Enabling Space warriors for the 21st century

EIGHT new capabilities for FA40s

By MAJ Robert Guerriero

Space support to tactical operations is in its infancy. We are just beginning to develop the techniques and procedures to effectively leverage our Space-based capabilities in support of the Army and the joint warfighter. As new Space-based and ground-based capabilities are developed and fielded, FA40s will have unprecedented ability to use Space to impact operations.

Our current constellations of military and intelligence collection satellites are impressive national achievements that have given the United States clear Space superiority. The Space architecture that has evolved was largely designed to support strategic objectives. This includes not only the satellites themselves and the associated sensors, but our ground stations, processing and exploitation infrastructure and dissemination systems. From the tactical perspective, Space support to the warfighter has meant adapting these strategic systems to solve tactical problems. One notable exception to this is the global positioning system (GPS) constellation. This constellation was designed from the outset with the tactical user in mind, and the result has been a revolution in warfare.

Despite the challenges to developing and fielding capabilities, the Army Space community has had some success in leveraging strategic systems and has made some substantial contributions. With new systems and capabilities designed specifically to support the tactical user and fielded to FA40s and Space Support Elements (SSEs) to deliver directly to the warfighter, the impact of Army Space on operations will grow substantially.

This article describes eight new capabilities that should be considered for fielding to SSEs and Space operations officers in tactical assignments. Some of these capabilities are already developed and in use, and simply need to be fielded to our Space cadre. Others will require development and testing before they will be fully operational. Some readers may dismiss some of these potential capabilities as not practical, too difficult to achieve or not appropriate for FA40s to control. Whatever the initial impressions, we need vigorous discussion on these and other new capabilities to keep Army Space relevant and valuable now and into the future.

Laser Dazzler — Mounted and Fixed

Force protection is consistently one of the top priorities of commanders in combat zones. One legitimate concern is an enemy's use of national or commercial imagery to identify concentrations of U.S. forces on the ground. This is especially true in places like Iraq, where U.S. forces have large numbers of troops based in static forward operating bases (FOBs). With minimal effort, an enemy could acquire satellite imagery of one of these FOBs to use for targeting purposes. The proliferation of commercial high-resolution imaging satellites will make imagery even easier to acquire in the future. Current mitigation strategies for this problem rely on "shutter control" that is applied by either purchasing all imagery time over a certain region or securing agreements not to image specific regions. Shutter control can be effective for short periods of time, but is not effective for longer duration conflicts like Operation Iraqi Freedom. Shutter control is also not timely enough to be put into place to prevent imagery of a crisis area.

One option to defeat overhead imagery is with laser dazzlers. Unlike laser blinders designed to damage optics, laser dazzlers can be adapted to simply wash out a portion of the image frame. A narrow-focus beam is not required for this application since the light must be dispersed over

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Part of the Advanced Concept Technology Demonstration, the Tactical High Energy Laser (THEL) at the High Energy Laser Systems Test Facility (HELSTF) has successfully demonstrated the Army's ability to intercept rockets and artillery pieces. On June 6, 2000, the THEL intercepted its first Katyusha rocket. Since then, testing in November 2002 has illustrated the THEL's increased abilities with intercepts of smaller and faster moving artillery pieces.

multiple pixels to be effective. In this case, atmospheric dispersion can be overcome to achieve the desired effect. Several lasers covering multiple wavelengths may need to be employed to disrupt an image taken in multiple frequency bands. A low-power dazzler could be left on permanently and mounted on rooftops or towers within FOBs to prevent imagery of U.S. forces. If a U.S. satellite needed to take an image in the vicinity of an FOB, the FA40 in the region would be the point of contact to shut the dazzlers down long enough to take an image. Another technique would be to have the dazzlers scheduled to turn on only during enemy satellite fly-overs. This technique is no more disruptive to a satellite than camouflage netting.

Another application of this capability could be as an attachment to a vehicle to prevent accurate assessments of the size and vehicle types of moving formations. This deception technique would use vehicle-mounted laser dazzlers to give the impression of a large formation that is being protected from observation.

Radar Receiver

Foreign nations are increasingly turning toward synthetic aperture radar (SAR) to provide a day/night, all-weather imaging capability. Commercial satellite imagery providers have also made SAR imagery available through Canada's RADARSAT1. An improved commercial SAR imager, RADARSAT2, is scheduled to launch in 2006 and will provide 3-meter resolution radar imagery.

SAR imagers emit a characteristic waveform when imaging that can be easily detected on the ground with the appropriate sensor. A capability that should be developed for employment by FA40s and SSEs is a small, mobile receiver that can detect these waveforms and determine if an overhead SAR imager is taking an image of the receiver's location. Combining a detection function with satellite fly-over data would allow Space operators to quickly determine which satellite took the image. A query to a commercial imagery provider could also lead to the identification of the purchaser. This capability would allow an FA40 to alert the commander to the fact that the unit or area has been imaged with radar and to identify the source of the image. This receiver could also be effective in detecting airborne SAR imagers being employed against U.S. forces.

The ability to know where an enemy's intelligence, surveillance and reconnaissance (ISR) efforts are being focused gives the U.S. commander a great advantage in understanding and disrupting the enemy's decision-making process. SAR receivers could be employed with mobile forces or emplaced on static bases. Use with mobile forces would allow a commander to assess the operational security implications to the mission from a possible compromise of a maneuver element. Use on static bases would be a significant force protection advantage and alert the commander when a base may have been imaged for targeting.

Secondary Payload Sensor Packages

The Army Space community should develop a series of payloads specifically designed to support Army users. These payloads should be designed to fly as secondary payloads on other national and military satellites. Taking advantage of an existing satellite bus and cost-sharing launch costs will dramatically reduce both the time and cost of getting new Space capabilities on orbit. One example of a potential secondary payload is an overhead non-imaging infrared (ONIR) sensor with see-to-ground capability. ONIR sensors in general have proven to be very effective and useful in tactical operations. Other examples include specialized communications equipment, non-imaging spectrometers, narrowband signal intelligence (SIGINT) collectors and low-light optical sensors. Data from these sensors, after processing at the appropriate ground stations, could be fed to ground commanders through their assigned FA40s. The FA40 serves as the focal point to task these sensors for collection and then to integrate and fuse the data from these tactical sensors.

Populating the Space environment with multiple sensors designed to support tactical users will give us a true battlespace characterization capability from Space.

Secure Blue Force Tracking over Communication Architectures

One of the largest shortcomings of the Force XXI Battle Command Brigade and Below (FBCB2) system — the Army's primary means of Blue Force Tracking (BFT) — is that the data travels over commercial communication satellites that are not secure. Not only are these signals easily intercepted or jammed but they are subject to all of the same interruptions that are found with other satellite communications. Commanders have come to rely on their BFT data and expect it to be updated and accurate when needed. Even a brief compromise of BFT data at a critical moment can have enormous impact. There are some secure BFT systems available, although these systems require a satellite architecture that must be specifically tasked to detect the devices.

The Army Space community should develop a small, secure BFT device that leverages existing military communication architectures. A BFT device that uses a low probability of intercept waveform with a high-frequency transmitter and an encryption capability will eliminate the security vulnerability that exists in current FBCB2 systems. If these devices transmit over military communication satellites, we can reduce our reliance on commercial communication systems and still avoid being forced to task satellites to collect BFT signals.

SSEs and FA40s in tactical units should be equipped with a large basic load of these BFT devices. They could then be employed by selected units or on high-priority assets during critical operations. These systems would not replace existing FBCB2 systems, but would augment them with a secure BFT capability. If these devices are made small enough, they can also be emplaced in a clandestine manner and used for enemy tagging and tracking.

GPS Augmentation

The launch of the GPS constellation initiated a revolution in warfare. Every branch of the U.S. military has come to rely on GPS to execute its various missions. Precision maneuver and precision strike have become virtual requirements in modern-day warfare.

FA40s have long been able to predict the accuracy of GPSs at any desired location. This capability is limited to providing information since there is little in the FA40's power that can be done to correct unacceptable GPS inaccuracies. However, GPS augmentation techniques are available to improve the accuracy of GPS position information, often by a factor of 10 or more.

The two primary augmentation methods are differential GPS and ground transmitters referred to as "pseudolites." Differential GPS uses a beacon that transmits corrected GPS information from a precisely surveyed point on the ground. A GPS receiver must be capable of receiving this additional differential signal to make use of correction data, but many GPS receivers produced today already have this capability. Pseudolites are either mobile or fixed transmitters that act as additional satellite signals. This method is particularly useful where GPS signals are blocked or obscured, such as in urban environments or deep valleys.

FA40s should be trained to advise commanders on the use and emplacement of differential GPS beacons. They should also be able to coordinate, through reachback, the emplacement of a differential beacon. Furthermore, SSEs should have several GPS pseudolite transmitters that can be employed at critical times and places on the battlefield. In this way, an FA40 can not only predict when GPS accuracy will be poor but can also deliver a solution.

GPS Jammers

It seems counter-intuitive to suggest that U.S. military personnel should employ GPS jammers. However, one of the great strengths of GPS is also one of its greatest liabilities from a military or security standpoint: it is available to anyone with a receiver. It is well known that our adversaries take advantage of the precision navigation capability that we provide and use it to make their own military operations more lethal and effective. The global reliance on GPS makes it impractical to degrade the entire constellation.

GPS jammers can be small enough to be hand-held. A relatively low-power output of only a few watts is enough to jam receivers within a very large area. FA40s with these selective GPS jammers would give commanders a powerful tool to negate a high-tech capability that our adversaries are learning to rely on, while keeping the same capability available to friendly forces. An alternative approach involves using GPS "spoofers" instead of jammers. Spoofers emit false signals instead of interfering in a random way. The advantage that spoofers offer is that an enemy might not know that any interference is occurring and would unknowingly be working with inaccurate GPS data.

7) Optical Augmentation Scanners

Optical augmentation is a technique that can be used to detect optical surfaces oriented toward the scanner. This is accomplished by using a low-power laser to rapidly scan a large area coupled with a sensitive detector to identify any bright reflections. Optical surfaces, such as lenses and mirrors, reflect much more light than their surrounding areas when they are pointed

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toward the detector. This bright reflection indicates an observer orienting their optics toward the scanner. Generally, an out-of-band laser is used for optical augmentation to prevent damage to optical equipment and to reduce the visible signature of the optical scanning.

Optical augmentation could be employed by FA40s and SSEs to detect imaging satellites oriented toward a particular point on the ground. The employment and utility of optical augmentation scanners are similar to that for radar receivers, but provides warning for electro-optical satellites. There are some drawbacks to this technique, however, that should be understood. First, an optical augmentation scanner will only indicate when a satellite is pointed at the scanner, not whether or not an image was actually taken. Second, the scanner must be positioned within the narrow footprint of the imager in order to detect it. Finally, this equipment would give FA40s the ability to identify the positions of national intelligence satellites. A process must be developed to mitigate this risk before optical augmentation scanners could be employed.

8) Mobile Very Small Aperture Terminal (VSAT) Studio

The U.S. Army psychological operations (PSYOP) community has the capability to develop, produce, and disseminate PSYOP messages to indigenous populations. Its primary means are printed handbills and radio broadcasts. One area where the PSYOP community struggles is in the ability to broadcast its messages through television. In the age of satellite TV, and with the proliferation of VSAT TV receivers, the PSYOP community has a critical capability gap. Although the Special Operations Media System-B has television capability, it is a direct broadcast system with a limited range, not a satellite system. The common method to get long-range or large-scale broadcasts is through local contracting with broadcast studios. This is time-consuming to establish, expensive to maintain and can be extremely challenging in a hostile environment.

The Army Space community could close this capability gap by fielding mobile VSAT studios to SSEs. The required equipment consists of a laptop computer with a DVD writer, a digital video camera and a VSAT transmitter. Coupled with leased channels on several broadcast satellites, FA40s and SSEs would then have a capability for rapid dissemination of PSYOP products anywhere in the world. Public affairs sections already have a similar capability to facilitate press statements and the release of news stories, but there is a strict division of labor between PSYOPs and public affairs that does not allow them to share equipment.

This capability does not have to be limited to PSYOP, but could also support the overall information operations campaign through uses such as facilitating a commander's ability to rapidly disseminate information or addressing foreign target audiences. Fielding mobile VSAT studios to our tactical Space forces could represent a great collaboration between the Space operations and information operations communities.

The capabilities described above are only a sample of the possibilities for Space operations as we continue to adapt to the increasingly complex nature of modern warfare. It is imperative that as warfare and the Army change, Army Space operations also change in order to continue to make valuable contributions. FA40s and SSEs must evolve to the point where they deliver unique, tangible and valuable capabilities to unit commanders. The capabilities discussed above can achieve this. Whether or not these particular suggestions are viable remains to be seen, but we must continuously look for new ways to support operations from Space. Only by aggressively pursuing new tools and new capabilities will Army Space operations keep pace in the dynamic environment of modern military operations.

MAJ Robert Guerriero is the III Corps Space Operations Officer at Fort Hood, Texas. He was previously assigned to the National Reconnaissance Office's Advanced Systems and Technology Directorate. Guerriero is a graduate of the Space Operations Officer Qualification Course. Comments and feedback are welcome. Please send to: robert.guerriero@us.army.mil or robert.guerriero@hood.army.smil.mil