Arming B–1 with 2,000-pound JDAM.

U.S. Air Force (Dave Nolan)

U–2 returning from mission, Enduring Freedom.

1st Combat Camera Squadron (Reynaldo Ramon)

FORGING Space Warriors

By LANCE W. LORD

In Enduring Freedom, U–2s are flying over Afghanistan, collecting data, and then sending it back to 9th Intelligence Support Squadron at Beale Air Force Base, where the imagery is analyzed and potential target coordinates are mensurated. The coordinates are passed along to the Combined Air Operations Center at Prince Sultan Air Base to prioritize and include in the air tasking order. Coordinates and imagery sent from the United States are used to match weapons with targets. This reliance on reachback is key to expeditionary culture and has reduced the number of deployed personnel. The capabilities provided by Air Force Space Command are an indispensable but nearly transparent part of what makes reachback possible.

In one of the most decisive battles in Western history, Aetius defeated Attila the Hun at the Battle of Châlons in 451, in part because of a considerable advantage gained by seizing high ground on the enemy flank in an initial battle. After many centuries and myriad technological advances, that

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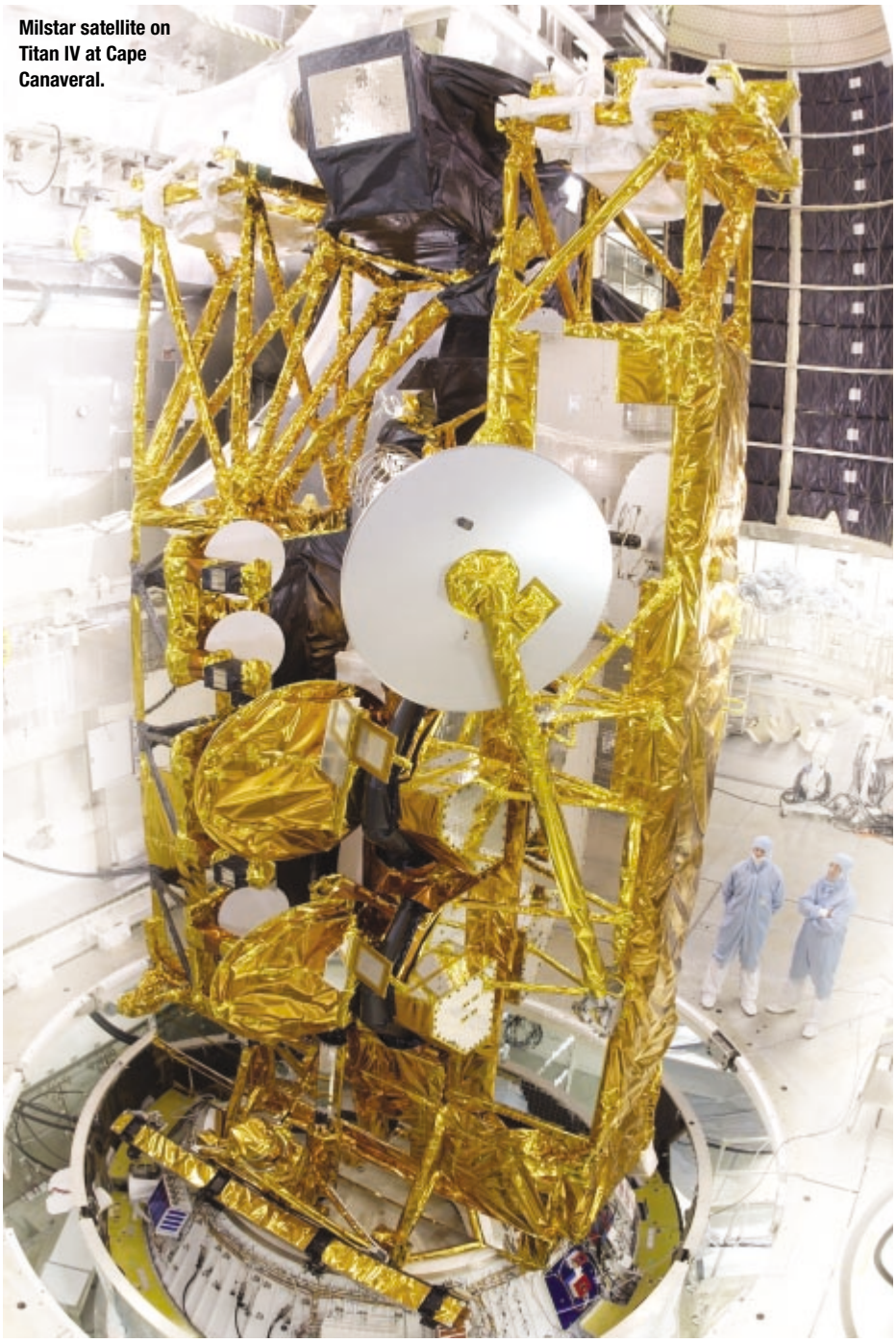
tactic is still valid. Joint Publication 3-14, *Joint Doctrine for Space Operations*, highlights the fact that space is the ultimate high ground, because it provides global access and extensive advantage. Within the Air Force, those capabilities and their battlefield effects are the responsibility of Air Force Space Command, which organizes, trains, and equips space and missile forces to exploit and control the high ground of space.

The joint force relies on space capabilities that were not envisioned at the start of the 1950s. Military capabilities originally developed for strategic purposes have evolved to be employed on the operational and tactical levels. Space provided both satellite communications and weather data to operational-level commanders in Vietnam. The Phu Lam Signal Battalion was one of the first units in the Army to deploy satellite capabilities, and the Air Force brought the defense meteorological satellite program out of the black world to support warfighters. In Desert Storm, a range of space capabilities was employed, from navigation and timing to missile warning.

Space assets are key enablers in the process of finding, fixing, tracking, targeting, engaging, and assessing an enemy—the so-called kill chain. Controlled through satellite relays, unmanned aerial vehicles attack targets on the ground. Satellite-guided weapons such as the joint direct attack munition are used with devastating effect while minimizing collateral damage. Capabilities in space have become critical to military effectiveness. In his testimony before Congress, the Commander of U.S. Central Command, General Tommy Franks, USA, remarked that much of the success of Enduring Freedom would not have been possible without those assets.



Milstar satellite on Titan IV at Cape Canaveral.

Lockheed Martin Space Systems (Russ Underwood)

Providing and Enabling

Air Force Space Command is both a force provider and a force enabler. It is an integrated organization of 40,000 military, DOD civilian, and contract personnel who ensure that the systems designed, built, and operated by the command provide capabilities for the Armed Forces to generate battlefield effects. The command has three main roles. First, it organizes, trains, and equips joint warfighters in the space and missile business. Second, it places great emphasis on its componency role, not only on expertise in intercontinental ballistic missiles and space. As part of the joint team, Air Force Space Command must be versed in land, sea, and air operations to provide capabilities to combatant commanders when and where needed. And third, the command is helping to make the new role of the Air Force as executive agent for space a resounding success.

These three roles are critical to defending the Nation through the control

Force Enhancement Mission Areas, Primary Orbits, and Current and Planned Systems

Mission Areas	Primary Orbits	Current and Planned Systems
Environmental Monitoring	Polar Low-Earth Orbit (LEO)	Defense Meteorological Support Program (DMSP), National Polar-Orbiting Operational Environmental Satellite System (NPOESS)
Communications	Geostationary Orbit (GSO)	Defense Satellite Communications System (DSCS) II, DSCS III, Global Broadcast System (GBS), Wideband Gapfiller System (WGS), Advanced Wideband System (AWS), Transformational Communications System, Milstar, Advanced Extremely-High Frequency (AEHF) System, Ultra-High Frequency Follow-on (UFO) System, Mobile User Objective System (MUOS)
Position, Velocity, Time, and Navigation	Semi-synchronous Orbit	Global Positioning System (GPS), GPS II/IIA, GPS IIR, GPS IIR–M, GPS IIF, GPS III
Integrated Tactical Warning and Attack Assessment	Polar Low-Earth Orbit and Geostationary Orbit	Defense Support Program (DSP), Space-Based Infrared System (SBIRS) High, Space Tracking and Surveillance System (STSS)
Intelligence, Surveillance, and Reconnaissance	Various	Legacy Systems, Future Imagery Architecture (FIA), Integrated Overhead Signals Intelligence Architecture (IOSA)

Source: Joint Publication 3-14, *Joint Doctrine for Space Operations,* and *Air Force Magazine,* Space Almanac edition.

and exploitation of space. In support of that broad mission, systems and capabilities are grouped into four areas.

space superiority—the freedom to conduct operations without significant interference from enemy forces—must be achieved in future conflicts

First, the counterspace mission area addresses the need to gain and maintain space superiority—control of space—as an initial step in space operations. As history has demonstrated, the ability to exploit a medium comes with control of it. Space force enhancement and application are mission areas that utilize exploitation capabilities. Finally, space support is a mission area that provides the foundation of space operations. These four areas match the core competencies that were recently refined by both the Secretary of the Air Force and the Chief of Staff of the Air Force.

Counterspace

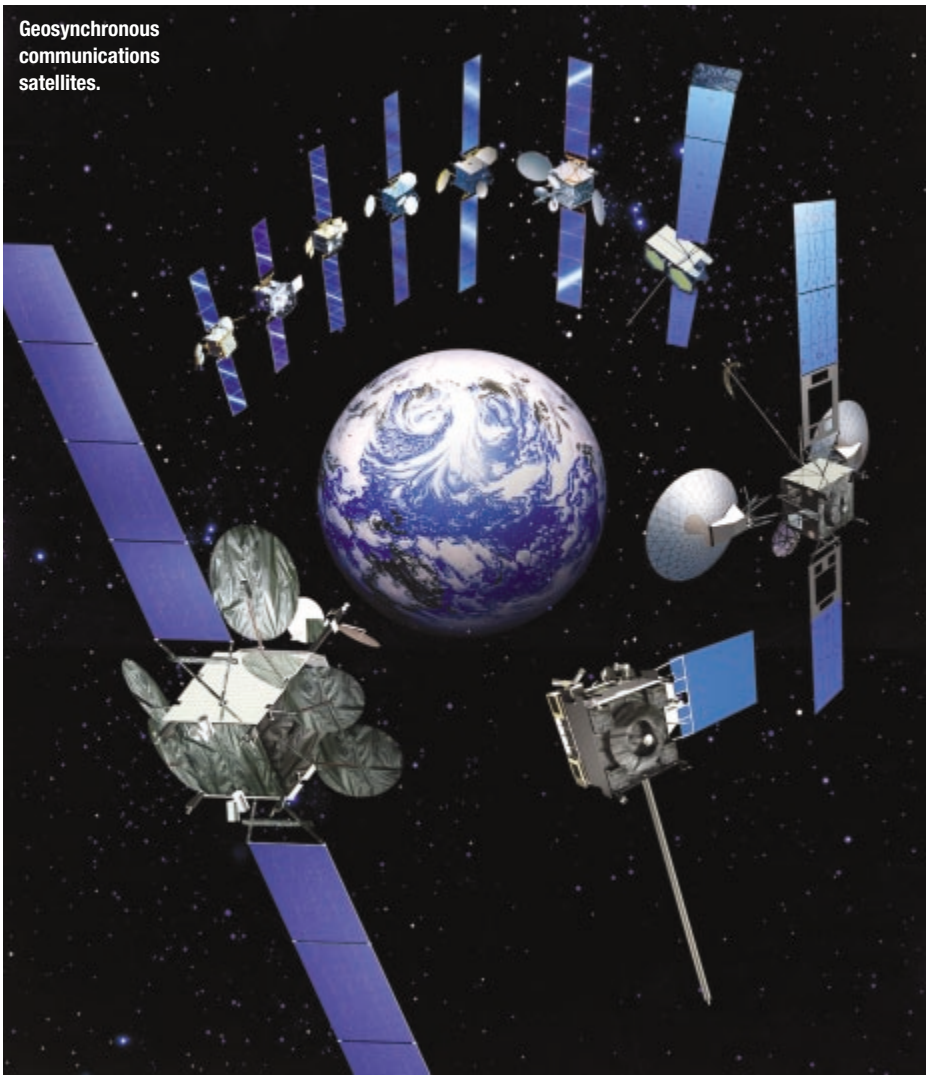
The military has historically evolved to exploit new means of warfighting. The Montgolfier brothers tested the first hot-air balloon in 1783. Benjamin Franklin observed some of the trials in Paris and wrote home of the military utility of balloons, predicting that they would be employed for spying, dropping bombs, and ferrying invading armies across enemy-dominated seas. Eleven years after those first tests, the French used a tethered balloon to observe the battlefield and direct fire against the Austrian forces at the Battle of Fleurus. The Austrians took exception to what they regarded as a violation of the Napoleonic code of war, and on the second ascent fired artillery at the balloon.

Just as the Austrians challenged the French after identifying a new center of gravity, those who are dependent on space should expect to be tested. The United States holds an asymmetric advantage in space, and if history is any indication, potential enemies are watching and learning. Space superiority—the freedom to conduct operations without significant interference from enemy forces—must be achieved in future conflicts. The counterspace mission area relies on space situation awareness, defensive counterspace, and offensive counterspace.

Air Force Space Command uses a space surveillance network that combines ground-based radars and optical sensors to perform the space surveillance portion of space situation awareness. It enables 1st Space Control Squadron at Cheyenne Mountain to detect, identify, characterize, track, and catalog high interest space objects. The Space Situation Awareness Integration Office was also recently established in Colorado Springs to work on a number of initiatives. For example, an effort is underway to identify system requirements for sensors and communication links among satellites to determine whether a spacecraft is the target of intentional interference. The office will move the command beyond simple space surveillance, fusing information with intelligence, reconnaissance, and environmental data to provide an integrated operational picture.

In terms of defense, the Air Force has added protective (survivability) countermeasures on a case-by-case basis to satellite systems to protect against jamming, signal interception, and nuclear detonation. Active defensive counterspace measures include satellite maneuvering and advanced antennas. Improvements are being made in detecting, characterizing, locating, and assessing attacks or intrusions into friendly operations. Work is also being done to negate counterspace systems and prevent enemies from exploiting U.S. capabilities. Last, spacecraft survivability is being enhanced by improved tactics, techniques, and procedures.

The conventional offensive counterspace capability to negate enemy use



Geosynchronous communications satellites.

Boeing Satellite Systems

of space consists of physical attacks against a terrestrial node. The near- and mid-term strategy for improvement in these capabilities includes fielding initial ground-based assets like mobile countercommunications systems and counter-ISR systems to deny and disrupt enemy use of satellite communications and optical sensors respectively.

A growth area, the counterspace mission is being transformed by revolutionary space-based capabilities in the mid and long term. One example is a space-based surveillance system that can provide details of space objects unattainable by ground-based systems. This development will expand on lessons learned from the mid-course space experiment, an advanced concept technology demonstrator sponsored by Air Force Space Command. Another is an attack detection and reporting architecture that can detect, characterize (identify and geo-locate), and report attacks on space systems as well as assess the mission impact. Other concepts include active protection capabilities and full-spectrum space-based systems to prevent unauthorized use of friendly space services and negate those of an enemy.

Space Force Enhancement

Many space systems critical to warfighting fall within the force enhancement mission area. In this enabling role, they provide missile warning, navigation and timing, vital communications, and environmental monitoring to the joint warfighter. These capabilities, and perhaps more importantly integrating them with other assets, were demonstrated in Enduring Freedom. Coalition forces used unmanned aerial vehicles, precision guided munitions, laser spotting equipment, and secure satellite radios, combined with veteran B–52s and horseback riders. This unprecedented integration had devastating effects.

Currently, space provides the capabilities to gather and disseminate timely, highly accurate information to enable situation awareness and effective command and control (C^2) on all levels.

- Air Force Space Command missile warning capabilities consist of defense support program satellites and ground-based radars to warn of missile attacks on the United States and Canada as well as theater missile attacks.
- The global positioning system (GPS) provides precision-positioning, navigation, and timing information, from basic navigation and synchronization of communications to basing, targeting, and terminal guidance of precision weapons.
- Air Force Space Command operates the Milstar constellation and provides day-to-day command and control of the defense satellite communications system (DSCS) to provide the voice, data, and video links essential to military operations.
- With the National Oceanic and Atmospheric Administration, Air Force weather satellites (including defense meteorological satellite program satellites and terrestrial and space environment sensors) provide battlespace environment forecasts vital to military planners and operators.

Systems are being replaced and upgraded to provide even better warfighting support while making the systems more efficient, easier to maintain, and more survivable.

- In the near term, Air Force Space Command will sustain the defense support program and field the space-based infrared system to modernize and ensure an uninterrupted and improved missile launch warning capability. The first segment of this new capability, the ground-processing segment, just declared initial operational capability. The enhanced launch detection and impact point prediction the system provides will greatly improve response options for theater missile threats.

Checking elevation with GPS in Persian Gulf.

100th Communications Squadron (Deborah K. Alvarado)

■ GPS satellites will be replaced with follow-on systems that feature additional military and civil signals with improved performance.

■ Requirements for satellite communications already exceed the capability. The transition from DSCS and Milstar to an integrated system-of-systems approach for follow-on wideband and extremely high-frequency networks will significantly increase capacity and data rates. Together with the Transformational Communications Office, efforts are underway to define an integrated defense and intelligence transformational satellite communications and relay system (part of the larger architecture) to support the intelligence, surveillance, and reconnaissance information needed for information dominance and operational awareness and to provide flexibility to support network-centric operations.

■ The evolution of the integrated command and control system for combatant commands will combine the missions of North American Aerospace Defense Command and U.S. Strategic Command into a single system rather than replace a mission-unique, stovepiped collection of systems.

In addition, transformational efforts have been initiated to provide improved support to Air Force Space Command. An initial space-based ground moving target indication capability is being planned for the midterm that integrates with air-breathing assets such as the joint surveillance and target attack radar system, unmanned aerial vehicles, and the multimission command and control aircraft. This will enable global strike forces to identify and track moving targets anywhere.

Space Force Application

In addition to being a force enabler, Air Force Space Command serves as a force provider, operating space force application capabilities that focus on nuclear deterrence and warfighting with both Minuteman III and Peacekeeper ICBMs and the infrastructure to maintain and protect them. Intercontinental ballistic missiles were designed to deter attack and remain critical to global stability. The Air Force was charged under the Nuclear Posture Review to "extend the life of Minuteman III until 2020, while beginning the requirements process for the next-generation ICBM." Existing nuclear strike forces are undergoing modernization, which will be critical to the offensive strike leg of the triad—offensive strike systems (nuclear and nonnuclear), defenses (active and passive), and responsive infrastructure.

in addition to being a force enabler, Air Force Space Command serves as a force provider

The command is also developing an advanced, flexible, and responsive global deterrent force as it explores ways to transform strike capabilities through the use of new types of launch systems and nonnuclear munitions. Options for conventional, prompt global strike would provide a range of selective lethality and could be fielded in the midterm. This capability from and through space will transform space force application. Most notably, a conventional strike capability will provide the President and Secretary of Defense with space power options for deterrence and flexible response when time is critical or other options are too risky. One option being considered is the common aero vehicle, a conceptual maneuvering reentry system launched by a ballistic missile or space launch system, delivering a payload from a suborbital or orbital trajectory.

Space Support

Access to space or spacelift as well as on-orbit satellite operations is provided through space support. For example, a DSCS satellite was recently launched on a Delta IV from Cape Canaveral that will provide wideband communications for U.S. Central, European, and Pacific Command areas of responsibility over the Indian Ocean. Operationally, 1st Satellite Control Battalion has responsibility for the Army communications payload and uses the Air Force satellite control network to relay commands to the satellite via a remote ground station like that operated by 50th Space Wing on Diego Garcia. This combination of spacelift and satellite control illustrates the mission of space support.

Getting into space today requires launch systems—with medium- and heavy-lift expendable boosters—and the ranges used for launch and testing. The Eastern Range is controlled from Cape Canaveral and the Western Range from Vandenberg Air Force Base. In the near term, the transition is being made to evolved expendable launch vehicles, the Atlas V and Delta IV, which represent a significant step toward a more responsive spacelift capability for both routine and time-sensitive military operations.

In addition to spacelift, space support includes satellite operations. The command operates a network of worldwide ground stations that monitor and control satellites and their payloads. This allows on-demand operations of government space assets supporting the full spectrum of military operations. Modernization includes implementing a strong operational training capability and work on an integrated client/server network with global connectivity shared by all the space organizations in both the civil and military sectors.

Moreover, Air Force Space Command is currently transforming space support capabilities by exploring

Building GPS SV11.

Lockheed Martin Space Systems (Russ Underwood)

launch systems, rapid satellite checkout, and other technologies to provide quick-turn, on-demand, assured space access for time-sensitive operations. The goal is an order of magnitude reduction in costs. There are also efforts to examine the development of orbital transfer vehicles to reposition or boost on-orbit assets and improve space-based elements of the launch and test range to increase coverage while reducing costs associated with the ground-based infrastructure.

Combat Capabilities

Success in any mission area is impossible without capable people. As dependence on space grows, the Air Force must meet the challenge of acquiring, operating, and employing space assets. A proactive space professional development program safeguards national leaders in space and develops airmen as the heart of that combat capability—an Air Force core competency. The recommendations of the Space Commission and the direction by the Secretary of Defense provide an opportunity to more deliberately focus on space professional development.

To implement this vision, a structured approach to developing space professionals has been established. It provides a comprehensive blueprint to address training, education, and experiential needs while recognizing the roles of military and civilian personnel. Additionally, it considers the disciplines represented by the space professional cadre, which accomplishes complex functions to take intercontinental ballistic missiles and space systems from concept to employment.

The harder task of implementing initiatives on the education, training, and experiential needs of the force will begin soon. Given the importance and complexity of professional development, this will constitute a long-term commitment. The Nation has the best space and missile operators and acquirers in the world and the Air Force will continue to improve on that standard.

Space superiority is essential to the vision of controlling and exploiting space to provide the Armed Forces with an asymmetric advantage. Although Enduring Freedom has provided the first opportunity for a fully integrated space presence on all levels of warfare, the mission of Air Force Space Command goes beyond any single operation. Improved missile and space systems, as well as concepts for their employment, will have greater results. As the security environment changes, more must be done to maintain the military advantages of the Nation. At the same time, achieving asymmetric advantage through a capabilities-based air and space force must be enabled. To meet that challenge, Air Force Space Command will ensure unparalleled space capabilities for joint forces when and where they are needed. **JFQ**