

HIGH FRONTIER

THE JOURNAL FOR SPACE AND CYBERSPACE PROFESSIONALS

Report of the

**COMMISSION TO ASSESS
UNITED STATES NATIONAL SECURITY SPACE
MANAGEMENT AND ORGANIZATION**

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THE SPACE COMMISSION: 10 YEARS LATER

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Introduction

General William L. Shelton, USAF
Commander, Air Force Space Command

This issue of *High Frontier Journal*, our final edition, appropriately focuses on the Report of the Commission to Assess United States National Security Space Management and Organization and its impact 10 years later. Commonly known as the Space Commission, this landmark study helped shape today's national security space enterprise.

The Space Commission's recommendations sparked many changes, from the president establishing space as a national security priority, designating Air Force civilian leadership as Executive Agent for Space within the Department of Defense, eliminating multi-hat responsibilities by assigning an Air Force Space Command (AFSPC) commander singularly focused on the organization, aligning Space and Missile Systems Center under AFSPC, to establishing the National Security Space Institute. I am pleased that our last issue of *High Frontier* includes the insights and perspectives of notable leaders who served on this commission, and whose vision and wisdom influenced the trajectory of US national security space. These leaders have my sincere thanks for their dedication and insights.

We also owe gratitude to the commission for the recommendations that provided unifying constructs for the multitude of government organizations involved with space activities. Space capabilities have since become integral in joint operations, a vital part of our American way of war. Even as national security space evolves, we have improved our personnel development, processes, and operations, and we are now mission partners in everything from humanitarian assistance/disaster relief in Japan to air operations over Libya to counterinsurgency operations in Afghanistan. AFSPC capabilities are foundational and essential for military operations across the entire spectrum.

Although not envisioned by the Space Commission, AFSPC is now the Air Force lead for organizing, training, and equipping our cyberspace operations. Operations in Afghanistan and Iraq have demonstrated the synergistic possibilities of the space and cyber domains. But we have just scratched the surface. The Space Commission pushed us toward better education and training of our space professionals. We are on the analogous path for our cyber professionals and we need to grow the professionals who are conversant in both domains to promote the synergy our instincts tell us is there.

As the Department of Defense works through a very different economic landscape, we are necessarily examining how to be more efficient while maintaining the effectiveness required by our joint force commanders. We seek versatility, resiliency, and affordability in our capabilities, and mature technologies will be the watch words to achieve those ends.

Since the Space Commission completed its work, continuous conflict has provided the crucible to test the recommendations which were implemented. A very different world than

anyone could have predicted has emerged, and while national security space has certainly progressed, we must find ways to adapt to the economic times ahead if we are to maintain the momentum brought about by the Space Commission. And speaking of adaptation, with the publication of this final issue, we graduate to a different approach for this journal's dialogue. The Space Commission and its recommendations proved to be a powerful change agent for our profession. So, too, have the thoughtful writings of so many in the years of the *High Frontier Journal*. It is time for our space and cyber narrative to move into the mainstream academic discussion in other professional publications. Our community must continue sharing insights, concerns and ideas, and my pledge to you is we will continue to facilitate your efforts.

In closing, I thank all who have contributed to this journal. I also want to pay homage to the many leaders who helped forge the National Security Space community into the joint-minded warfighting force it is today. Pioneers of the past have given us the vision of global access, persistence, and awareness for the 21st century. Our continued teamwork ensures we will secure and advance our nation's operational advantage in the domains of space and cyberspace.



General William L. Shelton, USAF (BS, Astronautical Engineering, US Air Force Academy [USAF], Colorado; MS, Astronautical Engineering, US Air Force Institute of Technology, Ohio; MS, National Security Strategy, National War College, Washington, DC) is the commander of Air Force Space Command, Peterson AFB, Colorado. He is responsible for organizing, equipping, training, and maintaining mission-ready space and cyberspace forces and capabilities

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General Shelton entered the Air Force in 1976 as a graduate of the USAFA. He has served in various assignments, including research and development testing, space operations, and staff work. The general has commanded at the squadron, group, wing and numbered air force levels, and served on the staffs at major command headquarters, Air Force headquarters and the Office of the Secretary of Defense. Prior to assuming his current position, General Shelton was the assistant vice chief of staff and director, Air Staff, US Air Force, Pentagon, Washington, DC.

Enduring Issues: The Space Commission 10 Years Later

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Background of the Space Commission: Origins and Composition

The Space Commission had its origins in legislation sponsored by Senator Robert Smith (R-NH). He and a few colleagues had become increasingly concerned that the Department of Defense (DoD), and the US Air Force in particular, were not well organized to manage the national security dimensions of space. Senator Smith had a particular interest in the creation of a military “Space Service,” the core mission of which would be to conduct operations to, in and from space. Air Force officials had given thought to an “aerospace force” or an “air and space force,” but Senator Smith was not persuaded that those proposals answered the need he perceived. With modest bipartisan support, he inserted into the fiscal year 2000 Defense Authorization Act a requirement for a commission to examine the organization and management of national security space.

Congress gave the body that would become known as the Space Commission, officially known as the Commission to Assess United States National Security Space Management and Organization, a broad charter to assess the role of space assets in military operations and the relationship between “white” and “black” space—those programs acknowledged and unacknowledged, respectively, by the US government. There had been several previous commissions on the subject of space. What distinguished this latest effort was the direct interest of the Congress in the manner in which our national security institutions were organized to manage the frontier of space. This interest motivated the central goal of the commission: to assess the costs and benefits of establishing an “independent military department and service dedicated to the national security space mission.”

The commission was composed of 13 members. Three of them, the Honorable Duane P. Andrews, Mr. Robert V. Davis, and Mr. Douglas H. Necessary, had previously served in senior

staff positions on the House Permanent Select Committee on Intelligence, Appropriations, and Armed Services, respectively. Andrews and Davis also served in the G. H. W. Bush and Clinton administrations, respectively, in senior positions directly responsible for DoD space activities.

Dr. William Graham served as the deputy and acting administrator of National Aeronautics and Space Administration and later as a senior adviser on science and technology to President Ronald Reagan. Generals Howell M. Estes, Ronald R. Fogelman, Charles A. Horner, and Thomas S. Moorman brought extensive US Air Force experience in operations and management at both command and headquarters levels. Lt Gen Jay M. Garner and General Glenn K. Otis brought the Army’s perspective to the table. Adm David E. Jeremiah, in addition to his other accomplishments, had led a review of the intelligence community’s surprise in the wake of India’s underground nuclear test in 1998.

The authors of this article were chairman and staff director of the commission, respectively. We had both served with the “Commission to Assess the Ballistic Missile Threat to the US” in the same roles two years earlier. That commission was credited with delivering to Congress a compelling report on the threat posed by the proliferation of ballistic missile technology and pursuit by rogue regimes of advanced missile technology.

Given their earlier success, we imported and the commissioners unanimously adopted, several rules from the earlier Ballistic Missile Threat Commission to govern the meetings and final report of the Space Commission. The first addressed the adage that one could have one’s own opinions but not one’s own facts. On any matter of disagreement subject to analysis, we agreed to pursue the facts until all were persuaded that the known universe of facts had been fully and fairly canvassed.

We understood that known facts did not encompass all facts—indeed, we wrestled with the existence of “known unknowns” and “unknown unknowns.” It was therefore altogether possible that after due diligence, there might still be a disagreement based on facts, or the lack thereof. To resolve any disagreements, we decided that a fact-based dissent by at least two members would be required to break a consensus among the commissioners. The effect was to encourage members to base their judgments on the facts they could share, debate, and agree upon (and agree on what they did not know) rather than on the unique experiences and sometimes iconoclastic opinions

If a bipartisan group of individuals with divergent views on the subject of space could unanimously agree on recommendations for the way forward, it would give added urgency to their implementation.

The second rule followed on the first. We sought from the beginning to generate a unanimous report. If a bipartisan group of individuals with divergent views on the subject of space could unanimously agree on recommendations for the way forward, it would give added urgency to their implementation. Indeed, one of the hallmarks of the earlier Ballistic Missile Threat Commission was the stunning fact that Republicans and Democrats, with widely varying assessments on intelligence and ballistic missile capabilities, created a unanimous report highlighting the threat those weapons posed to the US.

The members of the Space Commission were chosen because individually and collectively they understood the importance of space, as both a “place” and a “mission,” to the national security of the US. They were not only keenly aware of the necessity of space operations for military and intelligence purposes, but also its influential role in diplomacy, the economic life of the nation, and the daily activities of the American people, all increasingly on a global scale.

In light of the growing importance and dependence of the US on its space assets, we had a shared concern for their vulnerability. Those concerns were rooted in a number of factors. The first derived from the high and increasing US dependence on space assets—whether on orbit or on the ground. That de-

The real and growing vulnerability of space assets was also driven home by the commission's review of technology developments in the post-Cold War era. The globalization of trade and the increasing ease with which technical expertise and technology flowed through international channels demanded our attention. A 1998 satellite glitch that affected pager service, the advent of commercial companies marketing small satellites on a global basis, indications that communications satellites were being jammed, and the proliferation of ballistic missiles that could potentially serve as anti-satellite weapons—punctuated by a three-stage North Korean missile launch in July 1998—were some of the developments that contributed to the commission's views on the vulnerability of space assets.

An evident vulnerability does not, by itself, constitute the existence of a threat. Advance notice that a state or non-state actor intended and was preparing to exploit a vulnerability would depend on indications and warning provided by the intelligence community (IC). But the IC was suffering still from the dislocations and lean budgets of the 1990s, and the commission found that it did not have intelligence related to space high on its agenda. We were also convinced that even if increased attention were to be given to space the indicators and warning of attack in a “noisy” environment would be difficult to dis-

Figure 1. Labyrinthine chart of the US government organizations involved in space activities which appears in the 2001 Space Commission Report.

Over several decades, the legislative and executive branches of our government had created a large set of overlapping and sometimes conflicting legal, regulatory, and organizational arrangements to manage the nation's space-related affairs.

cern. The intelligence surprises of the 1990s reinforced these concerns. Hence, the commission wrote of the potential for a "Space Pearl Harbor"—the possibility that with no forewarning, the US might find itself the victim of a surprise attack on our space assets, crippling our military and intelligence capabilities and the American economy.

In some ways our country's vulnerability was self-inflicted. Over several decades, the legislative and executive branches of our government had created a large set of overlapping and sometimes conflicting legal, regulatory, and organizational arrangements to manage the nation's space-related affairs. To illustrate the point, the final report included a labyrinthine chart rendering the commission's mapping of these overlapping relationships (figure 1).

Given the complexity of the subject and its vital importance to the nation's security, all of our members were firmly of the view that strong presidential leadership was essential to the creation and operation of a more effective and efficient organization and management structure for space and to reduce the evident and growing vulnerability of America's space assets. Toward that end, we recommended the creation of a Senior Interagency Group for Space within the National Security Council (NSC).

But we also recognized that presidential leadership by itself would produce little if the secretary of defense (SECDEF) and then-director of central intelligence (DCI) did not reach agreement on what needed to be done and how it might be accomplished. As the heads of the two agencies with the most influence over and that were most dependent on space assets, the commission believed their leadership on the matter was essential.

Inter-agency arrangements between DoD and the IC did not require a great deal of the commission's attention. Revitalization of the executive committee (EXCOM), an informal but powerful tool used by past SECDEFs and DCIs to surface and resolve matters of the moment over which they held control, was seen by the commission as a reasonable and effective way to address interagency issues.

The central charge from Congress to the commission was to assess the cost and benefit of establishing a military department and service dedicated to the national security space mission. There was a general consensus within the commission for the creation of a "Space Service." That consensus, however, was tempered by an understanding of the bureaucratic and political difficulties associated with such a massive change to the organization and management of national security space and within the DoD. An alternative to a Space Service was explored in the form of a space-focused "corps" within the Air Force. But in the end, this too was thought to be equally fraught with difficulty.

We instead recommended an internal reorganization of the Air Force that would consolidate the entire DoD's space-related activities—policy, acquisition, and operations—under the undersecretary of the Air Force (USECAF) who would act as the department's executive agent for space. We recommended that two additional "hats" be given to the USECAF. The second was to designate the USECAF as the DoD executive agent (EA) for space, responsible for all DoD space programs. The third hat would be as the director of the National Reconnaissance Office (DNRO), the agency responsible for building and operating space-based reconnaissance platforms. As it stood (and still does), the NRO was a joint venture between SECDEF and the DCI (now director of national intelligence [DNI]). Its director was then an assistant secretary of the Air Force.

By elevating the stature within the US Air Force of the DNRO, and assigning to the USECAF responsibility as DoD EA for space with control over the rest of the DoD's space programs, the commission believed a powerful forum for national security space requirements, acquisition, and operations could be created. It would have a single person in charge of research, professional development of space personnel, requirements, and budgeting. It also enabled rationalization across the DoD space program on essential capabilities such as ballistic missile launch warning; communications; weather; and positioning, navigation, and timing. And, by combining the DoD and NRO programs under a single entity, it promised to economize, rationalize, and eventually re-energize the "black" space programs in relationship to the "white" programs managed by DoD. Finally, it created a position that could have significant influence in the broader interagency discussions on space.

The resulting organizational structure created the conditions under which a future SECDEF had three options: (1) mature the organization and processes as designed; (2) create a Space Service by moving the new organization out of the US Air Force and elevating the USECAF to a service secretary; or, (3) take an evolutionary step toward a service by creating a "corps" within the US Air Force.

A Scorecard on the Recommendations

The commission's focus on these major themes resulted in a set of specific recommendations. It would fall to the incoming SECDEF to decide which of the recommendations to implement. As it turned out, one of us left the Space Commission in late December 2000 to accept the nomination by President George W. Bush to become SECDEF.

Shortly after taking office in January 2001, we directed the reorganization of the Air Force along the lines recommended by the commission. Toward that end, in addition to "triple hatting" the USECAF, we realigned Air Force Space Command (AFSPC) and the Space and Missile Systems Center to bring

the operational and acquisition arms of the US Air Force under the undersecretary. In addition, we assigned the Air Force the lead role of conducting offensive and defensive space operations within the joint warfighting structure. In keeping with this newfound responsibility, the Air Force undersecretary was assigned milestone decision authority over space programs by the undersecretary of defense for acquisition, technology, and logistics.

The commission had recommended creation of a major force program for space. In the end, a “virtual” major force program was established by the comptroller by adding prefixes to space items in the budget reporting system to increase visibility.

An undersecretary of defense for space and intelligence was recommended by the commission but not created. It was envisioned as the counterpart to the Air Force undersecretary within the Office of the Secretary of Defense (OSD). As the SECDEF’s principal staff assistant on these matters, the undersecretary of defense for space and intelligence (USD[SI]) would have had policy oversight and played a significant role in internal programming and budget decisions within DoD and represented DoD interests within the broader US government.

Instead, in 2003 an undersecretary of defense for intelligence (USD[I]) was approved by Congress. The USD(I) exercised oversight of DoD equities within the then-National Foreign Intelligence Program (NFIP) and later the Military Intelligence Program (MIP). The NFIP (now National Intelligence Program) and the MIP included national space programs related to intelligence, surveillance, and reconnaissance (ISR). However, the USD(I)’s oversight did not extend to “white” programs related to warning; communications; weather; positioning, navigation, and timing (e.g., GPS); and so forth.

The DoD’s “white” programs remained fully under the purview of the Air Force undersecretary who exercised oversight of those programs in his US Air Force and EA for space “hats.”

This turned out to be a workable, but less than ideal arrangement. By design, the USECAF did not, either as a service undersecretary or as DNRO, have a seat at all of the inter-departmental and intra-agency forums where matters that affected national security space were discussed and decided. But nowhere in OSD was there a single office, as had been recommended by the commission, the sole purpose of which was to oversee all aspects of national security space. The oversight of national security space was made easier by the close working relationships shared by the SECDEF, and successively by DCIs, Mr. George J. Tenet, Mr. Porter J. Goss and the first DNI, Ambassador John D. Negroponte. Significant issues related to national security space, primarily those affecting the “black” programs, were resolved by this EXCOM. By all accounts, Secretary Robert M. Gates maintained close relations with DNI John M. McConnell and continued to do so with DNI James R. Clapper, who in his previous position had served as Gates’ USD(I).

Central Intelligence Agency Director Tenet agreed to the commission’s recommendation on the dual-hatted appointment of the DNRO and USECAF. The new arrangement proved particularly challenging. The US was on the verge of recapital-

izing nearly all of its national security space assets, and each of them was experiencing significant difficulties. The seeds of those troubles were sown in the 1990s and their resolution was not achieved until several years later.

Subsequently, we decided not to dual hat the USECAF as the DNRO. A number of developments within the Air Force, as well as the creation of the DNI, contributed to that decision. This decision placed a greater responsibility on the USD(I) to provide oversight of the ISR-related programs and to forge a working relationship with the newly formed staff of the DNI on policy, requirements, acquisition, and budgets.

Over time that oversight was distributed among a number of Pentagon offices, including those of the undersecretaries for acquisition, policy, and the comptroller, as well as the assistant secretary for network information and integration with residual oversight remaining in USD(I) for some aspects of national security space.

Although the early internal DoD and SECDEF-DCI/DNI adjustments went forward with some dispatch, organizational adjustments within the White House, via the National Security Council, did not. The advancement of any issue of national scope is strengthened by high level White House involvement. Whereas the commission had called for a Senior Inter-agency Group for Space, President Bush instead opted for an Interagency Working Group for Space, chaired by a director for space policy on the NSC staff. The commission had also recommended creation of a Presidential Advisory Commission of space experts and former government officials that was not acted upon in the White House.

In the period after 2006, the momentum behind the effort to organize and manage national security space along the lines recommended by the commission diminished. Some of that momentum had begun to dissipate earlier for a number of reasons. Not least among them was the time devoted by senior DoD leadership to the efforts associated with repairing the troubled “black” and “white” space programs, planning and prosecuting the global war on terror, and the recalibration that followed the creation of the DNI and the authorities assigned to him as the head of the IC, particularly with respect to acquisition.

For its part, the Obama administration has undertaken efforts to lend greater attention to space-related issues. The new National Space Policy reflects the foreign, defense, and domestic policies of the administration. It reinforces the belief expressed by the Space Commission about the central place of space in the well-being of the nation. There are departures from the policy of the Bush administration—notably the willingness to entertain arms control proposals related to activity in space. The Obama administration’s interest in teaming with foreign partners on space capabilities and activities vital to the US is also a marked departure from the previous administration. At the same time, language in the current policy underscoring the vital American interests in space and its determination to defend those interests are very much in keeping with the long tradition of US policy.

Within DoD, interest in space related matters seems driven in the main by the desire to control costs in a budget-constrained

environment and assure that systems meet schedule and performance targets. Both are worthy objectives. The recent decision by the deputy secretary of defense to designate the SECAF as the executive agent for space is intended to centralize, at the very least, policy oversight and budgetary and acquisition advice within DoD. The SECAF will represent all space issues at the Deputy's Advisory Working Group and at the recently established Defense Space Council.

That said, the SECAF as the DoD's point person for space has not been given the wide range of authorities either contemplated by the Space Commission or delegated in the 2001-2003 timeframe, most especially milestone decision authority (which was subsequently withdrawn in 2005). Whereas in the earlier iteration the objective was to render the executive agent the senior-most official other than the SECDEF who could say "yes" and make it stick within the bureaucratic processes of the Pentagon, the current charter does not go that far.

Within the US Air Force, the decision to consolidate space acquisition within the Air Force's larger acquisition process evinces a different set of concerns than those of the Space Commission. It is in keeping with the increased emphasis on acquisition management not only in the US Air Force but across DoD. A valid case can be made that the acquisition of space assets is little different than any other asset and that senior professionals, properly trained, should be able to manage across portfolios. To be sure, space has a number of unique characteristics affecting procurement, but the same could be said of stealth aircraft and submarines. So long as there is a cadre of space professionals intimately involved in the generation of requirements and the management of acquisitions, those unique characteristics should be addressed. The fact that the commander of AFSPC remains a four-star billet within the US Air Force ensures that there is a pool of expertise to draw upon. That said, the effect of the decision is to undo a critical element of the management structure that the Space Commission had recommended as a way-station to a "corps" or Space Service.

The DoD and ODNI may be embarking on parallel paths to manage that portion of national security space that falls within their respective purview. If so, this may reflect genuine differences in their needs and approaches to defining and acquiring space capabilities. If it does, and "lanes in the road" are well marked and the larger issues of priorities and budgetary resources are properly framed and resolved through consensus reached by the SECDEF and DNI, such an approach could succeed. Indeed, well managed parallel approaches would be preferable to a single approach that does not satisfy the two most important suppliers and users of the nation's space capabilities and partners in defending them.

Enduring Issues

Of greater concern is the enduring potential for a "Space Pearl Harbor." Successive war games have illustrated how attractive our space assets are as a target for those looking to degrade US intelligence, military, and diplomatic capabilities.

The recent Chinese antisatellite weapon intercept of a satellite in orbit underscores the vulnerability of those assets. But it is worthy of mention that space assets are not vulnerable to direct attack alone. Cyber attacks can cripple US space capabilities as well.

For both the IC and DoD the vulnerability of our space assets presents a difficult, though solvable, problem. Knowing what goes on in space, or space situational awareness, is a challenging and potentially expensive task. Inevitably, we will be unable to know all that is going on. More broadly, efforts to identify, track, and warn about the full range of threats to space assets on orbit, on the ground or in the supply chain will yield—for the foreseeable future—at least as many questions about what we do not know, as answers about what we do know. Furthermore, the continuing advancement and proliferation of technologies that could harm the nation's space capabilities will undoubtedly generate threats entirely unknown to us until they are manifest through hostile action.

However our nation chooses to organize and manage its space capabilities, an investment in improving our awareness of potential threats to our national security space assets, the collection and analysis of intelligence, and the development of contingency plans to defeat and mitigate the effects of an attack are enduring issues in need of prompt and sustained attention.



Hon. Donald H. Rumsfeld (BA, Princeton University) was chairman of the Commission to Assess United States National Security Space Management and Organization (2000) and the Commission to Assess the Ballistic Missile Threat to the United States (1998). He was the 13th and 21st US secretary of defense. He currently chairs the

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Hon. Stephen A. Cambone (PhD, MA, Political Science, Claremont Graduate School; BA Political Science, The Catholic University of America) served as the staff director for the Commission to Assess United States National Security Space Management and Organization (2000) and the Commission to Assess the Ballistic Missile Threat to the United States (1998). From 2001 through 2006 he served, successively, as the special assistant to the secretary and deputy secretary of defense; principal deputy undersecretary of defense for policy; director of program analysis and evaluation and undersecretary of defense for intelligence. He is currently an executive with QinetiQ, North America, headquartered in McLean, Virginia.

The Space Commission: 10 Years Later - Still a Work in Progress

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Recommendation 6: Separate Commander in Chief (CINC) of US Space Command (USSPACECOM) and North American Aerospace Defense Command (NORAD); from commander, AFSPC.⁴

At the turn of the century, national security space (NSS) had its roots in many different US government defense and intelligence organizations. Because there was no single home or agency responsible for NSS below the president it was difficult to get the myriad of organizations involved to agree, much less to execute a common set of NSS objectives. Looking at a chart that showed the organizational relationships for NSS was enough to make anyone's head hurt.¹ Poor organizational alignment contributed to inefficiencies. More importantly our national security was not being well served and taxpayers' dollars were not being well spent.

To provide recommendations on a better way of doing business, the US Congress in the National Defense Authorization Act of 2000 chartered the Commission to Assess United States National Security Space Management and Organization (also known as the Space Commission). As a group of 13 commissioners, we produced a report in January 2001 that contained 10 major recommendations, which we unanimously approved, aimed at restructuring the NSS community to accomplish the charter set forth by Congress. We intentionally limited the number of recommendations. Our thinking was that 10 was a manageable number and would not overwhelm decision makers who had the responsibility of considering our report.

Reviewing all 10 of our recommendations cannot be done appropriately in this short article. So, I will focus on specific aspects of the three I believe were most important to creating a more effective NSS community:

Recommendation 7: Military Services.²

- Keeping Air Force space a part of the Air Force and not creating a space corps or separate space service.
- Realigning the Space and Missile Systems Center (SMC) under Air Force Space Command (AFSPC).

Recommendation 8: Aligning Air Force and National Reconnaissance Office (NRO) Space Programs.³

- Combining the positions of undersecretary of the Air Force (USECAF) and director of the NRO, and the continued separation of black (NRO) and white (Air Force) space.

Keeping Air Force Space a Part of the Air Force

As part of our review, we hotly debated the organizational placement of Air Force space. There were feelings the Air Force could not afford space and/or had not been a good steward of space, and a change was in order. Three options were considered: (1) leave Air Force space as part of the Air Force, (2) create a space corps under the Department of the Air Force similar to the Department of the Navy's Marine Corps, or (3) create a separate space service. Some commissioners strongly believed the Air Force was never going to get adequate funding to support both the air and space missions, and therefore, a separate space service was the best choice. Others felt aligning all the Air Force space forces in a space corps created just the right separation between the air and space parts of the Department of the Air Force and would allow resources to be properly allocated between the two. Still others felt keeping Air Force space totally within the Air Force provided the best solution because it was important to keep close coordination and alignment between air and space. Further, the overhead expense of creating a separate service or corps would in large part come out of Air Force total obligatory authority providing less funding for the air and space missions.

In the end the commissioners unanimously decided to leave Air Force space as a part of the Air Force. Looking back now after 10 years have gone by, I believe the commissioners provided the right advice. The nation has greatly benefited from the integration of air and space in direct support of warfighters, particularly in Iraq and Afghanistan. I believe this would not have happened to the degree it has if we had split off Air Force space into a corps or separate service. Additionally Air Force space just did not have enough mass to justify the overhead expense of creating a corps or a separate service. The same holds true today. Until we operate routinely in space it is difficult to justify moving space out of the Air Force. I am not convinced it will ever make sense. In my opinion our former Chief of Staff, General Ronald R. Fogleman had it right when he said in the late 90s that we are an Air Force today migrating to an air and space force and someday we will be a space and air force. This is still the right construct for the Air Force to think about space.

There will always be the argument from well intentioned

More importantly our national security was not being well served and taxpayers' dollars were not being well spent.

people that the Air Force does not have the resources to fund both air and space, but there is no feasible alternative. At best the defense budget is a zero sum game, especially given the budget environment we are experiencing today and will likely experience for the next decade. In my opinion, shedding the space mission at any point in the future could number the days in which the Air Force remains relevant. There will come a day when the US Air Force will become the US Space Force.

Realigning SMC under the AFSPC

The importance of realigning SMC under AFSPC was not evident to many of the commissioners who had not been part of the Air Force. The alignment at the time of SMC under the Air Force Material Command (AFMC) seemed logical because acquisition, which SMC did for Air Force space, was part and parcel to AFMC. What was not evident was that prior to 1982 when AFSPC was formed, the center of the universe for Air Force space was at what is now called SMC. In fact, much of AFSPC was formed from elements of SMC. This organizational arrangement, space operations in AFSPC and space acquisition in AFMC, set up a battle for control of Air Force space, not a healthy situation for the Air Force's fledgling space mission. This was just another manifestation of a dysfunctional NSS organization.

Having SMC as a part of AFMC also created another problem. The vast majority of our Air Force is related to our air mission. In 2001, all of our major commands except AFSPC had an air focus. This made it easy to form a cadre of air professionals. With the formation of AFSPC, all of Air Force space resided in one command except for space acquisition. This was dysfunctional for both AFSPC and SMC and made training of a cadre of space professionals very difficult.

After much discussion the commissioners settled on placing SMC under AFSPC. Doing so corrected the problems mentioned above by aligning all of Air Force space under one command. This was important to some of the commissioners who felt that if the Air Force could not afford or did not provide proper stewardship of space, having all the Air Force space elements aligned would make it easier to split off space from the rest of the Air Force to create a space corps or separate service at some point in the future.

In the decade since the Space Commission produced its report, the alignment of AFSPC and SMC has provided a critical mass for Air Force space at a very important time given the problems we faced in the execution of Air Force space programs. It has taken some time to right the ship, but having SMC as a part of AFSPC helped the process by being able to more easily focus the Air Force's attention on the problems at hand and having all of Air Force space speak with one voice.

That said, putting SMC under AFSPC has not always been the happiest of marriages. That is primarily because SMC still serves two masters. For its acquisition responsibilities it reports to the assistant secretary of the Air Force for acquisition. For its organize, train, and equip responsibilities it reports to the commander of AFSPC. This bifurcation at the senior leadership level is not optimum, but living with it, in my opinion, is

far better than putting SMC back under AFMC, as some have proposed in recent years. It has been my experience that when it comes to creating effective organizations, aligning by mission far outweighs aligning by function in most cases.

Combining the Positions of USECAF and Director of the NRO and the Continued Separation of Black (NRO) and White (Air Force) Space

To provide synergism in the Department of Defense (DoD) for NSS, the commissioners felt both black and white space should report to the USECAF who would also be appointed the director of the NRO. The rationale was straight forward. A common leader could eliminate duplication and waste and could identify best practices from both organizations to implement across NSS. There had been a long history of combining the two positions at the level of the undersecretary and in some cases the secretary of the Air Force, although at the time of our report the positions were separate.

In this case, as commissioners I don't think we got it right. Our recommendation was good as far as it went, but we did not anticipate the workload the combined positions would experience and as a result were not prescriptive on how to deal with it. Further, when the position had been dual-hatted in the past the person filling it had always enjoyed the support of intelligence and defense bosses. We did not anticipate support would wane, especially on the third floor of the Pentagon, in the years following the implementation of our recommendation.

As time went by, key decision makers felt one person doing both jobs was overwhelming to the detriment of both the Air Force and the NRO. Dealing with poor execution of both black and white space programs, resulting in large part from the total system performance responsibility initiatives of the 90s, contributed to the perception that a single person could not effectively deal with all the issues. As a result, in 2005 the positions were separated and remain so today. This is not a good outcome and continues to feed a dysfunctional NSS.

On the other hand, maintaining the separation between black and white space in my opinion was the right call and still is. The government clients these two organizations serve are the same in some cases and different in others. Putting all of black and white space together in a single organization would not serve the best interests of the nation, but sharing and commonly implementing best practices, which could have huge benefits, has only been pursued at the margins and deserves another hard look. I would add there are some mission areas or elements within mission areas that would serve NSS better if they were combined into one organization or the other. For example, in some cases letting the NRO be the acquiring agency and the Air Force the operating agency might be a good model for the future. The cultures of the two organizations are different for good reason, but that does not mean common ground cannot be found to the benefit of both, especially as DoD pursues initiatives outlined in the 14 September 2010 undersecretary of defense for acquisition, technology, and logistics memorandum entitled *Better Buying Power: Guidance for Obtaining Greater Efficiency and Productivity in Defense Spending*.

One solution might be to stand up a separate USSPACECOM again, but that is probably not in the cards given the budget situation.

Separating the Positions of the CINCSpace and the Commander, AFSPC

The separation of the positions of CINCSpace and the commander, AFSPC (COMAFSPACE) each to be filled by a four-star equivalent officer was not a contentious issue for the commission. Certainly there were reasons to link the two, but when the position of CINCNORAD (CINCNORAD) was also added to the mix, precious little time could be spent by the triple-hatted commander on AFSPC business; at least that was the case during my watch. Consolidating the three positions in a single commander was not in the best interest of the men and women of NORAD, USSPACECOM, or AFSPC.

There was a time in the late 80s and early 90s when the two positions were separated. The CINC position at USSPACECOM and NORAD was a four-star, but AFSPC was commanded by a two or a three-star. While the intent was good, the fact that AFSPC was an Air Force major command lead by a two or three-star while all other major commands were lead by four-stars did not bode well for AFSPC. To some it meant that in the eyes of the Air Force, space was not on an equal footing with air. Whether it was perception or reality is a debatable point, but to the men and women of AFSPC it meant they did not have the same clout as Airmen in the other major commands.

In 1992, the positions were once again united with a single four-star holding the positions as CINCSpace, CINCNORAD and COMAFSPACE. That arrangement continued until April 2002 when the commission's recommendation to separate the dual-hatted CINC positions from COMAFSPACE took effect with the AFSPC commander appointed to four-star rank. This was a major event in AFSPC history. Finally AFSPC had a four-star commander unencumbered by other command responsibilities.⁵

Indirectly related to this change in Colorado Springs was the decision by the secretary of defense implemented in October 2002 to place all "global missions" in US Strategic Command (USSTRATCOM) and to stand down USSPACECOM. The Space Commission did not discuss or even contemplate this change. The loss of a unified command focused on space, strategic warning/defense, national missile defense, and cyber was a huge mistake and has hurt the nation. Simply put, these missions alone were a full time job for a unified command. Placing the four USSPACECOM missions together with the responsibility for global strike, global intelligence, surveillance and reconnaissance, combating weapons of mass destruction, and defense information operations at USSTRATCOM has, in my opinion, created a no-win situation. We are asking too much of the combatant commander at USSTRATCOM and his staff. All these missions deserve full-time attention or they would not be unified command missions.

When over tasked, you prioritize. The instinct is to focus first on supporting our forces in harm's way. No question that

is the right decision. But it also means with limited resources some missions are not done as well as they should be. You do not have to look far to see what I am talking about. It is clear now that we took our eye off the ball in the last decade when it comes to the Air Force strategic nuclear mission. The incidents at Minot and Ogden are well documented. There was plenty of blame to go around. With all the things we are asking USSTRATCOM to do, were they able to keep the strategic nuclear mission front and center? I suspect not. Would there have been a different outcome if they had? I suspect so. I believe it is time to come up with another organizational arrangement to reduce the burden we have placed on the USSTRATCOM commander and his staff. Do we have to wait for another major incident to act?

One solution might be to stand up a separate USSPACECOM again, but that is probably not in the cards given the budget situation. So what else could be done? Since AFSPC now has the responsibility for both space and cyber, does it make sense to relieve USSTRATCOM of those two missions and change the organizational structure in Colorado Springs to form a new command that combines the aspects of a joint unified command with the traditional responsibilities of AFSPC? Some dual-hatting and the addition of joint billets would be required, but it would not be as financially burdensome as standing up a separate unified command, and it would provide important focus on two very critical national security missions for the nation. Additionally USSTRATCOM would now be able to concentrate on its remaining missions, again to the benefit of national security.

What the organizational construct should be I will leave up to those of you in uniform today and your civilian leadership. I encourage you to discuss the issue. It is a different world today. What would have worked in the past may not be feasible today, but what took place in the past should be an important part of any debate. In my opinion we made a serious mistake in standing down USSPACECOM. The mission area needs more attention than USSTRATCOM is able to give it. I am not pointing a finger at USSTRATCOM or its joint components. The men and women in those organizations are doing the best they can given the hand they have been dealt. But because their plate is so full, things are not being done that need be done to further our nation's security in space. The longer we wait to bring back focused and sustained attention on space, the further behind we will find ourselves. What are we waiting for, a "Space Pearl Harbor?"

Final Thoughts

Every year within the national security arena there are a number of commissions, panels, boards, and so forth that provide recommendations to decision makers. It has been my experience that most of the recommendations are considered, but few are implemented. The Space Commission was a bit

unique in this regard. Our chairman became the secretary of defense. This clearly gave a push to the recommendations we made. While not all were implemented, many were and had the desired effect on NSS. Since the 2001 Space Commission there have been other reviews of NSS, which says to me that work still needs to be done. I have heard people say rearranging the deck chairs (organizational changes) really does not get at the root causes of problems, and therefore, is not worth the effort. I disagree. We are dealing with a complex issue here. There is no single set of solutions that will be acceptable to all the parties concerned. However, it is important to keep chipping away at the problems and make changes where we can achieve agreement. We owe that much to our fellow taxpayers. More importantly, we owe it to our nation, which demands we do our utmost to ensure NSS is serving the greater interests of our national defense in the protection of all our citizens.

Notes:

¹ House Committee on Armed Services, *Report of the Commission to Assess United States National Security Space Management and Organization*, 11 January 2001, fig. 1, 3.

² Ibid., 89.

³ Ibid., 90.

⁴ Ibid., 87.

⁵ General James V. Hartinger (1 September 1982 - 30 July 1984) and General Robert T. Herres (30 July 1984 - 1 October 1986) were both four-star commanders of AFSPC but were dual-hatted as CINCNORAD. From September 1985 to October 1986 General Herres was also CINCSPACE. In October 1986 General Herres passed command of AFSPC to Maj Gen Maurice Padden, but retained the positions as CINCNORAD and CINCSPACE until February 1987.



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General Estes retired from the US Air Force in 1998 after serving our country for 33 years. At that time he was commander in chief of the North American Aerospace Defense Command and the US Space Command, and commander of the Air Force Space Command headquartered at Peterson AFB, Colorado.



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Reconsidering the Space Commission 10 Years Later

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The initiation and completion of the Commission to Assess United States National Security Space Management and Organization (Space Commission) 10 years ago was one of the most significant events in Air Force space governance since the space age began. The reason is it had very senior attention on how the Air Force, intelligence community (IC), and Department of Defense (DoD) should be organized for space. And just as significant, when it was completed, the former chairman of the commission, Donald Rumsfeld, became the secretary of defense (SECDEF). This allowed him to implement key portions of the Space Commission report. Not all such reviews get implemented for a variety of factors, but this report was one that saw a vast majority of its recommendations put in place.

But it is time to take a look at where we are ten years later in regard to the Space Commission. Factors leading to the creation of the Space Commission, its major recommendations and their implementation, the role of Secretary Rumsfeld, and the impact of the 9/11 attacks, as well as other changes in the strategic environment are important considerations in setting the context for this reevaluation. Understanding of more recent developments, including the Review of Headquarters Air Force Management of Space Responsibilities directed by Secretary of the Air Force Michael Donley and the current space management structure, is also needed to provide a more complete perspective.

Context for the Space Commission

The Space Commission was empowered by a comprehensive charter and high-level members; it was the most important and influential group ever formed to examine these broad issues. The Space Commission was the brainchild of then-Senator Bob Smith (R-NH); it was established by the fiscal year 2000 National Defense Authorization Act, met over 30 times beginning on 11 July 2000, and delivered on schedule its final report to Congress and the SECDEF on 11 January 2001. The Air Force, contributing the overwhelming majority of DoD space capabilities (estimated in 2000 to include 90 percent of space personnel, 85 percent of the military space budget, 86 percent of space assets, and 90 percent of space infrastructure),¹ was the actor studied most closely by the Space Commission.

Since the recognition of the importance of space to the DoD in 1961, the Air Force has had a key role. On 6 March 1961, Secretary of Defense Robert McNamara issued DoD Directive 5160.32, which assigned to the Department of the Air Force responsibility for all “research, development, test, and engineering of DoD space development programs or projects which are approved hereafter.”²

This was modified in 1970, but stayed in place as the guiding document until the creation of the Space Commission and implementation of its recommendations—some 40 years later. Much has changed since then and the Air Force made many modifications to its internal structure on space, but a large part of how it was structured stayed in place.

To effectively manage space capabilities, the Air Force has made significant changes in its organizational structure during its history. Most of these changes, however, affected organizations outside of the headquarters (HQ). For example, the first major change occurred on 17 March 1961 when Air Force Systems Command was created, in part, “to manage its newly acquired responsibilities for all research, development, and acquisition of aerospace and missile systems more efficiently.”³ In September 1982, Air Force Space Command (AFSPC) was created to consolidate the management of space operations. Most of these changes were the result of major studies, white papers, or blue ribbon panels assigned to look at the future role of space in the Air Force.

These efforts did not address in detail how the HQ should be organized and were generally outward looking. By contrast, the Space Commission focused on how HQ Air Force and Office of the Secretary of Defense (OSD) staff should be organized. It led to the structure where the secretary of the air force was designated the DoD executive agent (EA) for space and was given centralized authorities for Air Force, DoD, and National Reconnaissance Office (NRO) space management. The Air Force was also given the authority to re-delegate the DoD EA for space to the undersecretary of the Air Force (USECAF). The HQ Air Force then reorganized with the USECAF as the focal point for its space authorities and responsibilities.

For most of its existence, the Air Force used the aerospace concept to structure its thinking about space; this doctrine indicates air and space form a seamless operational medium and implies the Air Force should be the lead service in providing space capabilities. Air Force Chief of Staff General Merrill McPeak emphasized the importance of space assets in enhancing the combat effectiveness of coalition forces during the 1991 Gulf War, when he called the conflict “the first space war” and changed the Air Force mission statement in June 1992 by adding the words “air and space.”⁴ According to General Thomas Moorman, McPeak’s vice chief of staff, with this change, “Air Force space operations were formally legitimized and placed conceptually on an equal footing with air operations.”⁵ Shortly thereafter, in its *Global Engagement* vision statement of November 1996, the Air Force issued what is probably its most strident position ever regarding the importance of space to the Air Force’s future: “We are now transitioning from an *air* force to an *air and space* force on an evolutionary path to a *space and air* force.”⁶ But this was reviewed in 1998 when Air Force Chief of Staff General Michael Ryan created the Aerospace Integration Task Force, tasking it to look in particular at the wis-

dom of continuing to use the separate “air and space” construct. The Air Force’s white paper of May 2000 (*The Aerospace Force*) and its vision statement of June 2000 (*Global Vigilance, Reach & Power*)⁷ are the fruits of this effort and took the service back to the aerospace concept with its emphasis on aerospace integration. This then set the stage for the creation of the Space Commission.

Space Commission Recommendations and Their Implementation

The Space Commission report was a very comprehensive examination of space and security that provided foundational analysis, a broad range of findings, and ten major recommendations. Important findings of the commissioners included: current US dependence on space, rapid growth in this dependency, and the vulnerabilities this creates, which demand that US national security space interests be recognized as a top national security priority; warning that the US was an attractive candidate for a Pearl Harbor-type attack in space; and assessing that because space, like all previous mediums humanity has encountered, will eventually see conflict, the US must develop superior space capabilities to deter and defend against hostile acts in and from space. Secretary Rumsfeld signed a memo on 18 October 2001 directing DoD to undertake 32 specific implementation actions and to make other changes, initially resulting in several significant national security space (NSS) organization and management changes in direct response to Space Commission recommendations.

The Air Force moved quickly and effectively to implement these major recommendations by taking actions. These actions include: making the commander of AFSPC a non-flying four-star billet and moving AFSPC out from under authority of US Space Command (USSPACECOM); designating the USECAF as the director of NRO, Air Force acquisition executive for space, and DoD EA for space with milestone decision authority (MDA) over all DoD space programs; aligning the Space and Missile Systems Center (SMC) underneath AFSPC instead of Air Force Materiel Command and designating the commander of SMC as the program executive officer for space with a direct report to the USECAF; and establishing a Major Force Program (MFP) accounting category for the NSS budget.⁸ In addition, the Directorate of Space and Nuclear Deterrence (SAF/AQS), moved from the Office of the Assistant Secretary of the Air Force for Acquisition (SAF/USA) to the Office of the USECAF and was renamed director, space acquisition, a deputy for military space was created in the Office of the USECAF, and the Office of the Director, National Security Space Integration (SAF/USI) was established.

The Impact of 9/11 and Other Evolutionary Changes in NSS Management and Organization

When George W. Bush became president in 2001 and Donald Rumsfeld was confirmed as SECDEF, many believed that the stars were favorably aligned for the US to move rapidly and far down the path toward greater military use of space. Secretary Rumsfeld brought into the Pentagon Dr. Stephen Cambone, the Space Commission executive secretary, making him his “go to” person for space and eventually placed him in the undersecretary of defense for intelligence (USD[I]) position created in March 2003.

When 9/11 occurred, the US government began to look at how it was organized to help deal with the new terrorist threat. This

had an impact on the principles on which the Space Commission was based, and in time, led to many significant changes. The director of national intelligence (DNI) position was established by the Intelligence Reform and Terrorism Prevention Act of 2004, and the DNI assumed new legal, budgetary, and oversight authorities over the IC, including the NRO. These changes, along with the evolving role of the new USD(I) position within DoD, complicated the organizational relationships between NRO and DoD.

Another major initial change to the Space Commission’s vision for NSS management and organization came on 1 October 2002 when USSPACECOM was merged into US Strategic Command (USSTRATCOM). This change came after the 9/11 attacks and was associated with creation of US Northern Command and increased emphasis on homeland defense. This was a major reorganization that placed USSPACECOM within USSTRATCOM. Under the new structure, space is one of a wide range of very important USSTRATCOM mission areas that include: deterring attacks on US vital interests, ensuring freedom of action in cyberspace, delivering integrated kinetic and non-kinetic effects including nuclear and information operations in support of US joint force commander operations, synchronizing missile defense plans and operations, and combating weapons of mass destruction. This provided an integrated command of a scope that allows true cross-domain integration.

Gradually, many of the centralized authorities and responsibilities granted to the Air Force were removed. Major ongoing changes included: returning MDA for DoD space programs to the undersecretary of defense for acquisition, technology, and logistics in March 2005; separation of the NRO director position from the USECAF in September 2005; creation of Major Force Program for Space (MFP-12) in the fiscal year 2008 Defense Appropriation Act and rescinding National Security Space Policy 03-01 in March 2009. Additionally, the USECAF was assigned a significant additional duty as the chief management officer of the Air Force with responsibility for the management of business operations of the Air Force. Cumulatively, these changes challenged the foundation of the changes put in place beginning in 2001.

Changes in DoD and Headquarters Air Force Space Management

In December 2009, Air Force Secretary Michael Donley directed a review of HQ Air Force space management and responsibilities. This study was completed in July 2010 and Secretary Donley used its results to make some important changes. He appointed the USECAF as the focal point for space on the Air Staff. As such, the USECAF has responsibility for Air Force space issues within the Pentagon. The USECAF is responsible for coordination of functions and activities across the HQ Air Force space enterprise and is the senior Air Force official for all space matters to include planning, policy, strategy, international relations, and space interagency relations, as well as serving as the primary interface to OSD for space issues.

To help support the USECAF, the Air Force created the Air Force Space Board, which brings operations, policy, intelligence, acquisition, finance, legal, and strategy all together to provide guidance on critical space issues. This is a very significant move on the part of the Air Force; the board is co-chaired by the USECAF and the Air Force vice chief of staff. The Board meets

on a monthly basis and in just the first several months has looked at many important topics, including the evolutionary acquisition for space efficiency proposal, criteria for new launch entrants, international space cooperation, Red Flag exercise results, and the 15-year Space Investment Strategy. One of the other reorganization steps taken was to bring space acquisition back under the assistant secretary of the Air Force for acquisition. This move allows greater synergy, synchronization, and consistency of acquisition policy, no matter what the Air Force is developing.

In addition to the internal Air Force changes, DoD has also made significant changes within its structure. The creation of the Defense Space Council (DSC) puts in place the principal advisory forum on all space matters. Secretary Donley is the chair of this council that is comprised of defense and intelligence personnel from OSD, the services, and the IC. It, too, meets on a monthly basis and has discussed key areas such as the National Security Space Strategy (NSSS) and the space industrial base. The DSC allows a high level of discussion across DoD to occur on a regular basis. It will set priorities, provide strategic guidance, and help align programs with overall policy and strategy. And just as important, it will guide the development of architectures and an international engagement framework to support the strategy.

The reason the secretary of the Air Force is the chair of the DSC is Deputy Secretary of Defense William J. Lynn also re-validated the position of the EA for space, which is held by Mr. Donley. The EA for space is the principal advisor for space to the deputy secretary of defense and the DSC is the EA for space's primary means to help carry out that role. One of the first tasks of the DSC was to recommend consolidation or realignment of the numerous DoD bodies currently involved in space. Mr. Lynn also authorized the dissolution of the National Security Space Office and the establishment of a new joint space office. Each of these moves is a significant and positive development that is helping us reconsider how we acquire and manage space capabilities. There will be a professional staff to support both the EA for space and the DSC.

The DSC also will oversee the implementation of the NSSS. Although the NSSS states that space is becoming contested, congested, and competitive, it also talks about a more cooperative and collaborative approach for NSS. It emphasizes the need for increased information sharing and cooperation through our international partnerships, a commitment to help energize our space industrial base within the confines of an evolving fiscal reality, and an awareness that our space-based capabilities are vital to our national defense and must therefore be robust and resilient.

The new NSS management and organization recognizes the changes that have occurred since the Space Commission recommendations were implemented. But one thing that has not changed is the immense value that space assets and space operations provide for our warfighters and for our national security. It has been a busy year in space in terms of policy and organizational structure, with an increased focus on the space enterprise from senior leadership. The Air Force and DoD have made significant changes in space governance, and will continue looking for ways to advance efficiency and effectiveness. The goal of these changes, however, has always been to assure and improve the space effects provided to our warfighters.

Notes:

¹ General Michael E. Ryan and the Honorable F. Whitten Peters, *The Aerospace Force: Defending America in the 21st Century: A White Paper on Aerospace Integration* (Washington, DC: Department of the Air Force, May 2000), 5.

² For the text of DODD 5160.32 see John M. Logsdon, ed., with Dwayne A. Day and Roger D. Launius, *Exploring the Unknown: Selected Documents in the History of the US Civil Space Program, Vol. II: External Relationships* (Washington: National Aeronautics and Space Administration History Office, 1996), 314-15.

³ Joshua Boehm with Craig Baker, Stanley Chan, and Mel Sakazaki, "A History of US National Security Space Management and Organization," paper prepared for the Space Commission, (Washington: Space Commission Staff, n.d.), <http://www.fas.org/spp/eprint/article03.html>.

⁴ General Thomas S. Moorman Jr., "The Air Force in Space, Its Past and Future," in *The US Air Force in Space: 1945 to the Twenty-First Century*, ed. R. Cargill Hall and Jacob Neufeld (Washington, DC: USAF History and Museums Program, 1998), 174.

⁵ Ibid.

⁶ General Ronald R. Fogleman and the Honorable Sheila E. Widnall, *Global Engagement: A Vision for the 21st Century Air Force* (Washington, DC: Department of the Air Force, November 1996), 8; emphasis in original.

⁷ Gen Michael E. Ryan and the Honorable F. Whitten Peters, *Global Vigilance, Reach & Power: America's Air Force Vision 2020* (Washington, DC: Department of the Air Force, June 2000).

⁸ Government Accountability Office, Report to Defense Committees, Defense Space Activities: Organizational Changes Initiated, but Further Management Actions Needed," (Washington: GAO, GAO 03-379, April 2003), 25-27.



Mr. Richard W. McKinney (BA, Business Administration, Washington State University; MBA, University of Montana; BS, Electrical Engineering, Air Force Institute of Technology), a member of the Senior Executive Service, is the deputy undersecretary of the Air Force for space programs, Washington, DC. He provides guidance, direction, and oversight for the formulation, review, and execution of military space programs. He provides the principal support to the undersecretary's role as the Headquarters US Air Force focal point for space matters and in coordinating activities across the Air Force space enterprise. He supervises military space and space related matters for the undersecretary; developing and executing Air Force space policy; integration of military space activities between Air Force, National Reconnaissance Office, NASA, other agencies and nations; and advising and supporting USECAF for strategic planning for the Air Force space programs.

Mr. McKinney is a 1973 distinguished graduate of the Air Force ROTC program. He served 28 years on active duty, retiring as a colonel in May 2001. Mr. McKinney is certified level three in the acquisition areas of program management, acquisition logistics, and systems planning, research, development, and engineering. He was the first program director of the Evolved Expendable Launch Vehicle Program. Mr. McKinney was appointed to the Senior Executive Service in 2002. Mr. McKinney previously served as the director for space acquisition in the Office of the Undersecretary of the Air Force, and was the Air Force liaison to Europe to facilitate and expand Air Force international cooperation on space with Europe. Prior to his current assignment, he was special assistant to the administrative assistant to the secretary of the Air Force where he was responsible for the review of the headquarters management of space responsibilities.

The Space Commission: 10 Years Later, But Not Quite 10 Years Closer

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US Strategic Command
Offutt AFB, Nebraska

In March 2001, I stood for the last time in the warren of empty offices at the corner of 21st and K Street NW in Washington, DC. These offices had been the home for the Commission to Assess US National Security Management and Organization (The Space Commission) for the past eight months, but the 13 commissioners and the 10 professional staff had almost all returned to their lives in and out of government. The Space Commission's report had been delivered to Congress on 11 January 2001, and in an unusual twist of fate, our chairman Donald H. Rumsfeld was now the secretary of defense (SECDEF) and our Staff Director Stephen A. Cambone was his special assistant. There was an air of excitement and expectancy across the entire space community that change was coming and coming soon.

That day in March 2001 was a magical time regarding my personal excitement and expectations regarding the Space Commission and the impact it would have on the nation's national security space (NSS) enterprise. Now, on its 10 year anniversary, it is a good time to assess the commission's findings and recommendations, how they were implemented, whether they had the desired effects, and discuss potential next steps.

Based on my experiences and insights, as well as recent interviews with former commissioners and experts in the area, I believe the Space Commission's fundamental conclusions, findings, and recommendations were for the most part sound, but we still have work to do to find more effective ways to organize and manage NSS.

My views have been informed by having a ringside seat inside the Space Commission as a member of the professional staff and while assigned to the Office of the Secretary of Defense (OSD) staff with a sole focus on staffing and briefing Space Commission implementation recommendations to Secretary Rumsfeld in the spring and summer of 2001. Last, as a senior Air Force space officer, I have lived the ebb and flow of Space Commission-related changes for the past 10 years.

The Space Commission's Conclusions, Findings, and Recommendations: On Target or Off the Mark?

Few people argue with the Space Commission's five, unanimous conclusions. I believe these conclusions were accurate statements of the problem at the strategic level and a solid foundation from which to anchor the rest of the report.¹

Most of the controversy surrounding the Space Commission centers on the 11 findings and 13 associated recommendations

aimed at implementing changes to national security management and organization. Now, 10 years later, the commission's findings and recommendations are convenient targets for criticism. For many, it is easier to say that the reason the NSS enterprise still struggles in some areas is that the "commission got it all wrong." I believe that is a convenient, but inaccurate analysis of our current state of affairs. In my opinion, the commission got most of it right. However, in hindsight, there are a few recommendations that were not as well founded as others and the next few paragraphs will cover two of the most important.²

Black/White Space Integration

The commission's report stated that both the "Department of Defense (DoD) and the intelligence community (IC) would benefit from the appointment of a single official within the Air Force with authority for the acquisition of space systems for the Air Force and the National Reconnaissance Office (NRO) based on the 'best practices' of each organization." The commission's solution to this finding was to dual hat the undersecretary of the Air Force (USECAF) as the director of the NRO (DNRO). This recommendation hearkened back to what some would call the glory days of the 1980s when Mr. Pete C. Aldridge adroitly managed both hats, including a few years as both the DNRO and secretary of the Air Force (SECAF).

There were two reasons this recommendation was not as effective as it might have been. First, the USECAF and DNRO had much less autonomy and freedom to manage their programs in 2001 than they had in 1981. Second, the commission recommended a significant restructure of the Air Force and the NRO without sufficient regard to the fact that there were fundamental differences in statutory authority and missions between the SECDEF and the director of central intelligence (DCI). As a result, there was no buy-in from the Air Force or the IC regarding the premise of *a single official within the Air Force with authority for the acquisition of space systems for the Air Force and the NRO based on the "best practices" of each organization*. This arrangement only lasted for the tenure of Mr. Peter B. Teets and the positions were split again after his term.

Incomplete View of Space Operations

The commission focused its work on a broad segment of the NSS enterprise, and made recommendations to streamline and realign organizations, career fields, and authorities based on a premise that the Air Force should adopt the NRO's acquisition and operations model, referred to as the "cradle-to-grave approach" in which a single organization was responsible for all aspects of the designing, building, and operating satellites.³

In addition, the commission also made specific recommendations to develop a military space culture. Their report stated

Space forces in the Army, Navy, and Air Force are now forward deployed afloat and with tactical maneuver units and are increasingly responsible for ensuring space products and space effects are integrated into the mission of a joint force commander.

“space benefits from a unique and close relationship among research, development, acquisition, and operations,” and the “exchange of personnel across space communities, between the operational and acquisition commands and between the Air Force and the NRO, is clearly desirable....” Further, the commission’s report stated that “improving the exchange of personnel among these organizations, would expand the space manpower base and could also help to reverse the retention problem among space acquisition officers by opening up new career paths and leadership opportunities within the Air Force.”⁴

The recommendation’s shortfall is that the NRO does not have true “cradle-to-grave” responsibility in the execution of the space-based intelligence, surveillance, and reconnaissance (ISR) mission. They build and operate national reconnaissance space platforms, but the National Security Agency (NSA) and the National Geospatial-Intelligence Agency (NGA) plan and task NRO satellites, and exploit and disseminate the data. In a sense, NSA and NGA employ the on-orbit NRO operated platforms, much the same way that the back end crew of a RC-135 Rivet Joint employs their weapon system, while Air Force pilots operate the platform.

This created a weakness in the Space Commission’s recommendation because it implied that the most important linkage from a career development perspective was a close connection and crossflow between personnel involved in space acquisition and operations. In hindsight, space systems are more and more integrated into tactical and operational combat operations. The military space culture was adding an entirely new segment of its force focused on planning and executing space operations in support of the joint fight. Organizations such as the Joint Space Operations Center at Vandenberg Air Force Base, California plan and task DoD space operations in close connection with directors of space forces in the geographic combatant commands. Space forces in the Army, Navy, and Air Force are now forward deployed, afloat, and with tactical maneuver units and are increasingly responsible for ensuring space products and space effects are integrated into the mission of a joint force commander. This new segment of the military space culture was not on the Space Commission’s radar and not accounted for in their recommendation.

Implementing the Space Commission’s Recommendations: Partial Success, but Work Remains

The very last paragraph in the findings and recommendations section of the Space Commission report states, “The commission believes that its recommendations, *taken as a whole*, will enable the US to sustain its position as the world’s leading space-faring nation.”⁵

The phrase “taken as a whole” is important. The commission’s findings and recommendations were mutually supporting

and all were viewed as necessary to fix the problems associated with a broken NSS enterprise. In my opinion, the fact that some were ignored and some were not fully implemented, undermined the overall effectiveness of those recommendations that were implemented. I believe that our nation remains in search of an effective way to organize and manage national security because we have not yet taken all of the specific measures required to make real and lasting change. The following paragraphs cover the major areas in which the government did not make the changes recommended by the commission that were needed in our NSS enterprise.

Strong and Focused OSD Oversight

In the years preceding the Space Commission, many leaders expressed concern about the direction of our NSS program, as well as the Air Force’s stewardship of space. The Space Commission report provided a blunt assessment of the situation:

Few witnesses before the commission expressed confidence that the current Air Force organization is suited to the conduct of these missions. Nor was there confidence that the Air Force will fully address the requirement to provide space capabilities for the other services. Many believe the Air Force treats space solely as a supporting capability that enhances the primary mission of the Air Force to conduct offensive and defensive air operations. Despite official doctrine that calls for the integration of space and air capabilities, the Air Force does not treat the two equally. As with air operations, the Air Force must take steps to create a culture within the service dedicated to developing new space system concepts, doctrine, and operational capabilities.⁶

As a result of these concerns, the Space Commission was tasked to assess the potential costs and benefits of establishing an independent military department or a corps within the Air Force dedicated to the NSS mission. In the end, the commission recommended a fundamental realignment and rechartering of the Air Force, but left the door open for a Space Corps within the Air Force or a military department for space at some future date.

It was in this context that the commission’s recommendation to establish an undersecretary of defense for space, intelligence and information (USD/SII) was critical. However, SECDEF Rumsfeld decided not to create an USD/SII and instead kept OSD space oversight fragmented among several OSD organizations and key advisors.

Why Secretary Rumsfeld walked away from a critical recommendation he had endorsed as the commission chairman is a topic for another article, but I believe the impacts were significant. The most significant in my opinion is that there was no senior official in OSD with both the clear responsibility, focused staff, and authority to work with the Air Force to

assist in the implementation of recommendations in a manner consistent with the spirit and intent of the commission's report. As a result, a key element of the Space Commission's overall vision was not in place during the most critical years following the commission's report.

A Re-Chartered and Re-Vectored Air Force

I believe the Air Force made several positive changes as a result of the Space Commission's findings and recommendations. One can point to significant successes in the past decade, such as the creation of a separate four-star Air Force Space Command commander (AFSPC/CC), the fielding of six new generation space systems, over 70 consecutive Air Force launch successes, and the continued reinforcement of the Air Force leadership as the executive agent for space. However, there is still more to be done and below are some of the areas that were implemented in a manner that may have limited progress towards the goals articulated in the commission's report.

- ***The Space Leadership Triangle:*** In my opinion, the senior leader model implied by the Space Commission's recommendations was a leadership triangle formed by the USD/SII, the USECAF, and the AFSPC/CC. I believe these three senior officials were intended to work together to wield the new NSS enterprise consisting of Air Force and NRO research and development, acquisition, budget, manpower, training, and operations in a manner that was just shy of a Space Corps inside the Air Force. The role of the USD/SII would have been to provide top cover for the USECAF and AFSPC/CC in their efforts to transform the NSS enterprise in the manner envisioned by the commission. Without the USD/SII, the USECAF and AFSPC/CC maintained more traditional roles inside the Air Force structure and their overall effectiveness in pursuit of the goals outlined by the Space Commission was limited. It does not mean the men in these positions did not do their job well, but I would argue their priorities, focus, and "operating space" were defined more by their position inside the Air Force corporate structure than by the vision established in the commission's report.
- ***Insufficient Progress Towards a Military Space Culture:*** The Air Force took steps aimed at satisfying direction to create a military space culture, but in some ways fell short of the goals stated in the commission's report, as well as some key aspects of the guidance from SECDEF Rumsfeld. Based on the commission's report and SECDEF Rumsfeld's 18 October 2001 Implementation Guidance memorandum, the Air Force was directed to "Assign the

commander of AFSPC appropriate responsibility within the Department of the Air Force for managing the space career field ..." and to provide a space career management plan that included "... methods for developing a space career field that combines research, development, acquisition, and operations; and a personnel management policies that will result in a cadre of space professionals with greater depth and breadth of experience in the space career field."⁷⁷ The Air Force finessed the issue of a new career field that merged space acquisition and operations, by creating the construct of a "credentialed space professional" that included space, intercontinental ballistic missile (ICBM), acquisition, intelligence, communications, and other officers. Although the AFSPC/CC was the space professional functional manager, he only had direct authority over space and ICBM officers. Air Force acquisition functional leaders maintained ownership of the acquisition corps, and space acquisition officers were not directly integrated into a new space career field. It is arguable that the Air Force space acquisition work force continues to suffer from lack of depth and experience and the fact that AFSPC/CC is unable to control all of the resources he needs to accomplish his mission may be a factor. Another issue mentioned in the commission's report, but not specifically addressed by SECDEF Rumsfeld, was whether the space career field should include ICBM officers. Though there was not much public dialogue or insight into Air Force thinking at the time, the service decided to keep the structure that still exists today of a space career field comprised of space and ICBM operators.

- ***Air Force Organizational Realignment:*** While the Air Force realigned its "headquarters and field commands to more effectively organize, train and equip for prompt and sustained space operations," the realignment did not fully provide "the resources to execute space research, development, acquisition and operations, under the command of a four-star general." Within the research, development, test, and acquisition communities, the result has been more akin to rearranging the deck chairs on a ship. There were two primary areas that limited overall effectiveness in this area. First, since AFSPC/CC is not in the acquisition chain of authority between the program executive officer for space and the service acquisition executive, he is unable to fulfill the tasks mentioned in the commission's report. This arrangement sometimes caused Space and Missile Systems Center (SMC) to operate independently from AFSPC, which undermined the authority of the AFSPC/CC and prohibited a true

The most significant in my opinion is that there was no senior official in OSD with both the clear responsibility, focused staff, and authority to work with the Air Force to assist in the implementation of recommendations in a manner consistent with the spirit and intent of the commission's report.

Some think the Air Force of the future will focus more on unmanned ISR, space, and cyberspace capabilities, with only a small force of manned strategic and tactical platforms.

integration of SMC into the fabric of AFSPC. Last, the Air Force was unable to create a management model that allowed the AFSPC/CC the ability to prioritize, oversee, and direct Air Force space research executed by Air Force Materiel Command's Air Force Research Lab.

So What Now? Moving Beyond the Space Commission

The world has changed a great deal since the Space Commission issued its report. The US has been at war almost 10 years since the attacks of 9/11 and winning that fight has been the primary focus of the DoD. The US and much of the world has been in a serious economic down turn for the last five years and the national debt is threatening to overtake Islamic extremism as the number one threat to our national security. Cyberspace, not space, is the hot topic today in the DoD and across the nation. The premise that the US, as the sole global superpower, could act unilaterally in many areas has given way to the notion that the US is one of many world powers and that our continued preeminence in economic or military matters is not assured. Because of the focus on fighting global insurgencies and the dismal economic and budget outlooks, all military departments are under pressure to cut force structure and reexamine roles and missions. Against this backdrop, the very identity of the Air Force has been challenged. Some think the Air Force of the future will focus more on unmanned ISR, space, and cyberspace capabilities, with only a small force of manned strategic and tactical platforms. I for one am skeptical of any future Air Force that is not centered on manned, air platforms and believe in the continued need for high end, manned conventional and nuclear capable aircraft. That being said, there can be no doubt that DoD will get smaller and that we will likely accept some degree of risk in a reduced ability to fight high-end, conventional warfare.

However, these changes in the strategic landscape do not alter the fundamental truisms documented in the Space Commission's conclusions, they do not change the fact that NSS remains a vital national interest for the US. For that reason, we must refocus our efforts on the actions needed to ensure the US remains the world's preeminent spacefaring nation.

To generate discussion towards this end, below are a series of steps that could be considered to ensure our NSS enterprise remains on the footing needed to protect America in the coming century.

Air Force Next Steps

The Air Force remains the DoD's executive agent for space, but some have opined that the Air Force has no inherent right to this role. Many would say that the Space Commission report, and the subsequent Young Panel and Allard Commission, were shots across the Air Force's bow with regard to its stewardship of space. I would argue that the Air Force has taken many posi-

tive steps towards assuming the role envisioned by the commission and needed by the country, but I also believe that we need to consider additional steps to continue movement in a positive direction.

Inside Headquarters Air Force

As a result of the Space Commission recommendations, the SECAF created a focused space organization within his staff. It may make sense to create a similar staff structure on the uniformed side of the Air Staff to provide some degree of organizational balance and priority. One way to do this would be to consider the creation of a three-star deputy chief of staff for space and cyberspace. In this model, the major space and cyberspace elements inside the existing deputy chiefs of staff would be reassigned to this officer, who would provide the uniformed military equivalent to the space staff created under the SECAF in 2001. This would create a much stronger voice at the table advocating for Air Force space and cyberspace issues, but would stop short of creating a Space Corps within the Air Force. It could be done with very little additional cost or overhead.

Space Career Field Changes

This remains one of the most important aspects of ensuring US preeminence in space. While the Air Force took some positive steps in 2001, more is needed. Some changes that might be considered are covered below:

- Split the ICBM career field out of the 13SXX career field and no longer manage them jointly. This move makes even more sense now that the Air Force has created Air Force Global Strike Command and moved the ICBM force out of AFSPC. There are clearly challenges to be overcome in terms of sustaining separate career fields, but it is possible there are other options that could be explored. The current model remains flawed in terms of prerequisite requirements and career path development and should be changed.
- Create separate mission area shred outs for the 13SXX career field. These should include shred outs for personnel in five separate, but interrelated communities with permeable boundaries: Space superiority, strategic space-lift; global information services; global reconnaissance, surveillance and tracking; and space special operations (focused on tailorable, responsive, combatant commander support for theater level effects in any mission area).⁸
- Because of the host of reports pointing to a diminished space acquisition career field, it is worth developing a new model that would more clearly provide for a space test, engineering and acquisition career field and associated Air Force specialty code (AFSC). This AFSC, to

include accessions and career development would be managed by the AFSPC/CC, but in close partnership and cooperation with the commander of Air Force Material Command.

A Different Means to an End

As mentioned earlier in this article, the global environment has changed a great deal in the 10 years since the Space Commission published its report. In addition to serious security challenges, such as the ongoing war against Islamic extremism and threats from cyberspace, the burgeoning national debt is beginning to dominate American politics and is viewed by many as the most serious long term threat to our country.

Another change in the strategic picture is the ongoing evolution and maturation of US Strategic Command (USSTRATCOM) as a combatant command. Since 2001, USSTRATCOM has evolved from a nuclear deterrence focused combatant command (COCOM), to a command with broad responsibilities in nuclear deterrence, space operations, cyberspace, combating weapons of mass destruction, global ISR, information operations, electronic warfare, and global strike. While USSTRATCOM's forces are global in nature, an increasingly important focus is support to geographic COCOM commanders regional and trans-regional operations to win today's fight and to be prepared to win in the future.

In addition, there is mounting pressure on the NSS enterprise to deliver capabilities more quickly and less expensively than in the past, with a particular focus on those capabilities most important to supporting ongoing COCOM operations.

Against this backdrop, I believe it is worth considering a series of new steps that might be taken to ultimately achieve the strategic aims of the Space Commission, as well as the current objectives established in the most recent National Space Policy approved by President Barack Obama. These steps would create a more robust USSTRATCOM, with similar authorities as US Special Operations Command, to bring about some of the focused organization and management changes envisioned by the commission. These steps might include:

- ***USSTRATCOM Acquisition Authority.*** Providing the USSTRATCOM commander the authority to acquire specialized space systems required for the conduct of specified missions in support of the COCOMs. This approach would have the potential to place the responsibility for acquiring tailored space systems under the same COCOM with the responsibility for employing those systems. It would also provide a fresh environment, similar to that envisioned for organizations such as the Operationally Responsive Space (ORS) Office, in which NSS leaders could leverage a different acquisition model

focused more on speed and agility, the ability to manage risk differently, and the focus on delivering capability on time. The current Air Force and NRO space acquisition models are best suited to larger, more complex systems and may not be the best approach for some space systems requiring more rapid fielding.

- ***Joint Space Acquisition Command (JSAC).*** This command could be established under the USSTRATCOM Commander for the purpose of acquiring specialized space systems, using the acquisition authority described above. This organization would be given streamlined acquisition authority to acquire systems focused on missions such as Space Control, SSA, and ISR. It would be advisable to determine if there are current organizations, such as the Joint ORS Office, that would logically fit in this command.
- ***Realign Major Force Program (MFP)-12.*** The Space Commission recommended the creation of a separate MFP for space programs in order to provide insight into the management of space programs, but to do so without unnecessarily restricting the flexibility of the SECDEF, the director of central intelligence, or the military departments. SECDEF Rumsfeld directed the establishment of a "virtual" MFP for space to increase visibility into the resources allocated for space activities. The "virtual" Space MFP is known as MFP-12. In order to provide dedicated resources for USSTRATCOM-procured space systems, it would be necessary to make the needed funds directly available to USSTRATCOM, much in the way MFP-11 funds are provided to Special Operations Command. This realignment would create the dedicated funding USSTRATCOM would use to acquire specialized space warfighting systems under a JSAC.
- ***Create a Joint Space Special Operations Command.*** This organization would be created to employ specialized space systems, to include the majority of those employed by USSTRATCOM in support of space control, SSA, ORS, and ISR. It would also be responsible for deployable, tailored expeditionary space units and personnel in support of theater commanders.
- ***Create a Joint Warfare Integration Command.*** While not solely focused on space, this command would be a joint extension of the service warfare centers and would focus on the integration of space, cyberspace, electromagnetic spectrum control, air and missile defense with conventional capabilities in the air, sea, and land domains. The primary focus of this organization would be joint and integrated testing, tactics, and training across levels of security to ensure America's forces are prepared to win on future battlefields.

... [T]here is mounting pressure on the NSS enterprise to deliver capabilities more quickly and less expensively than in the past, with a particular focus on those capabilities most important to supporting ongoing COCOM operations.

Conclusion

The Space Commission was a landmark event in the evolution of the US NSS program. Many of the commission's recommendations have been implemented in a way that moved the entire program forward. However, we have much more work to do to ensure the US NSS program remains not only preeminent, but highly relevant over the long term. I have attempted to provide some personal insights into the commission's recommendations and how they were implemented, as well as offer some possible suggestions DoD could consider to continue to make progress in today's strategic environment.

Notes:

¹ House Committee on Armed Services, *Report of the Commission to Assess United States National Security Space Management and Organization*, 11 January 2001, 99-100. The five conclusions are:

- First, the present extent of US dependence on space, the rapid pace at which this dependence is increasing and the vulnerabilities it creates, all demand that US NSS interests be recognized as a top national security priority. The only way they will receive this priority is through specific guidance and direction from the very highest government levels. Only the president has the authority, first, to set forth the national space policy, and then to provide the guidance and direction to senior officials, that together are needed to ensure that the US remains the world's leading space-faring nation. Only presidential leadership can ensure the cooperation needed from all space sectors—commercial, civil, defense, and intelligence.
- Second, the US government—in particular, the DoD and the IC—is not yet arranged or focused to meet the NSS needs of the 21st century. Our growing dependence on space, our vulnerabilities in space and the burgeoning opportunities from space are simply not reflected in the present institutional arrangements. After examining a variety of organizational approaches, the commission concluded that a number of disparate space activities should promptly be merged, chains of command adjusted, lines of communication opened and policies modified to achieve greater responsibility and accountability. Only then can the necessary trade-offs be made, the appropriate priorities be established and the opportunities for improving US military and intelligence capabilities be realized. Only with senior-level leadership, when properly managed and with the right priorities, will US space programs both deserve and attract the funding that is required.
- Third, US NSS programs are vital to peace and stability, and the two officials primarily responsible and accountable for those programs are the secretary of defense and the director of central intelligence. Their relationship is critical to the development and deployment of the space capabilities needed to support the President in war, in crisis and also in peace. They must work closely and effectively together, in partnership, both to set and maintain the course for NSS programs and to resolve the differences that arise between their respective bureaucracies. Only if they do so will the armed forces, the IC and the National Command Authorities have the information they need to pursue our deterrence and defense objectives successfully in this complex, changing and still dangerous world.
- Fourth, we know from history that every medium—air, land, and sea—has seen conflict. Reality indicates that space will be no different. Given this virtual certainty, the US must develop the means both to deter and to defend against hostile acts in and from space. This will require superior space capabilities. Thus far, the broad outline of US national space policy is sound, but the US has not yet taken the steps necessary to develop the needed capabilities and to maintain and ensure continuing superiority.

- Finally, investment in science and technology resources—not just facilities, but people—is essential if the US is to remain the world's leading space-faring nation. The US government needs to play an active, deliberate role in expanding and deepening the pool of military and civilian talent in science, engineering and systems operations that the nation will need. The government also needs to sustain its investment in enabling and breakthrough technologies in order to maintain its leadership in space.

² As a disclaimer, this assessment of what the commission got wrong might be better stated as what I got wrong in terms of the advice I provided as a member of this staff. If there was an error in the report, it started with me.

³ *Report of the Commission to Assess United States National Security Space Management and Organization*, 68.

⁴ *Ibid*, 45.

⁵ *Ibid*, 98.

⁶ *Ibid*, 57.

⁷ Secretary of Defense Memorandum, National Security Space Management and Organization Implementation Guidance, paras 7.3-7.4, 18 October 2001

⁸ Col J. Kevin McLaughlin and Col Chris D. Crawford, "Forward to the Future: A Roadmap for Air Force Space (Part II)," *High Frontier* 4, no. 1 (November 2007): 31.



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General McLaughlin was commissioned through the USAFA in May 1983. He has served in a variety of space operations and staff positions. His experience in space operations includes space control; space launch; satellite positioning, navigation, and timing; and satellite command and control. His operational assignments include commander, Space and Missile Systems Center, Space Development and Test Wing; commander, 50th Operations Group; commander, 2nd Space Operations Squadron; and chief, Current Operations Flight, 45th Operations Support Squadron; deputy chief standardization and evaluation, 45th Operations Group; chief, Launch Operations and Titan IV Launch Controller, Titan Combined Task Force; and chief satellite officer, Space Defense Operations Center, Cheyenne Mountain Complex.

General McLaughlin has served in staff assignments at the Office of the Secretary of Defense, Headquarters Air Force, the National Reconnaissance Office, and Headquarters Air Force Space Command. He also served as a professional staff member on the Commission to Assess National Security Space Management and Organization chaired by Secretary of Defense Donald Rumsfeld.

Leading into the Future: Creating the Cadre of Space Professionals

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Military space professionals will have to master highly complex technology; develop new doctrine and concepts of operations for space launch, offensive and defensive space operations, power projection in, from and through space and other military uses of space; and operate some of the most complex systems ever built and deployed. To ensure the needed talent and experience, the Department of Defense (DoD), the intelligence community and the nation as a whole must place a high priority on intensifying investments in career development, education and training to develop and sustain a cadre of highly competent and motivated military and civilian space professionals.¹

~ The 2001 Space Commission Report

A memorable hallmark of the 2001 Space Commission Report was its emphasis on the creation of a “cadre of space professionals”. The call for the “cadre” became a ubiquitous theme throughout the document (with such a cadre referenced no less than 20 times in the report). The report gave specific attention to the education and training required to develop the Space Cadre. Depth and breadth of both *technical* and *operational* knowledge was recommended at all levels of experience, especially those in leadership positions: “... leaders must provide the vision, the technological expertise and doctrine, concepts and tactics to generate and operate space forces in this new era of space...”²

Ten years have now passed since the call was sounded to de-

velop a cadre of space professionals. How far have we come? How far must we go? We offer here a retrospective and prospective analysis of the commission’s recommendation for the Space Cadre with special attention paid to the training desired and required. We provide context from an Air Force perspective of the “cadre.” Future technical challenges in space are briefly examined. The nuclear navy was explicitly noted by the Space Commission report as the quintessential model for professional technical development: a short history of “Rickover’s Navy” is provided, and details on its training program is given. Specific recommendations on future direction for the Air Force for professional Space Cadre, with attention to lessons learned from Rickover, are detailed. Finally, attention is paid to the role of commercial industry in this endeavor.

History Repeats Itself

The US will invest in space situational awareness capabilities and launch vehicle technologies; develop the means to assure mission essential functions enabled by space; enhance our ability to identify and characterize threats; and deter, defend, and if necessary, defeat efforts to interfere with or attack US or allied space systems.³

~ Presidential Policy Directive 4, 28 June 2010 ~PPD 4

More than 50 years ago, on 4 October 1957, the Soviet Union successfully placed Sputnik-1 into orbit. While Sputnik only stayed in orbit for three months, the psychological crisis in the US challenged its belief that it was the world leader in both space and missile technological development. The threat, both real and perceived, galvanized President Dwight D. Eisenhower and the Congress to give the US the ability to operate in and from space.

On the civilian side, these initiatives led to Mercury, Gemini, Apollo, and the Space Shuttle. In the DoD, technological leaps enabled programs such as the Global Positioning System, the Defense Satellite Communications System, and the Defense Support Program. These allowed commanders to pinpoint objects, communicate with forces anywhere on the globe, and detect missile launches. Yet, despite these successes, the space community failed to develop meaningful doctrine as a foundation for space power. In fact, the limited doctrine available was generally ignored.⁴ As a result, the space community has never convinced military and civilian leadership that Space is more than a “force enhancer.”

US air power, in its infancy, was viewed much as space power is today—a force enhancer or service provider. However, by the end of World War II, that notion was shattered. Beyond its success in combat, the quick rise of the US Air Force from “force enhancer” to co-equal separate service can be traced

back to three key factors.⁵ First, early Air Force leaders, such as Brig Gen William “Billy” Mitchell, fervently believed that air power would become the predominant force of war—and they steadfastly espoused those beliefs. Second, the Air Corps Tactical School not only instructed early Airmen in tactics, but also helped produce early air theory and doctrine. The premier example was the groundbreaking bombing theory that would become known as “Precision Daylight Bombing” as used in World War II.

The third factor in the Air Force’s emergence was cultural. New officer accessions and enlisted recruits were brought in as Airmen were trained and educated as Airmen, and immersed in the air domain. Thus was created a cadre of air professionals, who not only understood how to fight an air war but who would advocate for air power’s use.

The absence of similarly robust advocacy and leadership in the space domain was noted by the US Congress a decade ago. Believing that the space community lacked the key ingredients to ensure America’s continued dominance in space, the Congress mandated, through the *National Defense Authorization Act* for fiscal year 2000, the creation of the Commission to Assess United States National Security Space Management and Organization (Space Commission). Congress chartered the Commission to “assess the organization and management of space activities that support US national security interests [with a focus] on assessment of national security space activity.”⁶ Fulfilling its charter in 2001, the commission released an extensive review of US space policies and responsibilities, providing recommendations for ensuring future US superiority in the space domain. Pulling a page from the playbook of air power, the commission recommended that the US “create and sustain a cadre of space professionals.”⁷ Space has become a contested environment and with technological advances and the increasing number of nations entering the space age, the future is likely to be more challenging. To provide for continuing US dominance in space, the space community must establish a professional Space Cadre which understands space as a domain, not as a mission.

Space Operations and Technologies of the Future

*The US will not remain the world’s leading spacefaring nation by relying on yesterday’s technology to meet today’s requirements at tomorrow’s prices.*⁸

~ The 2001 Space Commission Report

Today’s space operations are relatively static. This may sound like a strange statement given orbiting objects with speeds of more than 5 miles per second (or 18,000 miles per hour). But spacecraft are on well-determined orbits, subject to Newton’s laws and little else. Space operations look little different from the early 1960s, except for the increased number of objects on orbit. The most dynamic situations occur when space weather events cause a temporary degradation of situational awareness. Occasionally, other nations engage in debris-producing exercises that add excitement, but once the new orbits are catalogued, the situation becomes static again.

This, however, is changing. Nations who seek an increased advantage from their space investments are adding more dynamic capabilities. Information infrastructures have vulnerabilities and these must also be defended. Dynamics will also be introduced by our own new technologies. On-orbit servicing, a concept proved in Defense Advanced Research Projects Agency’s (DARPA) Orbital Express demonstration, requires a much keener awareness of the laws of Kepler. Surveillance constellations can be designed for frequent maneuver, which adds unpredictability and increases coverage, and for refueling, which maintains agility despite high propellant consumption.

Dynamic operations mean challenges to situational awareness and to the security of space assets. New tools for space object detection and tracking, new human-computer interfaces for improved understanding, and new technologies such as artificial intelligence will be required to manage the new space order. Space operations will soon have the feel and intensity of Operation Red Flag seen from inside an Airborne Warning And Control System E-3.

To maintain space superiority in a dynamic environment, the observe, orient, decide, and act (OODA) loop of the US space operator must be shortened.⁹ New sensors, such as the DARPA space surveillance telescope, will provide far more frequent observations of object locations. Operators must have a superior grasp of the physics of orbital motion, the intricacies of signals and the peculiarities of optics. They must fuse these with an understanding of their information gathering tools to obtain the proper orientation within their domain. They must also understand the algorithms underpinning their decision support systems; human intellect is the final safety system as decisions are made and actions are taken.

Acquisition of the new systems will also require the technical supervision of highly trained professionals. The coupling between operational requirements, engineering, and cost will add complexity to the early program phases. Both operational and engineering experience in the space domain will be necessary for the future success of space acquisition. Development of a true Space Cadre will help ensure future program and mission success. In an era of tightened budgets, margins for error will be significantly reduced.

Developing a Military Space Culture and a Cadre of Professionals. The Space Commission’s Findings were Blunt:

*The DoD is not yet on course to develop the space cadre the nation needs.*¹⁰ *Since its inception, a hallmark of the US space program has been world class scientists, engineers and operators from academic institutions, industry, government agencies and the military services. Sustained excellence in the scientific and engineering disciplines is essential to the future of the nation’s national security space program. It cannot be taken for granted.*¹¹

~ The 2001 Space Commission Report

The commission went on to state that “military space professionals will have to master highly complex technology; develop new doctrine and concepts of operations for space ... the nation

as a whole must place a high priority on intensifying investments in career development, education and training to develop and sustain a cadre of highly competent and motivated military and civilian space professionals.”¹² The commission also emphasized the importance of developing within the professional cadre a culture focused on space. “The department must create a stronger military space culture, through focused career development, education and training, within which the space leaders for the future can be developed.”¹³

Despite some progress, including a recreated undergraduate space training course and a nascent space professional certification program, the commander of Air Force Space Command (AFSPC) has limited authorities to manage the entire national security space professional community. The Air Force still falls short of the Space Cadre and culture envisioned by the commission. However, the commission recommended a model for change. Recalling Admiral Hyman Rickover, who “blazed the trail that led to the nuclear Navy,”¹⁵ the commission recommended that the space community follow the model of the Navy’s nuclear submarine program, placing “strong emphasis on career-long technical education. This approach produces officers with a depth of understanding of the functions and underlying technologies of their systems that enables them to use the systems more efficiently in combat.”¹⁶

A Model for a Professional Nucleus

... Rickover’s solution went far beyond the usual on-the-job training. He was not content to teach procedures and techniques. He wanted to teach principles and fundamentals, and he wanted to create a change of mind—a whole new way of approaching the job.... It was a program of unprecedented scope and depth.”¹⁷ ~ Theodore Rockwell



Figure 1. Admiral Hyman Rickover, Father of the Nuclear Navy.

In January 1955, two years before Sputnik broadcast its iconic “beep-beep” to the world, the US put to sea a vessel that changed naval warfare forever. USS Nautilus (SSN 571) was the technological marvel of the age—the world’s first nuclear powered submarine. With the advent of Nautilus, no longer would submarines be limited to short stints beneath the waves—atomic power would allow them to remain quietly submerged for months on end (the ultimate duration limited only by food supply). Nautilus was an amazing feat of engineering—a mere three years after the Atomic Energy Commission initiated operations of the first power producing land-based reactor, nuclear power propelled this operational naval vessel. The reactor plant of Nautilus was not operated by PhD’s or specialized contractors, but by a highly trained crew of sailors and Naval officers.

Admiral Hyman Rickover is widely known as the man who created Nautilus, her atomic engine, and the cadre of men who operated her. A career naval officer, Rickover was a Captain



Figure 2. USS Nautilus (SSN-571), the first nuclear powered submarine. The reactor plant was operated by a highly trained Naval nuclear cadre. (Shown here at New York Harbor, 25 August 1958, after concluding the first ever submerged voyage under the North Pole).

in charge of a mothballed fleet in 1946 when he was assigned to Oak Ridge National Laboratory to investigate the possible utility of nuclear power.¹⁸ Rickover was well educated (having a Masters degree in Electrical Engineering from Columbia University) but knew nothing of nuclear power at the time of his new mission.¹⁹ Through determined study, Rickover himself became an expert in the field. He built a military team of technically competent engineering duty only officers and other specialized civilians who would later become the foundation of the Division of Naval Reactors (NR), the organization responsible for control and oversight of the entire Navy Nuclear Program. NR is today a part of the Naval Sea Systems Command.²⁰

Rickover understood well the technical complexities and risks of nuclear energy. It would take a new, highly trained, technical breed of officer to operate a nuclear plant. In some respects, it was reminiscent of the advent of steam-powered warships in the late 1800s. That new technology led the Navy to create a separate “Engineering Corps” that specialized in operation of steam plants—leaving the tactical operation of ships to less technical line officers. In 1899, under orders of Assistant Secretary of the Navy Theodore Roosevelt, this separation of operators and engineers ceased, and an “integrated” model was instituted for shipboard officers. Similarly, Rickover did not tolerate a division into “engineers” and “operators” (i.e., “ship drivers”); instead he insisted that all operators first become competent engineers. The tragic, engineering plant related loss of the fast attack submarine USS Thresher (SSN 593) in 1963 further cemented Rickover’s authority over the nuclear fleet and fortified his commitment to the highest standards of technical expertise. Post-Thresher, in order to achieve unparalleled mission success in the nuclear powered fleet, Rickover undertook a ruthless, uncompromising campaign of building the ultimate cadre of nuclear professionals. This pursuit of technical superiority left hundreds, if not thousands, of active duty diesel submariners (many with combat experience) behind.²¹

Initial Criteria and Screening

Consideration for initial entry into the nuclear navy program requires candidates to have taken both calculus and calculus-based physics during their accredited four-year degree program. Both Naval Academy and ROTC undergraduates are considered in their senior year. A special “Nuclear Power Officer Candidate” program also exists.

Once accepted for consideration, all candidates for nuclear power training and subsequent nuclear ship assignment undergo a daylong interview at NR. NR engineers interview each candidate to assess their technical capability. These interviews consist of in-depth verbal quizzes in physics, engineering, and math. The results of these interviews are recorded and sent to the admiral’s desk.

At the start of the nuclear program, Rickover assured Congress he would *personally interview each and every officer candidate* for the Navy’s Nuclear Power Program.²² He did—and his successors (four-star flag officers, who serve eight year assignments) continue to do so.²³ With technical interview results in hand, the director of Naval Reactors himself makes the decision on candidates to receive nuclear power training.

Nuclear Power School and Nuclear Prototype Training

Upon commissioning, the training program for prospective nuclear officers begins. The rigorous program prepares future shipboard officers for both engineering and operations duties.²⁴

The first six-month school serves as the foundation for an officer’s knowledge of nuclear power. Naval Nuclear Power School (now located in Charleston, South Carolina) is an intensive, graduate-level course. It begins with refresher classes, taught by Naval officers, in calculus and physics. Coursework then progresses through thermodynamics, heat transfer, materials science, electrical engineering, reactor physics, radiological science, corrosion chemistry, reactor design, and reactor safety. Weekly exams, course final exams, and a school final exam are given. Failure of a course (which is not uncommon) results in an officer’s dismissal from the program.

Upon graduation from Nuclear Power School, candidates receive hands-on experience in actual nuclear plant operation at a naval nuclear prototype facility. Like Nuclear Power School this is a six-month course, but the majority of time is spent operating an actual nuclear reactor. The use of simulators was rejected early in the program’s history. Operating actual reactors is considered vital to nuclear training. Valves must be turned, chemical and nuclear samples taken, turbines started, and oil levels checked. No simulator could capture the physical experience of actual reactor plant operations.

Several different training plants exist—one, a decommissioned submarine in Charleston, South Carolina, and land-based reactors at a site in upstate New York. Students qualify as operators of every system and sub-system within the plant (both primary reactor systems and secondary steam plant systems). The prospective nuclear trained officer (affectionately referred to as a “nuc”) must become intimately familiar with the theory of operation for each element of the plant; qualified enlisted and officer operators quiz students during “checkouts.” The candidate

must successfully stand watch at all watchstations, enlisted and officer. Casualty drills are initiated to test students’ responses. In addition to written exams, a final watch as engineering officer of the watch (EOOW) is monitored and graded.

Platform Tactical Training and Junior Officer Tour

The successful completion of naval nuclear training is a significant achievement. The year-long sequence is the most rigorous technical training in the US military. The final step before reporting to a ship (surface or submarine) is a school focused on tactics, ship design, weapons systems, and damage control.

With all training schools complete, the junior officer will report to his or her first ship assignment. Once there, the young officer will qualify as EOOW on the nuclear power plant. During this time he or she will also be assigned to lead a division of enlisted engineering personnel. The new officer will then focus on warfare specialty training, that is the operational employment of the ship and its weapons and sensor systems. Initial junior officer shipboard tours last approximately three years.

Engineers or Operators?

The initial training, qualification, and shipboard responsibility for the nuclear officer involves both engineering and tactical operations. This dual emphasis continues throughout an officer’s career. Prerequisites for a follow-on department head tour at sea require successful completion of both the engineering officer’s course (a two-month combination of nuclear power school, prototype, and shipboard engineering quals “on steroids”) and the Submarine Officer’s Advanced Course for example. Following command at sea, an officer may specialize in either acquisition or operations, but he or she is by then the beneficiary of *almost two decades of operations and engineering experience*.

One-half century after Nautilus first sailed, Hyman Rickover is recognized as an influential figure like no other in the long history of the Navy. He was a “technocrat” who believed in the power of engineering to solve tactical and strategic challenges. Today, the USS Nautilus is a museum ship. But, what lives on—Rickover’s ultimate legacy—is the program he created to assemble and mold the people who became (and today who are) the Naval nuclear cadre. Hyman Rickover is a national hero, and developer of an incredibly successful and exemplary model for technology driven organizations.²⁵

Making It Happen: The Institutional Challenge

*In general, leadership in the space field today suffers on all counts: limited experience in the field, little technical education and tour lengths that average less than a year and a half. This keeps space organizations from reaching their potential. Space leaders spend most of their assignments learning about space rather than leading.*²⁶ ~ The 2001 Space Commission Report

“Recognizing that a broad, deep pool of fully qualified, knowledgeable space professionals is the primary means of assuming national security space supremacy,”²⁷ the Air Force and AFSPC have begun to slowly make changes. Since the release of the Space Commission Report, the US Air Force Space

Professional Strategy, a roadmap for developing space professionals, was published. The National Security Space Institute, which houses space development courses such as Space 100, 200, and 300 was established. In addition, the space professional development database was developed to track the expertise of each member designated a space professional. This is a good start but much more needs to be done.

Organizationally, AFSPC has gone through some key restructuring as well. In 2009, with the stand-up of the Air Force Global Strike Command (AFGSC), AFSPC transferred its nuclear operations role to a command whose sole function is to oversee the Air Force's nuclear enterprise. This freed AFSPC from the highly intensive focus on nuclear matters. In 2009, the Air Force's newest numbered Air Force, the 24th Air Force was activated and placed under AFSPC. Its mission is to provide combatant commanders with trained and ready cyber forces to plan and conduct cyberspace operations, and when necessary defend the Air Force portion of the global information grid.²⁸ Thus AFSPC received another mission area that, much like space missions, requires highly trained individuals who not only have in-depth understanding of their profession, but also the ability to think "outside the box" to succeed in an incredibly dynamic mission environment.

These changes, while a positive start, do not go nearly far enough to meet the challenges facing the military space community. To create the kind of fundamental changes that Admiral Rickover drove in the nuclear navy, the space community must, just as he did, re-examine all of its basic approaches to career field structure, officer entry selection, education, training, officer growth, and career field development. These changes must be underpinned by an intellectual framework that pervades the entire military space community. This framework should drive selection, initial training, career field design, career field management, wing and group organization structure, acquisition organization structure, and doctrine at all levels. Without the foundation of this intellectual framework, properly codified and followed in all areas, the authors believe the fundamental changes will never take root and lead to the long-term progress that is possible and necessary. However, establishing and following the construct is more important than the particular approach. Once each mission area is established, all the other recommendations can be easily structured around the established model. Specific recommendations, informed by Admiral Rickover's design of the Nuclear Navy, are as follows:

Recommendation #1: Establish a new intellectual and organizational framework for Air Force Space built around five mission areas as follows:²⁹

- Space superiority (counterspace and enabling functions such as space surveillance activities).
- Strategic spacelift.
- Global surveillance, tracking, and warning (Earth focused activities).
- Global information services/utilities (space based communications, precision navigation and timing, etc.).

- Space special operations (focused on tailorable and responsive capabilities to produce theater level effects on demand).

While AFSPC would have the responsibility of managing overall space and cyberspace personnel and resources, each mission specialty would be managed separately and would be allowed and encouraged to develop its own sub-culture, mission specific training and tactics, techniques, and procedures. This will allow each mission area to grow its officer and enlisted corps across the full spectrum of the mission (acquisition, operations, intelligence, etc.) creating professionals with the expertise needed in each mission area.

Recommendation #2: Create five space Air Force specialty codes (AFSC) to match the five mission areas.

With the recent establishment of AFGSC and the creation of 24th Air Force within AFSPC, now is the time to create new AFSCs under the 13S career field to support the growth and development of officers. Additionally, there would be natural breadth opportunities that would allow personnel to expand on their mission area experience. For example, those professionals assigned to the space superiority area would spend time in the cyber network warfare area, and those in the global tracking specialty could also spend time in the National Reconnaissance Office. Additionally, there should be opportunities for space professionals in acquisition within their specific specialty since "there is great value in combined space operations and acquisition experience; therefore, acquisition assignments serve critical roles in adding depth and breadth to an operations space professional's experience base."³⁰ As a result of the need for greater expertise and development in specific areas, cross flow opportunities would be limited to other areas with common expertise and application and generally occur only early in an individual's career. Additionally, the eight areas used in the Space Professional Development Program should be revamped to match these five areas.³¹ Sub-areas should be developed under each mission area AFSC (i.e., counterspace and space surveillance under space superiority). Note that this structure does not include the intercontinental ballistic missile career field, which the authors recommend be split off into its own AFSC to be managed by AFGSC.

Recommendation #3: Revamp the space career field accession program:

To gain admittance into the space career field, cadets would be required to pass a number of math and science courses (i.e., physics, calculus II, etc.). They would need to have demonstrated strong academic performance and a high level of aptitude in appropriate areas. A space career field candidate program should be instituted during the senior year at the commissioning source. Finally, candidates should be selected based on an interview with a senior space officer. The authors believe that such higher selectivity will actually incentivize students to attempt to enter the space career field, and therefore increase the selection pool.

Recommendation #4: Revamp the initial training program for all prospective space professionals. Similar to the Nuclear Navy model divide, initial training into three segments:

1. A six month long expanded undergraduate space training (UST) program should be enhanced to lay the appropriate knowledge foundation the science of orbits (heavy in physics and math along with orbital mechanics). In depth coursework on each space mission area (space superiority, strategic space lift, global surveillance and tracking, etc.) should be provided. This course would encompass today's UST course and many components of Space 200. UST should be used to determine aspiring space professionals capabilities and track to particulate mission areas based on areas of aptitude and needs of the community.
2. A second six month training course that focuses on a specific mission area where young officers learn their mission areas systems, doctrine, and tactics in depth.
3. A third course, for operators only, lasting two to four months serving as initial qualification training, where these burgeoning operators receive training on their assigned weapon system and associated procedures and techniques.

The space community must apply Admiral Rickover's approach and teach principles and fundamentals creating a whole new way of approaching space. Additionally, the Air Force must invest not only in simulation systems, but also in test range capabilities for each mission area so that a capability akin to the nuclear prototype program exists to ensure our professionals receive initial and recurring training to the depth the dynamic operational environment demands.

Recommendation #5: Reconstruct the continuing education program.

Continuing education should include graduate degree level work or certification in a **specific** mission area or in a supporting specialty such as contracting, systems engineering, system design, simulation, or artificial intelligence so that the most capable young officers are equipped to lead analysis of alternatives, to write capability requirements and build budgets to grow the nation's space capabilities. These programs should occur while an officer is an O-3, so space professionals will be prepared for success in leadership positions and as staff officers at appropriate higher headquarters. The continuing education of space professionals must be closely managed so that the career field is populated with tailored expertise at **each grade level in each mission area**. Also, **each** mission area must have officers with appropriate supporting specialty expertise.

Recommendation #6: Modify the Air Force Space billet structure to allow for additional officers in the special operations and more technically complex positions.

This will include converting officer billets into enlisted bil-



Figure 3. The Air Force must invest not only in simulation systems, but also in test range capabilities for each mission area so that a capability akin to the Navy Nuclear Prototype program exists (here, US Air Force Academy Cadets discuss an upcoming pass on Falconsat-5 with their technical advisor).

lets in those areas requiring less academic and deep technical knowledge and experience. Also, converting some military billets to civilian or contractor positions should be considered, allowing for smaller operations crews and training staffs (due to the experience these operators could develop operating a specific system over years). The officers would focus on the most dynamic and complex missions and systems as well as leadership positions in other areas.³²

Industry—Partner in the Military Space Enterprise

Industry must play a vital role in the development and sustainment of a Space Cadre. As the Space Commission noted, cadre development is not limited to just military members, but to civilian space professionals as well. Therefore, it is worth considering how the US aerospace industry would view and interact with the new Space Cadre.

The development time for modern satellite systems has dramatically increased in the past decades. It is not unusual for the time between authority to proceed and launch to exceed eight years. This time span is considerably greater than the length of a typical officer assignment. Consequently, an entire career can be completed without having gained experience in all aspects of system development.

To compound the problem, many experienced professionals in the aerospace industry are nearing retirement or have recently retired. As a nation, we are moving towards a situation where neither the government nor the aerospace industry has a sufficiently experienced cadre of professionals necessary to avoid pitfalls in the development, deployment and operation of systems.

Aerospace companies are addressing this problem by actively recruiting young professionals and establishing formal retention programs. Steps are being taken to ensure that knowledge transfer occurs between these young professionals and those

nearing the end of their careers.

On the government side, the creation of a cadre of space professionals could provide experience with greater depth in system development, deployment and operations. When these professionals reach senior positions, they would be better equipped to lead programs. This would be welcomed by the aerospace industry, leading as it would to a better understanding of the technical impacts of requirements on the government side.

Significant technical expertise resides with the industrial partners and industry should assist in developing the professional cadre. If Space Cadre roles are not limited to merely overseeing the work of their industry partners, then significant professional development could be done in the factories of industrial partners. A closer working relationship between government managers and industry teams, with the government managers embedded, would provide the “scar tissue” necessary for successful leaders. As a result, military and industry leaders would speak with a common lexicon and have a common understanding of space program development, deployment and operations.

The recent deployment of small satellite systems with their shorter development times has provided an opportunity to gain cradle to grave experience in a highly compressed timeline. As an example, the XSS-11 program was launched 48 months after contract award, and operated successfully for a year and a half. Given constrained budgets, tight schedules, and limits on system size, weight and power, small-sats provide compressed, affordable lessons in managing programs. This could be an approach to training the Space Cadre, much like the prototype reactors used to train Navy operators.

Leading into the Future

As we move forward there are many uncertainties that face the US and its national security space community. The Space Commission clearly understood this and emphasized repeatedly that a cadre of capable, technically competent, and operationally expert space professionals is critical to that community’s ability to meet the needs of combatant commanders and national leaders. To satisfy this need the Air Force must take the lead, learn from the experiences of Admiral Hyman Rickover and the Nuclear Navy, and take bold and thorough steps quickly to develop and then maintain this cadre. It is a national imperative.

Notes:

¹ House Committee on Armed Services, *Report of the Commission to Assess United States National Security Space Management and Organization*, 11 January 2001, xviii.

² *Ibid.*, 44.

³ Presidential Policy Directive 4, *National Space Policy*, 28 June 2010, <http://www.whitehouse.gov/the-press-office/fact-sheet-national-space-policy>.

⁴ For more information on early space doctrine see Kevin McLaughlin and Chris Crawford, “Forward to the Future: A Roadmap for Air Force Space (Part I),” *High Frontier* 3, no. 4, 26-27.

⁵ Some will argue that without the advent of World War II the Air Force’s road to a separate co-equal service could have taken longer. While this may be true, the preparation during the interwar years prepared the nation for air power’s use in a decisive way.

⁶ *Report of the Commission to Assess United States National Security Space Management and Organization*, 2.

⁷ *Ibid.*, 27.

⁸ *Ibid.*, 39.

⁹ The OODA loop was created by Air Force strategist Col John Boyd to provide a framework to conceptualize the process by which people make decisions. Victory in battle comes by shortening one’s OODA loop relative to the adversary’s. See, for example, R. Coram, “Boyd: The Fighter Pilot Who Changed the Art of War,” Hachette Book Group, 2002.

¹⁰ *Ibid.*, 42.

¹¹ *Ibid.* Emphasis added by author.

¹² *Ibid.*

¹³ *Ibid.*

¹⁴ See Brigadier General Kevin McLaughlin’s article in this edition for a more detailed discussion of the authorities of the AFSPC/CC and why they are insufficient.

¹⁵ Space Commission Report, 42.

¹⁶ *Ibid.*, 45.

¹⁷ Theodore Rockwell, *The Rickover Effect – How One Man Made a Difference* (Naval Institute Press, 1992), 293. Theodore Rockwell served as an engineer (and for some time as its technical director) with NR for the first 15 years of the nuclear program.

¹⁸ Thomas B. Allen and Norman Polmar, *Rickover – Controversy and Genius* (Simon and Schuster, 1982), 125.

¹⁹ Dr. Edward Teller, father of the hydrogen bomb, recalled Rickover’s initial, self effacing, introduction to him at Oak Ridge in 1946: “I am Captain Rickover. I am stupid.” See Allen and Polmar, 127.

²⁰ For more on the Naval Reactor organization and especially lessons learned for the space community from it, see “NASA/Navy Benchmarking Exchange (NNBE)”, volume II, NASA Office of Safety and Mission Assurance, NAVSEA 08 Naval Reactors, NAVSEA 07Q Submarine Safety and Quality Assurance Division, 2003-07-15

²¹ USS Thresher was lost on 10 April 1963 during post-overhaul sea trials taking with her all 129 hands onboard. Although never fully proven, it is surmised that faulty welds resulted in flooding during a test dive. Subsequent inquiry suspected that the nuclear reactor may have shutdown during this flooding. The reaction to such a shutdown would have resulted in a lengthy stepwise procedural restart of the reactor, when in fact a timely startup was required to provide propulsion needed to drive the dying ship back to the surface. Although such emergency startup procedures did not exist at the time, Rickover was convinced that sufficient knowledge of the reactor plant would have enabled the crew to potentially get the reactor back online in time to save the ship. The implications were that the operators—from the commanding officer down—did not fully understand the technology they controlled. The events of Thresher forever changed Rickover’s domination over the entire fleet. See M. Hagerott, “Commanding Men and Machines: Admiralship, Technology, and Ideology in the 20th Century US Navy,” PhD dissertation, University of Maryland, 2008. Captain Hagerott is a faculty member in the US Naval Academy’s History Department.

²² The “Rickover Interview” is a subject of lore and legend. Conducted in Rickover’s office, the candidate’s chair had the front legs cut shorter than those of the back to cause the candidate to constantly be sliding off. The often harsh questioning was often on a mix of diverse subjects, demonstrating Rickover’s renaissance nature. By the time the candidate had reached Rickover, the admiral had been provided information on the candidate’s technical ability. This interview was the admiral’s way of determining how the candidate thought, not what they thought.

²³ The authors estimate that over the past 50-plus years of the nuclear program that tens of thousands of prospective nuclear power officer candidates have been personally interviewed by the director of naval nuclear propulsion.

²⁴ Although not detailed here, the nuclear training curriculum for enlisted engineers is identical in course length and location for both Nuclear Power School and Nuclear Power Prototype. Nuclear Power School is considered to be at the undergraduate level. Nuclear Prototype focuses on qualification at enlisted watchstations only. Nuclear power enlisted personnel practice specific disciplines onboard ships according to their rating, becoming specialized in electrical equipment and distribution, reactor controls, or mechanical machinery.

²⁵ As the Air Force considers the balance of engineering with operations and strategy in future development of the space cadre, more in-depth

study of the history of the nuclear navy's evolution of officer development should be conducted. This is especially true as future threats become more unconventional and volatile, and pace of technological change grows. In this case, adaptation becomes more important than specialization. See especially, Hagerott.

²⁶*Report of the Commission to Assess United States National Security Space Management and Organization*, 46.

²⁷Department of the Air Force, Air Force Instruction 36-3701: Space Professional Development Program, 20 May 2010, 5.

²⁸24th Air Force Public website, <http://www.24af.af.mil/library/factsheets/factsheet.asp?id=15663>.

²⁹See, McLaughlin and Crawford, "Forward to the Future: A Roadmap" for a more detailed discussion of why this is so critical.

³⁰Headquarters AFSPC, Space Professional Career Opportunities Guide, 6 April 2011, 25.

³¹For more information on the Space Professional Development Program, the authors suggest the readers review AFI 36-3701 Space Professional Development Program, specifically chapter 3.

³²The authors believe the global information services/utilities mission area and the ground based missile warning and defense portion of the global surveillance, tracking, and warning mission area offer the greatest opportunity for these changes. This has the potential to free up dozens (or more) officer operators to focus elsewhere. While this recommendation will assuredly meet reasoned resistance in many quarters of the space community, today's budget and manpower constraints require bold moves if the Air Force is going to provide cutting edge capabilities and continue to meet the challenges of now and the future.



Dr. Daniel Beary (BS, Physics and Mathematics, US Naval Academy, PhD Physics, Colorado School of Mines) recently retired from Lockheed Martin. During his 26-year career that concentrated on space systems, he led advanced development organizations and served in several senior technologist positions. A former nuclear submarine officer, he served onboard the fleet ballistic submarine USS George Washington (SSBN 598). He retired as a commander from the US Navy Reserve.



Dr. Owen Brown (BS, Engineering Science, Loyola University – Baltimore, MS and PhD, Aeronautical and Astronautical Engineering, Stanford University) serves as the chief technology officer of Kinsey Technical Services, Inc, a leading systems engineering and technical assistance organization providing technical services to the Department of Defense and intelligence community. A former nuclear submarine officer, he served onboard the fast attack submarines USS Flying Fish (SSN 673) and USS Sturgeon (SSN 637). He was

employed as a spacecraft engineer for Space Systems/Loral, where he supported the design and construction of a variety of geosynchronous weather and communications satellites. For six years, Dr. Brown was a program manager for the Defense Advanced Research Projects Agency. In this capacity he led the Microsatellite Technology Experiment program, created the fractionated spacecraft architecture, and began the associated System F6 program. He retired from the US Navy Reserve as a commander after serving as an engineering duty officer.



Col Chris D. Crawford, USAF (BS, Mathematics, University of Alabama; MBA, University of West Florida; National Security Fellow, Kennedy School of Government, Harvard University) is the commander of the 21st Space Wing (21 SW), Peterson AFB, Colorado, which consists of a work force of nearly 5,000 officer, enlisted, civilian, and contract employees. Spanning the globe this team provides missile warning and space control for combat forces and the

national leadership. Colonel Crawford previously served on the Joint Staff in the Operations Directorate. His assignments also include the National Reconnaissance Office, Headquarters (HQ) Air Force Space Command, and HQ Air Force. While deployed he served as space and information operations officer to the director of the air component coordination element at the Coalition Forces Land Component Command. His unit assignments include as an orbit analyst in the 50 SW and as chief of standardization and evaluation in 21 SW. He served command tours at the 50th Operations Support Squadron and 21st Operations Group.



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Getting There From Here: Realizing the Space Commission's Vision 10 Years Later¹

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There have been significant national security space (NSS) developments in the 10 years since 11 January 2001 when the Commission to Assess United States National Security Space Management and Organization (Space Commission) delivered its insightful and comprehensive report that recommended important changes. Initial efforts were made to implement most of the Space Commission recommendations, but many of these changes were rolled back while others languished. Nonetheless, during the past decade, the US continued to advance the transformation of military and intelligence operations by providing more timely and seamless delivery of increasingly sophisticated space capabilities to more and lower-level personnel at the operational- and tactical-levels. There is no question that at the operational- and tactical-levels of war, space operations have achieved new synergies and effectiveness since 2001 that make the commissioners proud. Today's impressive space-enabled operations are possible because of decades of sustained investment and a Cold War-inspired vision about the strategic importance of space.

Unfortunately, however, these advances are not built on a strong foundation because we have not reinvested enough resources or developed a compelling vision for the future of the NSS enterprise. As the Space Commission and subsequent reports, policies, and strategies warn, spacepower can become increasingly fragile as more actors develop capabilities to counter the asymmetric advantages space capabilities provide and as the space domain becomes more congested, contested, and competitive. Spacepower's trajectory has reached an inflection point where business as usual will no longer improve or even maintain US advantages—a point where the US must effectively implement different approaches at the strategic level or face diminishing returns from its space investments, erosion of space leadership, and attrition of its overall power.

To become more agile and adaptive in developing spacepower the US needs to build from the Space Commission and subsequent recommendations to make improvements in two broad areas: (1) strategic-level NSS management and organizational structures; and (2) the military structures for personnel supporting NSS. Changes in the first area are needed to improve unity of effort, efficiency, and effectiveness within the NSS enterprise. An improved military organization for personnel supporting NSS

will better enable them to focus on developing a more effective vision for space acquisitions and operations. While changes are much needed in these areas to improve NSS at the strategic-level, they are much less needed in the operational- and tactical-levels where current operations are much more effective. It is ironic but reflecting back on the Space Commission and its recommendations reveals the US actually has less unity of effort and less clarity in its vision for NSS than it did a decade ago. Building on the Space Commission recommendations and implementing them in more enduring ways will provide a stronger and more stable foundation for spacepower development.

Improving Strategic-Level NSS Management and Organization

Ten years ago major NSS actors included the Office of the Secretary of Defense (OSD), the Air Force, US Space Command (USSPACECOM), the director of central intelligence,² and the National Reconnaissance Office (NRO). With the exception of USSPACECOM, which was disestablished in 2002, all of these organizations remain key actors today, but there is greater fog and friction in the interrelationships between key space policy decision making structures, both internally and among these organizations, than this single major organizational change would suggest. Contentious issues include whether there is an identifiable and usefully delineated NSS enterprise, what elements should and should not be included within it, how best to foster better unity of effort and more clear lines of responsibility and authority within this enterprise, what space capabilities should remain under governmental control and which can be outsourced, and how best to leverage state-of-the-world commercial and international space capabilities. Despite the many Space Commission recommendations and other changes implemented since 2001 that have been designed to improve and assure delivery of space capabilities, foster unity of effort, and clarify lines of authority, the problem of "Who's in charge?" persists. Today it is even less clear than it was ten years ago which major actors and structures should have greatest responsibility and accountability for key NSS decisions.

Since the Space Commission, turmoil in the NSS enterprise has been compounded because so many NSS management and organizational changes have been implemented, undone, or modified in such a short span of time, the effects of previous changes were not always clear before the next ones were initiated. Since it can easily be 30 years or more from the time a new space system is planned until the last satellites are decommissioned, the only approaches to improving space management and organization that make sense require patience, transparency, consistency, and accountability. Management and organizational structures should be kept in place long enough to determine whether they are effective, policies implemented consistently across all organizations, and organizations and individuals rewarded for successes

or disciplined for failures. Studies of organizational dynamics indicate that new structures must be clear and in place for a number of years before their efficacy can be fairly assessed. In this regard, there is little justification for referring to short-lived or incompletely and inconsistently implemented structures, such as the deputy undersecretary of defense for space in the 1990s or the National Security Space Office in the 2000s, as failed experiments, since neither was given enough time or held consistent authorities needed to make lasting improvements.³

Due to a sweeping charter, powerful members, and comprehensive recommendations, the Space Commission Report remains the most important and influential examination of NSS issues.⁴ Initially, several significant NSS changes were made in direct response to the thoughtful Space Commission recommendations. The Air Force moved quickly and effectively to implement at least portions of the commission's ten major recommendations, such as making the commander of Air Force Space Command (AFSPC) a four-star billet that need not be flight-rated and moving AFSPC out from the combatant command authority of USSPACECOM; designating the undersecretary of the Air Force (USECAF) as the director of the NRO, Air Force acquisition executive for space, and Department of Defense (DoD) executive agent (EA) for space; aligning the Space and Missile Systems Center underneath AFSPC instead of Air Force Materiel Command; and establishing a major force program (MFP) accounting category for the NSS budget.⁵ Other Space Commission recommendations were implemented inconsistently, some were rolled back, and some never attempted.

Below, we consider the Space Commission recommendations from top to bottom, modify them as necessary based on other recommendations and subsequent developments, and suggest a structure that could operate effectively under a variety of leaders in enduring ways, independent of individual personalities. The highest-level Space Commission recommendations were beyond the power of DoD to implement and included the necessity for presidential leadership in recognizing space as a top national security priority, appointment of a Presidential Space Advisory Group and establishment of a Senior Interagency Group for Space within the National Security Council (NSC) structure, and the need for the secretary of defense (SECDEF) and director of national intelligence to work closely and effectively together on space issues. Several similar top-level recommendations were made in the July 2008 report of the congressionally mandated Independent Assessment Panel (IAP) headed by Mr. Thomas Young.⁶

We believe that only direct presidential leadership can sustain focus on space issues at the highest levels. The president led the effort to develop the National Space Policy released in June 2010 and should now lead an effort to develop the US' first compre-

hensive National Space Strategy, require this strategy be updated at least every four years, and reestablish the National Space Council (NSpC) at the White House. Only sustained presidential leadership and support throughout the Executive Office of the President can effectively synergize the four interdependent space sectors (defense, intelligence, civil, and commercial).

To manage the growing security, scientific, and economic value of space, the NSpC should be chaired by the National Security Advisor, include the director of the Office of Science and Technology Policy (OSTP) and the chair of the Council of Economic Advisors (CEA), and be supported by one or two dedicated staffers seconded from the NSC staff, OSTP, and CEA. A standing body with a sole focus on space is needed at the White House to provide space issues with the focused attention they require, develop recurring national space strategies and policies, bring a national perspective to adjudicating inevitable disagreements between powerful space organizations over relative priorities and shared responsibilities, work closely with the president to raise and resolve the most difficult issues, and ensure strategies and policies are comprehensively and consistently implemented. This approach is not favored by some White House staffers or by powerful space organizations and they are likely to make it difficult to reestablish the NSpC, but their opposition is not a good reason to retreat from this minimum and necessary initial step. Besides, no individual structural change would be sufficient alone or guarantee the most important factor: raising and sustaining presidential interest in space strategy. Nonetheless, it is important to reestablish the NSpC and institute a more enduring process for developing and implementing national space strategy at the White House, starting now rather than continuing to debate what the optimal structure might be and then working through improvements over successive administrations.⁷

Significant changes are also needed in executive branch organizations. One of the most important Space Commission recommendations left undone was primarily within the power of DoD to implement and called for creation of an undersecretary of defense for space, information, and intelligence. Instead of implementing this recommendation, Hon. Donald Rumsfeld, who led the commission before becoming SECDEF, made the Space Commission Staff Director, Dr. Stephen Cambone, his DoD point man for space and eventually placed him and space responsibilities for DoD in the undersecretary of defense for intelligence (USD[II]) position created in March 2003. This personality-dependent approach did not institutionalize centralized authority and responsibility for NSS within OSD in an enduring way, which helps explain why some important NSS programs lack unity of effort, and contributes to continuing unhealthy competition between OSD branches as well as overlaps, gaps, and unclear lines of authority

Proposed Strategic-Level NSS Management Structure

- The president should lead development of a National Space Strategy and reestablish a NSpC that is chaired by the National Security Advisor and includes the OSTP director and chair of the Council of Economic Advisors.
- Create a dual-hatted NSS Authority with the rank of undersecretary of defense and deputy director of national intelligence for space and milestone decision authority (MDA) over all major intelligence community (IC) and DoD space acquisition programs. Reestablish a unified command with space as its area of responsibility (AOR).
- Reintegrate the secretary or undersecretary of the Air Force, DoD EA for space, and NRO director into a single position.

and responsibility between OSD and the DoD EA for space.

The most appropriate way to address this shortcoming builds on a Space Commission recommendation and was provided in a key recommendation from the IAP: a dual-hatted NSS Authority should be established with the rank of undersecretary of defense and deputy director for national intelligence for space and be given Milestone Decision Authority (MDA)—authority to make decisions to start, continue, restructure, or end major acquisition programs at key decision points (milestones)—over all major IC and DoD space acquisition programs. Consolidation of MDA under the NSS Authority would end the current fragmentation of authority and responsibility at the OSD level among the principal staff assistants (PSA) who support the deputy and SECDEF on major space acquisitions within narrow mission area stovepipes. On the surface, current dysfunctions in authority and responsibility seem likely to be reduced if Secretary of Defense Robert Gates' efficiency proposal to eliminate the assistant secretary of defense for networks and information infrastructure (ASD/NII) is implemented since that office provides the PSA for three NSS mission areas—satellite communications; positioning, navigation, and timing; and space control—but it is unclear where these PSA responsibilities would migrate and likely that the problems may be exacerbated unless these PSA responsibilities find a champion. Our proposed NSS Authority is similar to the Space Commission recommendation to create an undersecretary of defense for space, intelligence, and information; aligns with Congressional direction to designate an OSD official to provide overall supervision of the preparation and justification of program recommendations and budget proposals to be included in MFP-12 (the space MFP); and would consolidate and clarify lines of authority and responsibility within OSD for NSS management while also strengthening linkages between DoD and the IC and helping NRO better prepare for operations in contested space.

Another very significant change to the Space Commission vision for NSS management and organization came on 1 October 2002 when USSPACECOM was merged into US Strategic Command (USSTRATCOM). This change came after the 9/11 attacks and was associated with creation of US Northern Command, increased emphasis on homeland defense, and the desire to bring together multiple “global” missions under one combatant commander. Initially, described as a modest rearrangement and a joining of equals, in practice this was a major reorganization that quickly absorbed USSPACECOM into USSTRATCOM, leaving very few vestiges of the original USSPACECOM. Instead of space being the sole focus of one of just nine unified commands, under the new structure space now competes for attention among a very wide array of disparate USSTRATCOM mission areas that include deterring attacks on US vital interests, ensuring freedom of action in space and cyberspace, delivering integrated kinetic and non-kinetic effects to include nuclear and information operations in support of US joint force commander operations, synchronizing missile defense plans and operations, and combating weapons of mass destruction. And because unified commands are the warfighters who operate systems and set capability requirements, this change has resulted in less focus on current space operations and future space capability needs. It is very difficult to reconcile this organizational change with the

Space Commission's overarching recommendation to make space a top national security priority, yet this change could not have been made without Secretary Rumsfeld's concurrence and it is unclear why his management priorities changed so significantly. Desires to achieve efficiencies by minimizing headquarters staffs are laudable but not as important as providing the right structure to focus military attention on key security challenges; moreover, creation of US Africa Command in 2007 broke the ceiling of only nine unified commands, a self-imposed limitation that made little sense strategically given evolving global security dynamics.

We believe moving USSPACECOM into USSTRATCOM would best be corrected by reestablishing a unified command with space as its mission and AOR in order to provide space with the focused attention it requires from the experts who understand the nature of spacepower best because they employ space capabilities every day. If reestablishing a unified space command proves too difficult given fiscal austerity, the next best option would be establishing a sub-unified US Space Command led by a four-star officer under USSTRATCOM as DoD did in establishing US Cyber Command. It is essential that the US military effectively develop, integrate, and protect space and cyber capabilities, but USSTRATCOM's current command structure with a three-star-led Joint Functional Component Command for Space (JFCC-Space) established in July 2006 and a four-star-led sub-unified US Cyber Command created in May 2010, is inconsistent with the importance of space operations, results in too broad and disparate a span of control, and undervalues the growing importance of both space and cyber operations.

Two other changes in internal Pentagon management structures also slowed steps towards improved NSS integration and unity of effort: movement of MDA for major NSS acquisitions away from the DoD EA for space to the undersecretary of defense for acquisition, technology, and logistics, and separation of the position of director of the NRO from the DoD EA. Removal of MDA took place shortly after Mr. Peter Teets left office as DoD EA in March 2005 and was originally explained as a temporary expedient due to a lack of Senate confirmed Air Force leadership able to exercise such authority at that time but also had the appearance of punishing the Air Force for performance failures and overruns in space acquisitions. Placing MDA in the new NSS Authority position described above would focus, clarify, and streamline lines of authority and responsibility and create better prospects for more effective and efficient management.

In July 2005 the USD(I) announced that incoming USECAF and DoD EA Dr. Ronald Sega would not, as had his predecessor, also be director of the NRO. Although very little public rationale was provided, this “divorce” was a very significant organizational change that, like closing USSPACECOM, called into question DoD's commitment to a key Space Commission recommendation since the need for better black-white integration was a major finding and it is difficult to understand how two people could achieve better integration than one. Moreover, the divorce revealed stark inconsistencies in the nation's approach to NSS management and organization because the argument was made that a separate NRO director was needed to provide more focused senior IC management attention on space shortly after USSTRATCOM had absorbed USSPACECOM and significantly reduced the amount of

focused combatant commander attention on space.

We believe the best approach for improving the structure at this level would be to reintegrate into a single position the DoD EA for space, the secretary or USECAF, and the director of the NRO. Reintegrating these three positions would realign the Air Force-NRO organizational structure to essentially the same hierarchy it had from the creation of NRO in 1961 until the 2005 divorce,⁸ provide better prospects for improved integration and unity of effort from the two most important NSS operators and acquirers, and retain continuity with important current architectural, planning, and assessment functions of the DoD EA such as the NSS plan and program assessment.

Creating an Improved NSS Personnel Structure to Foster Development of a More Compelling Vision for Operations and Acquisition

While implementing the changes recommended above would be important steps toward improved NSS efficiency, effectiveness, and unity of effort, they are insufficient for developing an even more important foundation for a robust NSS enterprise: a compelling vision for NSS. To develop a more compelling vision for NSS operations and acquisition, improved organizational structures for NSS personnel are needed to nurture the leaders who can develop and realize vision since it is only these unique individuals who can play this essential role. Of course, any movement toward creating and sustaining an improved structure also raises difficult timing, balancing, and chicken-and-egg issues that are exacerbated by efficiency considerations, as well as tradition and cultural resistance to change. No wonder it is only fools who rush in where angels fear to tread, but we cannot neglect exploring ways to improve this most important determinant of future success—creating structures that can incubate the leaders who can develop compelling vision.⁹

If the US, and in particular, the Air Force is serious about cultivating innovative approaches to national security space issues, it must carefully address the human dimension of this problem. People provide the leadership required to develop and implement vision. In *Winning the Next War*, Stephen P. Rosen explains that peacetime military innovation is most likely when senior military leaders develop a new theory of victory and then create “a new promotion pathway to the senior ranks, so that young officers learning and practicing the new way of war can rise to the top, as part of a generational change.”¹⁰ There is much the Air Force can do on the space front at both the junior and senior levels to help encourage the type of long-term innovation Rosen discusses. Yet both in the Air Force and throughout DoD, space remains largely the purview of the civilian leadership of the departments, a paradigm not true for land, air, or sea. The Air Force should develop promotion pathways so that junior space officers can rise to senior levels of command, not only within the space community but also—and this will be one of the best tests of whether development of the space cadre is rhetoric or reality—within the greater Air Force as well.

At the senior levels, the Air Force’s greatest need is for more stability and longer tenures. By design, a great deal of turnover normally occurs in senior military positions, but certain key positions such as commander JFCC-Space or commander

USSTRATCOM need to be broken out of this pattern in order to create more stability and long-term vision in an area in which these are lacking. The four-year tenure of General Lance W. Lord as AFSPC commander built the command in myriad enduring ways. By contrast, there were eight commanders-in-chief, US Space Command (CINCSpace) in the 17 years of USSPACECOM’s existence, and this type of rotating door at the top makes it very difficult for anyone to provide long-term leadership and stable vision for the future. Of the eight, only two (Generals Robert T. Herres and Donald J. Kutyna) had any significant space background prior to becoming CINCSpace, further aggravating the effects of rapid succession in command. It is particularly telling to contrast the plight of each CINCSpace or AFSPC commander with the long-term tenure enjoyed by Adm William Moffett (known as the “Air Admiral” for his leadership of the Bureau of Aeronautics from its creation in 1921 until his death in the crash of the airship USS *Akron* in 1933) and Adm Hyman Rickover (who helped create then served as the de facto head of the nuclear navy from the late 1950s until the early 1980s and personally screened all naval officers applying for duty aboard a nuclear ship) or to consider how a future space leader might create the vision to nurture a space transformation as significant as naval aviation or nuclear propulsion—the US Navy’s most important innovations during the 20th century.

We also believe that it is important to incorporate specific authorities and structures within the Air Force to increase its effectiveness in delivering space effects and on-time, on-budget space capabilities including: control over the space MFP; creation of a Space Staff separate from the Air Staff at the Pentagon; and control over space personnel actions, including promotion decisions. In order to provide a better environment for nurturing NSS leaders and vision, we believe the time has come for the nation to consider creating a separate Space Corps within the Air Force.¹¹ This Air Force Space Corps (AFSC) would be separate from the Air Force, but be part of the Department of the Air Force. The rationale for creating this corps and its standard operating procedures would draw from precedents developed by both the US Marine Corps that was established at our nation’s founding and from the Army Air Corps that was established in 1926 and served as an interim step on the path to the creation of an independent Air Force in 1947. Creating an effective AFSC will also require that its acquisitions and operations eventually encompass the current functions of AFSPC and NRO, although the specific timing and path by which this takes place would be determined best by the vision of the leaders nurtured for a generation within AFSC. Whether the AFSC should remain an independent corps or evolve into a separate department is a future issue that would be resolved best by incubating future NSS leaders within AFSC and empowering them to develop a compelling vision. Although it may not be time yet to create a separate space service, sometimes radical changes are more effective solutions.

Contrasting Brig Gen William “Billy” Mitchell’s comprehensive vision of the US as an airpower nation in *Winged Defense*, the Air Corps Tactical School’s (ACTS) vision for strategic bombing in the 1930s, or the Eisenhower Administration’s vision for opening up the closed Soviet state by legitimizing satellite overflight and freedom of space in NSC-5520 with whatever comprehensive

guidance the US has concerning space and future national security emphasizes just how little vision we currently enjoy.¹² To be sure, Mitchell, ACTS, and Dwight D. Eisenhower did not always get things right, which only reinforces how important it is to foster open and rigorous debate concerning space's role in the future of the Air Force and the nation. It is always challenging to think beyond current policy and organizational structures when considering the nature, possibilities, and limitations of spacepower. Amidst the changing international environment, the increasing commercial and military utility of space, and importance of cyber operations, these are issues concerning the very soul of the technologically savvy Air Force General Henry "Hap" Arnold envisioned—issues on which vigorous debate and doctrinal sorting is inevitable and overdue.

Revisiting the background of the Space Commission also convinces us of the need for greater rigor and consistency in the development of Air Force vision statements. Vision statements should illuminate a path to a desired future state by providing general, long-term guidance. They can endure only if they are clear and consistent. Rigor in developing vision statements helps to ensure that they are comprehensive, supportable, and do not need to be changed very often. Two recent Air Force vision statements clearly fail these basic tests: only about three-and-a-half years elapsed between the releases of *Global Engagement* in November 1996 and *Global Vigilance, Reach & Power* in May 2000, yet these consecutive statements represent starkly different visions of space versus aerospace and disagree about the importance of space in the Air Force's future.¹³ Imperfect but durable vision statements that merely get it less wrong than our potential adversaries (to use Michael Howard's phrase) are preferable to churning out new vision statements with every change in senior leadership.

Finally, and perhaps most importantly, we reiterate that it is more important to focus on the first-order issue of developing a robust and comprehensive vision for US spacepower than to become mired in seemingly endless debates about the best way to organize for NSS. Our recent missteps indicate that any road will get you there when you don't know where you're going; a more effective and better funded organization will only get you lost faster in these situations. Limited resources are always a problem, and although there is a clear need for much investment in some areas such as space situational awareness, simply throwing more money at the Air Force (or a new space service, for that matter) will not resolve America's unclear vision for NSS.

Ultimately, the problem facing the Air Force comes down in large part to issues of perception and trust. Creating commissions and mandating organizational changes in order to address underlying issues are what politicians in pluralist democracies do when they do not trust bureaucracies to promote and implement change on their own. In order to retain its responsibilities in space, the Air Force must not only be a good steward of space but must be seen to be a good steward. All of the Space Commission recommendations and the others we presented here address this challenge. Greater intellectual honesty and openness in discussions of strategy, greater coherence and rigor in the resulting vision statements and other public rhetoric, and greater efforts to develop knowledgeable and enduring military space leadership

at all levels could do much to build faith in the Air Force's management of space. Without improvement in these areas, progress in spacepower thought, the organizational health of the Air Force, and US national security will all suffer. But with such changes, the Air Force could establish itself as the champion of spacepower transformation and in the process, avert future crises of Congressional confidence and the public's lack of belief in its stewardship of space.

Notes:

¹ The authors conducted e-mail and telephone interviews with some of the space commissioners between 9 May and 6 June 2011; in addition, some provided comments on earlier versions of this article. We greatly appreciate their cooperation and insights but, of course, any interpretative or factual errors are solely our responsibility. In particular, we would like to thank General Thomas Moorman (USAF, retired), Mr. Robert Davis, and Dr. William Graham. We also appreciate comments on an earlier version of this draft from Roger Harrison and Scott Pace.

² This position was strengthened and given specific budgetary authority over the IC by the Intelligence Reform and Terrorism Prevention Act of 2004; it is now known as the director of national intelligence (DNI).

³ See Joan Johnson-Freese and Roger Handberg, "Searching for Policy Coherence: The DOD Space Architect as an Experiment," *Joint Force Quarterly* 16 (Summer 1997): 91-96; and Joan Johnson-Freese, "An Al-lard Commission Postmortem and the Need for a National Space Council," *Joint Force Quarterly* 60 (1st Quarter 2011): 54-60.

⁴ Other important previous NSS related committees and their key space policy recommendations include the: 1954-55 Technological Capabilities Panel (TCP) (establish the legality of overflight and develop spy satellites); President's Science Advisory Committee (PSAC), led by Science Advisor James Killian in 1958 (create NASA); group led by Science Advisor George Kistiakowsky in 1960 (create NRO); review led by Vice President Lyndon Johnson in April 1961 (race the Soviets to the Moon for prestige); Vice President Spiro Agnew's 1969 Space Task Group (establish NASA's post-Apollo goals); Air Force's 1988 Blue Ribbon Panel led by Maj Gen Robert Todd (integrate spacepower into combat operations); NASA's 1991 Augustine Commission (emphasize scientific exploration over shuttle operations); and Air Force 1992 Blue Ribbon Panel, led by Lt Gen Thomas Moorman (emphasize space support to the warfighter and establish the Space Warfare Center). The Space Commission was chaired by former and future Secretary of Defense Donald Rumsfeld and included 12 other members with a broad range of very high-level NSS expertise (listed with the top "space" job formerly held): Duane Andrews (assistant secretary of defense for command, control, communications, and intelligence); Robert Davis (deputy undersecretary of defense for space); Howell Estes (commander, US Space Command); Ronald Fogleman (Air Force chief of staff); Jay Garner (commander, Army Space and Strategic Defense Command); William Graham (president's science advisor and acting NASA Administrator); Charles Horner (commander, US Space Command); David Jeremiah (vice chairman, joint chiefs of staff); Thomas Moorman (Air Force vice chief of staff); Douglass Necessary (House Armed Services Committee staff); Glenn Otis (commander, Army Training and Doctrine Command); and Malcolm Wallop (senator). See John A. Tirpak, "The Fight for Space," *Air Force Magazine* 83 (August 2000): 61.

⁵ General Accounting Office, Report to Defense Committees, Defense Space Activities: Organizational Changes Initiated, but Further Management Actions Needed," (Washington: GAO, GAO 03-379, April 2003), 25-27. Secretary Rumsfeld signed a memo on 18 October 2001 directing DoD to undertake 32 actions to implement Space Commission recommendations and make other changes.

⁶ The IAP consisted of A. Thomas Young (chairman), Edward Anderson, Lyle Bien, Ronald Fogleman, Lester Lyles, Hans Mark, and James Woolsey. The Panel began deliberations in October 2007 and delivered their final report in July 2008. Their charter was in Section 913 of the Fiscal Year 2007 National Defense Authorization Act. The four major recommendations of the IAP were: (1) The president should establish and lead the execution of a National Space Strategy and reconstitute the National Space Council at the White House, chaired by the National Security advi-

sor; (2) Establish a National Security Space Authority with the rank of undersecretary of defense and deputy director for national intelligence for space and authority as the DoD EA for space; (3) Create a National Security Space Organization consisting of NRO, SMC, and operational functions of AFSPC and Army and Navy organizations providing space capabilities; and (4) Change Air Force and IC human resource management policies for space acquisition professionals in order to emphasize technical competence, experience, and continuity. See "Leadership, Management, and Organization for National Security Space: Report to Congress of the Independent Assessment Panel on the Organization and Management of National Security Space," (Alexandria, VA: Institute for Defense Analyses, July 2008).

⁷ John M. Logsdon, the dean of American space policy analysts, provides an outstanding historical review of White House space policymaking structures, finds that a separate organization such as a space council "has not been successful in demonstrating its superiority as an organizational approach," and advocates creation of a mini-space council within the NSC structure; see "Emerging Domestic Structures: Organizing the Presidency for Spacepower," in Charles D. Lutes and Peter L. Hays with Vincent A. Manzo, Lisa M. Yambrick, and M. Elaine Bunn, eds., *Toward a Theory of Spacepower: Selected Essays* (Washington: National Defense University Press, 2011), 277-97. Joan Johnson-Freese argues that the ability to stifle creation of a National Space Council during the Obama administration thus far "is a tribute to the power of bureaucratic and organizational politics" and finds that "the presence of a National Space Council does not assure that transformation will occur, its absence almost certainly does assure that it will not," see "An Allard Commission Postmortem," 60.

⁸ From the creation of NRO in 1961 until the 2005 divorce, the NRO director (DNRO) had always been an assistant secretary, the undersecretary, or the secretary of the Air Force; when NRO was a classified organization, this was referred to as "wearing the black hat." When Donald Kerr became DNRO in 2005 he initially had no Air Force position and was later made assistant to the secretary of the Air Force (intelligence space technology), a position also held by his successor Scott Large. Current DNRO Bruce Carlson does not have any Air Force position listed on his official biography. See NRO website: <http://www.nro.gov/directorlist.html>. In June 2003 Deputy Secretary of Defense Paul Wolfowitz signed DoD Directive 5101.2 designating the secretary of the Air Force as DoD EA for space and allowing the secretary to redelegate EA responsibilities to the undersecretary but no further.

⁹ Arguments presented here are updated and expanded versions of those in Lt Col Peter L. Hays and Dr Karl P. Mueller, "Going Boldly—Where? Aerospace Integration, the Space Commission, and the Air Force's Vision for Space," *Aerospace Power Journal* 15, no. 1 (Spring 2001): 34-49.

¹⁰ Stephen Peter Rosen, *Winning the Next War: Innovation and the Modern Military* (Ithaca: Cornell University Press, 1991), 20. For a very interesting and more comprehensive model for military innovation, see Maj Bruce McClintock, "The Transformation Trinity: The Role of Vision, Culture, and Assessment in Strategic Innovation" (master's thesis, School of Advanced Airpower Studies, Maxwell AFB, AL., June 2000).

¹¹ Almost all of our recommendations for creating a separate AFSC are drawn from James B. Armor, Jr., "Viewpoint: It is Time to Create an Air Force Space Corps," *Astropolitics* 5, no. 3 (Autumn 2007): 273-88.

¹² For a discussion of NSC 5520 and the complex maneuvering of the superpowers at the opening of the space age see Walter A. McDougall's Pulitzer Prize-winning book, *...the Heavens and the Earth: A Political History of the Space Age* (New York: Basic Books, 1985), 119-21; R. Cargill Hall, "Clandestine Victory: Eisenhower and Overhead Reconnaissance in the Cold War," in Dennis Showalter, ed., *Forging the Shield: Eisenhower and National Security for the 21st Century* (Chicago: Imprint Publications, 2005); and R. Cargill Hall, "Origins of US Space Policy: Eisenhower, Open Skies, and Freedom of Space," in John M. Logsdon, ed. *Exploring the Unknown: Selected Documents in the History of the US Civil Space Program, Vol. I: Organizing for Exploration* (Washington: NASA History Office, 1995), 213-229.

¹³ Gen Ronald R. Fogleman and the Honorable Sheila E. Widnall, *Global Engagement: A Vision for the 21st Century Air Force* (Washington, DC: Department of the Air Force, November 1996); Gen Michael E. Ryan and the Honorable F. Whitten Peters, *The Aerospace Force: Defend-*

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The Space Commission Recommendations in Retrospect: Four Key Lessons

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From 1998 to 2002, I was part of a small team in the Pentagon whose singular focus was space-related policy development and implementation. As a policy office (SAF/SXP) working for the assistant secretary of the Air Force for space, we watched with keen interest the activities of the Commission to Assess United States National Security Space Management and Organization (or Space Commission).¹ The commission released its report in January 2001 and the members on my team immediately began to review every aspect of the 100-page document. None of us were particularly surprised by the report or its key recommendations—our office was very familiar with each of the issues highlighted by the commission. Given that Donald Rumsfeld was the commission’s chairman, as well as the newly nominated secretary of defense (SECDEF), we had high expectations that many, if not most, of the recommendations would be implemented.

In its report, the Space Commission provided both general and specific recommendations designed to ensure the US has “the capability to use space as an integral part of its ability to manage crises, deter conflicts and, if deterrence fails, to prevail in conflict.”² For much of the spring and summer of 2001, our office worked closely with senior leaders in the Headquarters Air Force and the Office of the Secretary of Defense (OSD) to better understand the strategy necessary to implement these recommendations. Unfortunately, our work was preempted by the events that occurred the morning of 11 September 2001. It is impossible to determine what impact the Space Commission Report might have had if the nation’s attention had not been diverted to the war on terror. To this day, some of the Space Commission’s recommendations have not been implemented, while others were implemented with little or no positive impact. Still others were put into place with lasting, positive effect. Ten years later, some analysts can not resist the temptation to “grade” the implementation of each recommendation and analyze the attendant outcome. While a line-by-line review may be informative, there is greater value in examining the necessary conditions for successful policy implementation. Reflecting on the space commission’s work, four overarching lessons come to mind:

1. Posture for the Unexpected
2. Resources are Key (when it comes to policy implementation)

3. Rearranging the Deck Chairs Will Not Save the Titanic
4. Meaningful Policy Implementation Occurs at the Tactical Point of Contact

Lesson 1: Posture for the Unexpected

The Space Commission accomplished its work and published its report during a time when the US government had the luxury to indulge in consideration of matters unrelated to the immediate existential threats to the nation. The threat al-Qaeda posed to the US was one of many concerns, but certainly not the nearly singular pre-occupation it was to become. The economy was strong and the nation enjoyed a small budget surplus for the first time in decades.³

Today, the world is a much different place and the US faces challenges that few envisioned 10 years ago. Arguably, our national priorities have changed over the past 10 years. Posturing for the unexpected requires the US government to review our goals and assumptions continually and to have the flexibility, ingenuity, innovation, and leadership necessary to adjust our strategies based on evolving world conditions—not those of the past. It also requires that the US government separate means from ends. As the world changes, the US government must reassess our ends and adjust the means to meet them.

Consider the five “matters of key importance” highlighted in the Space Commission’s report. In a time of relative peace and prosperity, the commission unanimously concluded the following:

1. US national security space interests should be recognized as a top national security priority;
2. The Department of Defense (DoD) and intelligence community are not yet arranged or focused to meet national security space needs of the 21st century;
3. The SECDEF and director of central intelligence must work in partnership to set and maintain the course for national security space programs and to resolve the differences that arise between the respective bureaucracies;
4. The US must develop the means both to deter and defend against hostile acts in and from space; and
5. The US government needs to expand and deepen the pool of talent in science, engineering and systems operations as well as sustain its investment in enabling and breakthrough technologies in order to maintain leadership in space.

All five continue to be reasonable matters of key importance, but given the current environment, a reassessment of goals, recommendations, and assumptions is warranted. Which of these subordinate recommendations remain relevant? How can the relevant recommendations be implemented and prioritized? Are there alternative recommendations that are more likely to be implemented and will still meet the overarching goal?

Posturing for the unexpected begins by imagining a future dramatically different from the current environment. Interestingly, the Space Commission recognized the need to posture for the unexpected and quoted Harvard University's political economist Thomas C. Schelling to illustrate the point. Schelling wrote, "There is a tendency in our planning to confuse the unfamiliar with the improbable. The contingency we have not considered looks strange; what looks strange is thought improbable; what is improbable need not be considered seriously."⁴

What sorts of futures might be encountered in the next few years? Will a major technological breakthrough obviate the need for foreign oil? Will North Korea fail as a state and be peacefully integrated with its southern neighbor, or might it detonate a nuclear weapon in low earth orbit in a final, desperate move? Will a major earthquake destroy much of Los Angeles? Will the "Arab Spring" lead to an era of increased peace and stability or a deepening of tensions in an ever-growing regional conflict?⁵

In five years time, the world will look different from now. And it is safe to say that if we fail to imagine the possible futures and posture for an unexpected, changing world, the US will fall short of our enduring, strategic goals.

Lesson 2: Resources are Key

Policy is little more than a set of principles or rules designed to produce a desired outcome. In its report, the Space Commission concluded that the nation's fundamental space policy was sound, but required significantly greater attention from the president and resources commensurate to space's growing importance. The commission made 11 specific recommendations that, taken together, form the nucleus of what could have been a strategy (the coordinated use of means to achieve ends over time) to achieve their vision:⁶

1. Presidential direction to review and revise existing space policy with the goal of elevating space as a top national priority;
2. Formation of a Presidential Space Advisory Group to provide independent advice;
3. Formation of a Senior Interagency Group for Space that reports through the National Security Council;

4. Regular meetings between the SECDEF and director of central intelligence to address national security space policy, objectives, and issues;
5. Establishment of an undersecretary of defense of space, intelligence and information to provide policy, guidance and oversight for space within a single organization within OSD;
6. Assign responsibility for the command of Air Force Space Command (AFSPC) to a four-star officer other than the commander-in-chief of the US Space Command (CINCSpace) and/or the commander-in-chief of the North American Aerospace Defense Command (CINCNORAD);
7. Realign Air Force headquarters and field commands to organize, train, and equip more effectively for prompt and sustained space operations; designate the Air Force as the executive agent for space; realign Space and Missile Systems Center (SMC) under AFSPC;
8. Align the undersecretary of the Air Force (USECAF) as the director, National Reconnaissance Office (NRO); designate the USECAF as the component acquisition executive; merge current NRO and US Air Force activities to create a single organization responsible for development, acquisition, and operations of defense and intelligence space activities;
9. Direct creation of a research, development, and demonstration organization to develop revolutionary capabilities for intelligence collection;
10. Establish a Major Force Program for Space to provide improved insight into space-related funding; provide funds commensurate with the relative importance of space; and
11. Adjust congressional committee and subcommittee structure to align better with executive branch responsibilities.

The US government implemented some of these recommendations with mixed results. For example, US Space Policy was reviewed and revised by the administrations of both Presidents George W. Bush and Barack Obama,⁷ although it is debatable whether either revision significantly elevated space as a top national priority (recommendation 1). A separate four-star general officer was charged to lead AFSPC and SMC was realigned accordingly; however, the evidence that the SMC realignment has significantly improved the effectiveness with which the

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A key lesson to take from the Space Commission is that reorganization and realignment is most effective when responsibility and authority are provided to organizations unencumbered by multiple and competing priorities.

command acquires space systems is subject to interpretation (recommendation 6/7). Other recommendations were implemented in part, for a short period of time, or not at all.

Regardless of the myriad reviews and realignments effected by the commission's report, the overall success of this new presidential policy has been undermined by a failure to provide funding commensurate with the relative importance of space (recommendation 10). Although the commission did not identify a specific level of funding, they implied a very significant increase. The commission borrowed from the Defense Science Board Task Force on Space Superiority to make the point "the use of space has become such a dominant factor in the outcome of future military conflict and in the protection of vital national security interests that it should take on the priority ... similar to that which existed for strategic forces in the 1960s through 1980s."⁸ Moreover, the report noted that "investments directed to the buildup of strategic forces in the 1960s averaged some ten percent of the Defense Department's budget annually."⁹

The Space Commission provided policy recommendations and the outline of a strategy to implement the policy. But the strategy required a three to four-fold increase in resources. To assume the commission's recommendations will lead to its overarching goal absent additional resources is foolhardy. Thomas L. Friedman rightly observed that "a vision without resources is a hallucination."¹⁰ Consequently, the nation must reassess its policy or identify a dramatically different strategy—one that can be implemented at current resource levels.

Lesson 3: Rearranging the Deck Chairs Will Not Save the Titanic

Not all reorganization is effective. Certain Space Commission reorganization recommendations were implemented with clear success. Others were implemented with unsatisfactory results.

A key lesson to take from the Space Commission is that reorganization and realignment is most effective when responsibility and authority are provided to organizations unencumbered by multiple and competing priorities. Reorganization is least effective when responsibilities and authorities are merely shifted from one, over-tasked organization to another, particularly if authority and responsibility are diffused among numerous organizations.

The assignment of AFSPC to a four-star officer other than CINCSPACE/CINCNORAD has had significant positive results. The four-star officers that have held this position have been able to focus their time,¹¹ energy and four-star gravitas on US Air Force space organize, train, and equip issues. Over the last 10 years, the central responsibility for US Air Force space issues has slowly but effectively and appropriately migrated from HQ US Air Force to AFSPC. And because the command

is closely engaged with the operational and tactical level operators and users of space systems and services, it is in a better position to identify, appreciate, and address key space issues.

On the other hand, the reassignment of responsibilities from the dual-hatted assistant secretary of the Air Force (space)/director, NRO (DNRO) to the dual-hatted USECAF/DNRO did very little to improve Air Force and NRO space program alignment or address long-standing programmatic challenges. The undersecretary retained all the traditional undersecretary responsibilities and was not provided sufficient authority to align Air Force and NRO programs. The USECAF/DNRO was supported by the National Security Space Office (NSSO) (formerly the National Security Space Architect plus the assistant secretary of the Air Force (space) staffs). The staff's key responsibilities included development of space architectures, the National Security Space Plan to guide resource decisions and the National Security Space Program Assessment to review programmatic decisions. But these activities competed with AFSPC's organize, train and equip responsibilities. Additionally, the NSSO's responsibilities were only advisory, rather than directive, and failed to garner the additional resources required to meet the Space Commission goals.

The extent to which the Air Force has reconciled this critical lesson will be revealed in the near-term. The recent decision to reorganize Air Force cyber capabilities under AFSPC will likely prove to be an interesting case study over the next few years. Has the Air Force merely rearranged the deck chairs? Is AFSPC saddled with too much responsibility and too little authority to lead in both space and cyberspace domains effectively? Or are the domains sufficiently intertwined that separation would unravel important cross-domain synergy? Reorganization is most successful when responsibility, authority, and resources are all properly aligned. The case study in space produced mixed results. With respect to cyber, time will tell.

Lesson 4: Policy is Implemented at the Tactical Point of Contact

Despite the changing national imperatives shaped by the threats of our post-9/11 world, many of the Space Commission recommendations have been implemented by tactical units. Rather than cite numerous examples from AFSPC's operational wings, groups, and squadrons, highlighted below are examples from the Space Innovation and Development Center (SIDC).

The commission recommended development of comprehensive exercise, experiments, wargames, and modeling/simulation capabilities to uncover how best to employ and exploit current capabilities, to assess alternative architectures and emerging threats and to imagine alternative geo-political and technical futures.¹²

The SIDC's Distributed Mission Operations Center for

Space (DMOC-S) provides live, virtual, and constructive environments to space and terrestrial warfighters, allowing for efficient and effective exercising of current and near-future space capabilities. DMOC-S has developed tools such as the space systems generator (SSG) and the GPS environment generator (GEG) to model the man-made space environment more accurately.

The SIDC's Innovation Directorate has developed the integrated space situational awareness (ISSA) tool to reflect the broad capabilities of the world's space systems. ISSA, in conjunction with the DMOC-S's SSG and GEG tools, can model the impact of changes to satellite and ground systems configurations, regardless of whether these changes are driven by hostile actions, the natural environment, maintenance, or deliberate decisions.

The SIDC's 25th Space Range Squadron (25 SRS) provides a safe and secure environment in which the command's offensive and defensive space control units can realistically train new procedures and exercise the breadth of their capabilities in stand-alone events or in concert with larger scale activities such as Red Flags and combatant command exercises. The 25 SRS also facilitates the US Air Force Warfare Center's 527th Space Aggressor Squadron's active demonstration of hostile actions directed against space-based capabilities and the services these capabilities provide.

The SIDC's Innovation Directorate develops and executes the AFSPC commander's Schriever Wargames. This bi-annual event allows several hundred civilian and military experts from the US government, industry and close allies the opportunity to explore policy and force structure, architecture, and rules of engagement alternatives.¹³

The commission recommended the use of prototype experimentation and evaluation to improve space capability development.¹⁴ The SIDC's 3rd Space Experimentation Squadron (3 SES) is currently evaluating the X-37B Orbital Test Vehicle—the DoD's first "space plane"—to assess and evaluate the unique characteristics and capabilities an unmanned, reusable space vehicle can provide the nation. Consistent with Space Commission recommendations, the 3 SES works closely with system developers to identify technical limitations, inform concept development and organizational structures, and prepare AFSPC operational units for potential future capabilities.

One of the commission's key findings was that the US government had no comprehensive approach to incorporating commercial and civil capabilities and services into its national security space architecture.¹⁵ The US Air Force Tactical Exploitation of National Capabilities (AF TENCAP) office, managed under the SIDC, is addressing this finding with two active projects. The commercial radar operational support to US Southern Command (USSOUTHCOM) (CROSS) joint capa-

bility technology demonstration (JCTD) will provide routine access to synthetic aperture radar (SAR) imagery in response to intelligence, surveillance, and reconnaissance needs that are currently not met by government owned resources. CROSS will develop an unclassified collection management tool that will allow USSOUTHCOM to order new or archived SAR products from any of three commercial vendors from Italy, Germany, and Canada. The unclassified nature of the commercial imagery will also facilitate nation partnering in areas such as coalition counter-drug efforts, humanitarian assistance, and disaster relief.

Additionally, AF TENCAP has partnered with Stanford Research Institute, University of California Berkley and the Search for Extraterrestrial Intelligence Institute to investigate the use of radio telescopes for space situational awareness. Specifically, the Allen Telescope Array (ATA) in northern California has demonstrated the capability to track satellite positions consistently, reliably, and accurately. The proposed end state is an arrangement where time is leased for recurring observations to maintain the space catalog as well as reserve time for unplanned observations. This would provide the government with an additional sensor without the large up front development cost. The science and educational partners would benefit from a predictable income stream to continue radio astronomy work. If successful, the CROSS JCTD and ATA project may provide models for increased use of commercial and civil space capabilities and services.

Under the broad heading of "Space Technology Goals," the Space Commission recommended many areas for investment.¹⁶ The SIDC is actively addressing one in particular. AF TENCAP is working with the Naval Postgraduate School and the NRO director's Innovation Initiative Program to provide the next generation in satellite orientation control algorithms to slew, track, and orientate satellites optimally against a given set of targets. Recently demonstrated on NASA's Transition Region and Coronal Explorer satellite and onboard the International Space Station, algorithms developed under Talon Dark Mirror yield a 35 percent improvement in maneuverability over legacy control systems. This will enable existing spacecraft to maneuver more efficiently to meet requirements and allow spacecraft designers to design new satellites with smaller onboard control systems to meet existing specifications.

The Space Commission called for the creation of a cadre of space professionals.¹⁷ Toward this end, the SIDC's Advanced Space Operations School provides three broad categories of courses: basic space information for non-space professionals ranging from young Air Force pilots to senior all-service officers to members of the US Congress; advanced courses for select space professionals, focusing on distinct mission areas such as missile warning and defense, orbital mechanics, mili-

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In an environment where government, education, and private organizations are financially challenged, the end goal of an innovative organization like the SIDC is to find ways to leverage knowledge and resources effectively and efficiently in ways that benefit the nation.

tary satellite communications, and so forth; and pre-deployment courses for Airmen of all ranks deploying into space-related positions.

More generally, the Space Commission highlighted the need for the DoD to ensure “that an environment exists within which experimentation and innovation will flourish” and noted that a successful approach to organization and management for the future must, among other things, “... provide a structure that permits officials to be agile in addressing the opportunities, risks, and threats that inevitably will arise.”¹⁸ In an environment where government, education, and private organizations are financially challenged, the end goal of an innovative organization like the SIDC is to find ways to leverage knowledge and resources effectively and efficiently in ways that benefit the nation.

Despite the US government’s failure to enact many of the reorganization, realignment, reassignment, and funding recommendations, tactical units have made significant and visible progress toward Space Commission goals. Indeed, the most important aspect of policy implementation is often at the point of tactical execution.

Conclusion

It is instructive to reflect on the report and recommendations of the Space Commission. Doubtless, the lessons identified here may differ greatly from what others perceive. But a review of history—even recent history—can help the nation prepare for an uncertain future. It can illuminate and identify what works well, what conditions are required for success and what will likely undermine the most ambitious and well-intentioned plans.

Amid the uncertainty, however, the US will continue to struggle with emerging and unexpected threats and opportunities, insufficient resources, and an unwieldy bureaucracy fixated on reorganization and realignment. By developing strategies that acknowledge these factors rather than wish them away, and by continuing to learn from our past mistakes and successes, the next generation of professional warfighters will continue to make progress toward an enduring goal of improved national security.

Notes:

¹ House Committee on Armed Services, *Report of the Commission to Assess United States National Security Space Management and Organization*, 11 January 2001.

² *Ibid.*, 9.

³ *Ibid.*, 99-100.

⁴ *Ibid.*, 25.

⁵ Since December 2010, a series of protests and demonstrations across the Middle East and North Africa have become known as “Arab Spring.”

⁶ *Report of the Commission to Assess United States National Security Space Management and Organization*, 82-98.

⁷ President Bush’s administration released its *National Space Policy of the US of America* on 31 August 2006, replacing the previous 1996 policy of President Clinton. President Obama’s administration released the current *National Space Policy of the US of America* on 28 June 2010.

⁸ *Report of the Commission to Assess United States National Security Space Management and Organization*, 79.

⁹ *Ibid.*, 79.

¹⁰ Thomas Friedman, *Hot, Flat and Crowded* (NY: Farrar, Straus and Giroux, 2008) 207.

¹¹ Generals Lord (2002-2006), Chilton (2006-2007), Kehler (2007-2011), and Shelton (2011-present).

¹² *Report of the Commission to Assess United States National Security Space Management and Organization*, 77-78.

¹³ (see the November 2010 High Frontier [Volume 7, Number 1] for details).

¹⁴ *Report of the Commission to Assess United States National Security Space Management and Organization*, 77.

¹⁵ *Ibid.*, 72.

¹⁶ *Ibid.*, 70.

¹⁷ *Ibid.*, 42.

¹⁸ *Ibid.*, 80.



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strating cutting-edge technologies, providing advanced training, and operating a space test and training range. Colonel Barnes is a credentialed space professional, having completed a series of operational assignments in the areas of space control, satellite command and control, and ICBM launch operations. Additionally, Colonel Barnes served in staff positions for two 14th Air Force commanders. After completing Air Command and Staff College, Colonel Barnes was assigned to the Pentagon, where he led the Space Control and Force Application Branch. Following his Pentagon assignment, Colonel Barnes commanded the 12th Space Warning Squadron at Thule AB, Greenland. After graduating from National War College, Colonel Barnes returned to the Pentagon in 2004 as the chief of space policy for the Joint Staff, J5. In this capacity, Colonel Barnes was instrumental in development of the president’s National Space Policy. In 2007, Colonel Barnes was assigned to Headquarters Air Force Space Command as the command lead for space situational awareness and command and control systems.

Space Professional Development— 10 Years After the Space Commission: Managing Our Most Important Assets¹

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The talented men and women of Air Force Space Command (AFSPC) and the families who support them are essential.... We have trained and ready Airmen who deliver for the joint fight every single day in technically demanding domains. I strongly believe the continued development of our space and cyberspace professionals is key to our future.³ ~ General William L. Shelton

Ten years have elapsed since the publication of the Space Commission report. The 2001 Space Commission was established to examine the nation's needs and ability to operate in space, and was directed to assess both the organization and management of space capabilities that support national security.⁴ The commission realized US dependence on space capabilities potentially make it a target for a surprise attack by an adversary. As a result, the commission highlighted the need for the Department of Defense (DoD) to take a hard look at the way it operated in space.

The commission recommended the National Space Policy be reviewed and updated to provide guidance to US government agencies on ways to develop and employ space systems, to modernize the space force, defend the US homeland, and better support forward-deployed forces. The report covered recommendations on revolutionizing intelligence collection methods and shaping the domestic and international legal and regulatory environment for space. While system capabilities must always be evolving and policy must be updated to guide us to the future, one of the key findings of the commission was the need to “create and sustain within the government a trained cadre of military and civilian space professionals.” This required the deliberate development of a space cadre capable of ensuring the protection of, and continued access to space for the US and our allies. As Missouri State Representative Ike Skelton would sum up five years later, “You can get all the fancy weapons systems in the world, and if you don’t have the first-rate people to work with them, you haven’t gained a great deal.”⁵

As reflected in the quote at the beginning of this article, General William L. Shelton articulated his commitment to, and the importance of, the development of the space (and cyberspace) professionals to the Strategic Forces Subcommittee of the Senate

Armed Services Committee. But what has actually been done over the last decade? Plenty.

In 2002, in response to the Space Commission report, AFSPC established the Space Professional Management Office (SPMO),⁶ assuming responsibility for developing, maintaining and retaining skilled space professionals through the Space Professional Development Program (SPDP). Additionally, on 1 July 2003, the secretary of the Air Force approved the Air Force Space Professional Strategy for Air Force space career field planning and appointed the commander, AFSPC, as the Air Force Space Professional Functional Authority.⁷ As part of the Space Commission's recommendations, the secretary of defense charged the position with acting as the cross-functional authority for the space cadre.

The goal of SPDP is to build space professionals of tomorrow with a broad knowledge of the domain and specialized skills sets necessary to lead Airmen and leverage space capabilities. To make this a reality, the SPMO first needed to take inventory of the personnel and positions within the space enterprise and determine appropriate levels with which to develop the space cadre. SPMO looked at the career fields that contributed to the “launching, fielding or employing of space capabilities” and added them to the initial cadre of space professionals. After careful study and coordination with space units within the Air Force, the SPMO identified personnel from several career fields, analyzed skills possessed, and identified the gaps needed to be addressed by training and education. The initial cadre of space professionals included only the space and missile operators (13SX [officers] and 1C6XX [enlisted]) and scientists, engineers, and acquisitions personnel that worked with space systems. As the program expanded, additional career fields would be included into the program.

Early on, it became apparent that active duty, reserve, guard, officer, enlisted, and civilian space professionals all had a role in providing space capabilities and would need to be adequately developed if the US were to remain the preeminent space power. AFSPC used the Acquisition Professional Development Program (APDP)⁸ as a template and structured SPDP as a three-tiered certification program. SPDP uses education, training and experience milestones for the Total Force to mark entrance to each new level (space professional levels 1, 2, and 3), recognized with the basic, senior, and command space badges.

Education opportunities, the foundation of any professional development program, were established to ensure space professionals would receive space-specific professional continuing education (PCE) throughout their careers in space, in addition to their broad-based developmental education (DE) opportunities. While the goal of DE is to continue to build officer, enlisted, and civilian professionals, space PCE was designed to educate and instill a space culture in members of the space cadre at specific

points during their careers, and to provide ever-expanding views of space-related topics and issues. From 2003-2005 a continuum of training was developed, bringing together curriculum and expertise from across national security space. Air Education and Training Command's undergraduate space training (UST), once known as Space 100, forms the basis of space PCE. This course is at the tactical-level, giving space professionals a foundation in the space domain, followed by initial skills training in their specialty.

Air University's National Security Space Institute, formerly part of the AFSPC Space Operations School, developed Space 200 and 300. These courses, combined with specific amounts of experience in a space coded billet, coincide with space professional certification levels 2 and 3. Space 200 provides the operations-level education for mid-career space professionals broadening their understanding of the space domain and how national security space systems are developed and employed. Space 300 is strategic-level education developing comprehension of space policy, law, and international partnerships to develop senior space leaders taking command positions, major command, and joint staff assignments.

As the program began to take shape, SPMO continued to place emphasis on technical and space-related degrees and encouraged space professionals to pursue higher education in those areas. The Air Force Institute of Technology developed master and doctorate programs in astronautical engineering, space weather/physics, and space systems. The Naval Post-Graduate School created a Space Systems Operations Master program. Additionally, a host of civilian schools around the country had increasing numbers of degrees with "space options."

Training requirements for space professionals are often dictated by their particular duty positions and vary widely throughout the SPDP. In all three tiers, the individual must be current in his or her specific Air Force specialty code training, which could vary from initial qualification training and combat mission ready certification, to APDP certification or on-the job training. AFSPC's Advanced Space Operations School programs then target specific advanced space training needs, to include pre-deployment training, missile warning and defense, space fundamentals, executive-level space training, and others.

Recently, AFSPC made a large investment in a new state-of-the-art facility to house world-class space education and training. In his May statement before the subcommittee, General Shelton went on to state, "Last year we broke ground on the new \$14.4 million Space Education and Training Center, which will give a permanent, on-base residence to the National Security Space Institute (NSSI) and Advanced Space Operations School (ASOps)." ASOps provides advanced training to more than 1,600 DoD space professionals each year, and the NSSI provides space professional courses to another 800. This facility, located at Peterson AFB, Colorado is projected to be completed in 2012.

The existence of education and training opportunities alone do not fully address all that's needed in space professional development. The ability to identify and track personnel in the zone for targeted training and education opportunities became an ever-increasingly important part of professional development. In 2003, via a space professional oversight board comprised of space lead-

ers from across the Air Force and the National Reconnaissance Office; a series of space professional experiences were agreed upon and captured using a space professional experience code (SPEC). Using SPECs and creating a professional development database (PDD), the SPMO developed a means of tracking requirements tied to billets and experiences of individuals under the space professional construct. These three-digit SPEC codes allow for detailed accounting of an individual's space-related experience throughout his or her career. SPECs have been established for acquisitions, operations and staff experience, and are unique enough to identify a specific mission set within the space domain. Unlike the military and civilian personnel data systems (MilPDS) and defense civilian personnel data system (DCPDS), the PDD also tracks billet requirements by space professional certification level and SPEC requirement, allowing for a "supply-demand" look at space professional positions and the space professionals available to potentially fill each position. This tracking is an essential part of the office's input into the DoD executive agent for the space biennial report to Congress on the status of the national security space cadre.

So, given the recommendation of the Space Commission, are we "there" yet? Not quite. Although the SPMO has made great strides over the last nine years, there is still more work to be done. The SPDP was codified by Air Force Instruction (AFI) 36-3701 in May 2010, formally establishing guidelines and structuring the program for the continued development of space professionals throughout the Air Force. This instruction is used in conjunction with Executing Total Force Development AFI 36-2640 which is currently under revision.⁹ The concept of how cross-functional authority fits into the Air Force's force development construct is still being discussed, but has proven effective in the SPDP. Another area of continued work is in line with the commission's vision to ensure we continue the scientific and engineering excellence in the nation's space programs. In conjunction with the Air Force science, technology, engineering, and mathematics (STEM) strategic roadmap named Bright Horizon (which targets the scientists, engineers, and acquisition program managers), AFSPC continues to work to identify and incorporate STEM requirements into the space operations officer career field.¹⁰ The tracking of space professional education and specialty codes with PDD is currently done at Headquarters AFSPC. The SPMO continues to work with the Air Force personnel center to integrate the space professional certification levels, education, and experience into the Air Force's formal tracking systems. Finally, the career path tool (CPT) is the Air Force-enterprise solution as the follow-on to MilPDS. The CPT has adopted the practice of coding personnel much in the same way the PDD has done for years for space professionals.

Additionally, the latest Defense Security Strategy states, "The department's greatest asset is the people who dedicate themselves to the mission. The total force distributes and balances skills across each of its constituent elements: the active component, the reserve component, the civilian workforce, and the private sector and contractor base. Each element relies on the other to accomplish the mission; none can act independently of the other to accomplish the mission."¹¹ This strategy supports the current National Space Policy, which states, "The primary goals of space

professional development and retention are: achieving mission success in space operations and acquisition; stimulating innovation to improve commercial, civil, and national security space capabilities; and advancing science, exploration, and discovery. Toward these ends, departments and agencies ... shall establish standards, seek to create opportunities for the current space workforce, and implement measures to develop, maintain, and retain skilled space professionals....”¹²

Even though the SPDP is maturing as a more effective mechanism for managing the *military* space professional, more needs to be done in addressing total force needs and requirements. Earlier in this article, we acknowledged that civilian space professionals play a vital role in space power. How is this part of the National Defense Strategy referred to as “the total force” being developed and managed, given that it’s an integral part of the greater whole? Civilian space professionals are new to the program. Civilian Space Professionals are new to the program. Information from DCPDS does not provide the fidelity to allow SPMO to accurately code civilians in the PDD. As an initial step, resumes have been requested as a basis for documenting credit for the work civilians have done throughout their careers. After coding the experience of 2,400 space professional civilians, the SPMO will assign certification levels and experience credit to better align education and training opportunities at the right time in their careers. Unlike their military counterparts, there currently is no requirement for civilians to progress through the certification levels, although the education courses are highly encouraged.

Since the Space Commission Report in 2001, the SPDP has proven to be an effective tool in the deliberate creation and development of future space leaders. The three-tiered, cross-functional, total force program now includes space operators (13S/1C6); and cyber operations (17D/1B/3D), scientists (61S), engineers (62E), acquisition program managers (63A), weather (15W/1W), and intelligence (14N/1N) that work with space systems; and will soon include all space professional DoD civilians. The emphasis on continuing education, advanced space training, and the ability to track experience of the space cadre will ensure space leaders are prepared for future challenges and can protect the US and our allies against the danger of a “Space Pearl Harbor.”

Notes:

¹ This is a 10-year snapshot of space professional development, largely due to the recommendations of the 2001 Space Commission. *High Frontier* previously addressed space professional education in its Summer 2004 and November 2007 (vol. 4, no. 1) editions.

² House Committee on Armed Services, *Report of the Commission to Assess United States National Security Space Management and Organization*, 11 January 2001.

³ General William L. Shelton, commander, AFSPC, Statement for the Senate Armed Services Committee’s Strategic Forces Subcommittee, 11 May 2011.

⁴ The Commission to Assess United States National Security Space Management and Organization was established pursuant to the National Defense Authorization Act for Fiscal Year 2000, Section 1622. The charter included assessing, “The manner in which military space issues are addressed by professional military education institutions.”

⁵ Congressman Isaac Newton “Ike” Skelton IV (Missouri 4th congressional district), US House of Representatives, quote to journalists, as reflected in the (Mobile, AL) *Press Register*, November 13, 2006.

⁶ Now designated as the “Space and Cyber Space Management Office (SCPMO).” See James. C “Cal” Hutto, “Developing Space Professionals

Crucial to Critical Wartime Roles,” *High Frontier* 1, no 1 (Summer 2004), 8. The SCPMO supports the AFSPC commander as the Space Professional Functional Authority by managing the Air Force Space Professional Development Program (SPDP), maintaining the professional development database, overseeing the space professional certification process, synchronizing SPDP with force development, executing the Air Force’s Space and Cyberspace Professional Authority Advisory Council meetings, liaising with the other services’ space cadres and managing AFSPC’s executive force development. In so doing, the command can more effectively help identify training and education needs, past and future career progression activities, and credentials for key command and staff positions. SPMO is also developing the cyberspace equivalent, the Cyberspace Professional Development Program, which was jumpstarted by emulating the SPDP.

⁷ Secretary of the Air Force, “Air Force Space Professional Cadre Development,” memorandum, 15 July 2003.

⁸ The Acquisition Professional Development Program “promotes the development and sustainment of a professional acquisition workforce in the Air Force.... [t]hrough the integrated management of the acquisition professional certification program, leadership training and career field technical training, developmental education programs, and professional military education....” From the Air Force Secretariat’s Air Force Acquisition web page.

⁹ Space and Cyber Professional Functional Authority Advisory action item, May 2011. The cyberspace and nuclear communities are the cross functional authorities concept, as well.

¹⁰ STEM is an educational initiative, whereby science, technology, engineering, and mathematics are stressed, as a means to providing for a workforce to meet the country’s technical needs within the workforce.

¹¹ National Defense Strategy, the US DoD, June 2008, 18.

¹² National Space Policy of the US of America (public release), The White House, Intersector Guidelines, 28 June 2010, 6.



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Space Professional Continuing Education: One of Three Pillars

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Ten years ago Congress established a bipartisan commission comprised of experts from the private sector, Congress and the executive branch of government to assess how well the US was postured to meet national security space needs of the 21st century. Chaired by the Honorable Donald H. Rumsfeld, the commission's findings were formally published as the Report of the Commission to Assess the US National Security Space Management and Organization. Commonly known as the 2001 Space Commission, this report highlighted many shortcomings in how our nation was exploiting and protecting the space domain. One of the key findings of the commission was the necessity to create and sustain a cadre of space professionals. The report suggested that US military space professionals must be well versed on all aspects of space and that the Department of Defense (DoD) "must place a high priority on intensifying investments in career development, education, and training to develop and sustain a cadre of highly competent and motivated military and civilian space professionals." It became readily apparent after the report was published that the US military was doing a poor job of educating and retaining outstanding space professionals. The field of space operations is highly complex and requires a great deal of education and training. This means it takes a considerable amount of time to develop the highly skilled space professionals we need. It also means that we cannot afford to lose these experts to other career fields. This led to the obvious need for a formal space education process and one that links directly into the DoD career development process. Out of this requirement the National Security Space Institute (NSSI) was established along with the eventual creation of two space professional continuing education courses, Space 200 and 300.

The road of space professional development from 2001 to 2011 was a long one and took a great deal of effort to attain the level of deliberate professional development we have achieved to date. It started with the commission's report when the defense department was challenged to "create a stronger military space culture, through focused career development, education, and training, within which the space leaders for the future can be developed." Furthermore, since the Air Force has the vast majority of DoD's space personnel, the report called out the US Air Force as the service component with the most critical role.

The commission's report highlighted three key areas, or three pillars, which required focused effort. The first one, "career development" would eventually be managed by the manpower and personnel directorate at Headquarters Air Force Space Command (AFSPC). The other two pillars, "education" and "training," would be shored up by a new organization known as the NSSI. Eventually, the advanced "training" pillar would be split from the NSSI and led by a unit now called the Advanced Space Operations School. The "education" pillar has always resided solely in the NSSI and is the focus of this article.

Although the three areas highlighted in the report were spearheaded by two different agencies, both of these organizations needed to jointly move toward a common goal. The education and training pillars were handled from the very beginning with establishment of the NSSI. However, the education and training had to be integrated into intentional "career development" in order to ensure all space professionals were receiving the same high quality education and training it takes to stay current and relevant in this highly complex career field. This was eventually accomplished through development of a career progression path within both the Air Force officer and enlisted space career fields. As noted in the commission's report, the majority of our Air Force's key historical leaders such as Generals William "Billy" Mitchell and Curtis LeMay spent about 90 percent of their careers within their respective fields. This has not been the case for most military space professionals. Not only did many space professionals cross-train into other career fields (leaving the space career field devoid of their expertise), but even more importantly, prior to the commission's report, most military space organizations were led by personnel with little or no operational space experience. Creating essential education and training pillars for all space professionals was the key to building and sustaining a highly skilled and credible space cadre.

Developing a career path for military space professionals required both depth and breadth of various space disciplines. The creation of Space 200 and 300 provided a unique opportunity to increase a space professional's breadth of knowledge since these courses bring space professionals together twice during their careers and educate them on all aspects of military space. HQ AFSPC was then able to easily link the NSSI into the space professional's career development by making Space 200 and 300 required aspects of career progression. Currently, all Air Force space professionals are required to attend Space 200 and 300 as prerequisites to earning "senior" and "master" level space categories respectively. This effort goes hand in hand with sections of the commission's report that lauded the Navy as the model for specialized career development. The report noted that the Navy's nuclear submarine program puts

strong emphasis on “career-long technical education,” and it challenged the Air Force to do the same with space professionals. The NSSI now provides the Air Force an opportunity to place that same emphasis on military space professionals, which, as the report notes, “produces officers with a depth of understanding of the functions and underlying technologies of their systems that enables them to use the systems more efficiently in combat.” Space 200 and 300 also follow through with the report’s recommendations that “in-depth space-related science, engineering, application, theory, and doctrine curricula should be developed and its study required for all military and government civilian space personnel.” Space professionals attending Space 200 and 300 courses are not only taught these principles, but they are also required to analyze, apply, and sometimes even synthesize these concepts during in-depth course exercises and position papers, further reinforcing these ideals into their expertise and ultimately back into their careers.

When the commission’s report was first published, a fledgling organization known as the Space Operations School was in its infancy. The school was officially established in the summer of 2001 and was the first formal institution responsible for space training beyond prerequisite and initial qualification training. The commission’s report, however, noted the DoD and especially the Air Force were lacking in specialized training necessary to appropriately develop space professionals. While the Space Operations School was a good start, space professional education needed even more emphasis. Just one year after the school was opened, General Lance W. Lord, the commander of Air Force Space Command, set a goal to establish a school that provided space professional continuing education for DoD space professionals. He further emphasized this by saying, “Space professional development is one of the command’s highest priorities.” In a March 2003 report to Congress, then Undersecretary of the Air Force Peter B. Teets continued to move the Air Force toward this goal by saying, “We need space professionals in all services and agencies ... to exploit space effectively in the interests of national security. Development of a space cadre is one of our top agenda items for national security space programs in 2004.” Leadership vision became reality in October of 2004 when the Space Operations School was redesignated as the NSSI. The NSSI quickly became the nerve center for all Air Force space professional education and advanced training. It began with training classes focused on pre-deployment space training as well as education classes to ensure space professionals had the basic knowledge necessary to effectively execute the mission. These education classes became the foundation for today’s Space 200 and 300.

Initially, Space 200 emphasized technical knowledge along with a focus on spacecraft systems design, development and acquisition. Space 200 also touched on integration of space capabilities and tactics in joint warfare and provided education on various DoD, civil, commercial, national, and foreign space systems. With the inaugural course offering in 2004, Space 200 was designed for space professionals with eight to 10 years of service under their belt. The goal in 2004 was to graduate 150 students. In fiscal year 2005, this number more than

doubled to 360. In order to ensure a common foundation of space knowledge, the original Space 200 course taught students predominately at a tactical level. Students were taught the basics of space concepts, then in order to validate student learning and comprehension of these basic concepts, were tested on what they learned. As the course progressed over time, this comprehension level of learning slowly morphed into getting students to think critically about space, having them understand how space capabilities impact the joint force commander and how to generate force enhancing global and theater effects. For example, today’s final project for Space 200 requires students to draw from material they have learned throughout the course in order to brief a simulated chief of staff for a Combatant Command (COCOM) on how space capabilities can enhance or support COCOM actions in a fictional crisis scenario. The end result is that Space 200 graduates now genuinely consider themselves true space professionals. Additionally, graduates are motivated to continue this learning process through self study and education, thus opening the door to one of the biggest visions of the 2001 Space Commission report; to create a space cadre adept in the intricacies of space capabilities through years of education and experience.

Space 200 is now the model for formal space education and it has grown leaps and bounds over the years. In 2011 the NSSI will teach 17 courses and graduate over 500 students. These students not only come from the Air Force, they come from every service component and from a variety of career fields such as acquisitions, engineering, communications, intelligence, and space operations. Students come from tactical field units, operational level centers and various staff positions including numbered Air Force, major command, Air Staff, Joint Staff, and the Office of the Secretary of Defense. Some Space 200 students even come from outside of the DoD, for example, the State Department. Every Army space professional, known as a Functional Area 40, is required to start their formal space professional education with Space 200. The Navy is also moving towards this same process with their space professionals. Space 200 is now the spring board for reaching the goal established in the commission’s report of exchanging “...personnel across space communities, between the operational and acquisition commands and between the Air Force and the National Reconnaissance Office (NRO)....” Additionally, HQ AFSPC and the NSSI have continued to move beyond that goal by opening the doors of Space 200 to foreign partners as well. In May 2011, the first foreign national students (two Canadian Air Force officers) graduated from Space 200 and in July 2011 officers from Australia and the United Kingdom will attend Space 200.

Grooming mid-level space professionals has been a tremendous success story, but what about the more seasoned space professionals? It did not take long before the Air Force saw the need to continue expanding the development process in order to prepare our more senior space professionals for future roles as leaders in their respective career fields and services. This requirement paved the way to design senior space professional education, and thus, Space 300. Initial legwork to outline critical education requirements for Space 300 was completed in

early 2002, however, it was not until 2004 that leaders from NSSI, the National Security Space Office, HQ AFSPC, NRO and all three sister services formed a Space 300 working group and convened at the US Air Force Academy with the goal of finalizing the Space 300 course. The central idea was to develop a course for joint space professionals at the 12 to 15 year point of their career and to graduate about 100 students each year. The course would need to focus on space employment considerations at the strategic level to include planning and operational integration of space power, law, policy, and doctrine with and end state of preparing space professionals for more senior space cadre leadership roles. The ultimate goal of the 2004 working group was to refine previously drafted course objectives, constraints, and subject matter for Space 300. The final deliverable from the working group would be a “strawman” course chart as a first step in an iterative process of course prototype evolution. The conference was successful and the first prototype Space 300 class began in November 2004 with the first non-prototype class beginning less than a year later.

Today’s Space 300 class involves a high level of research by students. Both the curriculum and classroom arrangement are designed to facilitate group discussions and experience sharing across the space professional career field on high levels of policy and doctrinal issues. The final exam requires students to take all they have learned and synthesize it into a position paper in order to facilitate their ability to think critically about our national space policies and strategic impacts on our ability to support and defend the space domain, and essentially this nation. What started as a desire to reach 100 students each year has turned into graduating 264 space professionals in calendar year 2011. The bottom line is that today’s Space 300 graduates are prepared to effectively lead the next generation of space professionals. These graduates are also prepared to make knowledgeable and informed decisions regarding the employment of space power and they understand the criticality of protecting a contested, congested and competitive domain.

In the ten years since the release of the 2001 Space Commission, our country, our Air Force and AFSPC have made dramatic and deliberate improvements in the three pillars of space professional development: education, training, and experience. The NSSI now stands as the hub for DoD space professional continuing education. We have witnessed, and in some cases forged, many of the report’s recommendations to transition from vision into reality. Ultimately, implementing space professional continuing education has put us on target to achieve the most crucial goal of the Space Commission report, which is to ensure that military and civilian space professionals are primed and ready to keep the US and its allies as the front runners in protecting and exploiting the space domain. To this end the NSSI will continue executing its mission of “Educating Space Professionals ... Winning the High Frontier!”



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a multi-service, total force team providing in-residence professional continuing education for the national security space community, as well as space orientation programs for the Department of Defense. These programs provide instruction on military space systems and operations, warfare concepts, strategy, policy, doctrine, law, and tactics. The institute also offers selected courses to allied nations through foreign military sales. Colonel Epperson was commissioned through the Air Force Reserve Officer Training Corps program in 1986 upon graduating from East Carolina University in Greenville, North Carolina. He has served as a Minuteman II missile combat crew member, missile operations instructor, Ballistic Missile Early Warning System operator, MILSTAR communication satellite system operator, and the chief of combat operations in 614 AOC and the Joint Space Operations Center.

Colonel Epperson has commanded a squadron, and was deputy commander of the 381st Training Group at Vandenberg AFB, California, and the 506th Air Expeditionary Group, Kirkuk, Iraq. He completed staff tours in the Operations Directorates at Headquarters Air Force Space Command and at Headquarters US Air Force, the Pentagon. Colonel Epperson served two tours in Iraq: one tour as a Joint Task Force planner and Civil Affairs officer; and one tour as a deputy group/deputy base commander.



Lt Col Joseph B. Wurmstein, USAF (BA, Mathematics, Texas Tech University; MS, Space Studies, University of North Dakota, Masters of Space Systems, Air Force Institute of Technology) is the course director of Space 200 at the National Security Space Institute, Colorado Springs, Colorado. Space 200 is the mid-career course for space professional education. Colonel Wurmstein leads a team of over 20 instructors responsible for developing space professionals

who think critically about the application of space power. As course director, he plans and executes course reviews, updates, and redevelopment priorities; ensures courseware accuracy and quality; develops course goals, objectives, lessons, and schedules; and evaluates and documents student performance and trends.

Lt Col Wurmstein entered the Air Force in 1994 as a Distinguished Graduate of the Reserve Officer Training Corp program at Texas Tech University. His past assignments include satellite command and control, intercontinental ballistic missile operations, and airborne launch control system operational tours, as well as time as a Numbered Air Force and major command staff officer.

The Space Commission - Impacts on Policy and Professional Development

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Ten years ago, the Space Commission Report was released and became a defining document significantly impacting the evolution of the military's space force. The commission was established by an amendment to the National Defense Authorization Act for Fiscal Year 2000. At the time, some members of Congress felt the military was not paying sufficient attention to space nor allocating enough resources to a military space presence. Members of the Commission were appointed based on their "knowledge and expertise in the areas of national security space policy, programs, organizations, and future national security concepts."¹ The Honorable Donald Rumsfeld chaired the commission, before he was selected by President George W. Bush to become the secretary of defense. The report was released after he moved into the position, so for this and other reasons the report had wide-ranging implications and essentially served as direction for the Air Force and other services.

Since the Space Commission Report was released, much has changed in the space domain. For perspective, in 2001 your authors were lieutenants at their first duty assignments—the only space-related acquisition we contemplated was buying radio receivers for the newly launched XM satellite. Today, more than ever, space is a domain vital to military operations, global commerce, and a broad spectrum of civil applications. Space impacts areas we did not envision in 2001. In today's environment, US space superiority is challenged because space has become more congested, contested, and competitive. Fortunately, the Space Commission's recommendations aided our ability to respond to these new threats and challenges.

The 2001 Space Commission Report concluded that a number of key areas needed urgent attention. The commission recommended that space be made a national security priority and addressed the need for revisions to national space policy. Although not all of the proposals were implemented as policy, they have significantly influenced policy discussions over the last decade. Space professional development programs had

their genesis in the commission's recommendations that the US government "play an active, deliberate role in expanding and deepening the pool of military and civilian talent in science, engineering, and systems operations."² Since the majority of the authors' Air Force careers have been in the post-Space Commission environment, it is interesting to see how the commission influenced programs and policies we take for granted today. This article will focus on the commission's impact on space policy and space professional development.

Space Commission's Influence on Policy

The Space Commission Report emphasized the need for revised space policy that provided direction and guidance for the departments and agencies in the US government to "employ space systems to help speed the transformation of the US military into a modern force able to deter and defend against evolving threats directed at the US homeland, its forward deployed forces, allies, and interests abroad and in space."³ The commission recommended that space become a top national priority, which is clearly reflected in recent policy documents. Although, some of the commission's recommendations are not echoed in current policy, they were influential in facilitating the necessary debates that shifted views into more coherent and mature policy. For example, the report was written with a US-centric perspective, focused on international competition and suggested the US government "ensure the president will have the option to deploy weapons in space."⁴ Since that time, space policy has shifted to a tone of international cooperation versus competition and away from weaponization of space.

Space as a Top National Priority in Policy

The report's first recommendation was that space be recognized as a top national priority.⁵ The 2006 National Space Policy (NSP) is the first policy document where we see that recommendation restated: "freedom of action in space is as important to the US as air power and sea power" and "US space programs and activities shall be a top priority."⁶ The 2010 version states the US "considers the sustainability, stability, and free access to, and use of, space vital to its national interests."⁷ In support of this direction, as well as the recommendations provided by the commission, Air Force Space Command (AFSPC) is in constant pursuit of advancement in order to provide space capabilities at the "speed of need." In an effort to bolster space tactics, techniques, and procedures in support of the warfighter,

[S]pace policy has shifted to a tone of international cooperation versus competition and away from weaponization of space.

The Space Commission presented a case for competition; however, US space policy now focuses on cooperation to give global space-faring nations the optimum advantage and is in the best interests of our own national security.

AFSPC conducts Schriever Wargames and provides space inputs to many other Air Force and joint exercises. To educate others on the imperatives of keeping space a national priority, AFSPC presents briefings on “A Day Without Space” and provides road shows to demonstrate space-based capabilities that enable the warfighter. Over the last decade, the recognition of space as a top national priority has definitely resonated.

The NSP also reflected the commission’s recommendations that to effectively make space a national priority, we must deliberately develop space professionals.⁸ NSP in 2006 and 2010 discuss the importance of developing and retaining space professionals in order to achieve mission success in space operations and acquisition. Interestingly, the 1996 NSP, published prior to the commission’s findings, did not address the importance of the retention of the space work force. The commission was accurate in many of its findings and many of its recommendations have been instrumental in advancing the US space community and securing a spot as a top national priority.

International Competition to International Cooperation

The Space Commission Report promoted international *competition*, however the National Space Policies of 2006 and 2010 advocate for international *cooperation* to the greatest extent possible. While the Space Commission Report mentions other nations’ international collaborative efforts, it does not urge the US to be a part of them. All five of the commission’s overarching recommendations are written in a US-dominant tone seeking to advance US capabilities in a context of international competition. Of the 10 overarching recommendations of the report, none of them promote international cooperation. In fact, to ensure a degree of competitiveness and “remain the world’s leading space-faring nation” the commission suggests the US “invest in technologies to permit the US government to field systems one generation ahead of what is available commercially” and “encourage the US commercial space industry to field systems one generation ahead of international competitors.”⁹ The only mention of international actions to be taken is to “shape the international legal and regulatory environment for space in ways that ensure US national security interests and enhance the competitiveness of the commercial sector.”¹⁰ This suggestion supports US economic preservation and protects the US space industrial base.

Ten years after the report, the 2010 NSP emphasizes international teamwork, openness, and transparency rather than the report’s tone of competition. The 2010 policy states that the US will “expand international cooperation on mutually beneficial space activities.”¹¹ The National Security Space Strategy, released in 2011, discusses strategic approaches such as “promoting responsible, peaceful, and safe use of space” and “partner-

ing with responsible nations, international organizations, and commercial firms.”¹²

How did the perspective evolve from competition in space to cooperation in space? This shift is due largely to the increase of space-faring nations and constrained fiscal environments. In the last decade, the number of nations involved with space programs has increased from 40 in 2000 to 55 in 2009.¹³ In 2011, eleven countries now operate 22 launch sites and more than 60 nations and government consortia currently control satellites.¹⁴ In championing space exploration and technology with declining space budgets, the US now realizes that cost-sharing takes advantage of the special talents and amenities of multiple countries and rallies them toward a universal goal. Additionally, the strategy to involve and collaborate with other countries in our space efforts is in the interest of US national security. An attack on a multi-national space effort would be an attack on all the nations benefiting from commercial and/or security-related space activities tied to that effort. In addition to raising the cost of aggression, cooperative efforts weave alliances, increase resiliency, and strengthen our national deterrence posture. The Space Commission presented a case for competition; however, US space policy now focuses on cooperation to give global space-faring nations the optimum advantage and is in the best interests of our own national security.

Current international cooperation can be seen in US efforts to safely mitigate orbital debris and track man-made space objects via the Space Situational Awareness Program. The program warns US and foreign satellite operators of possible collision hazards to hundreds of maneuverable platforms. Additionally, partnership with the Australian government on the Wideband Global Satellite Communications System is a prime example of international partnering on military space systems. Since 2007, the Air Force, under the auspices of the International Telecommunication Union, has held discussions with China’s Compass/Beidou program to ensure radio frequency compatibility with the US’s Global Positioning System (GPS). In late-2007, the European Union signed an agreement with the US to make their Galileo position/navigation/timing satellite system interoperable with the US GPS.¹⁶ Started in 2008, the Space Data Association, a non-profit international association, supports an automated space situational awareness system designed to reduce the chance of satellite impacts in an effort to maintain the safety of the space environment.¹⁷ It is clear that international space cooperation efforts have risen sharply in the last decade.

Space Weaponization

The Space Commission Report warned of a “Space Pearl Harbor” and recommended the US “vigorously pursue the capabilities ... to ensure that the president will have the options

to deploy weapons in space.”¹⁸ The recommendation was supported by the argument that a space deterrence strategy must be supported by a wide range of space capabilities, “including weapons systems that operate in space and that can defend assets in orbit.”¹⁹ While the report often discusses promoting and protecting the peaceful use of space, it also made clear that the pursuit of defensive space weapons would be desirable. The weapons debate has been popular in the defense community for almost 20 years; however, national space policy has not reflected the pursuit of space weaponization, but instead the *peaceful* use of space.

It is possible that the Space Commission Report suggested weaponizing space because ten years ago the US was considering that possibility. The Air Force 2025 Study, an Air University document published in 1996, concluded that space warfare is inevitable and also stated that “by 2025 it is very likely that space will be to the air as air is to cavalry today.”²⁰ US Space Command’s Vision 2020 document, released in 1998, argued that “space power will ... evolve into a separate and equal medium of warfare” and discussed a requirement to provide planning that included “the prospects for space defense and even space warfare.”²¹ In 2002, President George W. Bush withdrew from the 30-year-old Antiballistic Missile Treaty, which banned space-based missile defense.²² Also in 2002, Undersecretary of the Air Force and Director of the National Reconnaissance Office, Peter Teets said, “I believe that weapons will go into space. It’s a question of time. And we need to be at the forefront of that.”²³ In the early 2000s, the Pentagon’s wish list consisted of several space weapon platforms such as space-based lasers and reentry platforms, and many senior military leaders made public statements in support of space weapons.²⁴

Ten years after the Space Commission, politicians and military leaders promote responsible and peaceful behavior, and policy continues restraints on actual deployment of weapons in orbit. In 2009, President Barack Obama pledged to seek a worldwide ban on weapons that interfere with military and commercial satellites and his 2010 NSP states that the US will consider arms control measures.^{25,26} In an ironic twist, the 2010 NSP advocates for international cooperation in space due to the fact that space is vital to our national security—the same fact the commission used to suggest weaponization. The 2007 Chinese anti-satellite test that destroyed a Chinese Fengyun-1C meteorological satellite generated 3,037 pieces of orbital debris.²⁷ This event could have amplified the need to weaponize space, but instead reinforced the importance of keeping the space environment usable for the global space-faring community.

We now seek international teamwork because we cannot afford a hostile environment that endangers our ability to operate in space. In recognizing space as a national priority, integral

to our way of life, we must protect it. The 2010 NSP acknowledges that the secretary of defense should “develop capabilities, plans, and options to deter, defend against, and, if necessary, defeat efforts to interfere with or attack US or allied space systems.”²⁸ This statement reserves the right to defend our interests in space but encourages these efforts primarily through coalition building, resilient space architectures, and international partnerships. Economic realities, proliferation of space operations by many nations, fragility of the space environment, and the need to protect these critical assets sustains policies that promote cooperation in place of competition.

Space Commission’s Influence on Space Professional Development

One of the biggest impacts to policy by the Space Commission was the creation of robust space professional development programs across the Department of Defense (DoD). A key element in building military culture is structured career development. In 2001, the “space culture” was fragmented, due to the diversity of space missions, the diversity of personnel working in the domain, and the lack of structured career development. The Space Commission identified the need to “create and sustain a cadre of space professionals” and to “create a stronger military space culture through focused career development, education, and training.”²⁹

Since these observations, the DoD has worked to improve the development of its space personnel. In 2009, the DoD published the directive on Management of Space Professional Development.³⁰ And, in 2010, the Air Force Instruction on the Space Professional Development Program (SPDP) was released.³¹ Since people are our most important asset, properly developing our personnel is arguably the most important area of emphasis to advance our interests in space.

The Air Force’s SPDP is a robust subset of the Air Force’s Force Development construct, and its purpose is to develop “Air Force space professionals fully qualified to field, launch, and employ space capabilities to achieve national security objectives.”³² In the program’s infancy, aspects of it invoked strong responses from a wide range of people both in and out of the space community. Some of the reactions were the result of misinformation and misperceptions, but much of it centered on the “new” space badge. “Why the change? What was wrong with the old badge? Why do I have to attend a course called Space 200 to “get” my senior badge?” Over the years, the program has evolved. For example, we no longer use the term “credentialed space professionals,” although certification is still the basis for career management, and initial schooling has changed from Space 100 to Undergraduate Space Training (UST). But, do not let these cosmetic changes blur the major changes that have been made.

The weapons debate has been popular in the defense community for almost 20 years; however, national space policy has not reflected the pursuit of space weaponization, but instead the peaceful use of space.

To implement the program, one of the first challenges the Air Force had to face was identification of all space billets and space personnel. The Space Commission stated that “personnel managers in the Air Force need to have a comprehensive view of all space career positions within the national security space community and the means to manage individual assignments among the acquisition, operations, and intelligence communities.”³³ In 2001, the Air Force did not have a firm grasp on its “faces” (i.e., personnel) or its “spaces” (i.e., billets). To correct this, the Air Force identified all of the billets related to space and over 13,000 total force Air Force space professionals from a variety of Air Force specialty codes (AFSC) to include space operators, scientists, engineers, acquisition managers, weather experts, intelligence specialists, cyberspace operators, and cyberspace support personnel.

Also in the report, the Space Commission found fault with the fact that “military leaders with little or no previous experience or expertise in space technology or operations often lead space organizations.”³⁴ Since the report was released, the Air Force has made significant headway in that arena too, and for the better part of the last decade there have been true space experts at the helm of AFSPC. The commission recognized the need for Air Force space leaders to “provide the vision, the technological expertise and doctrine, concepts, and tactics to generate and operate space forces in this new era of space and to generate the cadre of space professionals future military operations will require.”³⁵ In 2003, in response to this recommendation, the secretary of the Air Force designated the AFSPC commander (AFSPC/CC) as the space professional functional authority.³⁶ In this role, the AFSPC/CC, in concert with other Air Force functional authorities, is responsible for the development of Air Force space professionals.

Under the guidance of AFSPC space leaders, the Air Force SPDP came to fruition. SPDP certification “is based on specific education, training, and experience criteria used to document individual qualifications, identify space billet requirements and facilitate an effective match of individuals to jobs for mission success.”³⁷ The once reviled space badge now serves as a visual representation of the composite sum of a member’s expertise—reflecting the education, training, and experience milestones that an individual has attained. Initiated on 1 November 2005, the space badge is worn by all space professionals and recognizes personnel who directly contribute to the space mission.

Space Education and Training

To fight and win, it is vital that the Air Force deliberately develop the space cadre through structured education, training, and experience. The Space Commission emphasized the benefits of career-long education, and the Air Force embraced this recommendation.³⁸ Currently, Air Force space education consists of UST, Space 200, Space 300, and academic programs, targeted at different times throughout a space professional’s career.³⁹ This SPDP framework was designed to produce space professionals with a depth of understanding in multiple space areas and the role space brings to the joint fight. Whereas space education provides the broad, fundamental knowledge

about the space domain, space training gives professionals the skills to perform specific jobs and consists of initial qualification training, mission qualification training, specialized training, and advanced courses.⁴⁰ The Air Force has also taken steps to integrate space into Professional Military Education for all Airmen—another recommendation made by the 2001 Space Commission Report.⁴¹

Space Professional Development Program Way Ahead

The shared experiences and beliefs, established by the formalized SPDP, provides a common group identity that creates a space culture, helps to define the domain, and improves mission effectiveness. Although the authors have two different AFSCs, we definitely associate ourselves more closely with the space professional moniker over an alphanumeric specialty code. And, amongst our non-space peers, we are more commonly referred to as the “space people” versus the engineer or the operator. The SPDP has forged the path to this group identity and commonality of experience in the space domain, despite differences in occupational backgrounds. Based on the success of the Air Force’s SPDP, it is no wonder that the Air Force nuclear enterprise and the Air Force cyberspace development construct have also embraced a cross-functional approach to human capital strategies and professional development.

The Air Force needs to continue to focus on space professionals. We may not always know which future system or hardware to invest in next, but we will never go wrong by investing in the people who operate those systems. In a fiscally constrained environment, it is easier to cut the budget items that get the least resistance. Politicians protect constituents’ jobs and industry seeks to protect their technology, but we have to be careful not to cut our internal people programs. Poor development of our people can render a force hollow in the same way that poorly acquired or outdated equipment can. Specifically, the Air Force needs to continue its work to fold civilians into the SPDP. And, the service should strongly consider the 2008 Allard Report recommendations to allow space acquisition officers to stay within the space community for a longer period of time, without adverse career impacts.⁴² There is definite value in the SPDP focus on domain expertise versus AFSC specific career paths.

Even though it has been 10 years since the Space Commission Report was released, we have not yet seen the end result of the changes that evolved from the recommendations. For example, the authors have not been through the full complement of the space education curriculum. (We will attend Space 300 soon though and are looking forward to learning more from others about our profession.) Culture only changes after new processes produce a group benefit for a period of time. Nevertheless, the space professional development concept has become the cornerstone for developing a space culture.

Conclusion

There are many questions we still wrestle with trying to ensure space assets are employed in a way that benefits all military services, commercial pursuits, and public activities,

but we continue to take steps to maintain and provide a space environment supportive of space operations that are critical to our national security. One thing is certain—the 2001 Space Commission Report made several recommendations that have served as the foundational underpinning of our nation’s space paradigms. Its impacts on space policy and space professional development make it one of the most significant events in the space community in the last decade.

Notes:

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- ² House Committee on Armed Services, *Report of the Commission to Assess United States National Security Space Management and Organization*, 11 January 2001, Executive Summary, 10.
- ³ Ibid, 7.
- ⁴ Ibid, 12.
- ⁵ Ibid, 9.
- ⁶ President George W. Bush administration, *National Space Policy of the US of America*, White House, 31 August 2006, Executive Summary, 1.
- ⁷ President Barack Obama administration, *National Space Policy of the US of America*, White House, 28 June 2010, Executive Summary, 3.
- ⁸ *Report of the Commission to Assess United States National Security Space Management and Organization*, 10.
- ⁹ Ibid, 8.
- ¹⁰ Ibid, 8.
- ¹¹ President Barack Obama administration, *National Space Policy of the US of America*, White House, 28 June 2010, Executive Summary, 4.
- ¹² *National Security Space Strategy*, Unclassified Summary, January 2011, 5-8.
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- ¹⁹ Ibid, 16.
- ²⁰ *Air Force 2025 Study*, August 1996, Executive Summary, 13.
- ²¹ *US Space Command Vision for 2020*, February 1997, 4-7.
- ²² Tim Weiner, “Air Force Seeks Bush’s Approval for Space Weapons Programs,” *New York Times*, 18 May 2005, <http://www.nytimes.com/2005/05/18/business/18space.html>
- ²³ Sharon Weinberger, *Aerospace Daily*, 7 March 2002.
- ²⁴ Dawn Stover, “The New War in Space,” *Popular Science*, September 2002, p 40-47.
- ²⁵ “The Obama-Biden Defense Agenda 2009,” January 2009, http://change.gov/agenda/defense_agenda, (also at: <http://www.cfr.org/defense-strategy/obama-biden-defense-agenda-january-2009/p18313>).
- ²⁶ Obama administration, *National Space Policy*, 7.
- ²⁷ “Top Ten Satellite Breakups,” *NASA Orbital Debris Quarterly News* 14, issue 3, July 2010.
- ²⁸ Obama administration, *National Space Policy*, 14.
- ²⁹ *Report of the Commission to Assess United States National Security Space Management and Organization*, Chapter III, US Objectives for Space, 42.
- ³⁰ DoD Directive 3100.16, *DoD Management of Space Professional*

Development, 26 January 2009.

³¹ Air Force Instruction (AFI) 36-3701, *Space Professional Development Program*, 20 May 2010.

³² Ibid, 13.

³³ *Report of the Commission to Assess United States National Security Space Management and Organization*, Chapter III, US Objectives for Space, 45.

³⁴ Ibid, 43.

³⁵ Ibid, 44.

³⁶ Secretary of the Air Force to Commander, Air Force Space Command, memorandum, 15 July 2003.

³⁷ Air Force Instruction (AFI) 36-3701, *Space Professional Development Program*, 20 May 2010, 19.

³⁸ *Report of the Commission to Assess United States National Security Space Management and Organization*, Chapter III, US Objectives for Space, 45.

³⁹ Air Force Instruction (AFI) 36-3701, *Space Professional Development Program*, 20 May 2010, 13.

⁴⁰ Ibid, 16.

⁴¹ *Report of the Commission to Assess United States National Security Space Management and Organization*, Chapter III, US Objectives for Space, 47.

⁴² Senate Committee on Armed Services, *Report to Congress of the Independent Assessment Panel on the Organization and Management of National Security Space*, 15 July 2008, 24.



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Escaping the Space Acquisition Death Spiral

Part One of a Three Part Series

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Recent Troubles Turning Space Programs into “Black Holes”

Throughout the recent era of space systems, spacecraft acquisition programs have struggled. Saddled with non-executable technical, schedule and cost baselines, these floundering programs become incredible resource “black-holes” as problems spin out of control. They squander precious resources and drain the coffers of the government siphoning off billions of dollars of materials, intellectual and competent manpower, and inspirational capital,¹ all needed to sustain vital programs. The moneys used to shore up these programs are diverted from agencies that could better use them to field exciting new space exploration systems, sustain and expand a struggling US aeronautics and astronautics industrial base, and support important science and technology research to keep the US competitive in the world.

Spacecraft acquisition problems are endemic to the space community. For example, in recent years, nine of the 10 largest National Aeronautics and Space Administration (NASA) projects in an implementation phase suffered cost increases ranging from eight to 68 percent, and launch delays of eight to 33 months. These projects incurred an average development cost growth of almost \$121 million and average schedule stretch of 15 months.² One study determined that the average programmatic cost escalation of NASA space- and Earth-science missions was 33 percent.³ This phenomenon of snowballing cost growth is not found just in the US civil and national security space sectors; commercial and international acquisition efforts also confront the same failures. This is unfortunate, especially since the scientists, engineers, and managers involved in these activities are incredibly bright and they work their hardest to achieve programmatic and mission success.

These acquisition failures occur because programs get trapped into what could be characterized as “death spirals,” a rapid compounding of external influences, systems engineering, and management failures. To save a flailing program from excessive cost growth or, for better or worse, cancellation, a program manager must be able to spot the indicia of a pending death spiral. Attempting to escape the spiral, a program manager must confront each indicium and surpass all of them with smart and effective management, scientific and engineering responses while under

an increasingly microscopic examination of every move in a world that is risk adverse. Additionally, problems with space acquisition efforts are most efficiently confronted with rapid and decisive responses. The current environment and regulations virtually make such response an impossibility, and tie the hands of the program managers and directors.

Problems Span the National Security, Civil and Commercial Space Sectors

Space acquisition failures usually begin with overly optimistic technical readiness and resource estimates. Programmatic architectures and the technology readiness levels (TRL) needed to secure important objectives are left incomplete and woefully inadequate. Without proper TRLs, or sufficient on-or off-ramps to add or delete technologies inserted into a program, the program’s baseline can easily become unexecutable. Such improperly baselined and resourced acquisitions cannot achieve success—hamstringing even the best people and program offices. These programs are then strapped with inadequate management reserves, and unending non-value-added reviews that dilute focus, and make it hard to get to the root of inevitable problems in a cost-effective, time-efficient fashion. Collectively, these systemic failures contribute to out-of-control programs.

Marshalling the needed resources to build complex space systems is a daunting task and is becoming more and more difficult to accomplish. Allowing overinflated TRL levels and low-ball program bids discourages industry from becoming more efficient. This difficulty is compounded by a failure of most of the senior US government space leadership to recognize the true scope of the immense challenges confronting them.

The US government is no longer thinking strategically about its space activities, even though the president has issued on 29 June 2010 a *US National Space Policy* and, on 16 February 2011, the Department of Defense (DoD) issued a *National Security Space Strategy*. Program managers still are being asked to lead teams unprepared to secure overly ambitious and unrealistic objectives. Optimistic cost-objectives, an inability to make rapid decisions and failed resource strategies combine to crush hopes for programmatic success. For the space industry, avoiding these problems has all become a bit of a Gordian knot.⁴ Recent examples of failed large programs in the US national security and civil space communities include the examples summarized in table 1. Each of these programs is emblematic of acquisition processes and institutions gone wrong.

Future imagery architecture (FIA) and space-based infrared satellite system (SBIRS). The archetype for programmatic failure is the FIA program. FIA was started without enough money or resources. Proposed TRLs were woeful and a disaster waiting to happen. Then, hobbled by an unhealthy dose of man-

agement groupthink, cost estimators and systems engineers did not step forward to shout out warnings.

The errors committed by the National Reconnaissance Office (NRO) on FIA are the stuff of legend. The NRO did not award the program to a contractor who was well versed in the real problems of the mission, its technology needs and developmental challenges. Instead, it awarded it to a bidder who had little to no experience in the mission. With its eye-popping cost-overruns and grossly over-optimistic engineering objectives, FIA is now described by the *New York Times* as “perhaps the most spectacular and expensive failure in the 50-year history of American spy satellite projects.”⁵ Eventually, FIA was partially cancelled and dramatically restructured by an aggressive new program manager who recognized the failures. This manager had the imperative and power to move quickly to stent the losses.

The SBIRS acquisition suffered its own significant disappointments. It was begun by the US Air Force as an effort to update and replace the Defense Support Program missile launch detection and warning system. Its massive hardware systems and software engineering shortfalls generated budget and schedule failures. SBIRS suffered setbacks when its flight software failed testing and its ground support equipment experienced problems. These compounding problems served as an impetus to restructure SBIRS several times.⁶ While several SBIRS-system payloads have been successfully launched as hosted payloads on other classified spacecraft, the balance of the program limps along, with its only launch on 7 May 2011, its first geosynchronous satellite, a decade after initially planned.

One newly installed secretary of the Air Force “blinked” when confronted with the SBIRS programmatic and technology failures. Rather than confront the problems head-on, he declined to cancel the effort and start again. He opted to “stay the course.” The institutional pressures to preserve the program were tremendous. As a result, he and his successors approved pouring even more resources into the program. Nearly \$10 billion more has been spent in a hope that programmatic victory can be seized from the jaws of defeat.

The program might have been fixed earlier with aggressive management decisions on the technologies and program architecture.

Ultimately, both FIA and SBIRS struggled, even after the problems were recognized. Extraordinary government and contractor efforts were begun to better resource them, upgrade their system acquisition offices, and hire top talent. FIA was cancelled. It remains to be seen whether SBIRS will deliver a successful on-orbit constellation, and what the ultimate price tag will be.

James Webb Space Telescope (JWST) and National Polar-orbiting Operational Environmental Satellite System (NPOESS). The hissing by critics about the SBIRS and FIA missteps has abated as they have turned their attention to other embarrassing troubles on their own programs. They too have learned that the space acquisition business is difficult. For example, the JWST and the NPOESS programs also have suffered significant technical, cost, and scheduling hits.⁷

The planned price for JWST, successor to the Hubble Space

Space Based Infrared System (SBIRS)

- Started without enough money or resources; government systems engineering capabilities lost.
- Hardware systems and software engineering shortfalls generated budget and schedule failures.
- Setbacks when flight software failed testing and ground support equipment experienced problems.
- Continuing, compounding problems served as an impetus to restructure SBIRS several times.

Future Imagery Architecture (FIA)

- Started without enough money or resources; government systems engineering capabilities lost.
- Suffered from management groupthink and anti incumbent mentality.
- Program awarded to a contractor not well versed in the real problems of the mission, its technology needs and developmental challenges.
- Cost-overruns and grossly over-optimistic engineering objectives.
- Described by the *New York Times* as “perhaps the most spectacular and expensive failure in the 50-year history of American spy satellite projects.”

James Webb Space Telescope (JWST)

- Significant technical, cost, and scheduling problems and international cooperation headaches.
- Planned price, supposed to be around \$1.0 billion, exploded to well over \$5.0 billion; NASA has released “the findings of an independent review that found the JWST will cost more, some \$1.5 billion more, than its current \$5 billion life-cycle cost estimate.”
- About half program’s recent cost and development problems attributed to schedule slips arising from the launcher selection.
- NASA independent review—“flawed practice...of not adequately accounting for threats in the budgeting process...” —“The management approach...needs to change to focus on overall life cycle costs and a well-defined launch date.”

National Polar-orbiting Operational Environmental Satellite System (NPOESS)

- Significant technical, cost, and scheduling problems.
- Was originally estimated to cost about \$6.5 billion over a 24-year life. After its restructure, NPOESS was estimated to cost \$12.5 billion over a 32-year life.

Advanced Extremely High Frequency (AEHF) Satellite System

- Cost overruns and schedule slips.
- As of 2009, total cost was supposed to be \$10.3 billion for only 4 satellites, a per-satellite-unit cost increase of 109.3 percent. Research and development costs jumped 51.7 percent, from \$4.75 billion to \$7.2 billion.
- Procurement costs spiraled upwards even faster. From an initial estimate of \$1.4 billion for five satellites (with an average of \$281 million per satellite), procurement costs rose to \$3.1 billion for four (each now averaging \$775 million each, a whopping 175.8 percent increase).
- Some overruns blamed on “US National Security Agency’s failure to furnish key cryptography requirements and specifications, and to significant mechanical and construction difficulties.”

Mars Science Laboratory (MSL)

- Technical failures, mission creep, and runaway cost growth; parachutes, actuators and other materials delayed construction.
- Originally scheduled to launch in September 2009, costs have soared to over \$2.0 billion. In contrast, initial conceptual estimates in 2000 hovered in the \$800 million range; during summer 2009, MSL needed an additional \$115 million to fix broken actuators.
- No single item is blamed for the cost issues, “It all added up.” Parachutes, actuators and other materials delayed construction.

Table 1. Examples of acquisition program failures.

Telescope, was supposed to be around \$1.0 billion. It exploded to well over \$5.0 billion. NASA has released “the findings of an independent review that found the JWST will cost more, some \$1.5 billion more, than its current \$5 billion life-cycle cost estimate.”

JWST also suffers from the complexities of international cooperation.⁸ For example, the European Space Agency promised to supply NASA with an Ariane V launcher, and other European institutions plan to contribute another 70 million Euros to the cooperative venture. The European contributions are being made in return for NASA hosting the mid-infrared camera spectrograph payload onboard the satellite.⁹ The use of Ariane-space is intended to help NASA avoid launch costs; unfortunately, the expected savings have not materialized because its use was not contemplated by the prime contractor. The original plan specified that the spacecraft be integrated on a domestically produced, evolved expendable launch vehicle. The possibility of a change was not referenced in the original contract. Costs associated with integrating the JWST launch on Ariane have skyrocketed¹⁰—about half of the program’s recent cost and development problems can be attributed to schedule slips arising from the launcher selection.¹¹

The problem with JWST’s mushrooming cost increases is that they “imperil funding for NASA’s on-orbit astronomy missions while potentially wiping out big-ticket space observatories and a host of less-expensive development projects deemed high priorities by the science community...”¹² It is predicted that the burgeoning expenses “could ravage the agency’s \$1.1 billion annual astrophysics budget, 40 percent of which is already consumed by JWST development.”¹³ No doubt, the costs will exceed these figures and, as a result, the hoped-for NASA missions mentioned in its Astrophysics Decadal Survey will be placed at risk. The NASA independent review recommended restructuring the project office to “emphasize cost and schedule ceilings,” finding that it had a “flawed practice ... of not adequately accounting for threats in the budgeting process....” It argued “the management approach ... needs to change to focus on overall life cycle costs and a well-defined launch date.”¹⁴ It found that the observatory’s launch, previously slated for June 2014, could not occur before September 2015.¹⁵ Recent pronouncements by NASA indicate the launch will be delayed to 2018 or later.¹⁶

NPOESS was a US government interagency partnership of DoD, NASA, and the Department of Commerce (DoC) envisioned to develop a next-generation satellite system to monitor the Earth’s weather, atmosphere, oceans, land and near-space environment. The program atrophied as it suffered one technical problem after another, and resources consumed to address them caused the program to breach the statutory 25 percent threshold limits set out in the Nunn-McCurdy Act.¹⁷ To gain a Nunn-McCurdy certification needed in order to continue, NPOESS was restructured. This initially involved a decision to dramatically reduce both the total number of satellites acquired and the number and functionality of the sensors for each.

The system was originally estimated to cost about \$6.5 billion over a 24-year life. After its restructure, NPOESS was estimated to cost \$12.5 billion over a 32-year life.¹⁸ The changes had con-

sequence. With its restructuring, the Government Accountability Office concluded “the NPOESS system [had] significantly less capability for providing global climate measures than was originally planned.”¹⁹ Costs for the two remaining NPOESS satellites grew to over \$3.5 billion each. With late delivery of a key instrument being developed by project partners, the program suffered another \$111 million upsurge in development costs and a 26-month delay in its launch readiness date since the program was re-baselined. The NPOESS project was ultimately overwhelmed by the cost growth and schedule slips.²⁰ With the continuing problems, on 22 January 2010, the DoD announced it was ending its partnership with the DoC and NASA. The DoD will now develop a separate satellite system.²¹ On 1 February 2010, the White House confirmed that the partnership was to be dissolved, and two separate lines of polar-orbiting satellites to serve military and civilian users would be pursued.²²

In 2005, well before the recent announcements, then House Science Committee Chairman Sherwood Boehlert (R-NY) called out the NPOESS management and systems engineering failings:

You would think that, given how much is riding on NPOESS, this would be an especially closely supervised, well-managed program. It is now clear that, almost from the outset, decisions were made with too little analysis of the technical challenges involved in building NPOESS. It is clear that contracts were awarded at prices that did not take into account the technical risks the program faced. And it is clear the program was inadequately supervised, allowing problems to fester and worsen before being addressed.²³

There is no guarantee the new *split* weather satellite acquisition strategy will result in successful design, engineering, development, and deployment of systems ready to satisfactorily perform their respective missions.

Advanced Extremely High Frequency Satellite (AEHF) System. Like NPOESS and other troubled space programs, the AEHF program has been cited for exasperating cost overruns and schedule slips. The AEHF was supposed to launch its first satellite in late 2007. Its international program partners include the United Kingdom, Canada, and Netherlands. The system was designed and developed as a joint service satellite communications system to provide global, secure, protected and jam-resistant communications for high-priority military ground, sea, and air assets. Once on orbit, its communications capabilities and connectivity will support a number of mission areas: land, air, and naval warfare; special operations; strategic nuclear operations; strategic missile defense; theater missile defense; and space operations and intelligence. The first AEHF launch occurred on 14 August 2010. After launch, the apogee propulsion system developed problems and the orbit was raised over a longer period using the attitude control engines and the Hall Current Thruster electric propulsion system.²⁴

The AEHF program’s initial baseline cost of \$6.15 billion for five satellites skyrocketed as a consequence of technical problems and associated launch slips. With the resource and technical problems, optional satellites four and five were deleted from the program, with the intention of making AEHF “only an

interim bridge to the larger Transformational Satellite Network (TSAT) program.” But TSAT had its own resource and technology problems, and its leadership was unable to circumvent them. TSAT was first restructured, then cancelled by Secretary of Defense Robert M. Gates.

As of 2009, the AEHF program total cost was supposed to be \$10.3 billion for only four satellites, a per-satellite-unit cost increase of 109.3 percent. The program’s research and development costs jumped approximately 51.7 percent, from \$4.75 billion to \$7.2 billion. Procurement costs spiraled upwards even faster. From an initial estimate of \$1.4 billion for five satellites (with an average of \$281 million per satellite), procurement costs rose to \$3.1 billion for four (each now averaging \$775 million each, a whopping 175.8 percent increase!).²⁵ Some of the AEHF overruns have been blamed on “the US National Security Agency’s failure to furnish key cryptography requirements and specifications, and to significant mechanical and construction difficulties.”²⁶

The decision on the number of AEHF satellites is being revisited because “the bridge became the destination,” leaving the system “as the military’s main future guarantors of secure, hardened bandwidth.”²⁷ Efforts are now underway to look at the overall gap created by TSAT’s cancellation, and assess the priorities among the Wideband Global Satellite Communication (WGS), hardened AEHF, and other military communications satellite options, all to determine how gaps in military bandwidth requirements might be satisfied. As a result of the initial analysis, AEHF has seen its number of programmed satellites increased from three to four.

Mars Science Laboratory (MSL). Despite a strong institutional systems engineering program, even the famed Jet Propulsion Laboratory (JPL) has been stung by failures, mission creep, and runaway cost growth as it has tackled the flagship-class, large MSL space system acquisition. The MSL is a NASA car-sized rover scheduled to be launched on 15 September 2011. The rover is designed to assess whether Mars ever was, or is still today, an environment able to support microbial life. The system will analyze samples scooped up from the soil and drilled powders from rocks. It is also being designed and built to perform the first-ever precision landing on Mars.

Originally scheduled to launch in September 2009, MSL costs have soared to over \$2.0 billion.²⁸ In contrast, initial conceptual estimates for the system in 2000 hovered around the \$800 million range. No single item can be blamed for the exasperating cost issues, “It all added up.” Parachutes, actuators and other materials delayed construction.²⁹ During summer of 2009 the MSL needed an additional \$115 million to fix broken actuators.

...MSL’s project manager said that the project wanted to implement a dry lubrication scheme with lightweight titanium gears for the actuators, or motors that allow the lab to function autonomously. During fabrication, however, it was discovered that the lightweight titanium gears did not provide the durability needed for MSL, causing the project to revert to the heavier stainless steel gear system with wet lubricant used by prior projects. To keep the lubricant from freezing in Martian temperatures, the project also had to add heaters to the actuators, adding even more mass to the rover.³⁰

To meet launch window requirements, the MSL program’s contractors worked multiple shifts to make up for lost time.³¹ JPL has been unable to sidestep other significant problems:

- The heat shield. Such a big rover needs heavy protection to get it through the Martian atmosphere. It took engineers until mid-2007 to determine that the material they had chosen would not work.
- The 90-plus motors that drive the rover’s moving parts, such as its wheels. Engineers spent years working on cutting-edge motors. They decided last year that it would take too much time and money to develop them.
- The scientific instruments. Ranging from cameras to chemical sensors, the instruments ran so over budget that last year NASA officials kicked one instrument off the rover and stopped work on another. Work on the two instruments was restarted after corporate, foreign and federal sponsors outside NASA came up with more money.
- The landing system. Because it is so big, Mars Lab will touch down on the planet using a new combination of braking rockets, parachutes, and a long tether that will lower it to the ground. Engineers encountered glitches developing the system.³²

The MSL technical and construction delays have the potential to force extended launch postponements, which, in turn, adds to the total program price tag as an army of project teams sit and wait for the launch. “The project could not meet its original schedule due to difficulty in meeting delivery milestones for actuators, key avionics, and flight software while maintaining its full testing program.”³³ Earth and Mars come closest to each other approximately every 26 months, and the MSL program must be structured to match these favorable launch windows.³⁴ The slip to an October 2011 launch window added \$300 to \$400 million to the program.³⁵ “As a result of the 2009 to 2011 launch delay, project officials state that costs likely will grow by an estimated \$400 million bringing the project’s life-cycle cost to \$2.2 to \$2.3 billion.”³⁶ Mission planners presently say the launch window is between 25 November and 18 December 2011.³⁷

The MSL cost woes have stretched NASA’s entire Mars Exploration Program “to its limits ... with no funding for technology development and ‘next to nothing’ for education and public outreach.”³⁸ Given the cost containment failures, NASA’s program managers and administrators must face up to important programmatic questions: *Where will the needed money come from? Exactly how much will be available to keep the new rover on schedule and provide engineers the resources they need to overcome the latest technical problems?* Since it felt MSL could not be scaled back, without that leading to cancellation, NASA was compelled to seek additional moneys from Congress and realign funds from other missions to keep the program on-track. Interestingly, NASA did not propose using its research and analysis account to help resolve the problems, because it had already faced harsh criticism from Capitol Hill for past cuts in that account.³⁹ The MSL program is still alive—but only for the time being. Congress still could refuse further funding for the mission if the overruns continue to escalate.

Technical and Cost Problems are Firmly Rooted

How could this all happen? 400 to 500 percent overruns. Failures. Cancellations. Shouldn't the space community know better after over half century of engineering, launching, and operating space systems? Perhaps so, but attributes of the SBIRS and FIA super-failures can be seen in the JWST and MSL failures, and in NPOESS and other programs throughout the space community.

Winning space programs arise out of sound engineering, funding, acquisition, and management practices.⁴⁰ Sadly, despite best efforts, most large national security, civil, and commercial space efforts are unable to successfully contain costs and survive engineering problems. Perhaps this is because it is not easy to forge success with programs that must integrate a myriad of complex technologies. Several decades of government-charted studies of the defense industrial base have documented the serious and interrelated systemic factors that cause these issues. Nearly all highlight the same significant institutional and resource shortcomings in the acquisition of defense systems.⁴¹

The studies have usually addressed reducing program technical risks, then suggested approaches to minimize cost and resource problems.⁴² Little has changed in response to their recommendations, however. Technical and resource issues still haunt most space programs. And since most of the studies offer only general, resource-based recommendations, they do not provide guidance to a program manager if his or her program is suffering and about to enter a "death spiral" of technical failures and associated expenses.

Unfortunately, the US government responses to the acquisition problem are going in the wrong direction. Recent changes to DoD Instruction 5000.2, *Operation of the Defense Acquisition System*, add more non-value added program reviews, and dilute the abilities of managers to manage and make decisions on their programs.⁴³ The assumption that the newly announced US Air Force initiative entitled EASE (short for evolutionary acquisition for space efficiency) is the solution to space acquisition woes is plainly naïve.⁴⁴ While its proposed block buys should help reduce costs somewhat, EASE does not address the fundamental systems engineering issues; inadequate resourcing, poorly baselined programs, unwieldy/non-value added reviews, inability of program managers and directors to make simple decisions, inadequate program office staffing, and failures that managers confront in the development portions of their programs.

In the end, failure to heed compounding problems introduces a strong likelihood a project will suffer crushing technical failures, out-of-control cost growth and overruns, and eventual cancellation. Time and time again, a number of factors have been shown to devastate space acquisition efforts, especially in a constrained environment where there is so little room for error. Space acquisition pro-

gram offices do not usually build spare satellites to address the risk of launch or on-orbit failures or loss. So when the space community loses a launch, or a program is cancelled, it cannot easily reclaim the lost critical capabilities for its interested customers or warfighters.

Program managers must, therefore, be wary and prepared to detect the distinct *warning signs* of impending program doom, and take immediate action to confront them. They are:

- Failed systems engineering.
- Unrealistic funding realities, including incomplete budgets or volatile program funding.
- Unreasonably pushing the technology envelope, with unstable requirements.
- Overly optimistic planning estimates, with weak program cost and schedule reserves.
- Launch vehicle selection driving program complexity.
- Unreasonable "sunk-cost" arguments.
- Government/customer is not acting and thinking strategically.
- Faltering industrial base.
- Stunts being used as a substitute for mission value.

The manifestation of these systems engineering and process failure warning signs have a tendency to aggregate and compound to create the space program acquisition "death spiral," driving the overall program to failure, as depicted graphically in figure 1. Program managers, corporate brass, agency heads, and legislative sponsors must work their hardest to prevent their space programs from falling into a "death spiral," refusing to let the factors that manifest the spiral auger in by confronting them head-on.



Figure 1. The Space Acquisition Death Spiral.

**Parts two and three of
Escaping the Space Acquisition Death Spiral
are available at:
www.afspc.af.mil/library/highfrontierjournal.asp**

Notes:

¹ “Inspirational capital” is the motivation and willingness of people to attain organizational goals.

² NASA: *Assessments of Selected Large-Scale Projects*, GAO-09-3068P, March 2009.

³ The NASA Authorization Act of 2008 directed NASA to perform an independent assessment of the cost growth of large-, medium-, and small-sized space and Earth science missions. The final report was due 31 January 2010. The initial analysis was performed by SAIC for the NASA IPAO Office.

⁴ A very difficult problem, insoluble in its own terms.

⁵ Philip Taubman, “In Death of Spy Satellite Program, Lofty Plans, and Unrealistic Bids,” *The New York Times*, 11 November 2007.

⁶ Cristina T. Chaplain, *Space Acquisitions: DoD’s Goals for Resolving Space Based Infrared System Software Problems Are Ambitious*, GAO-08-1073, 30 September 2008, <http://www.gao.gov/products/GAO-08-1073>.

⁷ Amy Klamper, “Latest \$1.5B in JWST Cost Overruns Imperils Other High-priority Projects,” *Space News*, 15 November 2010, 1.

⁸ The authors have described these challenges in a separate paper. See James Rendleman and J. Walter Faulconer, “Improving International Space Cooperation: Considerations for the USA,” *Space Policy* 26 (2010), 143-151.

⁹ The total value of these contributions approximates about 300 million Euros. The JWST is a partnership between ESA, NASA and the Canadian Space Agency. Formerly known as the Next Generation Space Telescope (NGST), the JWST is considered the successor of the NASA/ESA Hubble Space Telescope. According to a formal agreement, ESA will manage and coordinate the whole development of the European part of MIRI and act as the sole interface with NASA, which is leading the JWST project. MIRI will be built in cooperation between Europe and the US (NASA), both equally contributing to its funding. MIRI’s optics, core of the instrument, will be provided by a consortium of European institutes. In addition to the MIRI, Europe through ESA is also contributing the NIRSPEC (Near-Infrared multi-object Spectrograph) instrument (funded and managed by ESA).

¹⁰ The program’s funding crisis surfaced ... during an exchange of correspondence between NASA and Northrop Grumman officials. The company advised NASA that it would need an additional \$270 million to make a series of changes to the program requested by the agency. Those changes included adjustments to the telescope’s instrument module and ground test equipment, Mohan said. NASA also advised Northrop to plan to launch Webb on a European Ariane 5 rocket rather than a US evolved expendable launch vehicle. In the case of Webb, “changing one thing tends to ripple more than it does on other programs,” Mohan said. Ben Iannotta, “Webb Telescope Cost-Control Effort Focuses on Schedule, Requirements,” *Space.com*, 22 August 2005.

¹¹ Changes in requirements and increases in the program’s contingency funding accounted for the remainder of the growth. NASA: *Assessments of Selected Large-Scale Projects*, GAO-09-3068P, March 2009, 32.

¹² Klamper, “Latest \$1.5B in JWST Cost Overruns Imperils ...,” 7.

¹³ Ibid.

¹⁴ Ibid., 4. Curiously, the NASA review also concluded: “... the JWST Project has invested funds wisely in advancing the necessary technologies and reducing technical risk such that the funds invested to date have not been wasted.”

¹⁵ Ibid., 1.

¹⁶ Brian Berger, “NASA Chief suggests JWST won’t launch before 2018,” *Space News*, 12 April 2011, <http://www.spacenews.com/civil/110412-jwst-launch-2018.html>.

¹⁷ The Nunn-McCurdy Act reflects the Congress’ interest in controlling the runaway cost of acquisition programs. It requires the DoD to take

specific actions when a major acquisition program growth exceeds cost thresholds. Under the statute, the secretary of defense must notify Congress when a major defense acquisition is expected to overrun its baseline by 15 percent or more, and then certify the program to Congress when it is expected to overrun its baseline by 25 percent or more. Certifying entails providing a determination that (1) the program is essential to national security, (2) there are no alternatives to the program that will provide equal or greater military capability at less cost, (3) new estimates of the program’s cost are reasonable, and (4) management structures for the program are adequate to manage and control costs.

¹⁸ *Environmental Satellites: Polar-orbiting Satellite Acquisition Faces Delays; Decisions Needed on Whether and How to Ensure Climate Data Continuity*, GAO-08-899T, 19 June 2008, 5, 10.

¹⁹ *Environmental Satellites: Polar-orbiting Satellite Acquisition Faces Delays; Decisions Needed on Whether and How to Ensure Climate Data Continuity*, GAO-08-518, May 2008, 19.

²⁰ NASA: *Assessments of Selected Large-Scale Projects*, GAO-09-3068P, March 2009, 41.

²¹ Andrea Shalal-Esa, “DoD pulls out of NPOESS – Exclusive: Pentagon budget seeks to kill 7 arms programs,” *Reuters*, 20 January 2010, <http://www.reuters.com/assets/print?aid=USTRE60K07I20100121>.

²² Turner Brinton, “White House Dissolves NPOESS Satellite Partnership,” *Space News*, 2 February 2010, <http://www.spacenews.com/civil/100202-white-house-dissolves-npoess-satellite-partnership.html>.

²³ House Science and Technology Committee, “NPOESS is as much as \$3 Billion over budget, as many as 3 years away, witnesses say,” press release, *SpaceRef.com*, 16 November 2005, <http://www.spaceref.com/news/viewpr.html?pid=18317>.

²⁴ Gunter Krebs, “AEHF 1, 2, 3,” Gunter’s Space Page, http://www.skyrocket.de/space/doc_sdat/aehf-1.htm.

²⁵ “Next-Stage C4ISR Bandwidth: The AEHF Satellite Program,” *Defense Industry Daily*, 1 December 2009, <http://www.defenseindustrydaily.com/nextstage-c4isr-bandwidth-the-us-militarys-aehf-program-updated-02165/>.

²⁶ Ibid.

²⁷ Ibid.

²⁸ Frank Morring, Jr. and Jefferson Morris, “Mars Science Lab in Doubt,” *Aviation Week: Aerospace Daily and Defense Report*, 3 October 2008, <http://www.aviationweek.com/aw/generic/story.jsp?id=news/Balloon100308.xml&headline=Mars%20Science%20Lab%20In%20Doubt&channel=space>.

²⁹ Traci Watson, “Troubles parallel ambitions in NASA Mars project,” *USA Today*, 14 April 2008, citing Doug McCuiston, head of NASA’s Mars Exploration Program, http://www.usatoday.com/tech/science/space/2008-04-13-mars_N.htm.

³⁰ NASA: *Assessments of Selected Large-Scale Projects*, GAO-09-3068P, March 2009, 40.

³¹ Nancy Atkinson, “Mars Science Laboratory: Still Alive, For Now,” *Universe Today*, 10 October 2008, <http://www.universetoday.com/2008/10/10/mars-science-laboratory-still-alive-for-now/>.

³² Watson, “Troubles parallel ambitions in NASA Mars project.”

³³ NASA: *Assessments of Selected Large-Scale Projects*, 0.

³⁴ Atkinson, “Mars Science Laboratory: Still Alive, For Now.”

³⁵ Morring, “Mars Science Lab in Doubt.”

³⁶ NASA: *Assessments of Selected Large-Scale Projects*, 40.

³⁷ “NASA’s Shuttle and Rocket Launch Schedule,” NASA, 16 May 2011, <http://www.nasa.gov/missions/highlights/schedule.html>; “MSL Launch Date Set,” *Softpedia*, 24 May 2010, <http://news.softpedia.com/news/MSL-Launch-Date-Set-142805.shtml>.

³⁸ Morring, “Mars Science Lab in Doubt.”

³⁹ Ibid.

⁴⁰ Thomas D. Taverney and James D. Rendleman, “Ten Rules for Common Sense Space Acquisition,” *High Frontier* 6, no. 1 (November 2009) 53-65. These time-tested axioms and practices have been summarized by Taverney/Rendleman as: (1) Put together the right team—one that is small, agile, intellectually honest, quick to respond; this team is the foundation for success; (1a) acquire the best people possible, empower them with enough authority to do their jobs, and hold them accountable; (1b) organize to be lean and mean; (1c) build and maintain healthy, open, professional relationships with team members, counterparts, and contractors;

(2) execute, or suffer execution; (3) establish a solid baseline; (4) control the baseline; it is your lifeblood; (5) manage risk; it never goes away on its own; (6) make the program schedule a leading metric; (7) nip problems in the bud; they usually do not get better with time; (8) test and verify; one test is worth a thousand opinions; (9) communicate; it is more important than organizing; and (10) deliver; it is all about delivering the needed capability to the user.

If employed, the rules set the stage for mature and proper resolution of a program's technical and other problems, which enables managers to avoid cost and schedule headaches. They help guide program government and contractor managers to establish proper engineering, resource, and schedule baselines and organize to successfully lead their programs. They empower a program manager to surpass program limitations, difficult and ever-changing environments, and evolving management approaches.

For other insights on what to glean from failed space acquisition efforts, see Douglas Loverro, "Getting it Right: Lessons from Failed Space Acquisitions," *High Frontier* 6, no. 1 (November 2009) 12-14. In this wonderful article, Loverro sets out winning lessons that point out a wise program manager learns from his mistakes and the mistakes of others. Loverro's six lessons are: (1) an overly constrained source selection can and will force an offerer to bid to an unachievable baseline; (2) to be a smart buyer, the government needs to know what it wants, needs to state it clearly, and needs to evaluate against those needs; (3) staying on course is only possible once you have plotted the journey; (4) when costs are constrained, the contractor will shortchange those aspects of the program that seem to be indirect to program execution; (5) ensure your entire team understands all the tools in their toolkit and uses them on a regular basis to track program performance; and (6) never get so close to a program that you can't make objective trade-offs, even those that might call the program into question.

⁴¹For example, see: *National Research Council Committee on Cost Growth in NASA Earth and Space Science Missions* (National Academies Press: Washington, DC, 2010) Packard Commission. *A Quest for Excellence: Final Report to the President by the President's Blue Ribbon Commission on Defense Management* (June 1986). *Commission on the Future of the US Aerospace Industry* (September 2002). See also Thomas S. Moorman, "The Health of the Space Industrial Base, An Update," presented to the commission on the future of the US aerospace industry (Washington, DC, 14 May 2002). *Space Acquisitions: Actions Needed to Expand and Sustain Use of Best Practices, Government Accountability Office* (GAO), GAO-07-730T (19 April 2007). *Space Acquisitions: Improvements Needed in Space Systems Acquisitions and Keys to Achieving Them*, GAO-06-626T (6 April 2006). *Space Acquisitions: DoD Needs to Take More Action to Address Unrealistic Initial Cost Estimates of Space Systems*, GAO Report GAO-07-96 (17 November 2007). *Defense Acquisitions: Improvements Needed in Space Systems Acquisition Management Policy*, GAO-03-1073 (September 2003). *Report of the Defense Science Board/Air Force Scientific Advisory Board Joint Task Force on Acquisition of National Security Space Programs* (May 2003)—otherwise known as the Young Report. Also refer to its follow-up (2004). *2006 Quadrennial Defense Review, Defense Industrial Base Assessment: US Space Industry*, Dayton, OH (31 August 2007). *Defense Acquisition Performance Assessment Project* (2006), *Defense Acquisition Performance Assessment Report* (Washington, DC: January 2006); the project was chaired by Lt Gen Ronald Kadish, (USAF, retired). National Research Council's *Pre-Milestone A and Early-Phase Systems Engineering: A Retrospective Review and Benefits for Future Air Force Acquisition*, The National Academies Press (2008).

⁴²Taverney and Rendleman point out that the studies' recommended solutions generally address problems only at the resource level. They summarize the study recommendations as: Streamline organizations; use technology to reduce costs; balance cost and performance; stabilize programs/realistic budgets and cost estimates; expand use of commercial products; enhance quality of acquisition personnel and rebuild program management and engineer processes; improve the requirements process; conduct planning and risk reduction activities and separate technology programs; establish quality program baseline/expectations and resources; set minimum thresholds for technology maturity; establish mission success as the guiding principle; allow program managers to trade requirements if needed; train and develop staff; clearly define authority/account-

ability and responsibility (including contractors); develop robust systems engineering; align contracts for success; budget programs to 80 percent success; schedule approaches to field needed capabilities rapidly; utilize risk-based source selection; pay attention to critical systems engineering processes early in the program, before making key acquisition decisions; and reinstitute development planning; establish key systems engineering/program manager personnel experience and stability. Taverney and Rendleman, "Ten rules . . .," 53-54.

⁴³DoDI 5000.02, *Operation of the Defense Acquisition System*, 8 December 2008.

⁴⁴See Amy McCullough, "Space Acquisition with EASE," *Air Force Magazine*, 16 February 2011, <http://www.airforce-magazine.com/Features/modernization/Pages/box021611ease.aspx>.



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Hopkins University's Applied Physics Laboratory (APL), leading 500 scientists and engineers on cutting edge space programs such as: the MESSENGER Mercury orbiter mission; the TIMED study of Earth's upper atmosphere, ionosphere, and thermosphere; the twin spacecraft STEREO study of the sun and its coronal mass ejections; and NEW HORIZONS, the first mission to Pluto. Before APL, he worked at Lockheed Martin Space Company and Martin Marietta Astronautics Company as a director, program manager, flight test manager, systems engineer, and mission operations lead on a wide variety of classified and unclassified programs dealing with space launch, space control, missile defense, Space Shuttle, and other missions. Mr. Faulconer is an Associate Fellow of the American Institute of Aeronautics and Astronautics, a member of the board of directors for the American Astronautical Society, and a member of the International Astronautical Federation and National Space Society. He has taught graduate level business marketing and strategy at John Hopkins University, Whiting School of Engineering.

Known and Unknown: A Memoir

Known and Unknown: A Memoir. By Donald Rumsfeld. New York: Sentinel, 2011. Acknowledgments. Acronyms. Illustrations. Notes. Index. Pp. xvi, 815. \$36.00 Hardcover ISBN: 978-1-59523-067-6

What is known about Donald Rumsfeld? While studying politics and government at Princeton University in the early 1950s, he joined the naval ROTC; after graduation in 1954, he served one tour as a Navy multiengine patrol-plane pilot, before transferring to the Naval Reserve. Chicagoans elected him to four consecutive terms as one of their congressmen in the 1960s; he voted for the Tonkin Gulf Resolution, cosponsored the Freedom of Information Act, and advocated an all-volunteer military. During the 1970s, he moved to the executive branch as director of the Office of Economic Opportunity for the Nixon administration. Rumsfeld became President Ford's chief of staff, before being appointed the youngest-ever secretary of defense. Even while working as chief executive officer for the major pharmaceutical company G. D. Searle in the 1980s–1990s, he advised three successive presidential administrations on military and economic affairs. His government career culminated with President George W. Bush appointing him in 2001 as the oldest-ever secretary of defense, a position he retained until December 2006.

Known and Unknown, the title of Rumsfeld's recently published memoir, comes from his unforgettable response to a reporter's question during a 2002 press conference. On that occasion, he delivered a mini-dissertation about "things we know we know," then explained, "We also know there are known unknowns." This led him philosophically deeper, of course, into "unknown unknowns—the ones we don't know we don't know" (p. xiii). If not already apparent to his observers, whether fans or critics, that impromptu excursion reflects the man's keen interest in the importance of word choices. In his memoir, he delivers mini-treatises on the meaning and relative appropriateness of "war on terrorism" or "war against Islamist extremists," "preemptive military action" or "anticipatory self defense," "guerilla war" or "insurgency," and "Operation Infinite Justice" or "Operation Enduring Freedom." For someone apparently so keen on linguistic precision, a trait inculcated by his schoolteacher mother, Rumsfeld nonetheless managed, more than once during his public service, to choose words and phrases that cast him as callously blasé or deliberately evasive.

Readers of this particular *High Frontier* issue might be surprised, even disappointed, by the absence of the words "outer space" in Rumsfeld's book. He discusses briefly his 1962 appointment "to what was considered one of the less important committees—the House Committee on Science and Astronautics, also known as the Space Committee" (pp. 76–77). In three different places (pp. 274, 293, and 487), he pays miniscule attention to the work of the Commission to Assess United States National Security Space Management and Organization, generally known as the Space Commission, which he chaired in 2000. Since the

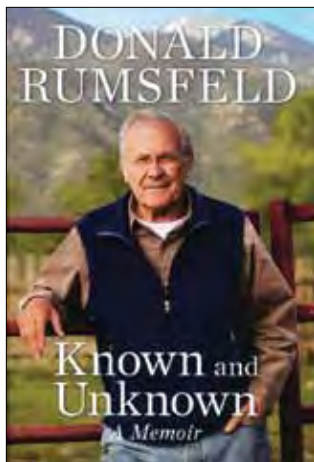
commission delivered its influential report only nine days before George W. Bush's inauguration and Rumsfeld himself implemented nearly all of its recommendations, one might have expected to see more about the subject. Unfortunately, Rumsfeld neglected this and many other topics, choosing instead to devote 60 percent of his massive, 50-chapter tome to affairs in Afghanistan and Iraq after the terrorist attacks of 11 September 2001.

Why he neglected many details from his earlier years and failed to enrich the story of his later career becomes obvious as soon as a reader perceives the author's primary purpose: vindication. Rumsfeld's narrative quickly devolves into an inexcusably self-serving, thinly veiled, defensive diatribe against all who failed to buckle under his personal badgering, submit to his vainglorious micromanagement, or cave to his bureaucratic manipulation. He exhibits particular dissatisfaction with, and bitterness toward, Colin Powell and Condoleezza Rice, but he certainly does not spare senators or congressional representatives, career diplomats, retired generals, judges, federal-employee unions, academics, news reporters, and "self-proclaimed human rights activists" (p. 634)—anybody he believes personally slighted him in one way or another. Only three individuals—Gerald Ford, Richard "Dick" Cheney, and George W. Bush—escape some degree of outright castigation in *Known and Unknown*.

Rumsfeld has based his memoir on a wide variety of sources, not simply his own recollections. The sources range from nearly 100 senior military officers, "colleagues, patriots, and friends," whose "distinct perspectives" he values, to primary documents in the Library of Congress and several presidential libraries, to secondary material from magazines, newspapers, and books. A substantial amount of the referenced material apparently comes from his personal collection, the "Rumsfeld Papers," which is online at www.rumsfeld.com. Unfortunately, this website reinforces the impression that Donald Rumsfeld is a man too convinced of his own importance and too confident, when comparing himself to his contemporaries, about his place in US and world history.

Known and Unknown is, first and foremost, an apologia. To understand the extent to which Rumsfeld distorts or ignores history's factual fabric in order to explain or justify his motives and actions, one might reread Bradley Graham's *By His Own Rules: The Ambitions, Successes, and Ultimate Failures of Donald Rumsfeld* (2009), a superbly balanced assessment of the former defense secretary's strengths and weaknesses. Throwing a couple blatantly partisan volumes into the mix might be even more interesting. Two good counterbalancing titles for the latter exercise would be inveterate admirer Rowan Scarborough's *Rumsfeld's War: The Untold Story of America's Anti-Terrorist Commander* (2004) and unabashed detractor Andrew Cockburn's *Rumsfeld: His Rise, Fall, and Catastrophic Legacy* (2007).

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