most up-to-date information on current and emerging Space-based capabilities. All of their other skills are secondary.

FA40s must be the Army's Space experts in a technical as well as an operational sense and the Army must track the expertise as well as the expert.



Technology presents its own challenges but sometimes nature adds to the mix. Here, Space Support Element member LTC James Rozzi checks on an antenna that was surrounded by water after a heavy rainfall. *Photograph courtesy of SMDC/ARSTRAT*

3. Modify FA40 Manpower Allocations. Army Space Support Teams and Space Support Elements cannot be viewed in a vacuum, and must be considered in the context of Land Component Space Operations as a whole. We should not assume that placing increasing numbers of FA40s at the tactical level will translate directly into improved tactical Space support, but should instead consider that effective Space support may be best delivered by balancing the numbers of FA40s at the tactical, operational and strategic/national levels to ensure Army core competencies are addressed from a Space perspective.

FA40s are not positioned properly throughout the Army and the Joint community to provide adequate Space sup-

port. The preponderance of FA40s has been placed into tactical positions at Corps level and below, while strategic positions have been largely neglected. The effect of this has been a large number of personnel attempting to leverage strategic systems for tactical purposes, and relatively few personnel working to influence, design and adapt systems to meet tactical needs. A solid strategic foundation provides essential support and growth for effective tactical Space support. In the roughly ten-year period since FA40s have been established, we have made very little progress in influencing Space from the strategic perspective.

One example that deserves particular attention is the allocation of FA40s to the Fires Brigades. This allocation is pre-

In the past five years, the Army Space Community has had considerable success in developing the means to deliver, and in delivering, tactical and operational Space support during a very challenging time. ... Without making some necessary changes in the near-term and the long-term, we are at risk of not being postured to provide adequate Space support to a changing Army in a dynamic operating environment.

mature, and will provide very little return for our investment of such a limited resource as FA40s. There are currently not enough Space support requirements in a Fires Brigade to justify the permanent assignment of an FA40. This should be considered in light of the value that could be added if that same FA40 were positioned in some other Army organization or in a strategic organization. Although there will be a time when it's appropriate to place FA40s at the Brigade or Brigade Combat Team level, this is probably several years in the future, after the FA40 population is large enough to support both strategic and tactical personnel requirements. Other Army organizations that would benefit from an assigned FA40 include Geographic Combatant Commands, Special Operations Command, and Battlefield Coordination Detachments.

FA40s at the strategic level will be responsible for ensuring that future Space systems are designed to support tactical operations as well as strategic requirements, and will help to develop new Space capabilities to meet tactical warfighter needs. FA40s should be assigned to

the National Security Agency and the National Geospatial Intelligence Agency to influence the collection and dissemination of Space-based intelligence, surveillance and reconnaissance. They should be assigned to the Air Force Space and Missile Systems Center to be directly involved in the design and development of emerging Space systems, and to Air Force Space Command to participate directly with the Air Force in their requirements development for Space systems. FA40s should be assigned to Buckley and Schriever Air Force Bases in Colorado, to be a part of satellite operations, and to Massachusetts Institute of Technology Lincoln Labs to participate in the development of cutting-edge Space Situational Awareness technologies and techniques. They should be assigned to various Integrated Program Offices for emerging Space systems and the emerging Operationally Responsive Space Office to influence Space system development with an operational perspective, and the FA40 presence at the National Reconnaissance Office should be increased significantly to achieve better Army

participation in the development of our critical national systems. As they gain experience in their particular areas, FA40s in strategic positions will become a pool of expert knowledge on the capabilities and limitations of all Space systems.

We potentially provide more Space support to divisions by impacting decisions at the strategic level than by having a Space Support Element, Army Space Support Team, or individual Space Operations Officer present on the ground.

4. Assess and Change Army Space Support Team/Space Support Element Equipment Set. Elements with different roles and functions do not require the same equipment. Space Support Elements, with primary responsibility as a planning and integrating elements, have limited use for SATURN suites, plotters and INMAR-SAT terminals. Although many Space Support Elements have used this equipment, providing products

and services was never intended to be their primary purpose. A Space Support Element can effectively accomplish their mission with a set of Space Operations System computers and associated Space software.

The existing Space Support Element Toolset was very valuable when initially developed about five years ago, but is quickly becoming obsolete. The rapid proliferation of Web-based information and services, the assignment of engineering topographic teams down to the Brigade Combat Team level, and the fielding of Internet Protocol-based Global Broadcast System terminals down to the Brigade Combat Team level have increasingly made the Space Support Element Toolset less and less relevant, except as an augmentation to other staff sections' capabilities. The equipment that makes up the Space Support Element Toolset should be reviewed to determine its current effectiveness and updated as necessary. As a first step, we should consider including a Global Broadcast System terminal as a component of each Space Support Element Toolset. The Global Broadcast System could provide Space Support Elements and Army Space Support Teams an alternate means to receive large files, with a bandwidth more than 10 times larger than normally achieved with the SATURN suite. The primary limitation of the Global Broadcast System vice SATURN is that the Global Broadcast System data flow is one-way.

An Army Space Support Team, with primary responsibility as capability provider and task executor requires a full set of all available equipment to access and leverage Space-based capabilities. An Army Space Support Team also requires maximum flexibility and the ability to remain self-sufficient in austere environments, which justifies their need for a variety of satellite communications capabilities.

Army Space support equipment must evolve to provide relevant and valuable capabilities for Army Space Forces and supported units.

5. Expand Army Space Support Team Role in Headquarters Without Space Support Elements. The headquarters that do not have organic Space expertise — Marine Expeditionary Forces, Theater Special Operation Commands, Theater Support Commands and Combined Joint Special Operations Task Forces — are growth areas for Army Space Support Teams. SMDC/ARSTRAT has assessed the Space requirements of some of these organizations, and should assess the requirements of others to aid in organizing and training Army Space Support Teams, and writing the appropriate doctrine to provide the necessary support. To provide Space Support Element-like support where an element does not exist, Army Space Support Teams should be

tailored and potentially augmented with an additional FA40 if appropriate.

Properly configured Army Space Support Teams, deployed with units lacking organic Space support, can provide tailored, tactical Space support to critical headquarters on the battlefield.

CONCLUSION

In the past five years, the Army Space Community has had considerable success in developing the means to deliver, and in delivering, tactical and operational Space support during a very challenging time. In order to keep the Space support that we provide relevant and valuable, the doctrine, organization, training and equipment for Army Space Forces must evolve. Tactical and operational Space support can be improved significantly by developing unique Space capabilities, improving Space technical training, modifying FA40 manpower allocations, expanding Army Space Support Team roles in headquarters without Space Support Elements, and updating the Army Space Support Team/Space Support Element equipment set. Without making some necessary changes in the near-term and the long-term, we are at risk of not being postured to provide adequate Space support to a changing Army in a dynamic operating environment.



LTC Tom James is the commander, 1st Space Battalion. He recently served as Chief, Space Capabilities Branch, Directorate of Combat Development, Space and Missile Defense Future Warfare Center. A Soldier since 1982, LTC James deployed to both Operations Enduring Freedom and Iraqi Freedom as a Joint Task Force Space and Information Operations Planner. He is a graduate of the School of Advanced Air and Space Studies, and holds a Master of International Relations degree from the University of Auburn — Montgomery.

LTC Jim Rozzi is a Space Operations Officer with U.S. Army Space and Missile Defense Command/U.S. Army Forces Strategic Command. He received a B.A. from Washington and Jefferson College, and an M.S. from The Joint Military Intelligence College. He is a graduate of Command and General Staff College and the U.S. Army Space Operations Officer Qualification Course, and has served in numerous command and staff positions.

LTC Bob Guerriero is assigned to the Directorate of Combat Development, Future Warfare Center, U.S. Army Space and Missile Defense Command. He has previously served as the Space Operations Officer for both III Corps at Fort Hood, Texas, and the Multinational Corps — Iraq. LTC Guerriero has also been assigned to the National Reconnaissance Office's Advanced Systems and Technology Directorate. Comments and feedback are welcome. Please send to robert.guerriero@us.army.mil.