Ten Propositions Regarding Space Power

The Dawn of a Space Force

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Editorial Abstract: Through an exhaustive historical review of space, multiple interviews with field professionals, and thorough examination of pertinent sources, Colonel Harter develops a list of fundamental propositions and keys to space power. From this discussion, he advocates that the logical consequence of these propositions for realizing the full potential of military space power is a separate and distinct space force, replete with its own doctrine, leadership, organization, and resources.

> *No one can predict with certainty what the ultimate meaning will be of mastery of space.*
>
> —Pres. John F. Kennedy, 1961

ON 4 OCTOBER 1957, the Soviet Union stunned the world by successfully launching the first artificial satellite, *Sputnik I*, into low Earth orbit (LEO). By repeating this feat within a month (*Sputnik II*), the Soviets made a bold statement of profound technological, political, and military significance that ushered in mankind's race for space—"the final frontier." As the Cold War escalated, the United States quickly realized the global implications and military potential of space assets in the "high ground" and responded by developing its own space capability, culminating a decade later in the achievement of President Kennedy's vision and national goal of the National Aeronautics and Space Administration's (NASA) Apollo moon missions. Since then, space development has proliferated, as dozens of nations now pursue economic and military benefits from using space systems.

Based on the current demand for both military and commercial space operations, it is prudent to contemplate (and act upon) the essential elements that define the nature and potential of robust space power. What are the fundamental characteristics of a nation's potential strategic

military space power? Are there propositions regarding space that can provide guidance on the questions and issues that shape a nation's military space-power capability? The answer is yes.

What fundamental strengths best characterize the potential of military space power?

What are space power's key limitations, and how can they be overcome?

What are the keys to executing successful space power?

What resources and command and control (C2) structure are required?

How does a nation achieve space-power status?

This article provides a concise, fresh perspective on the nature and potential of national space power.[1] Through a historical examination of military and commercial space activity, personal interviews with nearly 100 space professionals, and a review of space-power literature from more than 50 sources, this research assesses the strategic *potential* of robust space power and the fundamental propositions that define it.[2] The results point to a "top 10" list of individual propositions and keys to space power, ultimately concluding that a nation's true strategic space power cannot reach its full potential without a separate, independent space force. In effect, this work parallels (in a limited respect, based on time and resources) the thought-provoking research of Col Phillip S. Meilinger, USAF, who published *10 Propositions Regarding Air Power* at the School of Advanced Airpower Studies (SAAS) in 1995, as well as several corollaries produced by other space professionals since then.[3]

Space Power: Historical Background

Space Power will be as decisive in future combat as airpower is today.

—Hon. E. C. Aldridge Jr.
USAF Space Policy, 1988

There is a familiar correlation between early twenty-first-century space power and airpower's infancy in the post–World War I era. The parallels in the development of airpower and space power are interesting if not predictable—the space community is currently wrestling with many of the same issues that plagued early airpower. Similar to post–World War I airpower, there is no question that today's space forces provide a wealth of force enhancement to joint war fighters. Additionally, from a national perspective, space systems provide essential economic, commercial, and scientific capabilities resulting in potential centers of gravity (COG).[4] Just as nations protect their land, sea, and air assets for economic, commercial, and military purposes, the protection of space capabilities is becoming increasingly important (space control). Like the early airpower advocates wrestling with how to achieve effective airpower, today's space community wrestles with very similar doctrinal, organizational, and operational issues:

Airpower: After World War I	*Space Power: Early Twenty-first Century*
Proven force enhancement (intelligence, surveillance, and reconnaissance [ISR]) from World War I.	Proven force enhancement (ISR, navigation, weather, communications) from Operations Desert Storm, Allied Force, Iraqi Freedom/Enduring Freedom.
Demonstrated support to ground/naval forces.	Demonstrated support to ground, naval, and air forces.
Can airpower be both offensive and defensive?	Can space power be both offensive and defensive?
How to develop strategic/tactical airpower?	How to develop strategic/tactical space power?
Best way to integrate airpower into joint operations?	Best way to integrate space power into joint operations?
Acquire adequate budget for airpower systems?	Acquire adequate budget for space-power systems?
Optimized airpower C2?	What is the most effective space-power C2 construct?
Develop airpower doctrine, policy, and training.	Develop space-power doctrine, policy, and training.
Does airpower warrant its own separate service?	Does space power warrant its own separate service?

Lessons learned from the history of airpower development allow national space power to avoid similar mistakes and pain. Recall that airpower emerged during the post–World War I era as a legitimate military capability, bringing with it the great airpower theorists William "Billy" Mitchell, Giulio Douhet, and Hugh Trenchard (to name a few), and leading to an eventual independent US Air Force. This author suggests that, based on the parallels with the birth of airpower, the space community is on the brink of undisputable space power, with the emergence of space-power theorists and the birth of an independent space force in the next decade.

Definitions

Proposition—something offered for consideration or acceptance.[5]

Space—begins where satellites can maintain orbit (81 miles) and extends to infinity.[6]

Power—control or authority to influence; the ability to produce an act or event.[7]

Space power—a nation's ability to exploit and control the space medium to support and achieve national goals.[8]

This article offers relevant guidance on the questions and issues that shape a nation's space-power capability. Military space operators, strategists, planners, policy developers, and acquisition professionals will benefit from contemplating these propositions as they develop their understanding of space power and employ space forces into the next century:

1. Space is the ultimate high ground.
2. Space is a distinct medium; space forces require space-focused theory, doctrine, and policy.
3. Space power is a force multiplier for every combatant commander and military service.
4. Space forces can support all levels of war simultaneously.
5. Space power leverages a nation's economic and military centers of gravity.
6. Space superiority starts with assured access to space.
7. Controlling space requires eyes, ears, shields, and swords.
8. Space forces require centralized command and control led by space professionals.
9. Space power is a function of a nation's total space capability (space unity of effort).
10. National space power reaches its full potential when a nation commits to a separate, independent space force.

Ten Propositions Regarding Space Power

These 10 space-power propositions are grouped in two categories: space characteristics and space challenges. Propositions one through five characterize the space medium, revealing the significance, advantages, and value of space power. Propositions six through 10 frame the challenges in achieving robust national space power. Arguments are provided for the security, control, and dominance of the space medium through space superiority (space lift, counterspace operations, and space-forces C2) and national unity of effort. The 10th proposition summarizes the key to achieving national space power—an eventual and necessarily separate, independent space force.

1. Space is the ultimate high ground.

Take the high ground, and hold it!

—Sun Tzu, circa 500 BC

Great military leaders realize the strategic, operational, and tactical advantages of controlling the high ground. From Sun Tzu's ancient Chinese warriors securing a hill, to US Civil War manned balloons, World War I aeroplane pioneers, World War II aviation heroes, and Cold War high-flying SR-71s and U-2s, the high ground provides the strategic advantages of security, situational awareness, reconnaissance,

targeting, and offensive force to dominate the battlespace. The space medium is the ultimate high ground, with unparalleled speed, range, altitude, and stealth.

High-ground space systems provide a conduit to channel instruments of national power (diplomatic, informational, military, and economic) to coerce an enemy to capitulate. The twenty-first-century information age, the global information grid, information technology, and network-centric warfare all depend on real-time global collection and dissemination of information, often only possible from space systems. The informational and military instruments of national power are closely linked. Information operations, information warfare, and information-in-war likewise depend on robust space platforms and illustrate that "bullets win battles; information wins wars." Space systems are one of the main pipelines for network-centricity, powering digital networks to distribute information instantly without borders. Satellite communications (SATCOM) provides real-time, secure, jam-resistant C2 to enable diplomatic actions among nations. Space systems support or disrupt a nation's economy by moving large data streams at the speed of light around the world, reshaping national economies with global connectivity (SATCOM, weather, navigation, environmental, scientific, etc.). The White House's national security strategy of 1998 benchmarked the importance of space.[9]

> *Space has emerged as a new global information utility with extensive political, diplomatic, military, and economic implications for the United States. Unimpeded access to and use of space is essential for protecting U.S. national security and promoting our prosperity.*
>
> *A National Security Strategy for a New Century*, October 1998

As the ultimate high ground, the space medium is potentially the most geopolitical, perhaps more so than any other medium in which the military operates. Space is global by nature. The space medium holds no geographic or nation-state boundaries. Satellites traverse in their orbits above every nation in the world, usually unnoticed and eluding traditional terrestrial choke points. In space, territorial sovereignty is nonexistent (with the exception of equatorial geosynchronous Earth orbit [GEO] slots directly above each country) but still highly geopolitical with numerous complicated space treaties, international policy, and the laws of armed conflict.[10]

2. Space is a distinct medium; space forces require space-focused theory, doctrine, and policy.

> *When you think about protecting this nation's global interests, you have to remember it starts with space. It is the fourth medium of warfare.*
>
> —Gen Ronald R. Fogleman, USAF
> Air Force Doctrine Document 2-2, *Space Operations*, 1998

> *At the very heart of war lies doctrine. It represents the central beliefs for waging war in order to achieve victory. It is fundamental to sound judgment.*
>
> —Gen Curtis E. LeMay, USAF, 1968

Just as ground, naval, and air forces operate in their own distinct environments (mediums), space forces operate in their own distinct medium—the vacuum of space. Air Force Doctrine Document (AFDD) 2-2, *Space Operations*, clearly states, "Space is a medium of warfare like air, land, and sea."[11] Physical laws constrain, empower, and distinguish each medium. Land forces are bound by gravity in two dimensions; sea and air forces are three-dimensional and fully dependent upon Bernoulli's laws of fluid dynamics; and space forces function via Kepler's laws of planetary motion. Accordingly, if ground, naval, and air forces are governed and optimized by their own medium-unique theory, doctrine, and policy, it makes sense that space forces would benefit from their own space-unique theory, doctrine, and policy. Because of each distinct operating environment, sea-power theory clearly does not translate to airpower theory; nor would it seem logical for airpower theory to transfer to space-power theory.[12]

The problem for current space forces is that, since the inception of the US Air Force

in 1947 until the 1990s, airpower has overshadowed space-power development, as both were governed under the umbrella of Air Force theory, doctrine, and policy. The USAF claimed in 1958 that the air and space vertical domain (aerospace) was "indivisible."[13] This unfortunately resulted in both airpower and space power being developed simultaneously in an airpower-centric service. Limited resources (budget and manpower) existed during the Cold War to develop both airpower and space power equally; airpower took priority, and space power—viewed as a subset of airpower—suffered.[14] Two major events in the 1990s reversed this 40-year trend and significantly improved space-power development: (1) the end of the Cold War freed up resources for space-power development, and (2) the Persian Gulf War proved to be a "watershed event in military space applications," quickly driving space investments throughout the Department of Defense (DOD).[15] Since then, space-power doctrine at both the service and joint levels has made significant progress, but there is still a long way to go.[16]

3. Space power is a force multiplier for every combatant commander and military service.

> *As proved during Desert Storm, and again during the Balkans air campaign, space is an integral part of everything we do to accomplish our [military] mission.*
>
> —Gen Lester P. Lyles, USAF, 2001

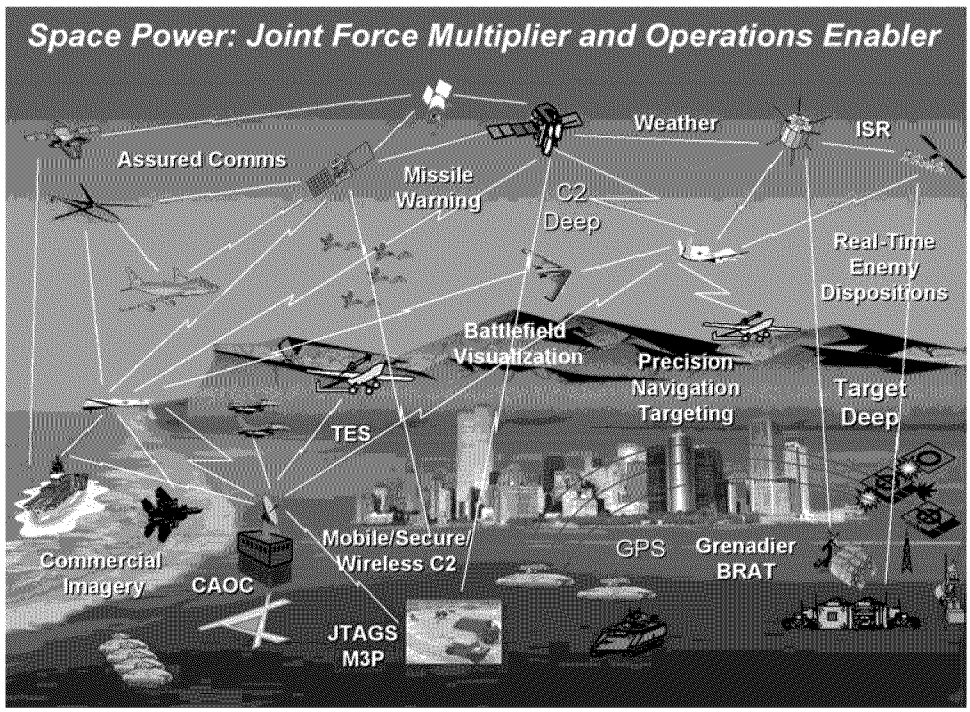
> *Any discussion of Desert Storm cannot ignore the immense contribution made by our space forces. Even less will we be able to ignore space contributions in the future.*
>
> —Gen Charles A. "Chuck" Horner, USAF, 1999

Space power provides military leaders, operators, and planners with enormous force-enhancement effects that multiply joint combat effectiveness in prosecuting theater campaigns. Space systems significantly improve friendly forces' ability to strike at the enemy's heart or COGs, paralyzing an adversary to allow land, sea, and air forces to achieve rapid dominance of the battlespace. Space assets reduce the Clausewitzian "fog of war" by providing synergistic, effects-based operations to terrestrial forces, producing effects that achieve campaign objectives in ways that air, land, and sea forces alone cannot (fig. 1). The emergence of military space following the Vietnam War produced monumental combat advances using 24 hours a day/seven days a week (24/7) space assets such as global precision navigation/targeting; global-reach SATCOM; strategic and theater missile warning; global weather data; phenomenal intelligence, surveillance, and reconnaissance (ISR); and highly integrated combat search and rescue. In addition to being a huge force multiplier, space power is joint by nature; its effects to earth-bound land, sea, and air combat operations can be direct or indirect, immediate or delayed. Integration of space into the joint force commander's (JFC) theater campaign plan, as well as deliberate and crisis-action planning, has come a long way since Operation Desert Storm, providing even more lethal and rapid dominance of the battlespace.[17] Simply put, terrestrial forces combined with effects-based space operations produce unparalled synergistic combat capability: 1 + 1 = 3!

4. Space forces can support all levels of war simultaneously.

> *Space is already inextricably linked to military operations on land, at sea, and in the air.*
>
> —Joint Strategy Review, January 1997

Space systems produce global and theater effects *simultaneously* due to their speed, range, precision, and global presence. Satellites, because of their high-ground advantage, have the ability to simultaneously cover multiple theaters. GEO constellations provide 24/7 SATCOM and missile warning due to their stationary position; LEO ISR satellites in populated constellations provide rapid revisits within hours; and global positioning system satellites provide 24/7 global navigation, tailored for specific theater operations. These capabilities allow space forces to directly impact combat operations at the global, theater, and local levels simultaneously.

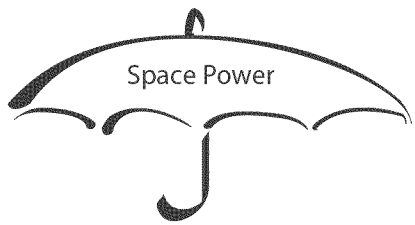


Legend:

BRAT	Beyond Line of Sight Reporting and Targeting
CAOC	Combined Air Operations Center
JTAGS	Joint Tactical Ground Station
M3P	Multimission Mobile Processor
TES	Technology Experiment Satellite

Figure 1. Effects-based operations

Likewise, because of its unique high-ground medium, space power delivers information critical to planning and execution of military operations in *all levels of war*—strategic, operational, and tactical (fig. 2). While terrestrial forces generally fight sequential tactical battles before they can move on to operational or strategic objectives, space forces (and to a limited extent, air forces) have the ability to engage in separate, parallel campaigns at all levels of war.[18] For example, the Defense Support Program constellation detects, identifies, tracks, and warns of *strategic* missile launches (intercontinental ballistic missiles), while also providing *tactical* theater missile warning from short-range enemy missiles.



Levels of War	*Effects*	*Spectrum of Conflict*
Strategic	Global	Conventional
Operational	Theater	Unconventional
Tactical	Local	Military Operations other than War/ Humanitarian Assistance and Disaster Relief
		Combat Search and Rescue

Figure 2. Space-power umbrella

Finally, space systems provide information across the *spectrum of conflict*, including conventional warfare, unconventional warfare (nuclear), asymmetric warfare (global war on terrorism), and military operations other than war, which include humanitarian assistance and disaster relief, peacekeeping operations, noncombatant evacuation operations, and so forth. As the US military's operations tempo continues to increase in quantity and duration (fig. 3), often at austere global locations that have limited or no existing infrastructure, military forces increasingly depend upon immediate space-based capabilities.[19] Space systems are usually first in-theater by virtue of their high-ground, ubiquitous orbits, ready to provide 24/7 navigation, weather, SATCOM, and ISR from the start of a conflict.

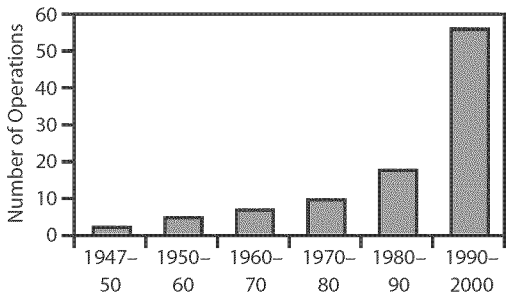


Figure 3. USAF operations tempo, 1947–2000

The key for space power to support all levels of war simultaneously and across the spectrum of conflict is to ensure that space systems have global access to the entire depth and breadth of an adversary or a regional conflict. However, if space assets are limited in number, capability, or constellation size, they quickly become very scarce, high-demand, low-density (HD/LD) assets that military leaders compete for in priority and support, ultimately reducing their ability to support all levels of war simultaneously.

5. Space power leverages a nation's economic and military centers of gravity.

> *Space will undoubtedly be a center of gravity in any future war.*
>
> —Jeffrey R. Barnett
> *Future War: An Assessment of Aerospace Campaigns in 2010*

Conducted properly, space power leverages military and economic COGs, providing an avenue for all instruments of national power to more effectively respond to global situations. Space is emerging as a military and economic COG for nations that conduct information-dependent military and economic operations.[20] The global increase of government, military, and commercial space activity is significant despite a brief economic hiccup in the late 1990s. For example, US space-industry expenditures (military, civil, and industry) are valued in excess of $80 billion per year; the space industry involves over 500,000 jobs in the United States alone; and since 1959 the total US government national space investment is nearly $1.3 trillion.[21] The late 1990s marked the first time commercial space-investment activities actually exceeded government activity in areas such as number of launches, satellite-manufacturing revenue, and launch revenue.[22] Most recently, during Operation Iraqi Freedom, commercial satellites provided 80 percent of all SATCOM used by the US military.[23] From a global perspective, space contributions will account for an estimated $209 billion in the 2006 global economy.[24]

A COG is a source of power from which a nation-state derives its freedom of action, physical strength, or will to fight.[25] The United States is more space dependent than any other nation, yielding an asymmetric advantage (and potential vulnerability).[26] Collectively, US space assets are already a COG, and dominance of the space medium is key to sustained national health, security, and prosperity. In the current information age, economies are built and wars waged increasingly with information (electrons); space is rapidly becoming the primary medium for information transfer. Like any other military or national COG, a nation's space COG must be secure. Consider the strategic implications and vulnerability of both military and economic COGs should space systems become unavailable. Space-based communication, navigation, imagery, and weather are now essential for global situational awareness, the transportation industry, and financial markets.

Space is a lucrative COG for other nations as well; it is no longer a "sanctuary" for the United States alone to enjoy. Other nations are rapidly getting into the space race. Currently, 58 nations have satellites on orbit for military or economic purposes; 15 nations have their own indigenous space-lift capability; and there are five international-consortium space-launch providers to launch satellites for those who cannot do so themselves.[27] While space growth occurs predominantly among technologically advanced nations, sales of commercial space products to all nations are on a dramatic rise. Dozens of international space-consortium SATCOM and imagery providers offer their services in open global markets.[28] The existence of these commercial and international space organizations means that a nation does not have to be a technologically advanced superpower to acquire space power—space imagery, weather, and SATCOM are available and can be purchased over the Internet with a credit card. Space commercialism makes all nation-states potential space players, blurring the line between hostile (red), friendly (blue), and neutral (gray) space forces.

6. Space superiority starts with assured access to space.

> *Whoever has the capability to control space will likewise possess the capability to control the surface of the earth.*
>
> —Gen Thomas D. White
> USAF Chief of Staff, 1958

> *The first principle that should guide our air and space professionals is the imperative to control the high ground.*
>
> —Hon. Peter B. Teets
> Undersecretary of the
> Air Force, 2002

The purpose of a nation-state's space power is to support and achieve national objectives. To accomplish this, a nation needs to be able to secure its space assets, control the space medium, and deter potential space adversaries. Space superiority—ensuring freedom of action in space by protecting space assets and, if necessary, denying an adversary's space capabilities—is fundamental to national space power and is currently Air Force Space Command's top priority.[29] The author suggests that space superiority is best represented as a pyramid consisting of three critical components: responsive space lift (getting to space), counterspace operations (space control), and a space-focused C2 structure (fig. 4).[30] Eliminate any of these three elements, and a nation's space power quickly deteriorates.

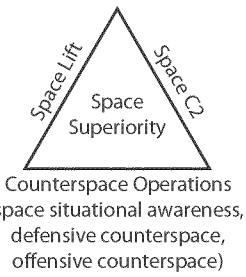


Figure 4. Space-superiority pyramid

Position is strategic. Position is vital. Position is the key to success in most aspects of life, whether sports, business, or politics—and *especially* military combat operations. To get the ultimate position in space, a nation needs assured access to space—it is the foundation on which space superiority operates. Space lift provides access to strategic, vital positions for on-orbit assets to achieve national objectives integrated with military campaigns. To ensure security and dominance of the space medium (space superiority), a space-power nation needs responsive, affordable space lift to deploy, sustain, augment, and operate space systems on orbit when required. Reliable, responsive, affordable space lift is the door to true national space power.

This research indicates that *space lift* (assured access to space) is without question the leading limitation to effective, sustained, robust space power. National space lift must be integrated among the military, civil, commercial, and international space-lift communities—sharing synergistic technology, common-core launch vehicles, and ground/range infrastructure is essential to national space-lift capability (see proposition no. 9). Replacing expendable launch vehicles with reusable launch

vehicles (RLV), single-stage-to-orbit systems, and air-breathing hypersonic propulsion systems (ramjets, scramjets) is overdue.[31] A space-faring nation requires indigenous space-launch capability for national defense operations but should also take advantage of international space-lift opportunities for non-DOD missions such as commercial, scientific, and civil space activities. National space power requires multiple spaceports from which to achieve orbit to eliminate ground choke points in time of crisis or increased launch activity.[32] Without these elements of space lift, a nation cannot execute efficient space power.

7. Controlling space requires eyes, ears, shields, and swords.

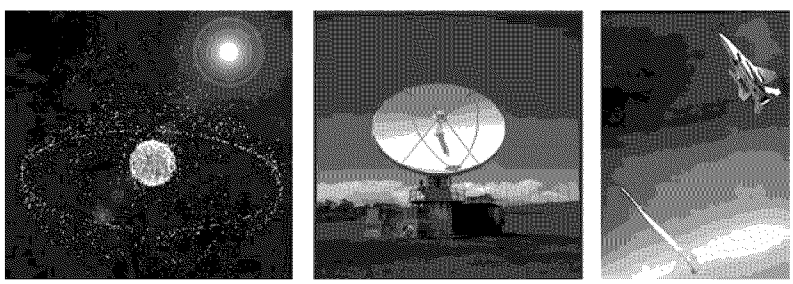
> *U.S. space policy is to promote development of the full range of space-based capabilities in a manner that protects our vital security interests. We will deter threats to our interests, and if deterrence fails, defeat hostile efforts against U.S. access to and use of space.*
>
> —National Security Strategy, 1998

> *The goal is not to bring war to space, but rather to defend against those who would.*
>
> —Donald H. Rumsfeld
> US Secretary of Defense, 2004

For a nation to achieve decisive space power in support of national objectives and goals, it must have the means to control the space medium. Space control, or *counterspace operations*, is the second element of the space-superiority triad. Ensuring and denying the use of the space medium require a robust counterspace architecture: space situational awareness (SSA) with corresponding defensive/offensive counterspace (DCS/OCS) means to protect space interests (fig. 5).[33]

SSA forms the basis for national space control, mapping the battlespace by providing the "eyes and ears" of friendly, neutral, and potentially hostile global space activity. Without SSA, a nation is blind and deaf to space activity, rendering DCS/OCS capabilities useless and jeopardizing national security. Robust SSA allows a nation to understand adverse environmental conditions (e.g., space weather), know where space adversaries are, predict nefarious foreign space operations, and determine courses of action. SSA includes finding and tracking space objects, identifying links and nodes, and characterizing the signals of red, blue, and gray forces. The goal is rapid, accurate, and meaningful space intelligence preparation of the battlespace with a single integrated space picture.

DCS operations are the "shields" for a nation's space power, deterring and defending space systems from enemy attack with active or passive means. As advanced nations depend on their space capabilities and develop military/economic COGs, this space dependence also represents a potential vulnerability for an adversary to exploit. A nation's robust DCS operations reduce this threat with hardened satellite systems, antijam components, kinetic attacks against ground jammers, frequency-hopping and spread-spectrum signals, on-



SSA: Eyes and Ears DCS: Shields OCS: Swords

Figure 5. Counterspace operations

orbit maneuvers to evade hostility, and rapid reconstitution of on-orbit systems.[34]

OCS operations provide the "swords" for national space power by negating an adversary's space capability (ground segment, satellite, or signal). Just as land, sea, and air forces all eventually employed offensive weapons, so will space forces; it is only a matter of time.[35] While the weaponization of space is highly controversial, it is not explicitly prohibited by international law and treaty.[36] OCS forces should be suited for effects-based operations; AFDD 2-2.1, *Counterspace Operations*, identifies five levels of desired OCS effects: deception, disruption, denial, degradation, and destruction. These effects are achieved through a variety of OCS resources, including aircraft, missiles, special operations forces, antisatellite weapons, directed-energy weapons, network-warfare operations, jamming systems, and surface forces.[37] Flexible, effects-based OCS is key to decisive, dominant national space power; together with SSA and DCS, they form the foundational architecture for operational space superiority.

8. Space forces require centralized command and control led by space professionals.

> *Future warfare depends on the rapidity of collecting information and making decisions.*
>
> —Gen Chuck Horner, USAF, 1998

The final piece of the space-superiority puzzle is effective *command and control of space forces* (C2 of both people and systems) (fig. 6). Unlike air, land, and sea power, space power is unique in that space systems have simultaneous impacts on and contributions to multiple theaters (proposition no. 4); this makes space-power C2 especially challenging. Just as experienced soldiers, sailors, and airmen control land, sea, and air forces, so are experienced military space professionals the best choice to centrally control space forces. Perhaps Douhet stated it best when he advocated that "only *airmen* can fully appreciate airpower's intricacies: therefore, only airmen should command air forces" (emphasis in original).[38] So is it with control of space forces—it needs to be done by space experts. The most straightforward

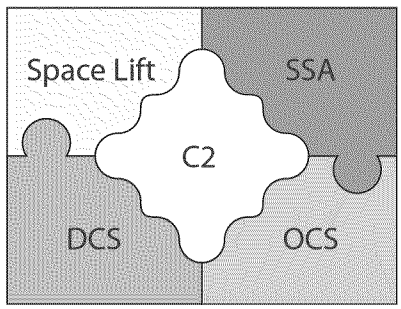


Figure 6. Space superiority: C2 brings it together

and effective solution for space-force C2 employment (both global and theater) is to fuse today's service- and agency-fragmented US space forces into an independent space force led by space professionals.

The current devolution of C2 of joint operational US military space forces is complicated and different for global and theater operations (described in AFDDs 2-2 and 2-2.1). To plan and execute global operations, US Strategic Command operates joint military space forces through its space and global-strike functional component (Eighth Air Force) via the joint space operations center (JSpOC) at Vandenberg AFB, California.[39] C2 of theater space forces gets more complicated. There is no question that space forces need to be integrated into the JFC's theater-campaign battle rhythm. The issue becomes how and by whom space forces are best controlled in-theater.

Currently, the joint force air component commander (JFACC) is normally responsible for air and space operations to accomplish the JFC's objectives; the JFACC is assisted by a newly created director of space forces.[40] As space forces become more "taskable" and lethal in theater operations, the author suggests taking C2 of space forces one step further by transitioning C2 of theater space forces from an already multitasked JFACC to the dedicated space leadership of a joint force space component commander (JFSCC) (fig. 7). The result would be a space professional leading and integrating theater space operations at a level equivalent with the other services (mediums), focusing on space power (not air *and* space power, as current JFACCs do).

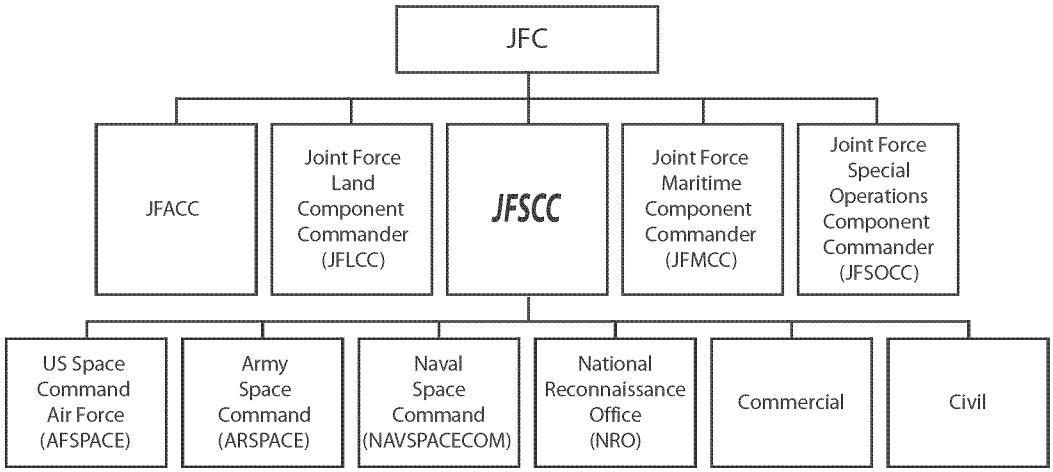


Figure 7. Proposed theater command and control of the joint force space component commander

9. Space power is a function of a nation's total space capability (space unity of effort).

> *Space power is the total strength of a nation's capability to conduct and influence activities to, in, through, and from space to achieve its objectives.*
>
> —Joint Publication (JP) 1-02, *Department of Defense Dictionary of Military and Associated Terms*, 12 April 2001 (as amended through 31 August 2005); and JP 3-14, *Joint Doctrine for Space Operations*, 9 August 2002

Current joint doctrine reflects the significance of a *national* space-power effort by its very definition. Space power is a nationwide endeavor. However, the 2001 report of the Space Commission identified a main problem with current US space capability: the US space community is fragmented and lacks unity of effort. This is primarily due to decades of stovepiped, agency-focused projects and security barriers between military and non-DOD space sectors.

The solution is cooperative efforts among military, government, civil, scientific, commercial, and, to a certain extent, even allied international space organizations (fig. 8). Clearly, because of the incredible technology and limited available resources to pursue space systems, space power must be a cooperative, synergistic endeavor. Even more so than airpower, space power and technology are integrally and synergistically related.[41] One way to overcome technological complexities and tremendous space-related costs is to encourage (and reward) the leveraging of technology and shared resources (infrastructure, ranges, etc.) among industry, the DOD, the National Reconnaissance Office (NRO), the National Geospatial-Intelligence Agency, NASA, the Defense Advanced Research Projects Agency, and academia. The Pentagon's newly created [May 2004] National Security Space Office

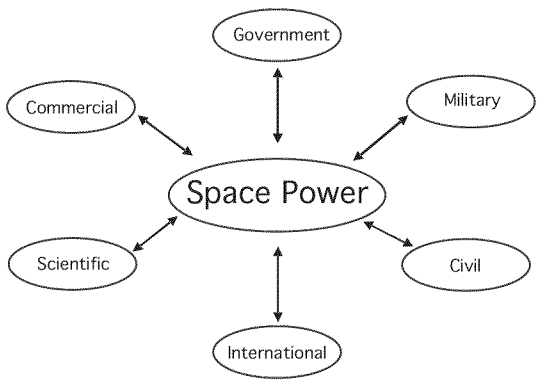


Figure 8. Space power: a function of national teamwork

(NSSO) is a good first step to building a cooperative space culture.[42] The NSSO charter is to identify both military and national-intelligence space activities, develop architectures and implement programs that bridge both communities, and improve the integration of space capabilities into joint war-fighting and intelligence operations. Synchronizing and integrating the NRO and the DOD space communities increase efficiency by reducing redundancy and space-system costs.

A cooperative space culture would most benefit the number-one space limitation today—space lift—due to its limited infrastructure, complex technology, and high operations cost. The co-use of HD/LD space-lift infrastructure assets and codevelopment of RLVs, advanced materials, and propulsion technologies would pay huge dividends to the national space effort by improving assured access to space. Government incentives and rewards for private industry to develop new space-lift capabilities, technologies, and approaches result in a win-win situation for a nation's total space capability.[43]

10. National space power reaches its full potential when a nation commits to a separate, independent space force.

> *So long as the budget for the development of aircraft is prepared by the Army, Navy, or other agency of the Government, aviation will be considered as an auxiliary and the requisite amount of money, as compared with the other services, will be subject to the final decision of personnel whose main duty is not aviation.*
>
> *The greatest deterrent to development which air forces combat in every country is the fact that they have had to be tied up to armies and navies where senior officers, unused to air work, were placed in the superior positions.*
>
> —Gen William "Billy" Mitchell
> US Army Air Service, 1925

True national space power cannot reach its full potential until a nation commits itself to a separate, independent space force. War fighters would do well to recall the prophetic words of arguably the most ardent forefather of a separate, independent US Air Force, Gen Billy Mitchell.[44] Plug in the word "space" for "air," and it is a close fit to the current twenty-first-century status of space-power development. It was right for the Army to nurture and shelter airpower in the Army construct until airpower demonstrated decisively that it warranted its own separate military service. Once the Air Force became an independent service, airpower rapidly grew into a global, strategic instrument of national power. Likewise, it was right for the USAF to shelter and nurture the vertical dimension of space—it has been the best place to foster space power since its inception 50 years ago. However, as airpower was constrained during the post–World War I era, US space power was constrained during the Cold War and morphed to airpower doctrine, policy, and theory. In spite of this restraint, military space power has grown to be a pervasive influence on nearly every facet of military operations. The United States holds a decisive asymmetric space-power advantage—clearly it is too critical to be considered a subset of airpower. An independent space-force organization would fully unleash the true potential of space power, allowing freedom to explore, develop, and refine space theory, doctrine, and policy without undue influence from other service cultures.

US Space Force: No Longer a Question of "If" but "When"

This may be an unpopular statement, but it is irrefutable, based on the historical precedent of the creation of separate and distinct land, sea, and air services. Nearly half of the surveys conducted in this research indicated that a separate space force was the eventual and *necessary* path of US space power. This does not mean that space power cannot positively influence joint military operations while under the umbrella of the USAF—it can and has proven so, as discussed throughout this article. The issue becomes availability of resources (e.g., budget, manpower, and equip-

ment), for which both airpower and space power compete in the USAF. In today's realistic environment of finite resources, space systems have historically received lower priority than terrestrial weapon systems. Today US space power has grown to the point where either a bigger USAF umbrella is needed (more resources to pursue space power) or an entirely separate umbrella is created (an independent space force).

> *Our space force may need to become a military entity in its own right, equal and apart from our air, land, and maritime forces.*
>
> —Gen Chuck Horner, USAF, 1999

From a joint perspective, there is also cause for a separate space force. Land and sea services are heavily dependent on USAF-controlled space assets. As the designated executive agent for space, the USAF controls approximately 86 percent of the DOD's $11 billion space budget.[45] With space assets competing within the USAF against airpower programs (e.g., the F-22A), the other DOD services are concerned that the USAF may not be pursuing adequate space capability (in a timely manner) to support joint land and sea combat needs. A separate, independent space force would provide more equitable representation among the services for space-power budget and combat-support capability as well as reduce or eliminate confusion and redundancy among the three services' own space efforts (AFSPACE, ARSPACE, and NAVSPACECOM).

While such a reorganization of space forces into a separate, independent space force is understandably delayed due to the current global war on terrorism, it no doubt needs to be addressed sooner rather than later. Some say that a separate space force is not justified until there is a serious space peer competitor that challenges US space superiority. The response to that argument is that although the United States holds a healthy asymmetric space-power advantage today, it would be foolish to wait for national space forces to be threatened or allow a potential "space Pearl Harbor" to occur when the opportunity exists now to organize space forces to prevent that very threat.[46] An independent space force will foster a space-force culture, reduce competition for resources, and allow space-power theory and resulting combat capability to develop more effectively to counter future space threats.

> *If the Air Force cannot or will not step up to its responsibilities as the executive agent for military space, then Congress must create a separate space force to become that strong advocate.*
>
> —Senator Bob Smith, 2002

Summary and Conclusions

These 10 propositions illustrate the necessity and challenges of national space power:

Characteristics	*Challenges*
• High Ground	• Responsive Space Lift
• Distinct Medium/Doctrine	• Counterspace Operations
• Joint Force Multiplier	• Space-Forces C2
• Simultaneity and Versatility	• Space Unity of Effort
• Center of Gravity	• Independent Space Force

The strength of space contributions in strategic military, commercial, and economic operations is undeniable. Space power is not just a continuation of airpower; space is a unique, distinct, war-fighting medium. Continuing to restrain US space power from developing its own identity, culture, theory, and doctrine is to confine a powerful dimension of war fighting available only through the fourth medium of space. Undisputed combat space power is drawing near, and the United States may be on the brink of unleashing decisive military space operations, ushering in the era of a separate space force. The reality is that, as in the evolution of airpower, the true potential of a nation's military space power will come to fruition only when a separate space force is created, complete with its own space-competent leadership, organization, doctrine, theory, policy, and resources. ❑

Notes

1. All research was conducted at the unclassified, public-release level.

2. Perhaps the most revealing aspect of this research was the prolific response received from a survey of nearly 100 space professionals across the nation, including military space operators, acquirers, industry, and academia. The demographics and combined space experience alone of these survey participants are staggering, totaling more than 1,500 years of collective space background from the backbone of today's space cadre. Survey participants include Army, Navy, Air Force, and Marine personnel, along with participants from key national space organizations including NASA, the NRO, Air Force Space Command, and the US Strategic Command. To ignore such a pool of knowledge would be foolish, and in fact their jewels of wisdom are woven into the fabric of this research. Additionally, the author visited more than a dozen key components of the space community to collect information and build the basis of this research.

3. Col Phillip S. Meilinger, USAF, *10 Propositions Regarding Airpower* (Maxwell AFB, AL: Air University Press, 1995). The author acknowledges the thought-provoking works of Maj M. V. Smith, "Ten Propositions Regarding Spacepower" (thesis, School of Advanced Airpower Studies, Maxwell AFB, AL, 2001); Maj Kevin M. Rhoades, USAF, "Bernoulians versus Keplerians: Is Airpower Doctrine Good Enough for Employment of Space Forces?" (thesis, School of Advanced Air and Space Studies, Maxwell AFB, AL, June 2004); and Maj Samuel McNeil, "Proposed Tenets of Spacepower: Six Enduring Truths," research report (Maxwell AFB, AL, Air Command and Staff College, 2003). The author also appreciates the sponsorship of the Institute for National Strategic Studies, in Washington, DC, for this research.

4. Already, many commercial and economic ventures are entirely dependent on space assets for modern commercial and economic growth and operations. For example, the global positioning system is critical for transportation-systems navigation (air, sea, rail, and highway) and also provides precise timing for international stock-market trades affecting national economies; weather satellites provide key environmental information and forecasts to predict potential weather disasters, facilitate agricultural planning, and monitor forest fires and solar (sun) phenomena; and information technologies depend exclusively on satellite communications for global communications, direct satellite TV/radio broadcasts, and emergency services.

5. *Merriam-Webster's Collegiate Dictionary*, 11th ed. (Springfield, MA: Merriam-Webster, 2003), 997. The "proposition" definition is consistent with Meilinger and Smith in their research.

6. Jerry Jon Sellers, *Understanding Space* (New York: McGraw-Hill, 1994), 60–61; and AU-18, *Space Handbook, An Analyst's Guide* (Maxwell AFB, AL: Air University Press, 1993), 4–5.

7. *Merriam-Webster's Collegiate Dictionary*, 973.

8. Definition is consistent with current joint-operations definitions of *space power* as defined in Joint Publications (JP) 1-02 and 3-14, and similar to Lt Col David Lupton's definition of the term in his book *On Space Warfare: A Space Power Doctrine* (Maxwell AFB, AL: Air University Press, 1988).

9. The White House, *A National Security Strategy for a New Century* (Washington, DC: The White House, October 1998), 25–26.

10. The GEO belt slots (22,300 miles above a country's equatorial longitude) are governed by the International Telecommunications Union and are becoming a highly sought after commodity since the GEO belt is getting crowded. Demand for geosynchronous slots and frequency allocations is intensifying to a geopolitical battlespace, resulting in recent political and international disputes.

11. Air Force Doctrine Document (AFDD) 2-2, *Space Operations*, 27 November 2001, 4; and AFDD 2-2, draft, 15 May 2005, 3. Headquarters AFDC/DR, Maxwell AFB, AL.

12. Lt Col Peter B. Hays, USAF, *United States Military Space into the Twenty-first Century*, Institute for National Strategic Studies Occasional Paper 42 (Maxwell AFB, AL: Air University Press, 2002), 25–26.

13. Chief of Staff of the Air Force (CSAF) Gen Charles A. Gabriel stated, "From battlefield to highest orbit, airpower provides deterrence," implying that space was a subset of airpower. Air Force Manual (AFM) 1-6, *Military Space Doctrine*, 15 October 1982. An earlier CSAF, Gen Thomas D. White, set the "aerospace" tone in 1958 by declaring, "There is no division . . . between air and space. Air and space are an indivisible field of operations." *Air Force*, March 1958, 40–41.

14. Rhoades, "Bernoulians versus Keplerians," 67–72. The paper provides a thorough historical review of Air Force doctrine and analogy to space-doctrine development.

15. Gen Thomas S. Moorman, USAF, former vice CSAF and commander, Air Force Space Command, stated, "Desert Storm . . . was a watershed event in military space applications because for the first time, space systems were both integral to the conflict and critical to the outcome of the war." AFDD 4, *Space Operations Doctrine*, 10 July 1996, http://www.fas.org/spp/military/docops/usaf/afdd4.htm. "During the 1991 Persian Gulf War . . . over 60 military satellites and others from the commercial and civil sectors were employed." George W. Bradley III, "A Brief History of the Air Force in Space," *High Frontier: The Journal for Space and Missile Professionals* 2, no. 2 (Fall 2004): 7.

16. Between 1995 and 2005, over 75 Air University research papers, articles, and books were produced dealing with space issues, and significant DOD service doctrine has been approved, including AFDD 2-2, *Space Operations*; AFDD 2-2.1, *Counterspace Operations*; AFDD 4, *Space Operations Doctrine*; JP 3-14, *Space Operations*; Army Field Manual (FM) 100-18, *Space Support to Army Operations*; and *National Security Space (NSS) Acquisition Policy* 03-01.

17. This is clearly evidenced in Operations Allied Force, Enduring Freedom, and Iraqi Freedom, and military operations other than war, including humanitarian assistance/disaster relief (HA/DR) activities.

18. Meilinger, *10 Propositions Regarding Airpower*, 35. "Parallel Operations occur when different campaigns, against different targets, and at different levels of war, are conducted simultaneously."

19. The trend indicates that the DOD operations tempo is growing and increasingly involved in small-scale contingencies and military operations other than war,

such as humanitarian relief, noncombatant evacuation operations, and peacekeeping/peace-enforcement operations. Data collected from the Air Force Historical Research Agency, Maxwell AFB, AL.

20. *United States Space Command Long-Range Plan: Implementing USSPACECOM Vision for 2020* (Peterson AFB, CO: US Space Command, Director of Plans, April 1998), 4–5.

21. Hays, *United States Military Space*, 21; Gen Lance Lord, commander, Air Force Space Command, quoted in Louis Arane-Barradas, "Civilian Sector the Biggest Space Customer," *Academy Spirit*, 24 February 2006; and $1.3 trillion in constant FY05 dollars. Data from Tamar A. Mehuron, "2004 Space Almanac," *Air Force Magazine*, August 2004, 26–53.

22. Hays, *United States Military Space*, 21.

23. AFDD 2-2.1, *Counterspace Operations*, 23.

24. Lord, quoted in Arane-Barradas, "Civilian Sector," 4.

25. Ibid., 50. The great Prussian military strategist Carl von Clausewitz defined a COG as "the hub of all power and movement, on which everything depends." Carl von Clausewitz, *On War*, ed. and trans. Michael Howard and Peter Paret (Princeton, NJ: Princeton University Press, 1976), 595–96.

26. *Report of the Commission to Assess United States National Security Space Management and Organization* (Washington, DC: Space Commission, 2001), 18, http://www.defenselink.mil/pubs/space20010111.pdf.

27. "Rest of World Space Launch," *Air University Space Primer*, chap. 20 (Maxwell AFB, AL: Air War College, July 2003), http://space.au.af.mil/primer/rest_of_world_launch.pdf.

28. Intelsat, Inmarsat, Arabsat, Eutelsat, LandSat, Spot Image, Indian Remote Sensing, Ikonos, Quickbird, etc.

29. Col James E. Haywood, USAF, "Making Vision a Reality: Delivering Counterspace Capability to the High Frontier," *High Frontier: The Journal for Space and Missile Professionals* 2, no. 2 (Fall 2004): 54.

30. Reference definitions in JP 3-14, *Joint Doctrine for Space Operations*; AFDD 2-2, *Space Operations*; AFDD 2-2.1, *Counterspace Operations*; and Department of Defense Directive (DODD) 3100.10, *Space Policy*. Space superiority encompasses space situational awareness (SSA), defensive counterspace (DCS), and offensive counterspace (OCS). Space-control missions include surveillance, prevention, protection, and negation. Space superiority is a *condition* of dominance, while space control is actually one of several contributing activities that result in national space superiority.

31. The United States needs to develop and employ RLVs, which will provide significant improvements in military responsiveness and life-cycle costs. Recent attempts (e.g., evolved expendable launch vehicles [EELV]) have made progress in standardizing the "family of systems," but US space lift remains largely unresponsive (months to launch), expensive (on the order of 50–200 million dollars per launch), and unpredictable (significant integration and launch infrastructure delays). Foreign launch services are becoming highly competitive and challenge US space-lift capability.

32. The two main US spaceports (30th Space Wing, Vandenberg AFB, CA, and 45th Space Wing, Patrick AFB, FL) represent two choke points for polar and GEO space launches. Elimination of either range would cripple US access to space due to lack of alternate sites and facilities. Range infrastructure needs an overhaul to improve cost and responsiveness (payload/booster processing, launch-facility maintenance, etc.).

33. SSA, DCS, and OCS are the three components of counterspace operations as defined by AFDD 2-2, *Space Operations*, and AFDD 2-2.1, *Counterspace Operations*.

34. AFDD 2-2.1, *Counterspace Operations*, 25–29.

35. "We know from history that every medium—air, land and sea has seen conflict. Reality indicates that space will be no different." *Report of the Commission*.

36. Maj Elizabeth Waldrop, USAF, "Weaponization of Outer Space: US National Policy," *High Frontier: The Journal for Space and Missile Professionals* 1, no. 3 (Winter 2005): 35–46. International space law *does not* prohibit conventional force-application weapons in space, antisatellite weapons, or protection of space assets, but there are some limitations. The 1963 United Nations (UN) Limited Test Ban Treaty bans nuclear-weapon tests in outer space. The 1967 UN Outer Space Treaty declares that outer space and all celestial bodies are free for exploration by all states and are to remain free of military bases; it bans Earth-orbiting weapons of mass destruction. The 1972 US-USSR Antiballistic Missile (ABM) Treaty prohibits the development, testing, or deployment of space-based ABM systems (the United States withdrew from the ABM Treaty in 2002).

37. AFDD 2-2.1, *Counterspace Operations*, 31–34.

38. Rhoades, "Bernoulians versus Keplerians," 9.

39. The Unified Command Plan assigns US Strategic Command as the functional unified command with overall responsibility and combatant command for space operations. The JSpOC provides day-to-day operational command of joint space forces by issuing daily and weekly space tasking orders to space units, which mirror the air tasking orders produced by an air operations center. The JSpOC fuses and analyzes space information into a single integrated space picture, determines courses of action, and serves as the reach-back interface for theater space support.

40. The JFACC is also usually assigned the role of space coordinating authority, the single authority in-theater to coordinate joint theater space operations and integrate space capabilities and effects. A newly created director of space forces assists the JFACC in planning, executing, and assessing space operations for the JFC's campaign plan.

41. Meilinger, *10 Propositions Regarding Airpower*. This is a space-power corollary to Meilinger's proposition regarding the synergism between airpower and technology. Similarly, and in parallel with airpower technology and development, Gen Billy Mitchell also recognized early on the symbiotic relationship between civil and military airpower. Rhoades, "Bernoulians versus Keplerians," 13.

42. The capstone directive for this effort is NSS 03-01, the result of a recommendation from the Space Commission report.

43. Similar to the recent $10 million space prize won by Burt Rutan's Scaled Composites Spaceship One endeavor.

44. Gen William "Billy" Mitchell, USA, *Winged Defense: The Development and Possibilities of Modern Air Power—Economic and Military* (1925: repr., New York: Dover Publications, 1988), 160, 248–49.

45. Mehuron, "2004 Space Almanac," 26–53.

46. *Report of the Commission*, 22, 25.