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**A RAND NOTE**

**Recommended Strategy for the  
Army's Role in Space**

**Elwyn Harris, Ken Horn,  
Ed Cesar, Paul Steinberg**

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## Recommended Strategy for the Army's Role In Space

Elwyn Harris, Ken Horn,  
Ed Cesar, Paul Steinberg

Prepared for the  
United States Army

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## PREFACE

The Arroyo Center has been helping the Army think about its role in space for over seven years. As part of its current project, *Army Space: Tactical Applications*, for the Deputy Chief of Staff for Operations and Plans, the Arroyo Center is helping the Army develop continuing guidance for investing in and managing space-related activities in support of the battlefield commander. An earlier version of the project included trade-off analyses of alternatives to space systems and identification of various strategies for acquiring desirable space capabilities. In February 1992, the Chief of Staff of the Army asked the Arroyo Center to provide input to help him think through what the Army's role in space might be. This Note, drawing on the Arroyo Center research mentioned above, lays out a recommended strategy for the Army's role in space that argues that space should be used to support the battlefield commander and that commercial systems have supplied and can supply a great deal of the needed capability. This Note is not intended as a summary of the Arroyo Center's previous work in this area; it is a think piece intended to initiate a *conceptual discussion of the Army's role in space*. Work is in progress on how much of an investment is needed for the recommended investment strategy.

This Note will be of interest to all parties interested in how space can be used to help ensure that the U.S. Army can meet the challenges of the new geostrategic environment. This includes appropriate agencies and organizations within the Army from the Chief of Staff and Secretary level to the Functional Area Managers, the Commanders-in-Chief, the Department of Defense, and Congress.

## THE ARROYO CENTER

The Arroyo Center is the U.S. Army's federally funded research and development center (FFRDC) for studies and analysis operated by RAND. The Arroyo Center provides the Army with objective, independent analytic research on major policy and organizational concerns, emphasizing mid- and long-term problems. Its research is carried out in four programs: Strategy and Doctrine; Force Development and Technology; Military Logistics; and Manpower and Training.

Army Regulation 5-21 contains basic policy for the conduct of the Arroyo Center. The Army provides continuing guidance and oversight through the Arroyo Center Policy Committee (ACPC), which is co-chaired by the Vice Chief of Staff and

by the Assistant Secretary for Research, Development, and Acquisition. Arroyo Center work is performed under contract MDA903-91-C-0006.

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## **SUMMARY**

### **BACKGROUND AND OBJECTIVE**

In the conflict environment of the future, global connectivity will be needed for deployment; simultaneous attack throughout depth will require synchronization, cooperation, and interconnectivity; command and control on the move will be essential; the Army will need to focus on avoiding incidents of fratricide; and the Army will need to plan for simultaneous contingency operations in regions without infrastructure. Given this environment, we believe that Army Future Operations will need to become Aerospace Land Operations, because this concept continues to reflect the aggressive, opportunistic spirit of Army Future Operations and gives the future Army the flexibility and agility it will need.

This Note draws on space-related research the Arroyo Center has performed (and is performing) for the Army and proposes a strategy for the Army's role in space—one that is grounded in the argument that the Army's primary role in space should be to support the battlefield commander. The Note then suggests that the Army must modify its organization to emphasize space, should pursue a two-part investment strategy that centers on aggressively exploiting existing commercial, civilian, and national space assets, and must modify operational procedures for space (specifically those involving acquisition, training, and information distribution).

### **MAKE SUPPORT OF THE BATTLEFIELD COMMANDER THE ARMY'S PRIMARY ROLE IN SPACE**

Although there have been a number of suggested Army roles in space—including developing and operating a CONUS-based ballistic missile defense and constructing large space structures and habitats—we believe the Army's primary role should be to support the battlefield commander, who is the central actor in achieving the U.S. Army's principal mission—success in ground combat. Achieving such success will require achieving power projection and decisive advantage in conducting joint and combined operations across the operational continuum that forms the core of Army Future Operations; accomplishing this, in turn, means the Army will need to exploit space.

The new geostrategic environment—in particular, the diminished threat from the Soviet Union—has lessened the traditional concerns of relying on space to

support the battlefield commander. But beyond that, the example of Operation Desert Shield/Storm (ODS) clearly showed the value of supporting the battlefield commander by exploiting space assets. Specifically, space systems were successfully used to support the battlefield commander in a number of areas:

- Positioning and navigation using the Global Positioning Satellite (GPS) system.
- Weather and meteorological data from the Defense Meteorological Satellite Program (DMSP) and from a commercial weather satellite such as the Meteorological Satellite (METEOSAT).
- Topographical information from multispectral imaging surveillance satellites.
- Tactical early warning of theater ballistic missile attacks.
- Communications, including distribution of intelligence information and imagery.

#### **MODIFY THE ARMY'S ORGANIZATION TO EMPHASIZE SPACE**

To implement this role, the Army needs to modify its organization in a series of ways. First, it must include space in its warfighting doctrine, which means institutionalizing it within the Army. The Army Long Range Plan for Space (ALRP-S), currently in review, and the modification of FM 100-5 to explicitly rely on space systems that is currently under way, are important steps in this direction. Second, the Army must eliminate the fractionation among Army organizations that currently exists in using space systems by establishing a high-ranking point of authority for space systems that unifies multiple Army space-related activities and sets priorities and objectives. Finally, the Army must improve its requirements and acquisition process for space-related systems. While the Army's efforts in developing requirements for new space systems should not be completely neglected, the Army should acknowledge that it presently has far more space capabilities available to it than it is prepared to use and that it should, therefore, emphasize and expand its current R&D and acquisition program for ground-based elements to exploit present or planned space systems.

## **PURSUE A TWO-PART INVESTMENT STRATEGY**

In pursuing a two-part investment strategy, the Army should first aggressively exploit current commercial, civilian, and national space assets:

- Establish long-term leases/purchased service agreements with commercial/civilian satellite organizations.
- Procure/lease commercial ground terminals for deploying to forces.
- Investigate the potential for modifying Military Satellite Communications (MILSATCOM) terminals to be dual capable.
- Evaluate phasing out/scaling back the Enhanced Position Location Reporting System (EPLRS) and mobile subscriber equipment (MSE).
- Consider making TENCAP equipment more accessible to the operational forces by bringing it out of the classified compartmented arena.

For the second part of the proposed investment strategy, we recommend that the Army become a member of the space community, participating in establishing new satellite requirements and being prepared to provide some of the investment funds.

## **MODIFY OPERATIONAL PROCEDURES**

In addition to modifying the Army's organization and pursuing the proposed investment strategy, the Army needs to modify its existing operational procedures. First, it must consider how it will train when it expects to rely on space systems during combat, thinking about how simulations can fill the gap when satellite support is unavailable or too costly. Second, the Army must rethink how information is distributed on the battlefield, considering connectivity architectures that maximize the benefits of space systems employing broadcast nodes direct to the user. Finally, with global connectivity becoming important in conducting future contingency operations, the Army must think strategically about space, with space systems being considered the primary choice and terrestrial systems serving in an augmentation role.

## **CONCLUSIONS**

The Army should take the high ground and declare that it is aggressively pursuing the use of space capabilities to support the battlefield commander at the strategic, operational, and tactical level. Moreover, exploiting existing space

capabilities offers an opportunity to improve the overall effectiveness of Army Future Operations at a time when budget pressures on the Army tend to preclude pursuing other opportunities. Specifically, our recommended strategy is to:

- Integrate space support into Army Future Operations as an essential element.
- Establish a high-ranking Army authority for space.
- Move out now—do not wait for funding to develop new space systems or directions from DoD.
  - Implement changes in requirements and acquisition process.
  - Rely more on commercial systems.
  - Concentrate on acquiring ground-based elements for GPS, DSP, GOES, SPOT, LANDSAT, INTELSAT and INMARSAT satellite systems (see the Appendix for brief descriptions).
  - Revise training programs to rely on space support.

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## 1. INTRODUCTION

In the conflict environment of the future, commanders will need to have access to space systems that provide enhanced global communications and synchronization; navigation and meteorological information; battlefield situation and damage assessments and reconnaissance, surveillance, and target acquisition (RSTA); and early warning and tip-off/cueing capabilities. Command and control will also need to be enhanced through the development of space-based capabilities that will enable commanders to automatically monitor friendly force maneuvers and supplies and the location of enemy force concentrations and dispositions. In short, we believe that Army Future Operations<sup>1</sup> will need to become Aerospace Land Operations, because this concept continues to reflect the aggressive, opportunistic spirit of Army Future Operations and gives the future Army the flexibility and agility it will need.

Based on research performed for the Arroyo Center's ongoing project on the Army's role in space, we lay out in this Note a recommended strategy for the Army's role in space. We start by urging that the Army should make supporting the battlefield commander the primary role of space, supplementing that argument with a discussion of how the Army used space to support the battlefield commander during Operations Desert Shield and Storm (ODS). We then suggest that implementing this role requires modifying the Army's organization so that it appropriately recognizes space, which involves institutionalizing space in the Army's warfighting doctrine, establishing a high-ranking space authority, and modifying the requirements and acquisition process. We then propose that the Army pursue a two-part investment strategy that involves exploiting existing space systems and participating in satellite requirement studies. Finally, we argue that the Army needs to modify its operational procedures for space to deal with such issues as training and information distribution.

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<sup>1</sup>We understand that the new AirLand Operations umbrella concept is being replaced with Army Future Operations.

## **2. MAKE SUPPORT OF THE BATTLEFIELD COMMANDER THE ARMY'S PRIMARY ROLE IN SPACE**

### **BACKGROUND**

The Army's Future Operations concept is an aggressive one that foresees and exploits ground opportunities wherever such opportunities may exist and unabashedly exploits current and future technologies to help it carry out its ground warfare mission. The challenges the Army faces as it confronts a new and uncertain geostrategic world make achieving that concept more problematic. Specifically, future contingency operations may be characterized by long deployment distances from continental U.S. (CONUS) bases to contingency areas throughout the world, possible denial or delay of U.S. access to ports and airbases, overflight restrictions on airlift, shifting base rights agreements, enemies who are not well identified, joint operations, and shifting allies/coalition partners. Another part of the challenge will involve joint and combined operations with forces with different doctrines, levels of applied technology, and command and control. These characteristics make future operations uncertain and complex and rapid lift difficult to achieve.

Given these concerns, we believe that the Army will need to exploit space to achieve power projection and decisive advantage in conducting joint and combined operations across the operational continuum that forms the core of Army Future Operations—that Army Future Operations will, in essence, need to become Aerospace Land Operations. Space systems offer the Army an overarching capability; they provide, for example, global connectivity for forces from the time they begin deploying from the CONUS through initial entry into the conflict area and subsequent levels of conflict.<sup>2</sup> This includes in-theater support for all levels of command. By being in place prior to deployment, space systems enhance the Army's operational flexibility and provide continuity throughout all phases of conflict without lengthy set-up times and breaks in service during mobilization redeployments and maneuvers. Space systems also provide the flexibility of responding gracefully to emerging communications requirements of a contingency situation without having to make commitments for extensive equipment shipments to the contingency area, i.e.,

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<sup>2</sup>U.S. forces may participate in conflict regions where they do not engage in combat, e.g., peacekeeping, disaster relief, and evacuation. In many of these situations space capabilities similar to those for combat would be needed.

terminals must be available in the field but the satellite transponders can be in position to be used as needed.

The primary role for the Army in space should be to support the battlefield commander, who is the central actor in achieving the U.S. Army's principal mission—success in ground combat.<sup>3</sup> Secondly, the U.S. Army's Space and Strategic Defense Command's (SSDC) responsibilities in the Strategic Defense Initiative (SDI) for ground-based defenses can be viewed as augmenting the Army's ability to provide active theater missile defense (TMD) for contingency operations.<sup>4</sup> Similarly, Corps of Engineers' activities on multispectral imaging and interferometric synthetic aperture radars provide, in the long run, a capability to improve intelligence preparation of the conflict area, target acquisition and tracking, and damage assessment.<sup>5</sup> However, in an era of ongoing budget cuts, the Army must continue evaluating the risks and

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<sup>3</sup>P-7396, *The Army's Role in Space: Support for the Battlefield Commander*, E. D. Harris, R. E. Darilek, K. P. Horn, and M. M. Nelsen, RAND, December 1987.

<sup>4</sup>P-7770, *The Army's Role in Ballistic Missile Defense: A Preliminary Review of the Prospects and Issues*, M. Eisenstein, E. D. Harris, J. R. Hiland, and P. Steinberg, RAND, 1992. The Strategic Defense Initiative Organization (SDIO) has the responsibility for managing the Global Protection Against Limited Strikes (GPALS) program, with the Army providing major R&D support. The National Missile Defense (NMD) portion of GPALS provides CONUS defense from a limited missile attack that is consistent with the ABM treaty. SSDC is responsible for the ground-based portions of NMD and shares the command center responsibilities with the Air Force. The space-based portion of the NMD is the responsibility of the Air Force. This includes the satellite early warning provided by Defense Support Program (DSP) and the Follow-on Early Warning System (FEWS), or a constellation of Brilliant Eye (BE) satellites capable of missile detection, tracking, and discrimination. As currently envisioned, the Global Missile Defense (GMD) system is achieved by adding a constellation of autonomous Brilliant Pebbles (BP) to the NMD system. The BP constellation is the responsibility of the Air Force.

The Army's warfighting capabilities will undoubtedly benefit to some degree from participating in the NMD program because of the involvement with the high-technology aspects of the ground-based missiles and sensors and the sophisticated command and control system. There is bound to be some transfer to the TMD role in these areas. On the other hand, the GMD program offers the limited potential for low-level attrition of theater missile attacks worldwide. Such a capability could enhance TMD by cueing the active defenses or it could offset or reduce the need for ground-based TMD systems, thereby contributing directly to the Army's warfighting mission. However, the BP concept is years away from deployment and the technology has not been fully developed. There are also unresolved issues of multinational cooperation and control authority.

<sup>5</sup>The Army conducted an extensive internal study of ways the Army could use space to support its mission areas. The results of this study are reported in *Army Space Initiative Study (ASIS)*, Volumes 1-5, 1985. One of the Army activities highlighted in this study was the Corps of Engineers role in NASA's space exploration program such as the one that it took in support of NASA's Space Exploration Initiative (SEI).

benefits—both to itself as an institution and to its warfighting capabilities—of too broadly diversifying its space-related activities among too many roles.

One of the major concerns in the past about depending on space to support the battlefield commander has been the threat of antisatellite (ASAT) attack and electronic jamming of U.S. satellites. However, the new geostrategic environment—primarily the breakup of the Soviet Union (which though it still has threat capability, is much less likely to be involved in combat with U.S. forces)—has lessened this threat. Although the republics of the former Soviet Union may sell such systems to Third World countries, these countries may not choose to use the capabilities.<sup>6</sup> Nevertheless, U.S. intelligence collection plans for likely contingency areas should take into account ASAT, electronic jamming threats, and countermeasures against electronic jamming threats, e.g., beam-riding missiles that can attack jamming emitters. Even if such capabilities develop in future contingency regions, suppressing these threats will probably be easier than it would have been for the former Soviet threat. Because of the lower threat level, U.S. space assets do not have to be capable of surviving a direct nuclear ASAT attack nor a high level of electronic jamming, thus allowing them to be designed to lower survival specifications and thus lower acquisition costs. More important, this means that the Army can more confidently depend on the availability of support for the battlefield commander from space-based systems in times of conflict.

#### **USING SPACE TO SUPPORT THE BATTLEFIELD COMMANDER: THE EXAMPLE OF ODS**

The value of supporting the battlefield commander by exploiting space assets can be clearly seen in ODS, where space systems played an important role. Specifically, space systems were successfully used to support the battlefield commander in six areas:

1. Positioning and navigation using the Global Positioning Satellite (GPS) system.

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<sup>6</sup>For instance, although Iraq had some capability to electronically jam satellite communication links during ODS, they did not do so for a variety of reasons: desire to continue broadcasting over the same communications satellites (comsats); the threat of suppression by the USAF; and the difficulty of electronically jamming a variety of space-based communications systems under combat conditions.

2. Weather and meteorological data from the Defense Meteorological Satellite Program (DMSP) and from commercial weather satellites such as the Meteorological Satellite (METEOSAT).
3. Topographical information from multispectral imaging surveillance satellites.
4. Tactical early warning of theater ballistic missile attacks.
5. Communications support.
6. Distribution of intelligence information.
7. Imagery dissemination.

Experience in ODS in each of these seven areas is discussed below.

### **Positioning and Navigation**

As demonstrated in ODS, reliance on GPS, which used commercial receivers, could replace the traditional map and compass approaches, as well as more advanced systems such as Enhanced Position Location Reporting System (EPLRS). In addition, GPS aided Field Artillery surveys in ODS by providing a third-order control network in the theater and by locating artillery survey points.<sup>7</sup> The Army quickly provided its ODS forces with small, lightweight GPS receivers (SLGRs), which are basically commercial units available on the open market. The military standard GPS manpack receivers were not available in the quantities needed.

Coupling GPS with a communication network enables Army commanders at all levels to know automatically the location and status of their forces and logistics support elements. This is truly a force multiplier, especially given the emphasis in Army Future Operations on mobility and distributed forces. In this connection, the Army Space Exploitation Demonstration Program (ASEDP)<sup>8</sup> includes a demonstration of this capability that couples GPS with the Single-Channel Ground and Airborne Radio System (SINCGARS). While this provides information on forces within the SINCGARS region of operation, a more extensive capability is needed that allows for theaterwide synchronization of forces and logistics elements. Coupling GPS position information with the International Maritime Satellite Organization

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<sup>7</sup>*The Ultimate High Ground: Space Support to the Army from Operations Desert Shield and Storm*, Center of Army Lessons Learned (CALL), U.S. Army Combined Arms Command (CAC), Fort Leavenworth, Newsletter No. 91-3.

<sup>8</sup>Army Space Exploitation Demonstration Program, Colonel Jim Murphy, HQDA, ODCSOPS, AIAA Paper Number 92-1616.

(INMARSAT) commercial communications satellite network offers a global capability.<sup>9</sup> One advantage of this capability would be the availability of an integrated Position/Navigation (POS/NAV) system for use by all the services, which should improve identification, friend or foe (IFF) and reduce fratricide.

#### **Weather and Meteorological Data**

Using DMSP or commercial weather satellites such as METEOSAT provides essential environmental information for the battlefield commander. These systems were used in ODS, and such capabilities should be provided directly to the battlefield commander without having to be processed through a vertical hierarchical distribution system. The Army took small commercial receivers<sup>10</sup> to Saudi Arabia that could display weather imagery from METEOSAT. These receivers were lighter in weight than DMSP receivers, and they allowed weather information to be more widely and more quickly distributed than did the DMSP. However, the Army would prefer to have additional weather data that could be provided by DMSP and small receivers.

#### **Topographical Information**

As demonstrated in ODS, multispectral imaging surveillance satellites can provide wide area maps of unfamiliar operational areas. In ODS, both LANDSAT and Systeme Probatoire d'Observation de la Terre (SPOT) satellite data were used in connection with multispectral imagery workstations and other processing systems. Although this capability was an ad hoc assembly for ODS, space-based topographical data for unfamiliar contingency areas should be provided in the future as a routine matter and guided using GPS inputs.

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<sup>9</sup>N-3386-A, *U.S. Army Communications Using Commercial Satellites*, D. R. Castleman, Susan M. Everingham, James M. Milanese, Elwyn D. Harris, and Edward Bedrosian, RAND, 1992 (Unclassified—Authorized to U.S. Government agencies and their contractors). A similar capability is widely used by the trucking and railroad industry to keep track of shipments. The Army also used a similar technique, i.e., tracking, command, control and communications (TRACS), to track ODS equipment and supplies during the return journey to the United States. The above reference discusses a commercial Radio Determination Satellite Service (RDSS) that would probably meet the Army's global needs.

<sup>10</sup>These receivers became known as Wraase receivers for their manufacturer—Wraase Electronics Company; however, there are a number of commercial weather receivers available to the Army for this purpose.

### **Tactical Early Warning**

Defense Support Program (DSP) satellites can provide tactical early warning of theater ballistic missile attacks.<sup>11</sup> As demonstrated in ODS, such warning is essential for alerting active defenses such as PATRIOT and for providing time for passive defense measures (e.g., dispersing, putting on protective gear, or taking cover). Again, this capability was hastily assembled to support ODS using a Constant Source/Tactical Receiver Equipment and Related Applications (TRAP) network for the dissemination of missile warning from Colorado Springs to the PATRIOT air defense systems and others in the theater. Experience with this setup came from the ASEDP and Tactical Exploitation of National Space Capabilities (TENCAP) programs.<sup>12</sup> In addition, SDC is planning a demonstration that provides DSP warning data directly to the battlefield commander, thereby maximizing the warning time. Such a capability is an important feature of an Army TMD program.

### **Communications**

Communications support used by the Army in ODS included substantial traffic over commercial communications satellites such as the International Telecommunications Satellite (INTELSAT) Organization and INMARSAT to augment the Military Satellite Communications (MILSATCOM) support provided by DoD.<sup>13</sup> In the past, the Army's access to MILSATCOM support has been limited by the low priority of tactical users at theater and below. Although the Army priority was raised for ODS, there is no assurance it will remain high during peacetime or for other contingencies. ODS also demonstrated that the mobility and distances between units was such that terrestrial-based Army communications systems were inadequate to maintain essential connectivity.

### **Distribution of Intelligence Information**

During ODS, the Trojan Spirit satellite mobile communications systems, installed on a High Mobility Multi-Purpose Wheeled Vehicle (HMMWV), was a highly valued system for connecting tactical and operational units to sources of

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<sup>11</sup>See Center for Army Lessons Learned (CALL), U.S. Army Combined Arms Command (CAC), *The Ultimate High Ground*, Newsletter No. 91-3, October 1991.

<sup>12</sup>See footnotes 7 and 8.

<sup>13</sup>ASEDP has a demonstration planned to explore the use of the National Aeronautics and Space Administration's (NASA's) Advanced Communications Technology Satellite (ACTS) to provide high-capacity communications compatible with tactical antennas and terminals (see footnote 8).

intelligence—especially imagery—from the CONUS and for rapidly disseminating intelligence to commanders at all the subordinate levels.<sup>14</sup>

### **Imagery Dissemination**

One of the important lessons of ODS about information dissemination—whether the information is about the enemy or friendly situation, maps, intelligence, weather conditions, terrain, road networks, maneuver vectors, minefields, and other barriers—is that primary and secondary imagery is the preferred form of communications. Other forms (e.g., typewritten text and voice messages) can be used to supplement imagery, but imagery has clearly already become the dominant form for the future.

Because of the need to register images accurately and uniformly to synchronize operations and support the Integrated Battlefield, standards for image sizes, grid, resolution, icons, etc., must be promulgated and followed, and they must be consistent across all the Army's functional areas and the Services. Consequently, imagery disseminated by space or other means of communications should not be the domain of a single agency, functional area manager, or Service.

The examples listed above represent only the "tip of the iceberg" in terms of potential future applications of space systems for the Army. Future possible applications that were not demonstrated in ODS include IFF, damage assessment, and logistics monitoring and control.

Overall, we believe that the Army's main efforts related to space should be in applying space capabilities to existing and future terrestrial systems—for example, fixed-wing aircraft (including Unmanned Aerial Vehicles, UAVs), helicopters, and ground vehicles/entities—and should be less concerned about developing new space systems, which, after all, will most likely be joint programs and very expensive.

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<sup>14</sup>*Operation Desert Storm, The Military Intelligence Story: A View from the G-2 3D U.S. Army*, BGEN(P) John F. Stewart, Jr., G-2 3D U.S. Army, April 1991.

### **3. MODIFY THE ARMY'S ORGANIZATION TO EMPHASIZE SPACE**

#### **INSTITUTIONALIZE SPACE AS PART OF WARFIGHTING DOCTRINE**

The Army tends to prefer to operate with organic assets on the battlefield. In the future, we believe the Army should think more strategically by relying more heavily on space systems support. To fully exploit space systems in support of the battlefield commander, the use of space systems as part of Army Future Operations must be institutionalized within the Army; in other words, such use must become an option that cannot be easily ignored. This means the Army needs to explicitly include space in its warfighting doctrine. The Army Long Range Plan for Space (ALRP-S) includes space systems as an enabling concept for Army Future Operations; its approval is an important step in institutionalizing space as part of the Army's warfighting doctrine,<sup>15</sup> but it is not sufficient by itself. Much must be accomplished before Army doctrine adequately accounts for the importance of space. For example, FM 100-5 and FM 100-18 need to be revised to reflect the dependence of Army Future Operations on the use of information on space systems.

#### **ESTABLISH A HIGH-RANKING AUTHORITY**

The responsibility for promoting the use of space systems is fractionated among several Army organizations. For instance, recent U.S. Army Training and Doctrine Command (TRADOC) and U.S. Army Materiel Command (AMC) organizational changes<sup>16</sup> do not bode well for the future of space system proponentcy in the Army acquisition system. In addition, it is not clear how the merger of SDC and the Army Space Command (ARSPACE) into the Space and Strategic Defense Command (SSDC) will affect this situation. However, the responsibilities and authority of the commander of SSDC, as laid out in the General Order,<sup>17</sup> appear to provide such an Army focal point for space. Thus, in addition to institutionalizing space as a part of the warfighting doctrine, the Army needs a high-ranking point of

<sup>15</sup>Draft, "The Army Long Range Plan for Space (ALRP-S)," February 1992, DCSOPS, Headquarters Army.

<sup>16</sup>The downsizing of the Army Space Institute and the resultant assignment of space proponentcy to U.S. Army Training and Doctrine Command schools and centers, and the scheduled phase-out of ASTRO in the U.S. Communications and Electronics Command (CECOM).

<sup>17</sup>Draft General Order, U.S. Army Space and Strategic Defense Command, undated.

authority for space systems that unifies multiple Army space-related activities and sets priorities and objectives; the commander of SSDC may provide this function.

### **CORRECT THE REQUIREMENTS AND ACQUISITION PROCESS**

It is also imperative that corrective actions be undertaken to improve the Army acquisition process for space-related systems. Careful review of how the space capabilities used by the Army in ODS came into being will show that it was mostly accomplished outside the normal Army Concepts-Based Requirements System (CBRS). Was this a failure of the CBRS, or just a coincidence that required the use of R&D systems that were not yet ready for full acquisition? We believe it was the former because the normal acquisition process does not allow for streamlined procurement or leasing of non-developmental items and commercial off-the-shelf equipment—even though several space-related procurements were in the Army requirement/acquisition process at the time of ODS.

Since doctrine and technology change at a pace that is faster than either concept development or the acquisition cycle, the Army must close these gaps to develop concepts, generate requirements documents—e.g., Mission Element Needs Statement (MENS) and Operational Requirement Document (ORD)—and apply materiel acquisition concurrently instead of serially as it has been doing. This may be aided organizationally by creating a body that works under a single command (albeit a combined one like the old Joint TRADOC-TAC AirLand Office) in which MENS, ORD, and materiel acquisition development plans are a single product, as contrasted with a process in which separate products are generated by separate Major Army Commands (MACOMs) over a long period of time.<sup>18</sup>

Army participation in multiple space-related endeavors (i.e., SDI, TENCAP, TMD, and support for operational forces) along with their associated acquisition systems creates the opportunity for unwarranted inefficiency, especially in a period of

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<sup>18</sup>An important aspect is to ensure that knowledgeable individuals with both operational experience and knowledge of systems are assigned to both TRADOC and the U.S. Army Materiel Command (AMC), including LABCOM, and wherever materiel requirements are conceptualized, developed, and planned. These individuals should be tasked (working together) to invariably consider ways that space capabilities can be integrated with all current and future terrestrial systems. This procedure should be performed concurrently under a single commander who has overall responsibility for a fully developed requirement, including the concept, doctrine, and materiel-feasible design, rather than as a multi-step serial process by separate commands and agencies.

budget reductions.<sup>19</sup> For example, the Army TENCAP effort is separate from other Army space efforts, operates under different authority and operational regulations, and operates under restrictive classification that hinders use, understanding, and wide acceptance by the total Army. With the end of the Cold War and with severe force and budget reductions under way, it is time to consider reducing TENCAP classification restrictions and redirecting the effort to better support the tactical Army forces.

The Army has been spending some of its time and effort developing requirements for new space systems. While this work should not be completely neglected, the Army should acknowledge that it presently has far more space capabilities available than it is prepared to use. The Army should, therefore, emphasize and expand its current R&D and acquisition program for ground-based elements to exploit present or planned space systems.

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<sup>19</sup>TRADOC and AMC have responsibility for traditional Army equipment; SDC, for the R&D of space and missile defense equipment related to SDI; and TENCAP, for support equipment keyed to national systems.

#### 4. PURSUE A TWO-PART INVESTMENT STRATEGY

The Army's conventional wisdom is that anything involving space is very expensive—a concern that tends to be greatly magnified in times of declining budgets; hence, most Army functional managers (e.g., Fire Support, Air Defense Artillery, Combat Service Support, Engineers, and Armor) feel threatened by it. Although not enough analysis has been done to demonstrate the full utility of information derived from space systems for enabling rapid deployment and lightening forces or facilitating responsiveness, we believe these capabilities are essential to Army Future Operations and that space systems play a key role in achieving Army Operational Precepts.

Given this belief, we propose a two-part space investment strategy that is consistent with the Army Long Range Plan for Space (ALRP-S) and is well suited to meet the needs of the Army given the major geostrategic changes that have occurred. The first part calls for making maximum use of all existing and future commercial, civilian, and national space assets by concentrating on ground-based elements designed to better serve the Army. The second part calls for further investigation and R&D into special-purpose satellites to prepare the Army as an informed participant in a broader debate on augmenting national capabilities.

At this point the cost of this type of investment strategy is being developed and will be forthcoming. Our assumption is that it will be reasonable, especially considering all of the cost factors, such as offsetting cost savings of eliminating a number of terrestrial systems as well as the overall performance and lift requirements.

#### EXPLOIT EXISTING SPACE SYSTEMS

Space systems are very expensive to develop, deploy, and operate. However, as the Army's experience in ODS illustrated, it can and should make effective use of information from existing national, civilian, and commercial satellites by developing or leasing ground terminals, receivers, and processors suitable for Army missions. The Army can also lease transponder capacity on commercial communications satellites (comsats) and buy wide-area surveillance photography from civilian or commercial organizations. *In essence, the Army should make maximum use of all available space systems.* Space systems should be considered the Army's primary

choice, with the traditional terrestrial systems serving as augmentation capabilities. This approach provides the Army with a tremendous capability, as long as attention is paid to the terrestrial elements (including the badly needed distribution network to all levels of command, as discussed in the M.I. Relook Study<sup>20</sup>). Attention must also be given to the negotiation of long-term lease agreements with commercial comsat organizations that allow for a significant preemption capacity.

This investment strategy also recognizes that commercial capabilities in a number of fields—e.g., communications, computers, and electronics—are expanding tremendously and that the Army's R&D acquisition system cannot keep abreast, especially in an era of decreasing budgets. The Army will inevitably fall farther and farther behind if it attempts to continue past R&D practices. The proposed space investment strategy calls for the Army to concentrate its R&D dollars on the terrestrial equipment that is Army-specific and, even here, to use commercial equipment whenever possible. The SLGR is one example; another is the INMARSAT and INTELSAT terminals used in ODS.<sup>21</sup> The bottom line about space systems is, whenever possible, transfer to the commercial sector the risks associated with bringing new technology into the marketplace.

Finally, attention must be given to the possibility of jamming and other countermeasures and provisions must be made to operate in such an environment. For the commercial comsats, this means providing dual-use terminals capable of operating with DSCS and commercial comsats that are equipped with spread-spectrum modems. By doing this, the commercial comsats are protected to the same degree as DSCS. The United States could also employ selective jamming without affecting U.S. communications.

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<sup>20</sup>"Estimating the Army's Intelligence Requirements and Capabilities for 1997-2001: Analytic Support to the Military Intelligence Relook Task Force," J. Bondanella et al., RAND, forthcoming.

<sup>21</sup>In addition, we want to emphasize that many Third World countries, rather than invest in indigenous space systems, can be expected to use the same strategy proposed here. The concern is that if the Army does not implement an aggressive space investment strategy as described above, it may be unable to effectively carry out its Army Future Operations concept and that it will face enemies who have taken advantage of space systems to the Army's disadvantage.

If both the United States and the Third World rely on the same types of commercial space capabilities, it is quite possible that neither would be willing to create a countermeasure environment. To some degree, this was the situation in ODS. Nevertheless, as discussed above, the Army should be prepared for such contingencies.

## **PARTICIPATE IN SATELLITE REQUIREMENTS STUDIES**

We also recognize that currently available or planned military satellite systems do not always entirely satisfy the Army's operational requirements. Thus, the investment strategy allows for the definition of Army-specific requirements for space systems and negotiations and investment by the Army to ensure that future satellite systems can satisfy the Army's requirements. Only in very special cases would we expect this to involve the Army acquisition of satellites. In most cases, this would consist of an Army investment to ensure that a desired capability is built into the next-generation satellite.<sup>22</sup>

Special-purpose satellites having jam-resistant communications capabilities or RSTA support for the battlefield commander need serious consideration in terms of operational utility vis-à-vis other means of satisfying these requirements. From these efforts, the Army should be able to articulate its position within the larger national debate about the need to augment other national space capabilities. The objective is not necessarily for the Army to become an owner-operator of its own satellite systems, but for the Army to be assured that it can have the space systems available for training and combat operations.

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<sup>22</sup>This is consistent with the Army Long Range Plan for Space (ALRP-S) Draft, 7 February 1992.

## 5. MODIFY OPERATIONAL PROCEDURES

In addition to modifying the Army's organization and pursuing the proposed investment strategy, the Army needs to modify some of its existing operational procedures in terms of training to use space systems, distributing information, and thinking about space.

### TRAINING THE ARMY TO USE SPACE SYSTEMS

The Army must consider how it will train when it expects to rely on space systems during combat. While the use of actual satellite support would be desirable and in many instances available for training purposes, simulations can be expected to fill the gap when satellite support is unavailable or too costly. This is not new to the Army,<sup>23</sup> and we expect that such simulation capabilities will improve substantially in the future, thus allowing the Army to train as it will fight.

### DISTRIBUTION OF INFORMATION

Although space support went reasonably well during ODS, the M.I. Relook Study<sup>24</sup> revealed that some processing and dissemination capabilities were not adequate to support the battlefield commander's expectations. This occurred mainly because the connectivity architecture was engineered following traditional service ground paths instead of by maximizing the benefits of space systems employing broadcast nodes direct to the user. Furthermore, the research supports the thesis that image intelligence production and dissemination must focus downward to support warfighters and that technical means must be developed to integrate collection results from other intelligence sources into a single digital image format. Space collections systems, both National Technical Means and special-purpose Tactical Satellites (TACSATs), offer the potential, in combination with UAV platforms, for fulfilling the Army imagery requirements of the future.

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<sup>23</sup>For example, corps and division commanders train regularly on the Battle Command Training Program (BCTP) and the Corps Battle Simulation (CBS). It would be straightforward to augment these simulations with photo-based intelligence inputs to the commander using simulated imagery. In addition, the Army is using Simulation Network (SIMNET) in tank commander training. R-3761-A, *Understanding Commanders' Information Needs*, J. P. Kahan, D. R. Worley, and C. M. Stasz, RAND, June 1989 and R-3816-A, *Implementing the Battle Command Training Program*, J. P. Kahan, D. R. Worley, S. M. Holroyd, L. C. Reger, and C. M. Stasz, RAND, August 1989.

<sup>24</sup>See Bondanella, footnote 20.

## **HOW THE ARMY THINKS ABOUT SPACE**

In the future, it is important to recognize that the Army must think strategically about communications because global connectivity can be very important in conducting future contingency operations with efficient deployment of forces and maximum application of power. The Army will continue to require terrestrial communications systems, mainly for backup, but the availability and versatility of satellite communications should dominate the mix of systems. With proper planning, commercial comsat availability can significantly augment the Army's military communications capabilities, as well as its ability to train as it fights. In short, space systems should be considered the primary choice, with terrestrial systems serving in an augmentation role.

## **6. CONCLUSIONS**

**It is time for the Army to take the high ground and declare that it is aggressively pursuing the use of space capabilities to support the battlefield commander at the strategic, operational, and tactical levels. Satellite operations in ODS demonstrated that space support gives the Army the flexibility and agility it needs to fight, survive, and prevail on the ground. In addition, the ad hoc way in which space systems were used during ODS demonstrated that the Army needs to modify its organization to emphasize space, pursue an investment strategy more focused on exploiting existing space systems, and modify its operational procedures for dealing with space.**

**As stated at the outset, the primary purpose of this Note is to present a proposed strategy for the Army's use of space-derived information, to emphasize the importance of the future use of space systems by the Army, and to start a dialogue. The timing of this dialogue is especially critical because the current pressures for reducing the Army's budget tend to preclude consideration of important and crucial opportunities for improving the overall effectiveness of Army Future Operations. We believe that exploitation of existing space capabilities by the Army is one such opportunity.**

**Appendix**  
**BRIEF DESCRIPTIVE GLOSSARY OF SPACE SYSTEMS**

|           | <u>Space System</u>                               | <u>Function/Description</u>                                                                                                                                               |
|-----------|---------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DMSP      | Defense Meteorological Satellite Program          | A U.S. military weather and meteorological satellite system.                                                                                                              |
| DSP       | Defense Support Program                           | Provides early warning of ballistic missile launches.                                                                                                                     |
| FEWS      | Follow-on Early Warning System                    | A follow-on program to DSP for early warning and tracking of ballistic missile launches.                                                                                  |
| GEOS      | Geostationary Operational Environmental Satellite | A U.S. geostationary weather satellite system that operates in the western hemisphere.                                                                                    |
| GPS       | Global Positioning System                         | Provides navigation and position information to users having a GPS receiver.                                                                                              |
| INMARSAT  | International Maritime Satellite                  | An international commercial satellite organization that provides global low-data rate, multi-user communications services.                                                |
| INTELSAT  | International Telecommunications Satellite        | An international commercial satellite organization that provides global wide-band communications services.                                                                |
| LANDSAT   | LANDSAT                                           | A U.S. multispectral earth observation and imaging satellite.                                                                                                             |
| METEOSAT  | Meteorological Satellite                          | A French geostationary weather satellite that is positioned to serve Europe and the Middle East.                                                                          |
| MILSATCOM | Military Satellite Communications System          | The U.S. military communications network that provides secure, global communications services for wide-band, low-data-rate multi-users and for control of nuclear forces. |
| SPOT      | Satellite Probatoire d'Observation de la Terre    | A French earth observation and imaging satellite.                                                                                                                         |
| TACSATs   | Tactical Satellites                               | Generally considered to be lightweight, special-purpose satellites that are to be used for augmenting other space capabilities. Status—research phase.                    |