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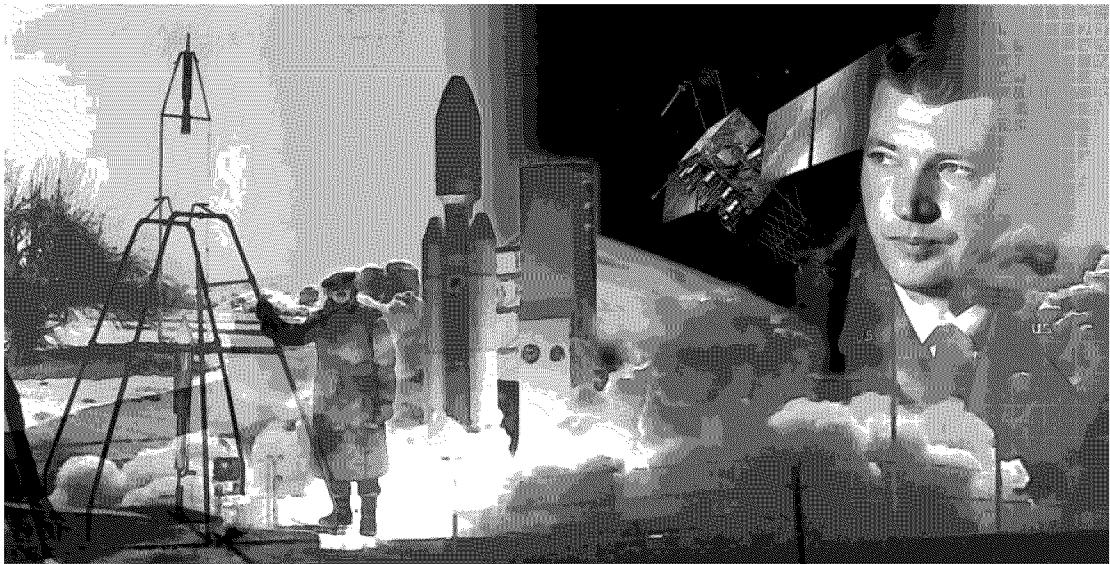


Building Space Power for the Nation

Air Force Achievements, Challenges, and Opportunities

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Editorial Abstract: Though an obvious and critical force multiplier for US combat power throughout its short history, US space power has been beset by numerous upheavals, stove-piped structures, military and civilian organizational rivalries, and an ever-expanding demand on its operational resources. General Hamel proposes new ways in which the United States can optimize its space assets for the future, with multiple steps toward fully mature space power fulfilling its role as a key element of our national military power.



ONGOING MILITARY OPERATIONS in Afghanistan, Iraq, and other regions of the world have graphically demonstrated the critical role that space capabilities play in planning and conducting joint military operations. Space forces provide unprecedented global presence, ac-

cess, precision, speed, and agility, which give unique and asymmetric military advantages to the United States. Military space capabilities came into being less than 50 years ago; since that time, they have advanced from simply proving the feasibility of orbiting satellites to providing routine and reliable service to all

military operations through a broad array of sophisticated space systems.

Although the Air Force and others have developed and fielded extraordinary space capabilities, one finds a prevailing sense that military space has not yet come of age—that it has not fully matured as a medium of military operations or a distinct warfare community. People disagree about the contribution of space in the spectrum of military capabilities, the best ways to employ it, and, more significantly, its role as an instrument of national power. Military space capabilities have grown for decades, but no unified and accepted theory of space power exists—certainly not as robust or mature as the body of theory and doctrine for land, sea, or air. One also finds no clear agreement on needed military space capabilities, their employment, and the Air Force's role in advancing our nation's military space power.

This article examines the evolution of military space within the Air Force, assesses where we are today, and discusses steps the service should take to advance military space capabilities. Its intended audience lies largely within the Air Force—both the space and air communities. Hopefully, the article will also prove helpful to other services and agencies as well as defense and congressional officials who have key responsibilities and interests relative to the military uses of space. In order to better indicate where we should be going and how best to get there, it examines issues by tracing from whence our military space capabilities evolved and how they did so.

How Did We Get Here?

Several factors have hampered researching and writing about the history of military space. Although we have operated in space for over four decades, from a historical perspective this is a relatively short period of time. Additionally, numerous changes in military space organization over the years have clouded institutional memory and the historical record. Further, much of the history of military space remains classified, by virtue of the secretive role space played throughout the Cold War.

Rather than providing a comprehensive history, this article discusses key events, decisions, and formative forces that have led us to our current status; most importantly, it offers lessons and implications for the future.

We recognized the potential military benefits of space as the “ultimate high ground” long before we proved the means of getting into or operating in space. Scientists and experimenters dreamed of spaceflight and worked diligently in the early twentieth century to develop rocket technologies. World War II accelerated rocket development, and Cold War competition between the United States and Soviet Union made long-range nuclear missiles the centerpiece of the nation's defense. Rapid advances in nuclear weaponry and rockets were essential to containing Soviet ambitions; the launch of *Sputnik I* in 1957 and the shootdown of the U-2 piloted by Francis Gary Powers in 1960 galvanized military space as a top defense priority. Space rapidly became a vital element of our national security strategy and international stability.

Fresh from post-World War II debates over the roles of airpower and the establishment of the Air Force as a separate service, the Air Force quickly asserted its vision and claims regarding military space. Through the 1950s and into the early 1960s, the service argued that space was a logical extension of the medium of air, coining the concept of aerospace and asserting that it should be the lead service for space within the Department of Defense (DOD). Other services and agencies had significant space capabilities and aspirations, but through visionary leadership, astute organizational moves, and key program successes, the Air Force established itself in the early 1960s as the primary space service. A parallel and covert National Reconnaissance Office (NRO) emerged to develop and operate space reconnaissance systems designed to collect critical intelligence over denied areas, primarily the Soviet Union. After solidifying space leadership in the 1960s, the Air Force led rapid growth in military space technologies, programs, and infrastructure. A broad array of space capabilities was developed and fielded in this decade, including communications,

weather, navigation, missile warning, nuclear detection, imagery, and signals-intelligence satellites, as well as launch systems, satellite control, and test ranges. These systems rapidly matured, becoming routine and reliable operations by the late 1960s and early 1970s.

The Air Force conducted most of its early space efforts in Air Force Systems Command (AFSC)—its research and development community. Some space capabilities, such as space surveillance, missile warning, and nuclear command and control (C2) operations, were the responsibilities of Aerospace Defense Command and Strategic Air Command. A unique culture developed in the space community during the first decades, characterized by innovative program management; cutting-edge technical and engineering expertise; rapid, spiral development of mission-unique systems; and close partnership between government and industry. Although strategic and operational needs of the Cold War clearly drove the overall space business, the capabilities produced were more often driven by “technology push” rather than “operational pull.”

By the early 1980s, the Air Force concluded it needed an operational space command to bring military space to full maturity, so it established Air Force Space Command (AFSPC) in 1982. Creation of United States Space Command followed in 1985. As interest and dependence on space grew, other services and agencies created space commands and organizations to develop and exploit space capabilities. This action inevitably fueled interservice and interagency rivalries and competitions; it also led to fragmentation of military space programs, operational capabilities, and authorities.

Simultaneously other major tectonic shifts in military space occurred. A national decision mandated establishment of the National Aeronautics and Space Administration’s (NASA) space shuttle as the nation’s sole means of accessing space, forcing redesign of virtually all military and intelligence satellites, major Air Force investments in military-unique shuttle capabilities, and significant organizational and cultural accommodations among the very different Air Force and NASA communities. Loss of the *Challenger* space shuttle in 1986 reversed

directions, and numerous program, organization, and personnel changes ensued. In addition, the president’s decision in 1983 to pursue space-based missile-defense capabilities—the “Star Wars” program—brought about major realignments of space programs and responsibilities within the DOD.

Operational commands for space continued to mature through the 1980s and early 1990s. The Air Force realigned space roles, responsibilities, and forces from AFSC to AFSPC and made a priority of “operationalizing” and “normalizing” Air Force space, including creating space wings, formalizing operational training, developing space-career tracks, and advocating operational space systems and programs. Shifts in responsibilities, organization, and culture created significant rifts and frictions among the space communities within the service—AFSPC, AFSC, and the Air Force NRO element—leading to internal conflicts and dilution of space expertise across the Air Force community.

The fall of the Berlin Wall and collapse of the Soviet Union brought into question the fundamental roles, capabilities, and purposes of military space. Operation Desert Storm, referred to as the “first space war,” quickly answered many of these questions. Space had been integral to strategic nuclear deterrence for decades but did not see its first large-scale operational and tactical use in a conventional war until the first Gulf War. Desert Storm provided a glimpse into a future in which space would serve as a key enabler of joint war fighting. The end of the Cold War also brought about many significant organizational, program, and budget changes. The Air Force disestablished Strategic Air Command and transferred its air assets to the newly created Air Combat Command and its intercontinental ballistic missile forces to AFSPC in 1993. AFSC merged into the new Air Force Materiel Command, and a new service acquisition-management structure was created, with the program executive officer and the assistant secretary of the Air Force for acquisition placed directly in charge of program-management execution. Finally, the NRO underwent realignment from its separate program structure—Program A

(Air Force), Program B (Central Intelligence Agency), and Program C (Navy)—to an integrated structure organized by major mission areas (imagery, signals intelligence, and communications).

The enormous organizational, program, and cultural change in military space that occurred from the early 1980s to early 1990s produced divergent communities, fractious relations, and competing visions and directions throughout the Air Force as well as the broader military space community. Systems and operations became both more interdependent and “stovepiped.” As the Air Force evolved into new post–Cold War organizations and forces, space played a more prominent role, and the service placed great emphasis on integrating space capabilities into war-fighting operations. The mission of the Air Force evolved to “controlling and exploiting air and space” with a vision of an “air and space force” evolving into a “space and air force.” To further emphasize the synergies of the air and space mediums, the Air Force focused for several years on “aerospace integration” as its guiding vision. Efforts to unite the Air Force institutionally to a common air and space vision produced much progress but also blurred the different capabilities, effects, nature, and contributions of both air and space.

In addition, much of the history of military space has seen continuing domestic and international debate over the uses of space for military purposes. Few people question such use to enhance or enable terrestrial military operations. However, heated debate persists regarding the use of space for delivering combat force against terrestrial or space targets. From the earliest days of the space age, the United States purposely advocated the principle of peaceful and unimpeded use of space by all nations, as well as the legitimate right to use that medium for military purposes and for defense of its vital interests. Since the 1970s, US national policy regarding space has proved remarkably steady—it has recognized space as vital to the nation’s well-being and competitiveness. Further, consistent with treaties and accepted international agreements and norms, the United States as a matter of policy will

maintain the right—and ability—to take any actions necessary to defend its space capabilities and interests, as well as deny adversarial uses of space that threaten American interests. Despite the constancy of policy, debates continue, and no clear national intent exists to field military capabilities for actual combat operations in or from space.

Where Are We Today?

Today space is integrated and employed in virtually every aspect of military planning and operations, from peace through crisis to major theater war. It critically enables warfare at all levels—strategic, operational, and tactical—and has become integrated into virtually all air, land, sea, and special operations. Although we use and depend upon space to an ever-increasing extent, we do not have a clear and consistent theory or intellectual framework for its use. For decades people have debated whether space is an area of operation, a medium, a mission, or a collection of functional capabilities. Each of these perspectives has proponents, but the absence of a unifying, broadly accepted intellectual framework for space impedes the development and employment of space power. The Air Force has long held the view that space is analogous to and a logical extension of the medium of air, but has wrestled for some time over the concepts of aerospace versus air and space. Most people generally agree that differences exist between the two mediums with regard to the physics of flight, vehicles, international law, attributes, and effects, all of which require different expertise and thinking. At the same time, one can also make a strong case that the vertical dimension of warfare requires unique, integrated perspectives best brought to bear by the Air Force.

Today military space includes numerous stovepiped systems operated by different communities, services, and agencies that use different concepts and approaches for operating and employing these capabilities in peace, crisis, and war. Some individuals view space-based communications as simply communica-

tion systems, while others see them as space operations. Similarly, some often look at reconnaissance, warning, and other missions performed in the medium of space as national intelligence functions—not as joint war-fighting operations.

The Air Force is responsible for the majority of the space programs, people, resources, and infrastructure across the DOD—roughly 85–90 percent of the total. However, other services and agencies have important needs for space in execution of their assigned missions and often bring service-unique space capabilities. In fact, even though the Air Force provides most military space capabilities, it is not the major user of them and their effects. This fact creates a number of tensions. The Air Force does not fully understand or appreciate the use of space by other services or agencies. Other services criticize the Air Force for not providing all the desired joint space capabilities. Inside the Air Force, one encounters concerns that growing demands for space capabilities will inevitably affect other needs and priorities of the service.

Most of today's space capabilities were originally conceived and fielded in the 1960s and 1970s, with the global positioning system (GPS) representing the most recent "new" one, reaching initial operational capability in the early 1990s. Significant enhancements in individual systems and technology have occurred, but development delays and cost overruns have become the norm while technological innovation has slowed and risk has become increasingly unacceptable. Some would argue that the culture of innovation, together with operational, technical, and management skills developed in the first decades of military space, has atrophied.

The many changes in organizations, programs, culture, and priorities over the past two decades have seriously fragmented the military space capabilities and community. Despite the fact that the Air Force provides the bulk of space expertise and capabilities, one finds serious fragmentation and dilution of authorities and responsibilities among the services, defense agencies, combatant commands, and DOD staffs. Operational responsi-

bility, service expertise, mission advocacy, operational requirements, system acquisitions, and budgets are not aligned as they are in other service-warfare communities.

Where Should We Go, and How Do We Get There?

The DOD is organized around mediums of operation—land, sea, and air—and depends upon military services to provide institutional capabilities and competencies to organize, train, and equip forces for combatant commands to plan and execute joint military operations. Air Force space should have the fundamental goal of leading and bringing operational capabilities in the medium of space to full maturity by building institutional capabilities—people, forces, and processes—necessary to employ space capabilities as an integrated element of joint war fighting. We have identified and studied many of the problems and issues associated with military space and have begun a variety of efforts and initiatives to enhance our capabilities in national security space. In 2001 the Space Commission provided a comprehensive assessment and recommendations concerning management and organization of national security space. Although many of these (discussed below) are important, other steps are also essential to the maturation of space power and its role as a key element of our national military power—developing a coherent and accepted intellectual framework for military space; focusing on space superiority as the overarching and unifying imperative for military space; building a critical mass of space professionals with common culture, expertise, and vision; getting space development and acquisition on track; and bringing a space-leadership mind-set to all we do within the Air Force space community.

Establishing an Intellectual Framework for Space Power

An intellectual framework for space needs to be founded on several important realities. First, space is inherently global and joint. Satellites operate by rules of orbital mechanics, func-

tion according to separate international rules, and afford unique global perspective and access. Space is joint in the sense that all services, agencies, and commands need it to fulfill their respective missions and to enable or enhance their distinct war-fighting capabilities. For the most part, joint and service doctrine on space describes roles, responsibilities, relations, and systems. It focuses neither on inherent attributes, capabilities, and effects, nor on the best means to employ or exploit space power. The intellectual framework needs to consider the inherent physical characteristics and operational capabilities of space and apply proven principles of war: unity of command and effort, centralized control and decentralized execution, speed, mass, surprise, and initiative. Information-centric warfare is becoming a critical center of gravity, and space has become the medium through which we enable information superiority for expeditionary operations. Space capabilities connect forces, sensors, and decision makers across the battlespace; they collect data on operationally relevant conditions; they reconnoiter, surveil, and target hostile forces and activities; and they enable precision, synchronization, and C2 of forces in the field. Combat advantages derived from space increase the imperative and incentives for adversaries to deny and disrupt our use of space and to gain their own space capabilities.

One of the key steps in developing and refining the intellectual foundation for space power is to define and describe space capabilities and effects in operationally relevant terms. We need concepts of operations that describe what we do, how we do it, and to what effect. AFSPC's current effort to develop a comprehensive set of space concepts of operation and employment constitutes an important step in moving from stovepiped, system-centric thinking to true operational capabilities and effects-based thinking.

The intellectual framework needs grounding in real operational employment and experience. Today space operates all day, every day, but we have not fully integrated it from the start in deliberate and crisis-action planning. We do not routinely and realistically use it in training or exercises to refine tactics, tech-

niques, and procedures for the joint use of space in the same way we do with air, land, and sea operations. Employed in crisis and war fighting, space has made major contributions to every conflict in which we have participated over the past decade. However, because we often use it in an ad hoc fashion, we have not institutionalized its lessons and capabilities—a situation that reduces the familiarity and confidence of users and commanders. The intellectual foundation for space must capture and codify real operational lessons and experience.

Gaining and Maintaining Space Superiority

The growing military advantage derived from space increases dependency upon those space capabilities, making space forces an attractive and lucrative target for adversaries as well as a serious potential risk to friendly operations. One way to mitigate this risk would be to reduce the use of and dependence on space, but the unique asymmetric advantage derived from space makes this impractical. Alternatively, we could take effective steps to protect friendly capabilities and deny adversaries access to space. Just as air superiority is a first priority in any joint operation, so should gaining and maintaining space superiority become a top priority in peace, crisis, or conflict. Such superiority includes knowing what is in space, natural conditions in the environment, status of friendly and nonfriendly forces, and hostile or threatening actions or events. That is, we need space situational awareness, comprised of a robust set of sensors, analyses, and C2 capabilities, to maintain awareness, formulate responses, and respond to situations/events; defensive counterspace capabilities to detect, characterize, assess, and react to hostile and nonhostile events; and offensive counterspace capabilities to deny an adversary's use of space that could threaten American lives or limit military freedom of action.

During the Cold War, we treated space superiority very seriously, spending billions of dollars on hardening satellites against attacks, building backup ground stations and links, and continuously monitoring adversary actions. Many of those capabilities and much of

that expertise passed with the end of the Cold War but have not been replaced with anything suited to current space threats and needs. Further, we have an overarching imperative for cooperation among all space services and agencies to assure space superiority. Despite disagreements over organization, roles, and responsibilities, all players within the space community can and must agree to work in a joint and collaborative way to ensure space superiority for joint operations. Given the growing dependence on space, we cannot assume space superiority; we must guarantee it—and if need be, fight for it.

Developing a Critical Mass and Common Space Culture

The Space Commission noted the need for a robust space-professional culture and community to develop, operate, and employ future space capabilities. This cadre must become truly expert in the space medium, platforms, and operations in order to plan, execute, and employ the full range of capabilities and effects. The commission made many recommendations about developing a space cadre, and the Air Force has taken important steps to invigorate its recruiting, education, training, and career development of space professionals. It is important for the space community to have a broad array of skills and develop a common culture and vision. Its members must identify with and consider themselves part of the space team, derive professional pride from being part of it, and support the larger air and joint war-fighting teams. Members of the space community must be experts in the development and operation of the full spectrum of space capabilities; moreover, they must understand and take responsibility for producing and delivering the combat effects they provide, whether communications; intelligence, surveillance, and reconnaissance; counterspace; or launch. The community must understand in joint war-fighting terms what kind of space capabilities we need and how best to deliver them, when and where we need them. This broad range of capabilities means that the space cadre must include a diversity of specialties beyond simply satellite operators; it must

include intelligence, acquisition, communications, and C2 experts. It must include other services and must leverage the full range of people—active military, Reserve component, civilians, and contractors. Space professionals not only must value the things that made military space programs and operations so successful in the early years—technical expertise, innovation, personal initiative, and mission focus—but also must have operational war-fighting focus and ethos. AFSPC's Space Professional Development Strategy and the Air Force's force-development initiatives are excellent frameworks that provide many of the needed tools and skills. However, development of a real space culture and a critical mass of space professionals remains up to the space community itself, which must set high standards of space knowledge, expertise, performance, and leadership. Furthermore, it must be inclusive and accountable for producing and delivering operational capabilities and effects.

Getting Space Development and Acquisition on Track

The end of the Cold War led to significant reductions in people and budgets across the DOD in the 1990s. At the same time, maintaining capabilities on orbit and meeting growing needs for space capabilities meant that demands exceeded available resources. Anticipated growth in commercial space products and services in the 1990s brought about significant private investment in a number of commercial space ventures, the Iridium satellite communications systems prominent among them. This led to a strategy within the DOD and the Air Force of leveraging the commercial investment and industrial base. A series of acquisition-reform initiatives put the Air Force into the role of a buyer rather than an active developer with industry. Wholesale reductions occurred in government people and roles in design, development, manufacturing, integration, and testing of space systems. Processes, practices, and skills that had developed over decades were discarded. Further exacerbating the erosion of capabilities, the air and space industry went through significant consolidation and downsizing in the 1990s. The effects

of these eroding capabilities first came to light with a series of launch failures in 1998 and 1999, leading to a loss of critical capabilities and billions of dollars. Similarly, numerous development problems in military space programs became clear: serious overruns, schedule delays, and program breaches on the space-based infrared system, future imagery architecture, evolved expendable launch vehicle, GPS, and national polar-orbiting operational environmental satellite system. These failures have served as a wake-up call for the space community. Nothing threatens US military superiority in space more than the loss of ability to develop, field, and sustain our space systems.

The Air Force's Space and Missile Systems Center at Los Angeles AFB, the leader in space and missile development for over 50 years, has roots in the Western Development Division begun by Brig Gen Bernard Schriever in 1954. The "birthplace of military space," it has conceived, developed, and fielded the vast majority of military space capabilities for over a half century. Recognizing the erosion of space-acquisition capabilities in the 1990s, we have started an aggressive campaign to get "back to basics," elements of which include restoring processes in the development and acquisition business—specifically, systems engineering, mission assurance, integrating and testing, cost estimating, and program control. Another key element calls for rebuilding the space-acquisition workforce—both military and civilian—together with federally funded research-and-development centers and industry through active recruitment and retention as well as education, training, and career incentives. Strong partnership remains the bedrock of success in space for all sectors: government, industry, developers, operators, users, military, intelligence, civil, and commercial. Finally, an emerging business model for space includes tiered, evolutionary development from basic technology to production of operational systems and the use of "lean principles" to reduce cycle time, cut waste, and focus on customer needs. The Air Force and the Space and Missile Systems Center have an aggressive program for change under way to improve

space development and acquisition—a key to ensuring continued space superiority.

Exerting Leadership of Military Space

The Space Commission recommended and the secretary of defense concurred with formally establishing the Air Force as the lead service and executive agent for space within the DOD. Realignment of organizational roles and responsibilities has included establishing the undersecretary of the Air Force as the senior space official within the DOD; creating a single budgeting mechanism for space programs (the so-called Space Major Force Program); consolidating oversight of space acquisition; and enhancing the development of space professionals. Realignment of space responsibilities to the new Strategic Command (STRATCOM), another major step in integrating space power with joint war fighting, makes STRATCOM the combatant command for space with responsibility and authority for global military space capabilities. At the same time, because of the enormous breadth of its assigned missions and responsibilities, the command must increasingly look to its service components and defense agencies to provide operational expertise, mission capabilities, resources, and knowledge to deliver joint space war-fighting capabilities and effects to other supported regional combatant commands around the globe.

Military space must focus on the operational capabilities and effects it provides—not simply the systems it builds, the satellites it flies, or the teams it deploys. The space community must become more than the provider of systems: it must serve as the thought leader, it must take responsibility and stand accountable for the combat effects it produces, and it must include all members of the joint team in producing and delivering those effects. These capabilities and effects must operate on a global basis, but theater commanders and forces must have access to them at the needed times and places. The Air Force has made good progress in building space's operational integration capabilities in theaters by assigning space officers to staffs and establishing the theater's

joint force air component commander as the space coordinating authority, with a senior director of space forces assigned to help execute those responsibilities. Making the space coordinating authority's responsibilities and authorities work requires having a well-integrated global space operational force and commander able to execute STRATCOM's space mission and the commander's intent.

The Air Force should act as STRATCOM's outspoken advocate for the space medium and operational missions and should serve as its principal provider of space-combat capabilities and effects. Given the breadth of STRATCOM's mission responsibilities, there exists a clear opportunity and need to establish a joint, operational-level space command and responsible commander to provide global space operational capabilities all day, every day. Doing so would bring much needed focus on operational space and offer the opportunity and responsibility for the Air Force to lead joint space operations, much as it does with airpower in regional combatant commands. Just as its role as executive agent conveys authority, responsibility, and accountability for developing and fielding space capabilities, so are integration and leadership of joint, global space operations under combatant command authority of STRATCOM essential to achieving the full potential of space power. This role will require the Air Force to fully develop the vision, concepts, and capabilities for joint space power; commit to its development; and earn the trust and confidence of STRATCOM, as well as the trust and confidence of the other combatant commands, services, and defense agencies.

Conclusion

In the nearly 50 years since the beginning of the military space and missile program, we have made remarkable progress in developing, fielding, and employing space capabilities. Today we find ourselves at a point where military space power has gained recognition as a critical element of our national military power. Having positioned itself at the forefront of leading space development since the earliest days, the Air Force should take great pride in its many achievements. Our service provides the vast majority of people, programs, budget, and expertise for military space but does not have a primary role in operationally delivering those space capabilities and effects. Numerous reorganizations, program restructures, career-field realignments, and mission changes have disrupted the maturation of the Air Force's space community and culture. Further, these events have led to fragmentation of space capabilities and responsibilities across the DOD. Growing dependence on space for success in joint operations demands firm steps to improve war-fighting capabilities within the space community. This in turn means that the Air Force, as the clear leader in DOD space, must assert its leadership—vision, commitment, and excellence. Our service's history in space provides key insights into the culture and expertise that produced incredible capabilities and successes over the past 50 years and can help refocus our people, expertise, operational capabilities, and organizational excellence. The Air Force must provide the essential intellectual, human, and institutional leadership if space power is to realize its full potential as an instrument of vital importance to our national security and defense of the nation. □