NATIONAL RECONNAISSANCE

JOURNAL OF THE DISCIPLINE AND PRACTICE

Issue 2005-U1

NATIONAL RECONNAISSANCE

JOURNAL OF THE DISCIPLINE AND PRACTICE

2005-U1

CENTER FOR THE STUDY OF
NATIONAL RECONNAISSANCE

The Center for the Study of National Reconnaissance (CSNR) publishes *National Reconnaissance* for the education and information of the national reconnaissance community. *National Reconnaissance* facilitates a synthesis of the technical, operational, and policy components that define and shape the enterprise of national reconnaissance. Employees and alumni of the National Reconnaissance Office, and its mission and industry partners, may submit items to be considered for publication.

The Center for the Study of National Reconnaissance (CSNR) is the NRO Office of Policy's research, policy analysis, and history component. CSNR products and activities help define and explain the discipline, practice, and history of national reconnaissance. CSNR functions are intended to help to provide NRO leadership with a historical context and conceptual focus for its policy and programmatic decisions. CSNR also responds to today's reality of an increasingly open NRO, and helps inform and educate the national reconnaissance community. By accomplishing its mission, CSNR supports the NRO's strategic goals to execute space reconnaissance acquisition and operations, transform sources and methods, and partner in delivering vital intelligence.

ISSN 1557-0304

Correspondence can be directed to:
National Reconnaisance Office
DA/OP/CSNR
14675 Lee Road
Chantilly, VA 20151
703-488-4733
csnr@nro.mil

NATIONAL RECONNAISSANCE

JOURNAL OF THE DISCIPLINE AND PRACTICE

2005-U1

COLUMNS

ARTICLES

UNCLASSIFIED

UNCLASSIFIED
UNCLASSIFIED

Editor's Note

This publication represents the first unclassified issue of *National Reconnaissance, Journal of the Discipline and Practice*, formerly entitled the *CSNR Bulletin*. *National Reconnaissance* is NRO's counterpart publication to our mission partners' scholarly journals: CIA's *Studies In Intelligence*, NGA's *Geospatial Intelligence Review—An Analytic Tradecraft Journal*, and NSA's *Cryptologic Quarterly*. The CSNR publishes *National Reconnaissance* for the education and information of the NRO community, and it supports the CSNR mission by promoting the study, dialogue, and understanding of the discipline, practice, and history of national reconnaissance. In addition to information, *Journal* articles provide NRO leaders with an analytical and historical context for their programmatic and policy decisions. Combining historical research and documentation with analysis of current practices and trends, this journal aims to create a scholarly forum to examine pertinent issues, and to educate and inform the national reconnaissance community. Although this issue contains only unclassified articles, CSNR also publishes a classified edition of *National Reconnaissance*, to provide a discussion forum for sensitive topics not approved for wider release.

The CSNR publishes this issue at a critically important stage in the transformation of the intelligence community. Oversight authorities, particularly the House Permanent Select Committee on Intelligence (HPSCI), debate continuously the intelligence budget priorities, with much discussion centering on national reconnaissance—often termed "technical systems" in open source literature—programs. While the committee's chairman stresses, in a statement quoted in the New York Times, that there are "overlapping and duplicative technical programs, and we believe we're coming up short on HUMINT [human intelligence]," other committee members argue that too drastic cuts to satellite systems would "cause a gap in our capabilities and diminish the industrial base so critical to fielding the technology against current and future threats." Even while it votes to reduce funding for a few satellite programs, the committee recognizes the need of continuing space-based reconnaissance. This debate reflects a reconnaissance community accepting of necessary change, but also protective of capabilities. The articles within explore these themes of transformation and continuity that remain relevant to a changing leadership environment and that illustrate the evolving relationships among intelligence collectors and analysts, the customers of finished product, and the oversight authorities that control acquisition and development funding. A few of these pieces address the challenges facing national reconnaissance policymakers as they try to transform intelligence institutions at a time when more data is demanded by more customers than ever before. One article recounts how the inherent risk present in procuring, acquiring, and developing satellite systems has been managed, and postulates that the current low tolerance for cost overruns and delays will doubtless affect future decisions taken by program managers, and will inform budget discussions between the Director and Congress. Still other articles examine the accomplishments and lessons of the past, and comment on whether these lessons remain valid. There are also prescriptive suggestions in two or three pieces, that recommend steps to improve the NRO, and these will hopefully generate discussion and debate throughout the community.

In the first article, the Deputy Director of the National Reconnaissance Office, Mr. Dennis Fitzgerald, discusses the evolution of risk in national reconnaissance programs from the NRO's inception in 1960 until the first years of the twenty-first century. He identifies four distinct periods within this time frame and analyzes the differing approaches to managing program risk. For each period, Fitzgerald compares management's relative willingness to take risks, and oversight authorities' willingness to tolerate program failure. He examines programmatic risk from a funding, technical, and operational context. Mr. Fitzgerald stresses the high-risk nature of space-based reconnaissance, while noting that management's willingness to take risks is directly proportional to the funding environment and oversight authorities' tolerance for failure. In conclusion, he offers eight risk-mitigation rules for managing and building national reconnaissance programs.

From one piece examining the reconnaissance environment of risk, we move to a story on the NRO's people. The second article recounts some accomplishments of the pioneers of national reconnaissance, with examples from the NRO's formative years. In "National Reconnaissance Leadership for the 21st Century: Lessons from the NRO's Heritage," CSNR Senior Analyst Patrick Widlake extrapolates the NRO Pioneers' lessons that remain relevant to national reconnaissance leadership as it confronts high-risk program management within the intelligence community and worldwide geopolitical landscapes of the early twenty-first century. Though operational systems and programs in development are managed and overseen differently in 2005 than systems produced during the Cold War, the best practices and most important lessons of that earlier era remain valid, and might be adapted to meet current leadership's objectives.

With the ideas expressed in the first two pieces as a backdrop, we next present an ongoing intellectual debate between a Pioneer and a current NRO leader. Mr. Robert Kohler, named a Pioneer of National Reconnaissance in 2000, and Deputy Director, NRO (DDNRO) Mr. Dennis Fitzgerald, each articulate their positions in four separate articles, two published previously, and two that appear here in print for the first time. In order to give context and relevancy to the updated observations, we start with the earlier exchange published in two issues of CIA's *Studies in Intelligence*. Mr. Kohler authored "One Officer's Perspective: The Decline of the National Reconnaissance Office" for Studies in Intelligence, Volume 46, Number 2, 2002, while Fitzgerald's response, entitled "Commentary on 'The Decline of the NRO—The NRO Leadership Replies,'" appeared in *Studies in Intelligence*, Volume 46, Number 4, 2002. Both articles are reprinted here with the permission of the Center for the Studies of Intelligence (CSI). Taken together, the two pieces articulate a lively debate on the NRO's present status and future outlook. While Fitzgerald maintains that the NRO's current civilian and military personnel mix constitute the smartest engineering workforce that has ever been assigned to the organization, and that the best days lie ahead, Kohler insists that the old NRO, with its multiple program structure, managed its separate programs more efficiently, and developed more revolutionary technology on time, and within budget, with greater consistency than the present consolidated structure.

Continuing the dialogue, we next present Kohler's update to his prior assertions, a follow-up piece entitled "Recapturing What Made the NRO Great: Updated Observations on 'The Decline of the NRO,'" along with Mr. Fitzgerald's reply to this latest critique. Kohler suggests that the NRO needs to regain end-to-end responsibility and fund programs realistically, and that the DNRO should be a full-time position, not a "dual-hat" title along with Undersecretary of the Air Force. While conceding many of Kohler's points, Fitzgerald puts the funding criticisms in proper context, concluding that what the NRO really lacks following the forward funding crisis is the flexibility to manage its programs effectively.

Since the publication of the last issue of the CSNR Bulletin, several important national reconnaissance figures have passed away, and we conclude this issue with tributes to each of them: John Parangosky, Dr. Mark Morton, Gen. Andrew Goodpaster, and Gen. Bernard Schriever. Mr. Parangosky, named in 2000 a Pioneer of National Reconnaissance, contributed greatly to some revolutionary national reconnaissance systems, including the U-2 and A-12/SR-71 high-altitude reconnaissance aircraft, and Corona, the first photoreconnaissance satellite.

Also a national reconnaissance Pioneer, Dr. Mark Morton supervised engineering teams that designed, fabricated, and tested the satellite recovery vehicle (SRV) for Corona. As White House staff secretary during the Eisenhower administration (1953-1961), Gen. Andrew Goodpaster proved indispensable as a liaison between the President and the developers of the first high-altitude and space-based reconnaissance systems. Finally, Gen. Bernard Schriever must be considered the father of US military space and missile forces. As head of the Air Force Air Research and Development Command's Western Development Division (WDD), Schriever oversaw production of four major missile systems—the Thor intermediate range ballistic missile (IRBM), and the Atlas, Titan, and Minuteman ICBMs—years ahead of schedule, and furnished the national reconnaissance community with the space launch vehicles used for boosting the world's first reconnaissance and communication satellites into orbit.

We design the *Journal* to provide readers with facts and insight into the many technical, operational, and management challenges—past, present, and future—that together constitute the enterprise of national reconnaissance. While we intend to engender dialogue and debate, this publication does not necessarily reflect the official views of the NRO, the Intelligence Community, or the Department of Defense. Please contact me if you have comments or questions concerning *National Reconnaissance*, or if you would like to submit an article to be considered for publication.

Robert A. McDonald, Ph.D.
Editor

Risk Management and National Reconnaissance From the Cold War Up to the Global War on Terrorism[1]

By Dennis D. Fitzgerald

The Executive and Legislative branches, subsequent to the 2004 Presidential election, focused on examining the Intelligence Community's structures, functions, and missions in light of the terrorist attacks of September 11, 2001. During these most recent reassessments, some have argued that the NRO has become risk averse, lost its technological edge, and lacks vision. In this article I will discuss the changing nature of risk and risk management as they relate to the NRO's mission, its technology, and its vision for national reconnaissance as we encounter the emerging national security challenges.

An important objective in implementing any realignment of Intelligence Community activities is to ensure there is an effective, efficient, and flexible application of resources in response to the wide range of both current and potential national security threats. As the National Reconnaissance Office (NRO) addresses the application of its resources to support the Global War on Terrorism, it is being faced not only with new emerging demands, but also with traditional demands, for its reconnaissance systems and intelligence output. However, the long-term fiscal experience has been one where the budgetary environment had been flat or declining. A strong correlation exists between the funding environment and the tolerance of oversight authorities for failures and the willingness of leaders to take risks.

By its nature, space reconnaissance is a high-risk enterprise. The technologies that are developed and employed define the state-of-the-art and are not commercially available. The history of the NRO is a story of consistently pushing technological boundaries to achieve breakthrough capabilities in the full spectrum of national reconnaissance systems and products. Pushing hard yielded many successes and innovations, but break-

[1] This article is an unclassified version of, "Risk Management and National Reconnaissance form 1960 to 2002," which CSNR published in the classified edition of *National Reconnaissance—Journal of the Discipline and Practice,* (Issue 2003-C1).

throughs sometimes came at a price. The NRO also suffered its share of setbacks and disappointments. These setbacks are endemic to the high-risk nature of the national reconnaissance enterprise and are a natural consequence of constantly redefining the state-of-the-art. As we explore risk management and national reconnaissance, we first need to frame the fiscal environment and define risk.

The Fiscal Environment

From the end of the Cold War until the events of September 11, 2001, the NRO operated in a constrained fiscal environment. This environment also was shared by other elements of the Intelligence Community. However, while the impact on the other Intelligence Community elements generally was immediate, the NRO did not show evidence of the impact immediately. The impact, however, was just as real and often far deeper. These other organizations are not as deeply involved in research, development, and acquisition as the NRO. Therefore, they generally experienced the budget impact in their current operations. In contrast, the NRO budget impact was directed in the areas of technological development and future acquisitions. This choice was made to avoid near-term degradation of national reconnaissance capability. The impact of the NRO's budget was delayed three to five years, and the impact became apparent when NRO systems and capabilities that were supposed to be ready for deployment were either delayed or not available. Another consequence of these budget reductions was that over time the national reconnaissance satellite constellation became more fragile. The budget reductions also put the NRO's space reconnaissance technological development at risk by eroding long-term investment in technology. This sets the stage for interaction with risk.

The Nature of Risk

Risk has multiple meanings and is dependent on a given set of circumstances at a specific point in time. Tolerance for risk is correlated directly with the operational environment, and this correlation is reflected in the NRO's history. Over the past four decades from the 1960s to the beginning of the 21st century, the risk environment has changed with regard to national reconnaissance programs.

When examining the issue of risk over this period of forty-five-plus years, there are two groups of actors who must be taken into consideration. The first group is internal to the discipline of national reconnaissance and includes senior NRO leaders, program managers, and the NRO's industry partners. The second group is external to national reconnaissance and is comprised of NRO oversight authorities to include the President, the National Security Council, and Congress. The interaction within and between these groups largely defines the level of acceptable risk and the tolerance for failure. To gain insight into the question of risk management for the NRO, it is useful when evaluating the risk environment for the NRO over the past forty-five years to divide the period into four thematic eras: The Imperative for Intelligence; The Drive for Technology; The Expectation of a Peace Dividend; and The War on Terrorism.

The Imperative for Intelligence (1960–1970)

The first era, roughly 1960-1970, is defined by the intelligence imperative to collect national-level strategic intelligence on the capabilities and intentions of the Soviet Union and China. The NRO's operational emphasis was on obtaining reconnaissance imagery that could provide indications of military capabilities and intentions of the Soviet Union and China, specifically with regard to their strategic capabilities. At the time of the 1960 presidential election there was a public debate on whether the Soviet Union had surpassed the United States in terms of nuclear weapons and strategic delivery systems, specifically whether a "bomber gap" or "missile gap" existed. President Eisenhower lacked adequate and timely intelligence to provide him with insight into the strategic balance. The primary source of reconnaissance information came from politically and militarily risky U-2 overflights. These overflights came to an end in May 1960 when a U-2 piloted by Francis Gary Powers was shot down. Consequently, President Eisenhower found himself facing critical decisions related to the types and amounts of strategic weapons and delivery systems that were required to provide for the national defense, yet he was relatively blind in terms of timely and reliable intelligence on Soviet capabilities (McDonald, 1997; Pedlow & Welzenbach, 1998).

During this era, NRO leaders demonstrated a willingness to take significant technical and program risks because there was national-level support and a high degree of tolerance for failure among oversight authorities. In the 1950s the United States began to explore the possibility of conducting national reconnaissance from earth-orbiting satellites. Although the U-2 program was a success from its first flight in 1956, national leaders recognized that sooner or later the Soviets would develop countermeasures. Space-based reconnaissance systems were not yet ready in May 1960 when Powers was shot down. Project Corona, the film-return photoreconnaissance system, was in development and testing (along with other systems), but had experienced a number of technical failures. In fact, the program experienced twelve consecutive failures before the first mission returned film to Earth successfully in August 1960. Despite the repeated failures, this program remained a national priority for the Eisenhower administration, because that administration accepted the fact that failures inevitably occur during the development of new, high-risk systems and capabilities (Hall, 1997; McDonald, 1997).

There were other significant aspects of this era. Intelligence analysts were starved for data, so virtually every piece of collected intelligence carefully was reviewed, and every image that was produced was analyzed. The principal intelligence customers were national level policymakers including the President and the National Security Council.

The contractor base was small, in large part, because of the emphasis on secrecy and the resulting substantial security requirements (Laurie, 2001). In terms of the production of reconnaissance systems, a pipeline existed in which more than one copy of a system was built at a time. In the case of Corona there had to be a robust pipeline, because the first twelve either malfunctioned or ended up in the ocean. The lesson from this experience was that a production pipeline helps mitigate risk. In terms of funding, the NRO calculated the cost of a program and added twenty to thirty percent in anticipation of cost overruns (Kohler, 2005). This streamlined budget practice was possible, in part, because of the covert nature of the organization. There was limited oversight, and the NRO could buy its way out of a lot of problems without having to explain to Congress (Laurie, 2001). Finally, during this era, failure was often viewed as a learning experience both by NRO leadership and by the organization's oversight authorities.

The Drive for Technology (1970–1990)

The second era, roughly 1970-1990, was characterized by a drive for technology where enhancements to baseline systems and capabilities were aggressively pursued and developed. Specifically, enhancements to imagery systems included advancing from film-return to electro-optical systems and near real-time image transmission and processing (Helms, 2003). The NRO also improved SIGINT collection and processing capabilities (Hall, 1999). During this era the willingness to take risk by NRO leadership could be described as moderate, which also describes the tolerance for failure by NRO oversight authorities.

The 1973 Arab-Israeli War highlighted the urgent requirement for near-real-time imaging capability. Secretary of State Henry Kissinger, in consultation with President Richard Nixon, ordered the premature return of a film capsule in order to obtain battlefield imagery that was required to support diplomatic efforts. This requirement for near real-time imaging capability contributed to the transition from film-return systems to electro-optical systems.[2]

Intelligence analysts kept pace with the volume of collected intelligence until around the mid-1980s, when the collection capabilities of NRO systems advanced to the point where they overwhelmed analysts with data (Taubman, 2003). The number of intelligence consumers grew beyond just the senior levels of the Executive Branch to include a variety of Intelligence Community organizations who came to rely on this information to perform their missions. The contractor base was growing, which contributed to greater competition among contractors. There was still a production pipeline, and as new systems became operational, there invariably were design and technical problems and refinements that needed to be addressed. When failures occurred, NRO leaders and oversight authorities generally viewed them as the result of over-reaching in terms of attempting to extend the boundaries of technology.

---

[2] Source material is classified.

As a result of the successes and achievements of the first two eras, the NRO developed a reputation as an organization that was exceptionally successful at pushing the boundaries of technology and that always exceeded requirements. In these early years, the NRO never built systems to requirements, rather it built systems to the limits of what the technology would allow. This reputation and track record was, in no small part, because of the streamlined financial and oversight environment that existed. Key elements of that environment were adequate funding, the willingness to accept failure as a learning experience and a consequence of taking risks, and of pushing the limits of technology.

Expectation of Peace Dividend (1990–2002)

The third era, roughly 1990-2002, is defined by the expectation of reaping a peace dividend from saving as a result of the end of the Cold War. During this era the NRO was expected to continue to deliver the quantity and quality of intelligence data that national leaders had come to expect. This expectation and the resulting environment had the unintended consequence of reducing the resources that supported NRO research, development, and acquisitions. In turn, NRO engineers and program managers wanted to keep their programs alive, so they took on greater and greater risk. This increased risk to long-term operations and development was evident by behaviors that resulted in the acquisition of fewer spares, the reduction of testing and evaluation procedures, the shortening of systems integration times, and the lack of developing parallel high-risk projects. To complicate this situation, when the NRO was assuming greater risk, the national oversight authorities were reducing their tolerance for failure.

During this era, investment in capacity made in the 1980s resulted in ever more efficient and effective national reconnaissance systems. The sheer volume of imagery and SIGINT increased to the point that analysts became overwhelmed (Taubman, 2003). The military was also downsizing its forces at this time, and the reduction in the military's analytic workforce further exacerbated the problem of inadequate analytic capability to exploit advancing collection capabilities.

Other important changes also occurred. Following the successes of space systems in Operation Desert Storm, the NRO's primary customer base broadened and shifted from the Intelligence Community to the military. In industry, a period of consolidation among national security contractors radically changed the NRO's industrial base, and we are now approaching the end of that period. The production pipeline that existed during the first two eras disappeared, and the practice of procurement based on mean mission duration also came to an end. Instead, the NRO employed a process in which each system's functional availability is re-evaluated every year, and procurement is based upon mean life expectancy.

These risks were compounded when the NRO reformed its financial practices following the discovery in 1995 of $3.8 billion of forward funding.[3] The practice of forward funding provided a measure of budgetary discretion and flexibility that assisted with risk management. However, oversight authorities objected to this practice and the NRO's senior leadership vowed, and has delivered on its assurances, that a similar situation would not happen again. One result of this experience was the transition from three accounting systems to a single integrated financial management system. In fact, the NRO was the only element of the Intelligence Community to successfully complete cash flow audits by an external accounting firm every year between 2000 to 2003.

In order to ensure that the NRO did not accumulate forward funding, and to be able to fund additional programs (particularly advanced research and development), the NRO developed an elaborate, detailed budget process that utilizes complex computer modeling and simulations that takes into account every piece of hardware and every line of code that is to be built. This acquisition methodology is particularly fragile when applied to first generation systems where there is little or no experience. When new systems push the state-of-the-art the amount of risk increases significantly, and some degree of failure is not only a possibility, it is virtually assured.

The War on Terrorism (2002 and Beyond)

The fourth and current era is defined by the War on Terrorism. This era entails a new operational environment and associated expectations regarding assured space reconnaissance capabilities. Current expectations are that there can be no coverage gaps in overhead intelligence collection capabilities because the military is heavily dependent upon NRO systems and products for planning and operations. The performance of NRO systems has been spectacular in terms of preventing the loss of lives, targeting of weapons with unprecedented accuracy, and obtaining a synoptic understanding of the battle space. For example, in Afghanistan and Iraq targeting is done with national reconnaissance assets because those assets can provide the geolocation that is required to target precision-guided munitions. SIGINT has also proven crucial in all aspects of military operations and planning.

This new environment in which coverage gaps are viewed as unacceptable has led the NRO to become increasingly conservative in terms of ensuring continued mission performance at a time when there is also tremendous pressure to move on to the next-generation systems. At the same time, intelligence analysts are being spread relatively thin and are now expected to pay attention to a broad range of targets in diverse geographic areas. In the meantime, other important targets are not getting the attention they require. This reduced attention translates into increased risk. The question for national and military decision makers and oversight authorities is how long can we tolerate this risk before we experience adverse consequences?

---

[3] The forward funding was a result of a number of contracting and accounting factors, including the use at the time of three district accounting systems. Other factors included disparities between budget allocations and contract obligations; disparities between contract obligations and execution rates; the withholding of award fees; and program delays. No funds were missing or misused.

To summarize the present era, the willingness to take on risk by the NRO leadership is moderate. The primary customer is the military, and there is no production pipeline. The leadership is very tentatively moving the NRO toward a new budget and acquisition process. This change will reduce programmatic risks, but these steps cannot be sustained without the support of the Community Management Staff and Congress[4]. Presently, when funds are appropriated to the NRO, 100% of those funds must be obligated as planned which severely restricts the NRO's ability to manage risks across the national reconnaissance enterprise. Additionally, without adequate funding that includes program margin the NRO is constrained from aggressively pursuing new technologies.

At the same time it has become clear that tolerance for failure by oversight authorities has become virtually non-existent. Now when failures occur the issue is "Whom do we fire?" This causes one to wonder whether this trend eventually will lead to investigations and the potential criminalization of prudent high-risk engineering decisions that inadvertently result in failure for technical reasons. These trends will have a chilling effect on the willingness of an organization and its leadership to pursue programs with significant technical and financial risks. In turn, this will have the unintended effect of stifling innovation and creativity at a time when it is needed most.

Current Challenges

A comparison between the first two eras and the second two eras illustrates that during the first two periods, NRO oversight authorities recognized and accepted the reality that developing, deploying, maintaining, and improving a space-based national reconnaissance capability was a very high-risk enterprise. In contrast, during the latter eras much of the risk was implicit and driven largely by fiscal imperatives. In other words, cost became the primary decision variable and a number of programs and ground stations were consolidated or eliminated in the pursuit of lower costs. In several cases these decisions contributed to increased risk and vulnerability of the national reconnaissance satellite constellation and the supporting infrastructure.

Shrinking budgets are forcing the NRO to attempt to accomplish more with fewer resources, and without the security of production pipelines. For example, the Future Imagery Architecture (FIA) is a cost-driven system in which the system is being built to requirements rather than technical capability. However, with a shrinking budget and a mandate to accomplish more with fewer resources while being denied a production pipeline, the NRO has been forced to become increasingly conservative. In other words, the organizational imperative has shifted from advancing technology boundaries to meeting current mission requirements.

[4] The Community Management Staff (CMS) is being subsumed into the Office of the Director of National Intelligence (ODNI).

THE NRO and RISK: COMPARING FOUR ERAS			
ERA	TIME FRAME	NRO WILLINGNESS TO TAKE RISK	OVERSIGHT TOLERANCE FOR FAILURE
Intelligence Imperative	1960-1969	High	High
Drive for Technology	1970-1990	Moderate	Moderate
Peace Dividend	1990-2001	High	Low
War on Terrorism	2002-?	Moderate	None

What Can Be Done?

The NRO's greatest asset continues to be the people in government and industry who do the research and development, acquire the systems, and fly the spacecraft. As a team, the people of today's NRO are as dedicated as any I have served with in my more than 25 years in the NRO. Today's workforce generally has more skills than the people I worked with 25 years ago in terms of the basic skills they bring into the organization. They tend, however, to be less experienced, and that presents a challenge because one way you obtain experience is by taking risks and exploring the unknown. But it is difficult to provide them with the room they need to gain valuable experience when the environment is risk averse in terms of technology and funding. The bottom line is that there is no shortage of good ideas in the NRO, but there is a shortage of funding.

Eight Rules for Managing Risk in National Reconnaissance Programs

A number of steps can be taken to avoid or mitigate some of the problems that I have identified. I offer eight rules to follow for building and managing realistic national reconnaissance programs:

1. **Avoid programs that require research and development in parallel with the program.**

   In the past, we almost always broke this rule. The problem is that if your research stalls so will your program, and that will leave you with a standing army burning money and going nowhere.

2. **Budget at 80% of the most probable cost for first-of-a-kind space systems.**

   There will be unforeseen problems with new systems, so plan for it, be proactive, and be prepared by ensuring there is margin in your budget over contract cost.

3. **Whenever possible, plan for a backup launch vehicle.**

   The launch vehicle has always been one of the highest risk elements of our programs. Launch failures (regardless of whether the payload is ours or someone else's) have an impact on schedules, and therefore cost, since the fleet has to stand down until the cause is determined and remedial steps taken to avoid duplicating the failure.

4. **Use multiple sources for high-risk components.**

   Generally, for budget reasons the NRO has not fully complied with this rule. Failure to adhere to this rule creates risk that must be mitigated in some way. When you are reliant on a single source for a critical component and the vendor fails, your program will stall and you will find yourself burning money and going nowhere.

5. **Test everything you can.**

   The space environment is especially hard on things built by humans and simulations are rarely an adequate substitute for real tests. There appears to be a "modern" trend to not build functional test assemblies to test hardware. This trend can be dangerous. Our experience has shown that simulators are seldom a substitute for real hardware when developing systems. On the ground a bad simulation or a failure to properly test can be a problem; in space it is generally a disaster because you cannot rework a system on-orbit to fix the things you forgot to test. Perhaps someday this will not be the rule, but until that day comes test and test again.

6. **Have sufficient test equipment.**

   Have enough equipment to test subsequent flight articles when the first one runs into trouble. We spent tens of millions of dollars buying more test equipment on a SIGINT program to avoid this problem. This was a worthwhile expenditure because when the first vehicle ran into problems we were able to use the second and third vehicles to try to see and understand what was going wrong.

7. **Allow for sufficient integration and test time.**

   We run into most of our surprises in the integration and test phase where almost everything is serial. A delay propagates through the schedule at a time when there is often no schedule margin left to work with. The NRO failed to adhere to this rule on a SIGINT program, and as a result we spent months testing the test equipment and software rather than testing the spacecraft.

8. **Manage your contractors aggressively.**

   You may not be their only customer, and their priorities may differ from yours.

Conclusion

The NRO looks forward to continuing to improve every aspect of the way we do business and to achieve the NRO vision of "One Team Revolutionizing Global Reconnaissance." The world is a significantly different place with different threats and challenges than in the NRO's formative years. If the NRO is to achieve its vision we will have to approach risk and risk management with the same commitment we had when we confronted the technical challenges of our early years. The NRO's primary objective should be to design, build, and operate best value, state-of-the-art national reconnaissance systems. I have every confidence that our people, both in government and industry, can excel in this endeavor.

References

Hall, R. C. (1997). "Post War Strategic Reconnaissance and the Genesis of Project Corona." In R. A. McDonald, 1997, *Corona: Between the Sun & the Earth—The First NRO Reconnaissance Eye in Space*, pp. 25-58, Bethesda, MD: American Association for Photogrammetry and Remote Sensing.

Hall, R. C. (1999, March-April). The National Reconnaissance Office: A Brief History of its Creation and Evolution. *Space Times*.

Helms, Richard, & Hood, William. (2003). *A Look Over My Shoulder: A Life in the Central Intelligence Agency*. New York: Random House.

Kohler, Robert. (2005). One Officer's Perspective: The Decline of the National Reconnaissance Office. *National Reconnaissance: Journal of the Discipline and Practice*, 2005-C1, pp. 35-44.

Laurie, Clayton D. (2001). *Congress and the National Reconnaissance Office*. Chantilly, VA: National Reconnaissance History Office.

McDonald, R. A. (1997). "Corona's Imagery: A Revolution in Intelligence and Buckets of Gold for National Security." In R. A. McDonald, 1997, *Corona: Between the Sun & the Earth—The First NRO Reconnaissance Eye in Space*, pp. 211-220, Bethesda, MD: American Association for Photogrammetry and Remote Sensing.

Pedlow, G. W. & Welzenbach, D. E. (1998). The CIA and the U-2 Program, 1954-1974, Washington, DC: CIA Center for the Study of Intelligence.

Taubman, Philip. (2003). *Secret Empire: Eisenhower, the CIA, and the Hidden Story of America's Space Espionage*. New York: Simon & Schuster.

Dennis D. Fitzgerald is the Deputy Director of the National Reconnaissance Office, a position he has held since August 2001. His most immediate prior assignment was as Associate Deputy Director for Science and Technology in the Central Intelligence Agency (CIA). Mr. Fitzgerald joined the CIA's Directorate of Science and Technology in 1974 and spent the majority of his career assigned to the CIA's Office of Development and Engineering (OD&E) with duty in the NRO. His many NRO assignments included service as the NRO's Acting Director between the retirement of Peter Teets and the appointment of Donald Kerr as DNRO, and Director, Signals Intelligence Systems Acquisition, and Operations with a concurrent appointment as CIA's Director of Development and Engineering. Mr. Fitzgerald began his professional career as a field engineer working on the Polaris and Poseidon missile program for Sperry Gyroscope.

National Reconnaissance Leadership for the 21st Century: Lessons from the NRO's Heritage

By Patrick Widlake

"[I]f we know transformation when we see it, it's because we've seen it before."

—Peter Teets, Former Director, National Reconnaissance Office

The principles that guided the national reconnaissance pioneers as they built a world-class capability remain relevant some forty-five years later. This is true even though the NRO has changed its acquisition and development methods, and increased program oversight has dramatically altered how individual programs are run. The pioneering principles from the days of the Cold War are lessons that are applicable to the 21st century global war on terrorism challenges.

The early pioneers worked tirelessly to produce seminal systems like the Grab electronic reconnaissance satellite and the Corona photoreconnaissance satellite that forever changed the Intelligence Community's view of what was possible. These pioneers believed absolutely in what they were doing, and they were not limited by conventional wisdom or prevailing assumptions. To apply their lessons to the 21st century, we first must understand the historical context of the formative years of national reconnaissance.

Historical Context of the Formative Years

During national reconnaissance's formative years, imagery systems like the U-2 high-altitude reconnaissance aircraft and Corona photoreconnaissance satellite provided undeniable national security support. The raw intelligence they collected about a closed Soviet society could not be gained otherwise in such quantity, or with so little risk to life (Hall, 1997). The looming danger of nuclear annihilation created a need for hard data that overcame issues such as political partisanship, inter-organizational squabbling, and budget reductions and risk concerns, most of which still confront reconnaissance leaders and program managers (Burks, 2003). SIGINT Pioneer Peter Wilhelm (2000) said, "Looking back, if we had not been as scared [of the Soviet threat] as we were, I do not believe we—as a country—would have put as much effort into developing the new technologies as we did" (p. 155).

The NRO satellites continue to provide invaluable collection data about the varied national security threats to the United States. The constellation now flying begins to show its age and limitations, though, and the intelligence priorities of the 21st century constitute a difficult targeting challenge for systems that were optimal for Cold War era spying. During that conflict, space-based reconnaissance provided economic data, and monitored military forces within the denied borders of a single, superpower enemy; after the centralized Soviet structure dissolved in 1991, targeting priorities changed. While NRO satellites continued to monitor adversarial states' compliance with arms control treaties, by the 1990s they also needed to track the movements and activities of unfamiliar and dispersed threats, such as terrorists and other nonstate actors (Teets, 2004). This changed the missions, but it did not alter the danger, a situation that remains. The worst scenario that leaders of the global war on terrorism can envision would be for terrorist cells to obtain nuclear, chemical, or biological weapons that they could detonate at any time, in any place. Despite an international political and military landscape that scarcely resembles the Cold War era, national reconnaissance leaders find themselves in this period confronting a similar danger to that which motivated the earliest reconnaissance pioneers.

Former Director of the NRO (D/NRO), Peter Teets, observed:

> The world we find ourselves in today, in the post 9/11 environment, bears many similarities to the world of new threat and dangers we found ourselves in back in the mid-1950s. As we did with Soviet ICBMs back then, we have, in the threat of terrorism, a new form of danger against our homeland. And again, the extreme form of that danger is weapons of mass destruction. There is also that same feeling of uncertainty, even fear, at not knowing the extent of the threat, or what can be done, in the near term, to best defend against it (2003).

Cold War leaders viewed building responsive reconnaissance systems as a matter of national survival; this remains true in 2005, when the national security objectives are both to defend against terrorism and to support regional military operations. Operation Iraqi Freedom's relentless tempo demanded continuous and timely intelligence to support military forces. The insurgents aligned against the U.S. in its ongoing combat operations pose, in many ways, a more difficult reconnaissance challenge than the one faced by reconnaissance pioneers. The terrorists' aims, however, bear a striking resemblance to those attributed to the Soviets at the dawn of the Cold War: the destruction of a way of life that is inimical to their beliefs or that threatens their power. Less than a year after VE-Day ended hostilities in Europe, George Kennan (1946), then a counselor in the US Embassy in Moscow, summed up Soviet ideology under Stalin:

> We have here a political force committed fanatically to the belief that with the United States there can be no permanent modus vivendi, that it is desirable and necessary that the internal harmony of our society be disrupted, our traditional way of life be destroyed, the international authority of our state be broken, if Soviet power is to be secure (Kennan, 1946, p. 17).

In 1999, Osama Bin Laden declared for the second time in three years a jihad, or holy war, against Americans. Bin Laden said "Hostility toward America is a religious duty, and we hope to be rewarded for it by God" (Yusufzai, 1999). Equally significant was Bin Laden's unabashed pursuit of weapons of mass destruction: "[I]f I seek to acquire these weapons, I am carrying out a duty. It would be a sin for Muslims not to try to possess the weapons that would prevent the infidels from inflicting harm on Muslims" (Yusufzai, 1999). Bin Laden's pronouncements suggest a gathering storm of terrorist action that threatens US interests abroad, and domestic security at home.

U.S. national security still depends greatly on intelligence provided by NRO systems, and the development decisions on future capabilities will be based on many factors. Long term reconnaissance objectives must encompass, in addition to the production and dissemination of collected data from existing systems, the acquisition and development of innovative solutions that integrate intelligence gathering and war fighting capabilities to counteract national security threats (Teets, 2004).

Though the national security environment created by the 9/11 terrorist attacks and the U.S. military response seems vastly different from the Pioneers' Cold War environment of the 1950s and early 1960s, there are parallels between the two time periods, as I have discussed. In both, U.S. policymakers formulated a reconnaissance strategy to prevent, or at the very least preempt, attacks that threatened the national survival. The types of reconnaissance systems, and the roles they could play, were also discussed and debated (Hall, 1997). These debates will continue.

With costs for some major satellite acquisition programs continuing to strain Department of Defense budgets, its future satellite constellation architecture experiencing developmental delays (ISR, 2004), and its collection capabilities questioned in congressional commission reports (2005), the NRO and its leadership find themselves at a decisional crossroads in planning the organization's future. External events like establishing a Director of National Intelligence (DNI), with a consequent redefining of intelligence community roles and responsibilities, could eventually reshape reconnaissance programs and offices into unfamiliar structures. Moreover, in a programmatic environment greatly changed since the NRO became openly acknowledged, with reform being a pervasive theme, reconnaissance leadership cannot take the exact approach its predecessors did. Nevertheless, a strategy to continue to deliver cutting-edge technology to support national security objectives should incorporate the hard-earned wisdom of the past.

The lessons in how to do this are in the experiences of the pioneers. In looking at their examples of dedication, motivation, and imagination, one sees principles that transcend the time and environment in which they were practiced. In the first decade of the 21st century, when the overriding reconnaissance leadership challenge is to transform space acquisition and development methods, while simultaneously supporting national security objectives to counter a complex and dispersed threat (NRO, 2003), the pioneers' stories continue to provide inspiration and encouragement for the future. Their experiences and accomplishments reveal important lessons about motivation, creativity, and the commitment to a common goal (McDonald, 2002). The key lessons for national reconnaissance leadership to consider are: cooperation between government and its industry partners helps leverage success; a strong industrial base is essential for knowledge and production; access to leadership at the highest levels can garner the support for research and development that increases the chances for program success; leaders and scientists must rekindle the creative spark; and, risk is integral to achieving technological breakthroughs.

Cooperation—Especially between Government and Industry—As Leverage for Success

Government agencies have partnered with industry scientists and developers throughout national reconnaissance's history and evolution. For many NRO programs, government managers directed and approved the engineering and development work of multiple contractors. The numerous past and present reconnaissance system successes were in no small way a result of this partnership, a fact that illustrates another important lesson: government and its industry partners need to collaborate and cooperate across the intelligence community. Over the years, NRO programs have derived great value from this collaboration and cooperation, not least of which has been the ability to occasionally prevent important programs from being prematurely cancelled.

Martin-Marietta engineer James McAnally led an industry team of engineers in successfully transitioning to the contractor environment a government-devised reconnaissance satellite that was launched in the late 1980s. When McAnally took over the program's management, it was experiencing serious financial and technical difficulties. In an effort to prevent imminent program cancellation, McAnally worked funding issues, and streamlined business management, while his contractor team designed, fabricated, tested, and launched the satellites. Commenting on his style of managing a diverse, multi-contractor workforce with a hands-on approach, McAnally (2004) said, "You can't manage an activity unless you understand it…I have never in my whole life asked anybody that worked for me to do something that I wouldn't do myself." The system not only provided unprecedented collection capability, but also survived more than three times longer than original specifications had called for.

Lockheed engineer Minoru "Sam" Araki, another IMINT national reconnaissance pioneer, attributed his company's success in developing projects like Corona to the collaborative relationship between government and contractor. From a business perspective, Araki believed it "[W]as an absolutely right on strategy to be in sync with the government" (1999, p. 32), while from a programmatic perspective, he stressed "[T]he success that the company achieved in conjunction with…the NRO…was because we had such strong strategic alliances, as well as program to program management alliance with customers" (1999, p. 32).

Though the pairing of government managers with industry scientists and engineers has existed since before the NRO came into being, that partnership's productivity has varied somewhat throughout time. Taubman (2003) wondered if the modern cost-conscious, risk-averse environment would allow similar breakthroughs that might be applied against emerging threats. Other intelligence community observers have interpreted the collaborative relationship differently.

Kohler (2005) believed that the antagonistic relationship among programs contending for project funding, and not cooperation between government and industry, led to reconnaissance technology breakthroughs. He maintained that when the legacy programs (Program A run by the Air Force; Program B headed up by the CIA; and Program C led by the Navy) were dissolved, and the component organizations consolidated in the Westfields facility, the greatest impetus for technological innovation was destroyed: the competition between Program A and Program B. Kohler argued it was this competition that produced the programs and products that met or exceeded the country's intelligence requirements (Kohler, 2005). While this represents one alternative explanation, there is another interpretation of past practices that supports the thesis that it was cooperation, and not competition, that was responsible for success.

The intra-program competition actually comprised a collaborative relationship between the contractor developers and the programs' government leadership. Fitzgerald (2005) argued that the design competition was really between different contractors, with each developer vying to come up with the revolutionary breakthroughs in intelligence gathering. This competition and the resulting innovation still exist, albeit between fewer contractors than before, due to company consolidations.

The NRO's 2003 Strategic Plan outlined the NRO's interest in facilitating continued collaboration between government and private industry, and between different government agencies. "The NRO is one element, along with National Imagery and Mapping Agency (NIMA)[1], National Security Agency (NSA), Central Masint Organization (CMO)[2], and others…" (p. 8), the plan stated. "The success of this system

---

1 Since renamed National Geospatial-Intelligence Agency or NGA.

2 In 2003, CMO merged with DIA/CL to form the Directorate for MASINT and Technical Collection.

of systems demands collaboration and cooperation…We also envision the nation's best scientists, engineers, and operators from government and industry working as a cohesive team…(p. 8)."

If cooperation across the intelligence community is to work, however, it must be done in the spirit of meeting common goals. Helman found that interagency coordination has become excessive, resulting in decision-making delays, as committees from each involved agency had their say. He quoted one senior manager who complained, "Organizations involved in interagency coordination often bring additional requirements to the table, but rarely bring additional resources" (Helman, 2004, p. 4-5). With the establishment of the ODNI, this situation will need to be re-evaluated.

Successful collaboration between organizations and integration of activities seems especially critical at a time when national reconnaissance systems support more customers, both military and civilian, with more challenging requirements, than ever before (Helman, 2004, p. 6). The complex systems that will be developed will require both industry executives and government oversight authorities to work together. Wilhelm offered one solution: "I would like to see an examination of a better way to develop new technology and new programs by creating more of a partnership between industry and government laboratories" (2000, p. 159). Burks (2003) observed that during his management tenure, government and industry collaborated to achieve the CIA's intelligence objectives, and that more recently the need was to achieve both IC objectives and the military's operational mission objectives. These dual objectives, sometimes linked, sometimes separate, cannot be accomplished without the engineering work performed by industry. A cooperative effort with industry can only be successful if there is a strong industrial base.

A Strong Industrial Base—Essential for Knowledge and Production

Developing and maintaining a strong industrial base is one strategic objective that fosters collaboration and innovation. NRO leadership has cultivated long-term relationships with a number of prominent defense contractors that provided the essential technological knowledge base upon which satellite programs were constructed. SIGINT Pioneer Alden Munson, Jr. considered this a critical lesson: "I believe that NRO programs have benefited from these relatively long incumbencies…If the NRO were to have a revolving door of suppliers in a particular domain, domain knowledge would erode" (Munson, 2000, p. 142).

The Corona program exemplified the strength of the early 1960s industrial base. Pioneering program managers like Burks could call upon the best technological expertise available in both government and industry. In the end, Lockheed Missiles and Space Company, Itek Corporation, Fairchild Camera & Instrument Corporation, Eastman

Kodak, General Electric, and Douglas Aircraft Company all made significant contributions to Corona (McDonald, 1997).

Wilhelm (2000) capitalized on industry's expertise by advocating and implementing government and industry teaming in his work at the Naval Research Labs (NRL). One success from that partnership was the Global Positioning System (GPS) program, which had been conceived for military application, but which eventually found widespread commercial use. "Development of GPS first required years of work at the NRL, and then a government/industry team was formed to produce the satellites that transitioned the technology out of the laboratory," Wilhelm remembered (2000, p. 158).

Since the Cold War's end, national reconnaissance leadership has faced increasing obstacles to keeping a strong industry force. Among these obstacles are a consolidating contractor base, a shrinking talent pool because of corporate mergers, and decreasing research and development funding (Teets, 2004). Experienced military staffing for reconnaissance support positions is difficult to retain because of the common practice of rotating personnel, particularly Air Force officers, to unrelated assignments every couple of years. Helman (2004) suggested this discontinuity, combined with the industrial base's consolidation and reduction, contributes to an overall weakening of technological expertise.

These developments and their significance have not gone unnoticed by senior leaders. The 2003 Strategic Plan stated "The NRO is dependent, to a large extent, on the advanced research, engineering, and production capabilities provided by a strong, commercial technology industry" (p. 19). Teets (2004) emphasized how technological and industrial advantages often overcome tactical disadvantages. He argued that innovation must be cultivated to ensure continued superiority in these areas. "We must, therefore, invest in skilled and dedicated people," he wrote, "leading edge science and technology, and a healthy industrial base as the foundations of producing and delivering national security space capabilities" (Teets, 2004, p.8). The report of the Commission to Assess US National Security Space Management and Organization (2001) listed among its key U.S. objectives for space, "…[a] healthy industrial base, improved science and technology resources, an attitude of risk-taking and innovation" (p. 18). Finally, Wilhelm (2000) argued for increased funding for research and development as one way to build and maintain the underlying strong technological base supporting reconnaissance programs.

It is vital that R&D be conducted efficiently, and at a high level, and this requires the retaining of experienced engineers with specialized expertise. In the quest to design, develop, and field reconnaissance systems, leadership must perform a balancing act between funding the resources—i.e., experienced engineers and scientists—to maintain legacy systems, and budgeting for future systems that are still being developed (NRO Strategic Plan, 2003). Reinvigorating research and development in industry and government labs could facilitate innovation, but the retention of experienced engineers necessary for a stronger industrial base remains a challenge for the leadership. Solving that challenge includes the securing of research and development funding to attract, and retain, scientific and engineering talent. This can only be accomplished if the highest level of government leadership is supportive.

Access to Leadership at the Highest Levels—Support for R&D and Program Success

One decisive factor that helped produce a space-based collection capability was national reconnaissance managers' access to the president. This was particularly true during the formative years under the stewardship of the Eisenhower administration (1953-1961). Taubman (2003) illustrated how Eisenhower's decisive, open-minded leadership, and, more importantly, his creative partnership with scientists and engineers during the Cold War's early days, enabled satellite reconnaissance development.

In 1954, Eisenhower formed the Technological Capabilities Panel (TCP) to review US military and intelligence technology, and appointed MIT President James Killian to lead it. Though created primarily to prepare a study of how the United States could avoid a Soviet surprise attack, Killian's group directly advised the President on a variety of projects through both of his administrations. The Killian panel—with Eisenhower's support—played a critical role in advancing the development of some of the most important intelligence systems used during the first two decades of the Cold War, including the U-2 and early reconnaissance satellites (Taubman, 2003, pp. 85-86). Assessing the importance of having regular, direct contact with the president, Killian said:

> My ready access to President Eisenhower made it possible for me promptly to bring to him, and to open opportunities for others to bring to him, new and important technologies, concepts and analyses that added to the strength of our nation… made it possible to achieve an extraordinary synthesis of minds and ideas to aid the President in achieving his goals in shaping our defense and intelligence programs and policies (Killian, 1985, p. 90-91).

Eisenhower began his military career as an Army engineer and was extraordinarily receptive to the scientists' new ideas. He also believed in limited oversight. He wrote, "Scientists and industrialists must be given the greatest possible freedom to carry out their research" (Eisenhower, 1946, quoted in Taubman, p. 89). The likelihood of a breakthrough was increased, the President continued, when "[D]etailed directions are held to a minimum" (Eisenhower, 1946, quoted in Taubman, p. 89).

Overall reconnaissance mission leadership at that time came directly from the oval office to the industry partners and scientists who performed the research and development. Taubman (2003) posited that this extraordinary access to the nation's leader, as well as Eisenhower's receptivity to taking risks and high tolerance for failure, contributed greatly to the early Cold War reconnaissance achievements.

Burks (2003) supported Taubman's view that access to and influence on the president was vitally important to the development of the NRO, and that such access should continue into the future. Though he admitted, in paraphrasing Taubman (2003, p. 369), "It is hard to imagine today people like [National Reconnaissance Founder Edwin] Land and Killian having oval office access to discuss projects germinating in the private sector that the Pentagon and military establishment are reluctant to pursue," he maintained, "Scientists should have access to, and the trust of, the president to develop useful systems in the twenty-first century" (Burks, 2003).

Fifty years after the TCP first convened, the possibility of scientists regularly visiting the oval office to confer with the president on developing a reconnaissance capability seems remote. Nevertheless, critical information on satellite technology capabilities—as well as other intelligence-gathering technology—needs to inform decision-making at the highest levels. Taubman (2003) argued that the collaboration between government and science broke down during the Vietnam War, and has not been the same since. This must be remedied. Informed, independent analysis from scientists could greatly aid national security strategy planning. It also could demonstrate a collaboration between government and industry that, in the NRO's formative years, was so integral to maintaining a strong industrial base. A reinvigorated industrial base, with support from government leaders at the highest levels, could foster an environment for the creative spirit, which is critical for much-needed innovation.

Leaders and Scientists Must Rekindle the Creative Spark

The evidence from NRO's heritage is that technological innovation began in the minds of the scientists and engineers, not government bureaucrats. Burks recalled that the creative spark underlying many of the advances in NRO's formative years originated, not in conference rooms at the CIA or Air Force, but in the laboratories of industry and government scientists (Burks, 2003). Some of these innovations were the result of trying to solve technical problems, while others were attempts to develop new capabilities. In the case of Pioneer Reid Mayo who worked in a government laboratory, he arrived at one discovery through personal vision supported by diligent calculations.

Mayo conceived the Galactic Radiation and Background (GRAB) system by making calculations on the back of a placemat. He had been traveling the mountains of Pennsylvania with his family in March, 1958, when a snowstorm stranded them at a restaurant. As his family slept, Mayo worked to produce the numbers that supported his proposition that a video technology developed for submarines could be modified to mount in a satellite. When he returned to the Naval Research Laboratories (NRL), he showed his manager the placemat with the calculations (Mayo, 2000, pp. 133-134). "Not quite as formal as we could be," Mayo said, "but innovative nevertheless" (p. 134).

Some community observers believe this creativity—or at the very least, its application—has become diminished in the twenty-first century NRO. If true, this represents a critical shortcoming in an era that requires new technological solutions to problems both familiar and unforeseen. Taubman (2003) argued that by the 1990s, national reconnaissance technologies were beginning to show age. Much of the technology still being used, with the exception of unmanned, remote control devices like Predator, was developed during the 1950s, and refined in succeeding decades. Though he conceded that satellites could contribute greatly to identifying emerging threats, Taubman indicated that for dealing with terrorists, space-based systems had inherent limitations, such as the inability to "supply the round-the-clock surveillance that is required to detect unfolding plots, and they offer no help in recruiting sources inside terror cells" (p. 361). He concluded that national reconnaissance entities like the CIA's science and technology office had lost their inventive spark and wondered "[W]hether the United States…will ever again see the likes of the inventors and risk-takers who revolutionized spying…[in the formative years.]" (p. 370).

Reconnaissance pioneers were able to bring about this revolution during the formative years because of the leadership support, and through their own relentless, searching dedication. Overhead reconnaissance technology—particularly space-based reconnaissance, which was barely conceived—was still being developed during the 1950s, so there were very few scientific experts. Eisenhower's trusted advisors were authorities neither in intelligence nor in military technology (Taubman, 2003, p. 90). For reconnaissance founders like Killian, they were, nevertheless, brilliant, visionary minds.

"What they did possess," Killian said, "were imagination, creative powers, and a deep understanding of physical science and technology…and these enabled them rapidly to come to grips with weapons technology, to bring fresh points of view to bear…" (Killian, 1977, p. 90).

As I noted earlier, a program environment with fewer requirements and oversight, lavish funding, and greater tolerance for failure also enabled these pioneering scientists of the 1950s and 1960s to create systems with capabilities far beyond the initial expectations. More recently, and particularly after the launching of Operation Iraqi Freedom, innovators find they are constrained by inaccurate independent cost estimates and increased oversight (Fitzgerald, 2005), and by the need to keep data flow constant, and to minimize area or time period coverage gaps. These factors result in an emphasis, by some program managers, on maintaining, or at best, refining current capabilities, rather than pushing the technological boundaries in risky developments (Helman, 2004). Such policy can be shortsighted, and inhibits leadership's ability to help solve tomorrow's national security challenges. Teets (2004) said, "[W]e must apply our most innovative thinking to exploit the inherent advantages of the space medium…" (p. 8). This echoes Burks's (2003) advice to current leaders to rekindle the creative spark that originated in the scientists' labs and, as in the story of Reid Mayo, sometimes in more unlikely places.

Mayo's spirit of innovation set an example for current and future engineers to emulate. Their ability to produce comparable breakthroughs will depend on their dedication and imagination, and, just as importantly, on leadership's strong commitment. When these elements—a cooperative and creative spirit, a strong, industrial base, a support from senior leadership—are in place, there will be the potential for risk taking that sometimes facilitates groundbreaking achievements.

Risk is Integral to Achieving Technological Breakthroughs

Another major lesson from the NRO's heritage is that taking risks with the development and acquisition of satellites is an essential component to achieving technological breakthroughs. Improving upon existing technology requires difficult, expensive, sometimes experimental, development that risks cost overruns, launch delays, and program failures that could cause time period or area gaps in satellite coverage. But some pioneers of national reconnaissance recollected that producing unprecedented technological capability was inherently risky, and that failures and the increased development time often led to unforeseen technical advances. At the program level, managers and system engineers learned from the setbacks. Corona Pioneer and erstwhile Technical Director A. Roy Burks (2000) said, "failure gives lessons for success…. While we certainly had problems, the important thing was that we stuck it out and learned from our mistakes" (pp. 179-180).

Developed in little more than a year, Corona experienced twelve failures before its first successful mission in August, 1960. Forty-five years later, a project would likely be cancelled after one or two failures—or would never leave the planning stage—but oversight then was more lenient, and the White House had a personal commitment to the program's ultimate success. Even while repeatedly receiving negative progress reports, President Eisenhower never wavered, reportedly saying: "Let's stay with it [satellite reconnaissance development]. It's so important and we need it. We need to just keep going with it" (cited in Taubman, 2003, p. 289-290).

The pioneering program managers and industry scientists shared the president's vision and carried out the challenge. The relationship that existed among national political leaders, reconnaissance program managers, and oversight authorities in the 1950s and early 60s facilitated such an environment for risk taking.

Many programs were covert, which reinforced the practice of limited oversight. (Fitzgerald, 2005). Without detailed oversight, setbacks were not as obvious and did not become an automatic reason for program termination; therefore, managers could afford to take great risks. This continued somewhat through the 1970s until the 1990s, with the focus shifting to pushing the technological limits (Fitzgerald, 2005). Developers designed space systems to what the technology would allow, because program managers had no formal requirements process and few budget restrictions.

Conversely, the reconnaissance community in the first four years of the War on Terror is one with no failure tolerance, increased bureaucracy, and greater congressional oversight and intelligence community involvement. Helman (2004) indicated that the additional scrutiny resulting from the NRO's change to an open, acknowledged community, when combined with these other factors, made it more difficult to translate vision into reality. Budget constraints contributed to greater risk, because staying within budget, rather than mission considerations, too often determined requirements definition (Helman, 2004). This would have seemed illogical to program managers in earlier eras. They exercised complete control over costs and schedules (Kohler, 2005), and their budget overrun justifications were more readily accepted by oversight committees. Given the many successes of that period, a case can be made for the idea that high-risk development, combined with a high tolerance of failure, fosters technological breakthroughs.

Risk and tolerance for failure interact to influence NRO program management. As Fitzgerald (2005) pointed out, there exists a direct correlation between oversight authorities' acceptance of failure, and senior leaders' willingness to take financial and technical risks. Helman (2004) found that concern over potential budget reductions can limit NRO program managers' willingness to approve development of systems having high technical risks that might require multiple phases of verification and validation testing to become operational. Such a conservative programmatic approach may inhibit the development of next-generation technology. Historically, NRO senior leadership acted differently.

But can an acquisitions and development environment that combines the pioneers' risk-taking spirit, with the realities of the contemporary management environment be facilitated? The NRO's 2003 Strategic Plan suggested such an approach. It stated that the organization is "[E]ngaged in major, long-term acquisition programs involving extraordinary risk and investment. The NRO must deliver promised performance of these programs, on schedule and within cost…" (p. 12). The plan also advised leadership to "Accept risk as an often necessary component of breakthrough transformations" (p. 9). An acceptance of risk would seem to indicate a higher tolerance for failure, but it is unlikely that oversight will be significantly reduced to accomplish this.

A more practical approach would be to manage risk better. As Fitzgerald (2005) has suggested, leaders should regard risk management as being equally important as technical challenges. Risk mitigation strategies represent one approach. If risk mitigation strategies are properly employed, programs will minimize technical difficulties during development, and managers will be better able to turn their visions into reality.

Teets (2004) developed a NRO program policy that focused less on overall cost, more on mission success. The objective was to reduce risk as much as possible, and to contain it within the early developmental stage.

"[People] understand the need for us to do the necessary hard systems engineering up front," he said. "You're not pushing risky work downstream; you're retiring risk early in the program. The worst place ever to encounter technical problems is after a spacecraft is in the assembly process…" (Teets, 2004, p. 19). Senior leadership's formalizing of a risk mitigation approach exemplifies again how access to leadership at the highest levels increases the chance for program success, and is a major component in the NRO's strategic planning. As Fitzgerald (2005) pointed out, "If the NRO is to achieve its vision we will have to approach risk and risk management with the same commitment as we confronted the technical challenges of our early years (p. 20)."

Conclusion

National reconnaissance leadership's decisions on the acquisition, development, and disposition of satellite resources are critical to solving current and future national security challenges. This is most evident at a time when more is being asked of satellite systems than ever before. Space-based reconnaissance daily supports military operations around the world, and collection systems designed to gather intelligence data must also facilitate battle space preparation and target weapons systems by delivering an uninterrupted data flow. Though these operational legacy systems continue to deliver high-quality product in unprecedented amounts, some reconnaissance leaders worry that next generation system development is getting shortchanged (Helman, 2004). This development is paramount, as military and national security planners look to the NRO and other intelligence community leadership to develop tools to keep the United States ahead of its adversaries. This means, among other things, designing new collection capabilities, producing breakthrough technologies, and transforming institutions (NRO, 2003). Combined with the ODNI's establishment, the changes effected by leadership, the choices it makes, may determine what the national reconnaissance community looks like for some time to come.

The transition period in which much of the intelligence community finds itself in 2005 affords leadership an opportunity to re-examine these lessons of the past, and to draw inspiration from them. Reconnaissance pioneers transformed the intelligence world during the early years of the Cold War by realizing the tremendous potential benefits of space-based surveillance, and the technology they developed contributed to advances in communications, global positioning, and weather-tracking systems (Teets, 2004). Their experiences were the solid foundation upon which the 21st century's astonishing capabilities were built. The fact that real-time space imagery data can be transmitted to customers around the globe in minutes is one such capability derived from their work (McDonald, 2002).

At a time when most discussions of the national reconnaissance environment focus on how much has changed, NRO's heritage reveals lessons for success that are almost always applicable: collaborate and cooperate on a common goal, build a strong technological base, effectively communicate to leaders at the highest levels, encourage creative innovation, and take risks to achieve greatness.

The innovative, collaborative, unselfish spirit of the reconnaissance pioneers sets a standard for the NRO workforce to reach, and perhaps exceed, as it continues to develop and field new capabilities in support of national security objectives. The changed programmatic environment prevents this standard from becoming a prescriptive formula, but in adapting these lessons to meet the challenges of the early days of the global war on terrorism, national reconnaissance leadership would be ensuring that the best practices and most important lessons from a period of extraordinary achievement are not forgotten.

References

Araki, Minoru. (1999, March 24). [Interview with Cargill Hall]. CSNR Reference Collection.

Burks, A. Roy. (2000). Three Decades with the NRO. In Robert McDonald (Ed.), (2002), *Beyond Expectations—Building an American National Reconnaissance Capability: Recollections of the Pioneers and Founders of National Reconnaissance* (pp. 173-183). Bethesda, MD: American Society for Photogrammetry and Remote Sensing.

Burks, A. Roy. (2003, August 13). [Panel Discussion]. In National Reconnaissance Office Center for the Study of National Reconnaissance (Producer), (2003), *Leadership and National Reconnaissance* [videotape].

Commission on the Intelligence Capabilities of the United States Regarding Weapons of Mass Destruction. (2005). Report to the President of the United States. CSNR files.

Commission to Assess United States National Security Space Management and Organization. (2001). Executive summary of report. CSNR files.

Fitzgerald, Dennis. (2005). Commentary on Kohler's "Recapturing What Made the NRO Great: Updated Observations on 'the Decline of the NRO.'" *National Reconnaissance: Journal of the Discipline and Practice*, 2005-U1, pp. 59-66.

Fitzgerald, Dennis. (2005). Commentary on "The Decline of the National Reconnaissance Office" The NRO Leadership Replies. *National Reconnaissance: Journal of the Discipline and Practice*, 2005-U1, pp. 45-59.

Fitzgerald, Dennis. (2005). Risk Management and National Reconnaissance from the Cold War up to the Global War on Terrorism. *National Reconnaissance: Journal of the Discipline and Practice*, 2005-U1, pp. 9-18.

Hall, R. C. (1997). Post War Strategic Reconnaissance and the Genesis of Project Corona. In Robert McDonald (Ed.), *Corona: Between the Sun & the Earth–The First NRO Reconnaissance Eye in Space* (pp. 25-58). Bethesda, MD: American Association for Photogrammetry and Remote Sensing.

Helman, Joseph. (2004). The National Reconnaissance Leadership Environment in 2004: Perspectives on the Current Environment. Unpublished manuscript.

Kennan, George. (1946, February 22). The Long Telegram. Quoted in Philip Taubman, (2003), *Secret Empire: Eisenhower, the CIA, and the Hidden Story of America's Space Espionage* (p. 17). New York: Simon & Schuster.

Killian, James. (1977). Sputnik, Scientists, and Eisenhower: A Memoir of the First Special Assistant to the President for Science and Technology. Quoted in Philip Taubman, (2003), *Secret Empire: Eisenhower, the CIA, and the Hidden Story of America's Space Espionage* (p. 90). New York: Simon & Schuster.

Killian, James, R. Jr. (1985). The Education of a College President, a Memoir. Quoted in Philip Taubman, (2003), *Secret Empire: Eisenhower, the CIA, and the Hidden Story of America's Space Espionage* (p. 90). New York: Simon & Schuster.

Kohler, Robert. (2005). One Officer's Perspective: The Decline of the National Reconnaissance Office. *National Reconnaissance: Journal of the Discipline and Practice*, 2005-U1, pp. 35-44.

Mayo, Reid D. (2000). Conceiving the World's First Signals Intelligence Satellite. In Robert McDonald (Ed.), (2002), *Beyond Expectations–Building an American National Reconnaissance Capability: Recollections of the Pioneers and Founders of National Reconnaissance* (pp. 129-138). Bethesda, MD: American Society for Photogrammetry and Remote Sensing.

McAnally, James W. (2004, October 13). [Classified Interview with Garnett Kiser].

McDonald, Robert A. (Ed.). (2002). *Beyond expectations–Building an American National Reconnaissance Capability: Recollections of the Pioneers and Founders of National Reconnaissance*. Bethesda, MD: American Society for Photogrammetry and Remote Sensing.

McDonald, Robert A. (1997). Corona, Argon, and Lanyard: A Revolution for US Overhead Reconnaissance. In Robert McDonald (Ed.), *Corona: Between the Sun and the Earth–The First NRO Reconnaissance Eye in Space* (pp. 61-74). Bethesda, MD: American Society for Photogrammetry and Remote Sensing.

Munson, Alden V., Jr. (2000). Automating Signals Intelligence. In Robert McDonald (Ed.), (2002), *Beyond Expectations–Building an American National Reconnaissance Capability: Recollections of the Pioneers and Founders of National Reconnaissance* (pp. 139-145). Bethesda, MD: American Society for Photogrammetry and Remote Sensing.

National Reconnaissance Office. (2003, January). *2003 Strategic Plan*. Retrieved October 18, 2004.

Reforming Space Acquisition. (2004, October). [Interview with Peter B. Teets]. *Intelligence, Surveillance & Reconnaissance Journal*, 3(9), 18-20.

Taubman, Philip. (2003). *Secret Empire: Eisenhower, the CIA, and the Hidden Story of America's Space Espionage*. New York: Simon & Schuster.

Taubman, Philip. (2003, August 13). [Panel Discussion]. In National Reconnaissance Office Center for the Study of National Reconnaissance (Producer), (2003), *Leadership and National Reconnaissance* [videotape].

Teets, Peter. (2004). National Security Space in the Twenty-First Century. *Air and Space Power Journal*, 18(2), 4-8.

Teets, Peter. (2004). Space Programs Reflect War-Fighting Priorities. *National Defense*.

Teets, Peter. (2003, April 8). *The Honorable Peter Teets National Space Symposium Corporate Dinner Address*. Retrieved October 14, 2004.

Wilhelm, Peter G. (2000). Cutting Edge Work at the Naval Research Laboratory. In Robert McDonald (Ed.), (2002), *Beyond Expectations–Building an American National Reconnaissance Capability: Recollections of the Pioneers and Founders of National Reconnaissance* (pp. 155-161). Bethesda, MD: American Society for Photogrammetry and Remote Sensing.

Wilhelm, Peter G. (2003, August 13). [Panel Discussion]. In National Reconnaissance Office Center for the Study of National Reconnaissance (Producer), (2003), *Leadership and National Reconnaissance* [videotape].

Yusufzai, Rahimullah. (1999, January 11). Interview: Conversation with Terror. *Time*.

One Officer's Perspective: The Decline of the National Reconnaissance Office[1]

By Robert J. Kohler

The National Reconnaissance Office (NRO) was once the benchmark organization for excellence in acquisition and program management. It had a reputation for designing and procuring the most sophisticated unmanned satellite and aircraft reconnaissance systems in history. These acquisitions were mostly accomplished on time and within budget, and they performed as promised. Despite an occasional problem program, the NRO's record of accomplishment was unsurpassed by any organization, considering the high technical risk that goes with developing state-of-the-art systems. A team of dedicated military and civilian personnel stood behind these accomplishments.

Unfortunately, the NRO today is a shadow of its former self. Its once outstanding expertise in system engineering has drastically eroded. This article explores the dissolving relationship between the NRO and the Central Intelligence Agency (CIA), which traditionally supplied a major portion of the organization's technical expertise. It provides a perspective on key issues as the NRO faces tough decisions and an uncertain future.

Post-Cold War Environment

Some would suggest that the NRO's decline resulted from the fall of the Soviet Union, the ensuing budget struggles (the famous "peace dividend"), and the resultant lack of a clear intelligence mission. These almost certainly contributed, but they are far from the whole story. The fall of the Soviet Union triggered a legitimate discussion about how big a military and intelligence structure the country should have, but there was never any doubt that reconnaissance satellites would still be needed.

[1] Editor's Note: This article is a reprint from *Studies In Intelligence*, Vol. 46, No. 2, 2002, pp. 13-20. We are reprinting it with the permission of CIA's Center for the Studies of Intelligence (CSI). *Studies* is CIA's journal of the American intelligence professional and is a publication of CSI.

Indeed, the end of the Cold War and the ensuing shift in the balance of power might have stimulated a useful national debate about what was required from the space reconnaissance system, and could have produced a vision for the future around which the Executive and Congress might have coalesced. Unfortunately, this did not happen. The then-Director of Central Intelligence (DCI), Robert Gates, did, in fact, recognize that a sea change in the NRO was in order. In 1992, he commissioned a full-scale review of the NRO. The resulting "Woolsey Report"—named for commission chairman James Woolsey, a prominent lawyer and arms control negotiator, made serious recommendations for changes in NRO programs. A unique chance for implementation became possible when President Clinton named Woolsey to be DCI. But this golden opportunity was lost.

DCI Woolsey and the Chairman of the Senate Select Committee on Intelligence, Dennis DeConcini, rapidly became adversaries rather than partners. In addition, Woolsey got locked in a fight with the Department of Defense (DoD) over the use of space systems vs. stealthy reconnaissance aircraft, which distracted attention from the real organizational issues. The new President did not seem much interested in intelligence and the DCI received no support or guidance from the White House.

It took nearly nine months to appoint a new director of the NRO. This was not for lack of trying. All senior executives from industry who were contacted turned the position down, mostly because they did not want to get stuck with onerous conflict-of-interest rules after they had served their term. The ultimate nominee withdrew after the appointment became bogged down for months. Finally, a young, energetic CIA officer was selected, but the Secretary of Defense and the DCI later fired him over an issue not of his making (forward funding). Thus, the NRO had no consistent leadership for over two years.

Concluding that the NRO cost too much, Congress decided that the solution was to shift to smaller, lower cost satellites (known around town as "small sats" or "light sats") A strong argument could have made that small sats would not be able to perform the complicated (and often multiple) missions called for by customers, but NRO management chose instead to stonewall Congress, digging in and claiming that small sats were not relevant and that the current constellation was essentially what was needed. While there were (and are) good points on both sides (and neither side was completely right), the process seriously harmed the trust that had existed between the NRO and congressional staffs. Everything that the NRO said about small sats, funding requirements, and even commercial imagery, was interpreted as protecting its turf.

At the Root of the Problem

These developments since the end of the Cold War exacerbated the fundamental cause of the decline of the NRO, which was the abolition of Programs A, B, and C in

1992 and the consolidation of the Office's components at the Westfields building. This story focuses on Programs A and B, because they were the largest part of the organization in terms of people and budget, and because the competition between these two programs was often seen as the root cause of the problems at NRO.

From its founding in 1962 until the late 1980s, the NRO was characterized by a lean central staff under a part-time director (usually the Under Secretary of the Air Force, later the Assistant Secretary for Space, and recently once again the Under Secretary of the Air Force).

Three entities managed the programs assigned by the director: Air Force-Program A; CIA-Program B; and Navy-Program C. The NRO had no positions/slots of its own. It "borrowed" people for its staff from the military services and the CIA, and sometimes from the National Security Agency (NSA) and the Defense Intelligence Agency (DIA). Programs A/B/C were completely staffed at the discretion of the parent organizations. The director of the NRO (DNRO) had some control over Program A personnel, but little authority over the selection or careers of the CIA or Navy personnel. In fairness, all three agencies supported the Office extremely well, in terms of positions allocated, quality of people assigned, and management of their employees' careers. DNRO was more akin to a Chief Executive Officer (CEO), with the directors of Programs A/B/C performing as Chief Operations Officers (COOs), holding the real management control over the programs.

The NRO's organizational structure encouraged competition, and the main contest was between Programs A and B. The competitive atmosphere fostered different technical solutions to each intelligence problem and forced the NRO director (and often the Secretary of Defense and the DCI) to choose between different approaches. While this process proved highly beneficial during the Cold War by stimulating valuable technical innovation, it did produce winners and losers, which sowed discontent.

Program A was envious of the access that Program B had to the DCI. Indeed, Program B used that access more than once either to overturn DNRO preferences or to influence the DCI on a particular NRO-related decision. Program B saw this as an appropriate role for a CIA entity responsible ultimately to the DCI. Program A considered such access unfair in the competitive environment in which the two programs existed. Program A clearly had one boss (DNRO), while the director of Program B was a CIA employee who owed his first loyalty to the DCI, even though he also worked for DNRO. This dual allegiance irritated many an NRO director as well, but they did not have the power to tighten control.

In the mid 1980s, Program A/B competition came to a head in a serious confrontation over the future of large-aperture signal intelligence (SIGINT) systems. The budget crunch was just getting underway and DNRO wanted one last big start. Since every major program decision on his watch had gone in favor of Program B (with his support), he was inclined this time to let Program A win one. He made his position clear to Program B. The new program, however, was not needed—the requirements foundation was weak and Program B thought it would cost considerably more than necessary. Program B concluded that enhancing one of its existing programs would be more cost effective and could be done in an incremental way allowing a flexible response to requirements over time. DCI William Casey bought Program B's arguments and overruled DNRO's recommendation for a Program A start. This triggered a series of events that resulted in the NRO that exists today.

Controlling Competition

DNRO decided that Program A/B competition and Program B's ability to influence the DCI had to stop. Collocation of the NRO's three main programs became one part of a solution. Program A was told to move from Los Angeles to the Washington, DC, area, where Program B was housed in CIA facilities and Program C was located at the Naval Research Laboratories.

Meanwhile, DCI Casey had passed away and Robert Gates was Acting DCI. Gates had always had reservations about the NRO—he considered it too expensive (gold-plated, in his view) and thought that Program B had undue influence. Setting out to remedy these "faults," he established the "Fuhrman Panel"—chaired by Robert Fuhrman, former CEO of Lockheed—to recommend changes to the NRO structure. The Fuhrman Panel recommended realigning responsibilities to consolidate imagery programs in one directorate and SIGINT programs in another, in effect breaking up Programs A and B and eliminating competition.

To this day it is not clear that the competition that existed between the two NRO programs was anything but positive. In most instances, the program that emerged from the competitive process was the right program for the country. Had there been no competition, it is not clear that the right program would have resulted. The same type of constructive rivalry exists between CIA, National Security Agency (NSA), and Defense Intelligence Agency (DIA)—it is healthy and produces better intelligence products.

Dramatic Reorganization

The Fuhrman Panel recommendations led to the abolition of Programs A/B/C and started the real downturn of the NRO. Apparently to show the true integration of the programs, NRO management adopted the principle that anybody could run anything, regardless of skill, background, or experience. People were shuffled around so that any semblance of loyalty to their parent organizations was lost; career planning fell by the wayside; and experience as a criterion in the position assignment process was discarded. Navy admirals who once were directly tied to NRO support of the tactical Navy mission now have jobs of no particular interest to the Navy. CIA SIS officers who once viewed themselves as intelligence professionals and saw their job as supporting the NRO from inside CIA, now feel disconnected from and unsupported by CIA. Air Force generals who once were leaders in Air Force space technology are now sent no particular requirement that they be "space cadets" or understand the mission of the NRO. In the past, the leaders of Programs A/B/C were people who had spent years in the business, having come up through the ranks. Now they no longer need that kind of experience to be senior officers in the NRO. The CIA no longer sees development of future civilian leaders in this business as its responsibility. The current crop of experienced SIS officers at the NRO is retiring and no replacements with comparable talent and dedication are being actively developed.

To combat weaknesses in its ranks, the NRO has embraced several processes to "protect" program managers from having to make decisions that in some cases they are no longer qualified to make. Examples include: the NRO Acquisition Manual that observes DoD contracting practices vice DCI authorities; over reliance on Earned Value Management and similar tools; a flawed Independent Cost Estimating Process (ICE); and an incredibly inefficient requirements process. The NRO has incorporated DoD acquisition reform practices such as Cost as an Independent Variable (CAIV) and Total System Integration Responsibility (TSIR), which puts program decision making in the hands of the prime contractors.

Today, no single person can realistically be held accountable for the performance of a program because so many people have their hands in the process. In the days of Programs A/B/C, program managers were kings. They controlled costs, schedules, and performance, and had the ability to trade those variables to make the program work. Support people worked for the program manager. Now, contracting officers, the financial oversight staff, and the Community Management Staff are the major power brokers in most of the NRO program offices, instead of the program managers.

The three dynamic, supportive, and different cultures that existed in Programs A/B/C were destroyed by the integration of the NRO and have not been replaced with a new culture. By the process of osmosis, the organization has adopted pieces of those cultures, usually the least common denominator, to the dismay of the people in the organization.

The declassification of the existence of the NRO added to its downturn. In the early 1990s, Secretary of Defense Richard Cheney declassified the "fact of" the National Reconnaissance Office. Subsequently, DCI Woolsey implemented a series of security-related changes that made the organization more open, including eliminating the "special access" requirements for each of its programs. These steps resulted, for example, in the first public awareness of the NRO's early imaging program, CORONA.

Openness brought pressure for the NRO to look more like a normal government organization. This entailed greater oversight by Congress—the NRO is now micromanaged, just like DoD. The NRO Inspector General's staff grew; the financial oversight staff (Resource Oversight and Management or ROM) expanded to over 100 employees; and a policy staff was added. What was once an organization with a small central staff and three Programs (A/B/C), whose technically qualified managers focused on executing projects, is now an organization dominated by large staffs not involved in the major accountability of the NRO: the acquisition, development, and operation of satellite intelligence collection systems.

Organizational structures in and of themselves are neither good nor bad. Usually, they are deemed effective or ineffective depending on how the people in the organization make them work. Clearly the old Program A/B/C structure was strange by Washington standards since it grew out of a compromise among the early innovators in the space reconnaissance business—the CIA, Air Force, and Navy. Yet it was an effective structure and served the country well. The current structure is more attuned to the "jointness" model preferred by DoD, but it is certainly less effective than the old model. It is pushing the organization on a downward slide toward mediocrity that the country cannot afford.

Mediocrity in the NRO will result in less innovation and risk taking, more reliance on contractors who are less accountable than government staff, and more cost overruns and schedule delays. Acquisition cycles will be longer. It will become harder and harder to attract the high caliber people needed to keep this a "first in class" organization. Evidence of these problems is already surfacing.

Impact on the CIA

Among NRO components, the slide toward mediocrity is having the most damaging effect on the CIA's mission and people. At this juncture, it is likely that the CIA will withdraw from the organization. If this occurs, the demise of the NRO will be complete. To understand the current dynamic, it is important to start at the top.

The original charter of the NRO assigned responsibility for managing the programs to the Secretary of Defense (hence a director from DoD) and the responsibility for establishing requirements for the programs to the DCI. For years, an executive committee (EXCOM)—comprising the Secretary of Defense, the DCI, and a Presidential appointee (usually, the President's Science Advisor)—exercised oversight of the NRO. Until its demise in 1976, the EXCOM protected the NRO from bureaucratic interference as well as managed the "high level" requirements process. In addition, the DCI orchestrated the Intelligence Community's requirements process through the SIGINT Committee, for signals intelligence, and the Committee on Imagery Requirements and Exploitation, COMIREX, for imagery.

With the eventual abolition of these committees, the DCI gave up significant control over the establishment of NRO requirements and bureaucratic interference increased.

The process for deriving the requirements for the new imagery architecture (FIA)[2] took two years and makes the point about the DCI's diminished power clear. DoD and the Joint Requirements Oversight Council (JROC) played key roles in the FIA requirements process; now DoD essentially controls all major NRO requirements. The DCI and the CIA have let DoD significantly erode what should be the DCI's major responsibility: the arbitration, consolidation, and establishment of national intelligence requirements.

The closing down of Program B complicates the ability of the CIA to carry out its NRO responsibilities. The CIA officer who ran Program B was an informal but powerful counterbalance to DoD influence. The Deputy Director for Science and Technology (DDS&T), who has daily access to the DCI, was usually double-hatted as the Director of Program B. Senior officers in the Directorate of Intelligence and the DS&T's Office of Development and Engineering (OD&E) worked together to develop the CIA's needs and, when appropriate, presented these to the DCI. This ensured that the strategic intelligence view was always available to the DCI. The current structure of the NRO, with CIA personnel assigned mostly at random, makes this very difficult.

Certain personalities on the CIA side made the situation worse than it needed to be. In the past, Program B was fortunate to have a number of DCIs and DDCIs who both understood and protected the role of the CIA component in the NRO—John McCone, William Rayburn, Richard Helms, George Bush, John McMahon, and William Casey come to mind. Support has not been as strong in recent years. DCI Gates started the slide and DCI Woolsey did nothing to stop it. John Deutch, the most technical DCI in memory, paid almost no attention to the NRO, and his hand-picked Executive Director totally failed to understand the CIA's role at NRO. DCI Deutch appointed a DDS&T who made no attempt to hide her dislike for OD&E, the CIA's main technical link to the NRO. OD&E managers, in return, made no effort to mask their dislike for the DDS&T.

Importance of a Civilian Component

Over the years, the majority of the highly innovative NRO programs came from Program B. They did not come out of an arduous requirements process, but, instead, resulted from CIA experts knowing the needs of the Intelligence Community, imagining what technology could do, and offering decision makers a solution to a need, sometimes before they knew they had a need. This was possible because Program B attracted top-notch talent and was able to keep that talent in the business for years as part of CIA. Moreover, the streamlined acquisition process that Program B was famous for came from DCI authorities that exist only in CIA. The military never liked the CIA's participation in the satellite business; however, this dislike was tempered by the respect that the nation's leaders (including DoD) had for the creativity and risk-taking

[2] Future Imagery Architecture

ability of the CIA contingent. Collection systems that the military heavily relies on today came out of Program B.

For the NRO to retain some semblance of its unique character that proved so successful, it needs a strong civilian element. The CIA can bring stability and experience to the organization. Civilian staff members can work years—many of us spent our entire careers on NRO programs—building an expertise in technology, organization, and management that simply cannot be duplicated by a "come and go" military element. It is not a matter of "smarts"—the military has people just as smart as any CIA officer. But military careers are built on rotations to different assignments. Today, even the military staff is not as stable as it was in the Program A days. More than ever, military assignees tend to see the NRO as just one more block to be checked in their career progression.

Among those involved, the DCI has the most to lose from the degeneration of the National Reconnaissance Office. The NRO consumes the single largest part of the DCI's budget. It is the only asset that the DCI has that can provide intelligence information worldwide, 24 hours a day, seven days a week. If the CIA walks away—by not bringing OD&E up to strength and not developing the talents and promoting the career aspirations of the CIA personnel assigned to the NRO—the rationale for the title "National" Reconnaissance Office would become much less clear. "Rational heads" in Washington might conclude that the NRO belongs, after all, in DoD, and any semblance of DCI influence and control would be lost.

Current CIA/NRO management did not create this situation—they inherited it. Indeed, DNRO Keith Hall initiated a much needed restructuring of the imaging architecture, undertook initiatives aimed at providing new and exciting capabilities, and, during part of his tenure, endured an adversarial DDS&T. Congress and DoD are responsible for imposing much of the current micromanagement. Furthermore, the creation of the National Imagery and Mapping Agency[3] in 1997, and the artificial interfaces created between the NRO and NIMA[4] have taken system responsibility in the imaging business away from the NRO and left it floundering, a situation that complicates the job of both sides of the interface.

Potential Solutions

Going back to the past—recreating Programs A/B/C—is not the answer. The three programs have been replaced by five stovepipes—signals intelligence, imagery intelligence, communications, advanced systems and technology, and management—which are referred to by everybody as the "towers." These stovepipes have fostered a lack of communication and cross-INT system engineering, hampering the NRO in its drive for

[3] In 2003 NIMA became the National Geospatial-Intelligence Agency or NGA.

[4] NGA.

a "system of systems" architecture. I propose a framework for a solution that might be palatable to both the military and the CIA. The intent is to apportion responsibility more in line with their individual cultures, experience, and expertise.

The NRO currently exists in two worlds. One is semi-secret (gray) and the other is really secret (black). Some programs are in a routine mode, requiring continuing purchases of the same systems and conducting routine operations. At the same time, the organization is developing technologies and programs that could provide revolutionary intelligence capabilities from space. These programs are often very risky and require tight security. This suggests a natural split of responsibilities.

First, I propose that the NRO be reorganized so that all programs "in continuation" are assigned to the military component, under the direction of DNRO. Military assignees would oversee existing systems, making decisions on acquisitions, conducting operations of these systems, and concentrating on relations with the military.

Second, I propose that all advanced system and technology development efforts, along with all new programs of high risk, advanced technology, or tight security, be assigned to CIA/OD&E, also under the direction of DNRO. Civilian experts can best provide the continuity that is required in the development of technology. Moreover, the CIA is the best component to work requirements with the national community (and the DCI) for programs that require radical new collection capabilities. This group could go back to truly streamlined program management (using DCI authorities) and hopefully receive less oversight and micromanagement than at present.

In January 2001, the NRO director commissioned a study of the state of system engineering. The commission's recommendations included a call for the appointment of a Deputy Director for System Engineering (DDSE). The position was established and is currently filled by a CIA SIS officer. The study also recommended that OD&E be affirmed as the "institutional holder" of system engineering in the NRO. It acknowledged that it takes long-term career development to produce top quality system engineers and that the civilian component in the organization was in the best position to accomplish that task. Both DNRO and the DDS&T accepted this assessment—it became codified in the same NRO directive that established the DDSE position. However, nearly a year later OD&E has not yet stepped up to this responsibility.

To this end, the OD&E staff needs significant additional technical positions. The component is less than half its former size, despite the fact that the number of NRO programs and activities that it manages has not dropped. While all organizations took position cuts during the post-Cold War defense downsizing, OD&E was hit particularly hard because of the interpersonal frictions discussed above. As a result of the decline in civilian personnel, the NRO looks "bluer" than ever before, which further dilutes the CIA's influence within this national organization. The DCI should work with Congress to add at least 100 technical positions to the OD&E contingent in the NRO.

Finally, I urge DNRO to work hard to cut the size of the central staff to reduce the amount of micromanagement and non-value-added processing and balance the influence of DoD in the requirements process. For this, the director will need the strong support of both the Secretary of Defense and the DCI.

Solid measures, conviction, and action are needed to re-create a strong, creative, and effective NRO. A structure such as I suggest would make better use of the talents of the contributing organizations. It would allow the CIA element to focus on activities for which it is best qualified, restore morale by giving the Agency component a role that it could "own," and go a long way toward re-establishing OD&E as an important CIA entity. Reinvigorating that relationship is critical to the NRO, and also to the DCI, if he is to retain influence in the area of satellite reconnaissance.

If the CIA does not get behind the NRO and give its full support, the Air Force is poised to take over. The reestablishing of the Undersecretary of the Air Force as the director in 2001, with a charter to more fully integrate "white and black" space, imposes additional pressure to clarify the CIA's role. The new charter raises the specter of the NRO becoming a wholly DoD organization. If that is to be the case, the CIA should go its own way in the space business, as it was prepared to do in the early 1960s. The counter argument, however, is that the country still needs a "national" reconnaissance organization and that the effort to integrate "white and black" space makes it more critical than ever to have a strong and well-defined CIA presence.

In the final analysis, DNRO needs to recognize the unique position he holds and that his dual responsibilities, in this function, top both the Secretary of Defense and the DCI. From the perspective of what is best for national reconnaissance, the recreation of the EXCOM would be a step in the right direction, ensuring that the NRO remains suspended between DoD and the CIA. In particular, however, the CIA needs to recognize the importance of the NRO to its responsibility as the Central Intelligence Organization.

Mr. Robert Kohler is a retired senior CIA officer who spent almost twenty years in the field of national reconnaissance. From 1982 to 1985 Kohler managed the engineering, development, and operation of major technical collections in support of the NRO. After retiring from CIA, Kohler held positions at ESL Incorporated, Lockheed Missile & Space Corporation, and TRW. He retired from TRW in 1995. Mr. Kohler is a Pioneer of National Reconnaissance in the class of 2000.

Commentary on "The Decline of the National Reconnaissance Office"—The NRO Leadership Replies[1]

By Dennis Fitzgerald

Robert Kohler's article on the decline of the National Reconnaissance Office (NRO) that appeared in *Studies in Intelligence* (Vol. 46, No. 2, 2002) contends that the NRO is currently "a shadow of its former self' and explores what might be done to improve "the dissolving relationship between the NRO and the CIA." The NRO that Mr. Kohler knew—"its former self"—was one composed of separate design bureaus known as Programs A, B, and C, which competed with each other. He judges that co-locating these organizations and then combining them into functional directorates, or "INTs," in January 1993 was chiefly responsible for a decline in the NRO's ability to innovate. Although his article provides an interesting historical perspective, I have to take issue with a number of his observations, conclusions, and proposed remedies.

Mr. Kohler contends that the disestablishment of Programs A, B, and C was a mistake because it eliminated the creative technical competition that existed among these NRO offices. His proposed solution would assign all overhead programs "in continuation" to the military component of the NRO, and all advanced system and technology efforts, along with all new programs of high risk, advanced technology, or tight security, to the Central Intelligence Agency's Office of Development and Engineering. Both of these activities would remain under the supervision of the Director of NRO (DNRO). Although Mr. Kohler advances some good arguments, his proposed solution would not restore the creative competition that he asserts is missing in today's NRO.

What Mr. Kohler describes as a design competition mainly between Programs A and B was in reality a competition among the major aerospace companies that supported Programs A and B. The NRO program offices guided the systems engineering, secured

[1] Editor's Note: This article is a reprint from *Studies In Intelligence*, Vol. 46, No. 4, 2002, pp. 27-30. We are reprinting it with the permission of CIA's Center for the Studies of Intelligence (CSI). *Studies* is CIA's journal of the American intelligence professional and is a publication of CSI.

the funding, and sold the ideas to the Executive and Legislative Branches. But the real engineering breakthroughs did not occur within the government program offices; they occurred at the contractor facilities. These contractors, albeit in fewer numbers because of consolidations, still support the NRO today. The innovation that existed 20 years ago is still there, but the ability of the NRO to tap into this creativity has been reduced due to the funding reductions of the 1990s.

Mr. Kohler claims that the NRO today is a "shadow of its former self" because its expertise in systems engineering has drastically eroded. In January of 2001, we spent several days reviewing the state of systems engineering in the NRO with Mr. Kohler, which included briefings by most of the systems engineers in each of the functional directorates. Afterward, he concluded that our systems engineering at the "INT" level was fine. At his suggestion, we did create an NRO Deputy Director for Systems Engineering officer and filled it with a highly respected CIA Senior Intelligence Officer and we are continuing to emphasize the hiring of systems engineers.

This brings me to an interesting point concerning personnel in the NRO. Civilian and military personnel assigned to the NRO today are smarter about space and engineering in general, than at any other time in our history. But they also are less experienced. This results from several conditions that Mr. Kohler identifies: First, civilian employment declined significantly because of downsizing during the 1990s. Second, military personnel regrettably can no longer spend a career in the NRO or in the "white" space world for that matter. The need to re-establish "space careers" is one of the findings of the Rumsfeld Commission[2]. It is an issue that each of the military services is beginning to address.

Mr. Kohler also raises an issue that I deal with frequently: former NRO senior managers' nostalgia for the much simpler past. That is, if we could just return to the way things were at the NRO when they left government, then many of the perceived problems afflicting the NRO today would disappear.

All organizations change and evolve to meet new conditions. Let me compare the environment of Mr. Kohler's NRO in the 1970s and 1980s to the one that we found ourselves in during the period roughly from 1990 to 11 September 2001. He left the NRO in the mid-eighties during an era that I will refer to as Technology Driven, as opposed to the last twelve years, which I will call the Peace Dividend era.

In the Technology Driven era, roughly 1970 to 1990, NRO space systems were based primarily on what technology would permit, rather than on the formal requirements process that drives space system development today. That approach led to charges of "NRO arrogance" and accusations of imposing technological solutions that went beyond what the customers wanted or needed. In the Peace Dividend world, you must have the

[2] The Commission to Assess United States National Security Space Management and Organization—known as the Rumsfeld Commission, or the Space Commission—published its report in January 2001.

imprimatur of the Joint Requirements Oversight Council on the military side, and a nod from the Mission Requirements Board on the Intelligence side, before you can have any hope of going forward with a request for funding from Congress. Neither of these demanding requirements forums existed when Mr. Kohler was in the NRO. In fact, the two intelligence oversight committees in Congress, the HPSCI and the SSCI, had barely gotten started when he left the NRO. Today, our customers and their needs are thoroughly discussed, accepted, and vetted again in Congress before we proceed with a major acquisition decision.

The last few years of Mr. Kohler's government service coincided with the peak of the Reagan build-up of the early 1980s, during which intelligence in general, and the NRO in particular, were lavishly funded. By contrast, funding during the Peace Dividend years was severely constrained - the demand was for the same intelligence, but at less cost. Everything we have done in the NRO over the past twelve years - up to 11 September 2001 - has been directed toward cutting costs. This has been accomplished by reducing the types of overhead systems that we build, maintaining the capability of our systems but building fewer of them, consolidating ground stations, and paring the cost of operations and maintenance.

Mr. Kohler claims that during his service at the NRO, new acquisitions were mostly accomplished on time and within budget. By "within budget," I believe he means what we told Congress a program would cost, not what we wrote a contract for with our industrial partners. This is indeed true because it was our practice at that time to take what a contractor bid and add a margin of 20 to 30 percent. This practice was halted in 1995 when Congress found that the NRO had accumulated excess forward funding of $3.7 billion.

Besides costing the NRO Director and Deputy Director their jobs, the excess forward funding debacle had several other long-term consequences to which Mr. Kohler refers. First, it gave rise to a vastly expanded and more powerful Resource, Oversight, and Management (ROM) function. Our congressional overseers absolutely insisted on a single, credible financial management system. Second, we began budgeting for programs using "average" or "most likely" costs, rather than just putting large margins on contractor estimates. This insured that forward funding surpluses were not built into our budgets, but it required Independent Cost Estimates (ICE). Mr. Kohler refers to the ICE process as flawed. I disagree. The NRO ICE process is the most sophisticated, the most refined estimating tool for space systems that exists anywhere. The problems that arise with ICE have more to do with how its results are utilized than with the tool itself.

Mr. Kohler also believes that the NRO Acquisition Manual, and the Directive 7 process for initiating major contract actions instead of using DCI authorities, are props that allow managers to make decisions that they are unqualified to make. I disagree and I suspect that he would also if he sat through a Directive 7 meeting. Directive 7 simply arranges information in an orderly fashion, like a checklist, which permits everyone to decide with confidence that a major procurement is ready to proceed to the next stage.

All those in the Intelligence Community and DoD who think that they have a stake in the procurement are invited to state their views. Rather than compensating for weak program managers, Directive 7 makes decisions more difficult because more constituencies must be heard and accommodated. The best engineering decisions are the ones debated in public; the worst ones are the deals made in back rooms - and the very worst are the ones hidden from scrutiny under the cloak of security.

During the Technology Driven era, the Intelligence Community and the primarily civilian National Command Authorities were the major consumers of NRO systems products. The major consumers today are the US military services. Today's reality is that most of the intelligence that the NRO collects on a daily basis is in direct support of combat operations. The performance of NRO systems has been spectacular in terms of preventing the loss of lives, directing the fire of weapons systems with unprecedented accuracy, and locating enemy positions, all the while providing a synoptic understanding of the battle space. The military has become a huge consumer of NRO resources and dollars, dollars that arguably otherwise might be spent on developing the next generation of intelligence space systems.

Moreover, during the Technology Driven era, when a failure occurred in development, launch, or on-orbit performance of space systems, our government overseers generally accepted that the NRO "had reached too far" or that the problem resulted from "the nature of research and development." Today, when a failure or the potential for a gap in coverage occurs, the response is: "Who do we fire?" Day-to-day combatant support, so dependent on NRO systems, allows no room for failure.

During the previous era, as Mr. Kohler observes, program managers indeed were kings. They controlled costs, schedules, and performance, and had the ability to trade those variables, without seeking permission, to make their programs work. That program managers have reduced freedom to make such trades today has nothing to do with the consolidation of the NRO. It is exclusively the product of much greater oversight by congressional committees, the Community Management Staff, the Assistant Secretary of Defense for C3I Staff, the Joint Requirements Oversight Council, and the Mission Requirements Board.

Finally, Mr. Kohler asserts that the current crop of experienced SIS officers at the NRO is retiring, which is true. But his contention that no replacements with comparable talent and dedication are being actively developed is both untrue and demeaning to the young senior officers who serve in the NRO today. They work on requirements-driven and cost-constrained overhead technical collection systems in an environment characterized by public openness and intense oversight by Congress. In the Peace Dividend era, I believe that they are producing superior intelligence under conditions that Mr. Kohler and his contemporaries never experienced.

Let me close by commenting that Mr. Kohler seems to be conflicted in terms of whether he is trying to fix the NRO or to restore the Office of Development and Engineering, the CIA presence in the NRO, to its former glory. The disestablishment of Programs A, B, and C was painful for the many veterans of those organizations. But that is now ten years behind us. The new NRO is functioning as the reorganization intended it to, with the DNRO firmly in charge of day-to-day decisions and operations. We have had four DNROs whose relations with both the DCI and the Secretary of Defense have been open and highly productive. The reorganization, centralization, and creation of the "INT" structure have significantly reduced duplication and costs. Instead of doing non-recurring developments many times and buying in quantities of a few, we do non-recurring developments once and buy in quantities of many.

Many of us miss the enthusiasm, dedication, and accomplishments of Programs A, B, and C, but those days are behind us. The NRO's current integration of military and civilian personnel from many agencies is a replication of the "centers" model that exists in CIA and throughout the Intelligence Community. Time-tested team partnering with industry continues to provide successful research and development in the design and production of overhead space systems that has always been, and will continue to be, the hallmark of the NRO.

The NRO appreciates the input of Mr. Kohler. We are striving to provide the nation with the best space-based reconnaissance capabilities to meet the changing national security demands of the 21st century. Although I recognize that our future successes are built on the foundation laid by Mr. Kohler and his contemporaries, the best days for this organization lie ahead.

Dennis Fitzgerald has been the Deputy Director of the National Reconnaissance Office (NRO) since August 10, 2001. His prior assignment was as Associate Deputy Director for Science and Technology in the Central Intelligence Agency (CIA). Mr. Fitzgerald joined the CIA's Directorate of Science and Technology (DS&T) in 1974 and spent the majority of his career assigned to the Office of Development and Engineering (OD&E) with duty in the NRO. Mr. Fitzgerald began his professional career as a field engineer working on the Polaris and Poseidon missile program for Sperry Gyroscope.

Recapturing What Made the NRO Great: Updated Observations on "The Decline of the NRO[1]"

By Robert Kohler

My article, "The Decline of the National Reconnaissance Office" was published nearly three years ago. A reasonable question is, have my views changed and do I have any additional thoughts to offer in fostering a dialogue on the status of the NRO today? The answer to both is yes.

It is not, in retrospect and after reading Dennis Fitzgerald's thoughtful response, that I reject any of the views from my original article. I suggest in this postscript that some of my views were incomplete and new events have occurred that warrant discussion, particularly in light of the creation of a Director of National Intelligence (DNI) and what that might mean for the CIA and its participation in the NRO.

The NRO, the CIA and the DNI

In the early 60's, the NRO was constituted as a joint venture (JV) between the DoD and the CIA. Director of Central Intelligence (DCI) John McCone fought very hard for this JV (in the face of severe DoD opposition) as he believed that the CIA had something to contribute (remember the CIA did the U-2, the SR-71 and started CORONA before there was an NRO), and felt that the combined talents and resources of the two would be better than any single entity.

The question today is, what does the CIA bring to the table and is it worth CIA's continued participation in the NRO? Certainly in the "old days" (and through the abolition of Program B), the CIA element brought civilian stability, technical expertise,

[1] Editor's Note: This article is an update to Mr. Kohler's "Decline of the National Reconnaissance Office," which first appeared in *Studies In Intelligence*, Vol. 46, No. 2, 2002, pp. 13-20, and which is reprinted in this issue with the permission of CIA's Center for the Studies of Intelligence (CSI). *Studies* is CIA's journal of the American intelligence professional and is a publication of CSI.

an understanding of intelligence community (IC) needs and access to the DCI. The CIA still can bring civilian stability and technical expertise, but they no longer bring an understanding of the future intelligence needs of the CIA or access to the DCI they enjoyed as Program B. It is interesting to note that every program that Program B invented came from our understanding of the needs of the community, and not from some arduous requirements process.

It was also clear to us in Program B that we were there to protect the DCI's interests in the overhead reconnaissance program and to insure that DoD needs and IC needs were balanced. With the creation of the DNI, one now has to ask how the DNI's interests are protected and what is the CIA's role in that regard. It is possible that the Director of the CIA will not have the same view of the NRO, as did the DCI. While it is painful for me to say this, at this stage in the evolution of the NRO, the role of the CIA in the NRO needs to be reevaluated. CIA people should not be relegated to being "bodies" with no real NRO or CIA careers. Another interesting question is, who appoints the DDNRO? The 1962 DoD/CIA Memorandum of Agreement (MOA) gave that job to the DCI (and historically the DDNRO has been a CIA employee). If the DNI now appoints the DDNRO, this person might well not be a CIA employee, further separating the NRO and the CIA.

NRO Management

Management of the NRO is, perhaps, one of the most vexing and important issues today. This is an important issue facing the new DNI. The creation of the Undersecretary of the Air Force (USecAF) as the "white/black" space manager (integrator) sounds good, but was a mistake[2].

There is no evidence that this experiment has paid off. DCI John McCone realized the danger of this construct when it was proposed that the USecAF be DNRO. In the record of a phone call between DCI McCone and then USecAF Brockway McMillan McCone stated,

> I stated if the above procedure was adopted and adhered to, then I thought that the resources in both the CIA and the Air Force could contribute to the success of our reconnaissance program. Any plans which did not utilize the resources of both organizations would not be agreeable to me. I took the occasion to tell Dr. McMillan I remained convinced that he, as Undersecretary, is making a mistake to attempt to run a line organization because of his varied statutory responsibilities from which he cannot escape and for that reason I urged him to consider some different in-house arrangement for directing the NRO.

[2] President Bush nominated Ronald Sega for the Air Force under secretary position on June 29. At a meeting in early July, the Defense Secretary Donald Rumsfeld, Undersecretary of Defense for Intelligence Stephen Cambone, and Director of National Intelligence John Negroponte jointly decided to separate the positions of DNRO and USecAF, reversing a 2001 management change.

The DNRO is a line management position, which is not the normal job of a service undersecretary. In addition, the NRO is the single largest part of the National Foreign Intelligence Program (NFIP), which further implies that it needs full time management. One cannot envision a company of this size being managed by a part-time CEO.

But the real evidence of the effectiveness of white/black integration should be better program management and the development of an integrated architecture. It is nice that the AF and the NRO have exchanged policies and practices and tried to rationalize all this across the National Security Space business, but the fact is that management of national security space programs is no better today than it was three years ago. In addition, no integrated architecture has been derived or proposed. DCI George Tenet was so frustrated by a lack of an integrated architecture that he created, in 2004, the Constellation Architecture Panel to develop one for the IC.

But in the end, the question becomes, can the NRO effectively be managed by a part-time DNRO? Past DNRO's argue that they did it successfully, so it should work. In the past, the NRO's world was quite different, however, and many would suggest simpler. There was much less visibility, the Program A, B, C structure provided an NRO management structure different (and more accountable) than today's NRO organization, plus the NRO had more end-to-end responsibility. Today, without this end-to-end responsibility, the DNRO needs to spend more time on interactions with the mission partners than the DNRO has the time for in the current construct. Further, management direction to the DNRO is as confusing as any time in its history. The Undersecretary for Defense (Intelligence) (USD(I)), Community Management Staff (CMS), DCIA (now DNI), and Congress all get to influence what the NRO does. This is not right or wrong but it is certainly more complicated than in the Excom days. The result is, however, that it consumes time and energy that past part-time DNRO's mostly did not have to endure. All this simply says that the DNRO's job today is considerably more demanding than in the old days.

Some have suggested that if the DDNRO had more authority, the NRO could be managed in a CEO/COO arrangement and the part time DNRO would work. It is not that this construct is impossible, as it works quite well in industry. However, industry has a model for this and government does not. Whether this construct would work is probably more dependant on the individuals than some model.

Lastly, from the new DNI's perspective the issue is who "owns" the NRO. In the original construct the NRO was a JV and hence owned by the JV partners, the Secretary of Defense (SecDef) and DCI. The NRO even had a board of directors known as the Excom who decided which NRO programs would be funded. Today there is no such neat chain of command. Everybody thinks that they have a say in what the NRO does, with CMS, USD (I) and Congress further confusing the direction to the NRO and further complicating the ability of the DNRO to architect an integrated NRO. In this confusion, the DoD increasingly thinks (and acts like) it owns the NRO. The arguments that have been advanced by the DoD and it's allies on the Hill are that the NRO and National Security Agency (NSA) and National Geospatial-Intelligence Agency (NGA) need to be owned by the DoD as they must be responsive to the military chain of command in supporting the troops. This is emotionally appealing but bogus. NRO systems have never been under the military chain of command, but have always been under the tasking control of the DCI and the mechanisms established by the DCI. In this process, the military has always been well served by the DCI when they needed priority access to these national assets.

The establishment of the NRO JV was recognition that not only the DoD and the CIA needed intelligence from space, but other elements of the USG did as well. Further, it was realized that the USG could not afford to have every department build its own reconnaissance systems; therefore, a national approach was needed. The needs of such an integrated national reconnaissance effort are as important today as anytime in our history. The new DNI needs to insure that the DoD not end up owning the NRO and needs to reestablish a proper balance between the DoD and the IC in forming NRO requirements and priorities. As an aside, it is interesting to note that a recent set of the President's Foreign Intelligence Advisory Board (PFIAB) recommendations to the President on IC acquisition policies recommended the reestablishment of an Excom.

Program Management

In the end the NRO is about managing programs and delivering needed collection capabilities. In the 2002 article, I observed that NRO program managers are no longer "king", that there is too much micromanagement of NRO programs, too much staff interference and that as a result NRO programs are taking significantly longer from inception to delivery. I retract none of these observations, but I overlooked a very important fact. Part of the problem is the unwillingness of the NRO to fund programs adequately. While all new programs of the complexity of the NRO's have development problems causing schedules to slip and costs to grow, the NRO's unwillingness to fund such programs realistically and with adequate margin is a major reason why it takes the NRO so long to deliver needed capabilities. This puts the NRO program managers in the difficult position of having no margin, and hence no flexibility, and having to exist year to year spending their energies on how to manage to an unrealistic budget and not on delivering the capability. The result of all this is that the NRO is delivering capabilities needed by the community now, years late.

The fundamental cause of this is not congressional micromanagement, or inadequate Independent Cost Estimates (ICEs), or even poor program management. It is the inability of the DNRO, and the community, to decide what are the priorities and the inability to kill anything. The result is that instead of doing a few programs well (including adequate funding), the NRO is trying to do everything and not doing it well. The result of this budgetary madness is that the chief architects of the NRO have become the budget people and the Congressional Committees. *The result is that nobody in the NRO is responsible for the integrity of the architecture in the context of the integrity of the budget.*

Systems vs. Needs

In the old days we focused on what the community needed and then invented programs to satisfy that need. In a very significant way we had to do this as, 1) we had end-to-end responsibility, and 2) we were very much part of the IC and had nearly daily contact with people in the Directorate of Intelligence (DI). Indeed, a significant number of people in the old Office of Development and Engineering (ODE) came from the DI. Without end-to-end responsibility and without the CIA contingent worrying about what the CIA needs from the NRO the focus is now on systems. *The NRO has dramatically changed from being a needs driven organization to an acquisition driven organization.*

The result is that the NRO is driven to sell programs not product. So the discussion becomes, how do we sell this program out of context of what the country needs? It is a fact that we used to worry a lot about what the community needed and then derive a program to solve that need. Today literally nobody is worrying about what kind of imagery is needed for the future. The focus is on selling programs and on convincing the users to support the latest NRO new program. *The NRO was once an intelligence organization at the beginning of the space age; now, it is a space agency in the information age.*

If the NRO is to succeed in this new age, it must be in the business of providing information not data. The creation of information in real time demands that we eliminate the divide between systems that collect IMINT or SIGINT and the systems that change that data into information products.

Final Thoughts

The NRO of the future needs to look and act differently than the NRO of today. The community needs to build on a simple fact. The NRO, in spite of how easy it is to criticize, is still the best acquisition organization in the IC and perhaps the US government as well.

In the old days we were proud of many things: our creativity, the dedication of our people, and our ability to keep our word. Programs were mostly delivered on time and within budget, and performed as promised. This is the hallmark of a well-managed organization—keeping your promises. The NRO is no longer the well-managed organization it once was and as a result it no longer keeps its promises. There are many reasons for this. Some I have mentioned: part-time DNRO, meddling by staffs, inadequate funding of programs, and the unwillingness to decide priorities. Much of this the NRO can fix.

But in the end, the new DNI has to decide what he wants the NRO to be and I suggest a few issues are critical.

1. The NRO needs to recover much of its end-to-end responsibility. This has started on the Signals Intelligence (SIGINT) side and needs to be readdressed in the imagery business. The interface between the NRO and NGA has been cut in the wrong place and needs to be readdressed. The NRO should budget for the end-to-end costs of its programs to preclude the budget discrepancies that exist to this day.
2. The NRO needs a civilian component both to bring stability and experience and to build long-term relationships with its mission partners. NSA and NGA already provide people to the NRO to help in managing NRO programs and to bring their view to that process, but the stability needed in acquisition and community understanding likely comes best from the CIA. The only problem is that CIA doesn't care anymore. The DNI will need to decide, in consultation with the DCIA, how to fix this problem. CIA people deserve to have space program careers for this to work.
3. The NRO needs to return to being an exceptionally well-managed organization that keeps its promises. This means a full time DNRO, it means filling senior positions based on competence and ability, it means adequate funding of programs and it means restoring a better balance between the government program staff and the overwhelming presence of Federally Funded Research and Development Centers (FFRDC) and Systems Engineering and Technical Analysis (SETA) personnel that currently exists in the NRO.
4. The people problems I mentioned in the 2002 article remain. It is amazing how visible these issues are to everybody except those that can actually do something about them.

The NRO is too important to the security of the nation to be left in its current state. As I suggested in the original article the NRO is in decline and the nation cannot afford, nor does it deserve, a mediocre NRO. Many suggestions have been made in numerous reviews of the NRO about what to do and how to "fix" the NRO. In my view, four steps are critical:

1. The NRO needs and deserves a full time Director. The job and the interfaces are too complicated to be managed on a part time basis.

2. All NRO programs must have adequate margin up front. On new NRO programs this should be at least 30-50%. Budgeting programs at the 80% ICE, instead of 50%, could accomplish this.

3. The CIA needs to make a conscious decision on its continued participation in the NRO. Currently, only 25% of the total CIA contingent in the NRO are engineer/scientist/program management personnel. The rest are administrative types. The CIA should not be the administrative arm of what is increasingly becoming a DoD

organization. If the CIA is to continue its presence in the NRO, then the CIA people should be reconsolidated into ODE, and a fulltime ODE director (with no NRO assignment) appointed to manage their careers, their assignments, and the interface with CIA.

4. The size of the NRO staff and its relationship with NRO program managers needs serious review. The NRO now has a staff larger than the number of people actually doing the main business of the NRO, managing programs. No successful company could allow this to happen and remain profitable. A top to bottom review of the staff functions, size, and authority is badly needed.

Certainly all of us "old timers" want the NRO to be like it used to be. But even us "old timers" recognize that the world has changed and that there are influences on the NRO today that we did not have to deal with. Having said that, however, there is no reason why the NRO cannot recapture what made it so good, which was excellence in program management and keeping our promises.

Mr. Robert Kohler is a retired senior CIA officer who spent almost twenty years in the field of national reconnaissance. From 1982 to 1985 Kohler managed the engineering, development, and operation of major technical collections in support of the NRO. After retiring from CIA, Kohler held positions at ESL Incorporated, Lockheed Missile & Space Corporation, and TRW. He retired from TRW in 1995. Mr. Kohler is a Pioneer of National Reconnaissance in the class of 2000.

Commentary on: Kohler's "Recapturing What Made the NRO Great—Updated Observations on 'The Decline of the NRO'"

By Dennis Fitzgerald

In Robert Kohler's updated critique (Kohler 2005) of what he earlier described as the decline of the National Reconnaissance Office (NRO), he made a number of recommendations for improving the management of the NRO and for redefining the Central Intelligence Agency's (CIA's) role in the NRO.[1] While I do not intend to address each of his points—many of which I agree with—I believe several need clarification. This is particularly true of his central point, which argues that the NRO does not fund programs realistically, thereby causing cost overruns and schedule slips. On this issue of funding, and several other of his related issues, I offer my comments as I have considered them within the context of the events of the last ten years.

Issue of Funding The NRO Programs

Kohler (2005) stated that the NRO is unwilling to fund programs adequately. This assertion ignores the fundamental changes imposed upon the NRO in the decade from 1995 to 2005. In 1995 the NRO had a funding crisis. The NRO was found to have accumulated $3.8 billion in forward funding (i. e., unused margin) across all NRO programs.[2] The timing could not have been worse. The U.S. was involved militarily in Bosnia during a period of declining defense budgets.

[1] Editor's Note: The 2005 Kohler update that Fitzgerald cited above appears on p. 51 of this issue of the *Journal*, under the title, "Recapturing What Made the NRO Great—Updated Observations on 'The Decline of the NRO.'" This Kohler article is an update his earlier 2002 critique that he originally published in CIA's *Studies In Intelligence*, and we reprinted on p. 35 of this issue of the *Journal*.

[2] Prior to 1995, the long-standing practice within individual NRO programs was to carry forward from one fiscal year to the next funds that had been appropriated and obligated, but not spent. A congressional review of NRO financial records between 1991-1995 revealed that the aggregate amounts were neither reported to the NRO comptroller, nor shared with congressional oversight committees. Under the accounting system of the time, only the individual program offices tracked how these funds were being spent (Laurie, 2001).

The discovery that a government agency had amassed $3.8 billion was greeted in Congress with both outrage and a sense of relief. There was outrage that the funds had been accumulated, but there was a sense of relief these newly identified funds could be reallocated to solve a funding gap related to ongoing military operations in Bosnia. At the same time, Director of Central Intelligence (DCI), John Deutch, publicly fired the incumbent NRO Director and Deputy Director (DNRO and DDNRO), and installed Keith Hall as the new DNRO with a mandate to get the NRO back on firm financial footing (U.S. Congress 1996, Weiner 1996).

Resolution of Funding Crisis. As one of his first acts toward achieving this objective, Keith Hall hired John Nelson to be Chief Financial Officer (CFO). Nelson's review of the NRO's budget approach revealed two problems. The first problem was that the NRO possessed no accounting tools to monitor NRO budget execution; the second problem was related to the way the NRO built budgets in the first place. From the accounting standpoint, the NRO had a hodgepodge of budgeting systems derived from those used by the former Programs A, B, and C (Laurie, 2001). The NRO had no way of reporting execution metrics traditionally done by Department of Defense (DoD). Nelson set up an NRO accounting system that enabled the NRO to monitor its budget execution and to report spending against metrics and standards similar to those used by other agencies, in particular the Department of Defense (DoD).

This new accounting system addressed the first problem by replacing NRO-unique forward funding metrics with DoD-like execution standards, essentially removing any capability to accumulate margin. Once the NRO started being evaluated against DoD's execution standards, any margin was lost to the Community Management Staff (CMS), Office of Management and Budget (OMB), or Congress, who would reallocate the excess funds to other agencies.

The new accounting system also addressed the problem of how the NRO developed its budget. Prior to 1995, the NRO built budgets by taking Contractor estimates and adding margin, typically 20-to-40-percent. After the forward funding revelations in 1995, the NRO moved to independent cost estimates (ICEs) and budgeted at slightly over the 50 percent probability estimate, a practice that continued through 2005.[3] The cumulative effect of greater budget visibility, comparisons to DoD metrics, and budgeting to an ICE was that NRO forward-funding margins disappeared, which was DNRO Keith Hall's goal.

New Problems. Meeting that goal of eliminating the margins was not without consequences. Budgeting at the 50 percent probability estimate meant that programs with perfect ICEs still had only a little better than even chance of staying within budget. The imprecision associated with the ICE on a new design program only drove down the

---

[3] An Independent Cost Estimate (ICE) is a budget estimate of a system's cost that is prepared external to the NRO directorate that is conducting the system's acquisition. It is designed to aid the procurement process.

cost probability curve until cost overruns were no longer a statistical probability; they became a certainty.

Without any margin, the program from which the money was taken would inevitably experience cost overruns after the money was moved. Thus, sick programs were fixed by making healthy programs sick. Nearly all NRO programs began to miss expected delivery dates. It was during this time that the NRO acquired its reputation as the producer of costly satellite systems that tended to drain resources away from the overall intelligence budget (US Commission, 2005).

The absence of margin and the certainty of cost overruns presented the NRO with a reality of not being able to fund programs adequately. Another result of the 1995 funding crisis was the NRO lost budget autonomy; whenever a program exceeded its funding limits, we had to go back to Congress to get permission to move money from some other program in the NRO to fix the problem.

Adding to the financial pressure between 1997 and 2001, the CMS took $3 billion out of the NRO budget to pay for covert action in the Central Intelligence Agency (CIA) and infrastructure expenses at the National Security Agency (NSA) and the National Geospatial-Intelligence Agency (NGA). This further lengthened NRO schedules and further confirmed the negative view held by some oversight authorities.

By the spring of 2001, the NRO was headed toward the cancellation of a number of programs. However, supplemental and increased funding in response to the terrorist attacks of 9/11 saved these programs. But CMS' reallocation of funds illustrates a continuing problem: whenever the Intelligence Community (IC) finds itself with a financial crunch, the NRO tends to be the "piggy bank" of choice. The reason for this is that the impact on NRO activities is not immediately apparent when compared with the impact on other components of the Intelligence Community.

If CMS takes a dollar out of the budgets for CIA, NGA, or NSA, there is an immediate impact. Some intelligence is not going to be on the President's desk the next day. Neither the White House nor Congress have regarded this as an acceptable option. The 2005 report on the Intelligence Capabilities of the United States Regarding Weapons of Mass Destruction—which principally blamed the lack of good information and analysis errors for the IC's mistaken pre-war judgments about Iraq's weapons programs—underscored this point (US Commission, 2005).

Alternatively, if CMS takes money out of the NRO, there is no visible impact tomorrow when the President looks for his intelligence. However, five years later when a needed satellite capability cannot be delivered, the NRO customers have a problem. As the WMD Commission (2005) conceded, satellite surveillance systems are costly, but they provide crucial battle space preparation and targeting information for the military, and they can gather WMD intelligence that cannot be obtained any other way.

The Core Question of Funding Margin. Kohler (2005) stated that all NRO programs must have adequate margin—at least 30-to-50-percent—up front, and that budgeting new NRO programs at the 80 percent ICE would accomplish this. This suggestion is not new. Tom Young ran a Defense Science Board Study (Teets, 2004) that looked at budgeting for both covert and open space programs to the 50 percent probability estimate. He concluded that the practice did not leave the program manager with sufficient margin to fix the inevitable problems that occur with first-of-a-kind satellite systems. Congress accepted that conclusion but asked about the ramifications of budgeting new NRO programs at the 80 percent probability estimate. When they were told additional funding would have to be added to the NRO or some programs would have to be cancelled, Congress dropped their proposal. After having budgeted to the 50 percent probability estimate for nearly ten years, the NRO could not—and still cannot—change overnight.

The Real Funding Problem. The current funding problem is not, as Kohler (2005) suggested, that the NRO does not budget individual programs responsibly (in light of execution standards), but that the NRO does not have the flexibility required to manage its programmatic portfolio effectively.

Budgeting each program to an ICE can provide a program manager the average of what other program managers have required to deliver products of equivalent complexity. That is reasonable only if I, as the senior program manager, can move dollars among programs. In any given year, I undoubtedly would have projected events that do not happen. And I also would have failed to project events that do happen (usually funding matters). As long as I have flexibility across the programmatic portfolio, I could shift funds to where they are needed. But the NRO does not have that flexibility. The 26 expenditure centers end up as 60 different budget control lines, and the NRO has to get each of those 60 exactly right. Further, the NRO has to get the projection for all 60 exactly right about a year in advance.

A Solution. Former DNRO Peter Teets, asked Congress for a margin line item, unattached to any program, to address this problem in the FY-06 budget. At this writing, it remains to be seen if Congress will go along with this suggestion. Even if the NRO gets the margin line item, it still will be vulnerable to CMS (or ODNI) adjustments and its need to find money when one of the other National Foreign Intelligence Program agencies gets into trouble.[4]

In reviewing these crucial funding issues, I wish we could do what Mr. Kohler (2005) recommended. I would like to go back to the days of putting margin on contractor estimates and allowing unused margin to roll into the following fiscal year. Unfortunately, that chapter of NRO history closed in 1995, and it is unlikely CMS, DoD, and Congress will allow it to be reopened.

---

[4] The Community Management Staff (CMS) is being subsumed into the Office of the Director of National Intelligence (ODNI).

The Other Related Issues

In addition to the issue of margin, Kohler (2005) raised programmatic issues associated with killing programs, delivery schedule, presence of staff contract support, percentage of engineer staffing, and the role of the NRO staff. All of these are valid issues to raise; however, they are not matters that can be resolved by returning to the "good old days."

Issue of Killing Programs. Kohler (2005) pointed out the IC's inability to kill any program. He is correct. Every program in the NRO has a strong constituency either in DoD or the IC. Even 22-year-old crippled satellites are almost impossible to turn off. It is a testimony to the power of space-borne collection. It also demonstrates the continuous intelligence demand on NRO systems.

Issue of Delayed Delivery. Kohler (2005) noted that the NRO is delivering capabilities needed by the community now, years late. He characterized it as the IC's inability to set priorities, but there are more immediate reasons, some of which I already discussed above. There are three major factors that contribute to this complaint: first, the reality of inadequate margins force the NRO to move programs to the right; second, contractors promise more than they can deliver; and third, parts have proven to be unreliable. The parts factor is of most interest.

Parts, from components as simple as capacitors to components as complex as Heterojunction Bipolar Transistors (HBT) and Field Programmable Gate Arrays, have plagued the entire space industry.[5] The negative effect of their unreliability on program schedules is especially bad when they are found late in the assembly process. The origins of this problem go back to the mid-1990s, when in the interest of trying to economize, the government eliminated the military specifications (MILSPEC) requirements on parts. The MILSPEC on parts are now back in NRO programs of the 21st century.

Issue of Staff Contract Support. Kohler (2005) talked about the overwhelming presence of Federally Funded Research and Development Centers (FFRDC) and Systems Engineering and Technical Analysis (SETA) personnel in the NRO.[6] This is something for which Congress criticized the NRO in the late 1990s. As a result, the NRO took our SETA personnel level from roughly 7.8 percent of the total NRO budget in 1998 to about 5.5 percent of the total budget in 2005 and the NRO monitors these numbers on a monthly basis. The FFRDC staffing, which is nearly all Aerospace Corporation, has been constant at the NRO at 650 Full Time Equivalent (FQE) staffing for the six-year period from 1999 to 2005.

---

5 HBTs have traditionally been used for various microwave and high-speed digital applications, while field programmable gate arrays (FPGA) are processor components used in Electronic Warfare (EW) sensors.

6 FFRDCs are established by the federal government and are principally financed by the Department of Defense (DoD) to perform or manage research and development programs. SETA refers to contractors supporting the NRO in various systems engineering roles.

Issue of CIA Engineer Staffing. Kohler (2005) complained that only 25 percent of the total CIA contingent in the NRO is engineers. The statistic is correct; however, the implication that the proportion of engineers to support staff has gotten out of balance is not. Who are the administrative support cadre? They are contracting officers, security, personnel, and Inspector General (IG), Legislative Liaison, and medical staff. When the NRO was organized as independent programs that were associated with parent organizations—i.e., Program A (Air Force), Program B (CIA), and Program C (Navy)—many of these functions were provided by the parent organizations. The Air Force's Los Angeles Air Force Station provided administrative support to Program A; The CIA's Langley Headquarters provided administrative support to Program B; and the Navy's Naval Research Lab provided administrative support to Program C.

When the Intelligence Community made the decision to abolish Programs A, B, and C, and to consolidate the NRO activities in Northern Virginia at the Westfields complex, the parent organizations pulled back their support.

When Mr. Kohler was in the NRO, the IG position was a part-time job for one person. Today it is 62 people, its size largely directed by Congress. In Mr. Kohler's time, Congressional contacts were few, and the legislative liaison function was performed by the DDNRO. In 2005 contacts are daily, mandating a staff of six. During the era of Program B, CIA paid the invoices for the Office of Development and Engineering activities in support of the NRO mission. In 2005 that function is accomplished by the NRO administrative staff.

In the mid-1990s, it became apparent that much of the NRO infrastructure support formerly provided by the Air Force, CIA, and the Navy would not be a part of the NRO consolidation at Westfields. As a result, the then NRO Director of MS&O, Roger Marsh, got Congress to appropriate funds for 800 administrative personnel to perform the support functions. The CIA was generous to allow the NRO to use the CIA personnel system to hire many of these people, and the NRO continues in 2005 to reimburse CIA for their salaries and benefits.

Issue of the Role of the NRO Staff. Kohler (2005) suggested a review of the size and relationship of the NRO staff to NRO program managers. This is something the NRO IG does on a regular basis. But I believe that what Mr. Kohler is hinting at is that some NRO program managers have complained about the apparent power and decision authority of NRO staff components, especially the staff's budget czars in Business Plans and Operations (BPO). Strong budget authorities always are looked at with a combination of suspicion and resentment. Mr. Kohler forgets how others viewed his budget czars. As DDNRO, I keep the BPO staff informed and involved in all program decisions because all program decisions also are budget decisions. What program managers might overlook is that BPO does not cut any program's budget on its own. The BPO merely lays out the alternatives. It is the DNRO who always makes the final decision.

Conclusion

In closing this commentary of Kohler's (2005) "postscript critique" of the NRO, I would like to thank Mr. Kohler for his thought-provoking article. With the passage of the Intelligence Reform and Terrorism Prevention Act of 2004, and the recommendations of the Commission investigating the Intelligence Community's capabilities to detect WMDs, the IC undoubtedly will undergo change as it transitions into a more collaborative and integrated group of agencies, flexible enough to meet an ever-changing threat environment. In this transition, dialogues such as this one can help facilitate a constructive exchange of ideas on how to keep the NRO a creative and vibrant organization.

References

Kohler, Robert. (2005). Recapturing What Made the NRO Great: Updated Observations on 'The Decline of the National Reconnaissance Office'. *National Reconnaissance: Journal of the Discipline and Practice*, 2005-C1, 51-57.

Laurie, Clayton D. (2001). *Congress and the National Reconnaissance Office*. Chantilly, VA: National Reconnaissance History Office.

Reforming Space Acquisition. (2004, October). [Interview with Peter B. Teets]. *Intelligence, Surveillance & Reconnaissance Journal*, 3(9), 18-20.

U.S. Commission on the Intelligence Capabilities of the Unites States Regarding Weapons of Mass Destruction (2005). *Report to the President of the United States*, March 31, 2005.

U.S. Congress (1996). "Nomination of Keith R. Hall," *Congressional Record,* Senate June 20, 1996, p S6608.

Weiner, T. (1996). "After Errant $2 Billion, Spy Satellite Agency Heads are Ousted," *New York Times*, 27 Feb 1996, A9.

Dennis D. Fitzgerald is the Deputy Director of the National Reconnaissance Office (DDNRO), a position he has held since August 2001. After the retirement of Mr. Peter Teets, he served as the Acting Director, NRO (ADNRO) until the recent appointment of Dr. Donald Kerr as Director, NRO (DNRO). His most immediate prior assignment was as Associate Deputy Director for Science and Technology in the Central Intelligence Agency (CIA). Mr. Fitzgerald joined the CIA's Directorate of Science and Technology in 1974 and spent the majority of his career assigned to the CIA's Office of Development and Engineering (OD&E) with duty in the NRO. His many NRO assignments included service as the Director, Signals Intelligence Systems Acquisition, and Operations with a concurrent appointment as CIA's Director of Development and Engineering. Mr. Fitzgerald began his professional career as a field engineer working on the Polaris and Poseidon missile program for Sperry Gyroscope.

IN MEMORIAM

John Parangosky

National Reconnaissance Pioneer

Former Central Intelligence Agency program manager Mr. John Parangosky died at the age of 84, on Sept. 9, 2004, in Leesburg, Virginia (Washington Post, 2004). In 2000, the National Reconnaissance Office (NRO) named Mr. Parangosky a Pioneer of National Reconnaissance in recognition of his accomplishments helping to develop several groundbreaking systems. The U-2 and A-12/SR-71[1] aerial reconnaissance aircraft exemplified two national reconnaissance breakthroughs that he helped facilitate. Mr. Parangosky made his most notable contributions as chief of the CIA development staff on Corona, the nation's first photoreconnaissance satellite program, which operated from 1960-1972 (Oder, Fitzpatrick, and Worthman, 1988). These pioneering programs established the precedent for future successful collaboration on reconnaissance projects among military, industrial, scientific, and intelligence sectors.

With the national reconnaissance capability still in its infancy, Mr. Parangosky became part of the top management team on the U-2 project in the mid-1950s. Designed to provide high-altitude monitoring of Soviet strategic capabilities, the U-2 represented the most technologically advanced project undertaken by the CIA to that point (Taubman, 2003). By 1959, Parangosky served as deputy chief of the U-2 unit at Adana, Turkey, a main staging base from which commenced U-2 overflights of the Soviet Union, its Eastern European satellite states, and the Middle East.

Parangosky also helped engineer the U-2's proposed successor, the A-12 Oxcart. The Oxcart implemented another technological advancement as the world's first successful stealth aircraft. Parangosky advanced its development from its inception in 1956 through the test flight stage in the 1960s, and made significant contributions toward creating a reconnaissance aircraft that possessed unprecedented speed, range, and altitude capabilities for its time (Pedlow & Welzenbach, 1998, McIninch, 1971).

Project Corona, which Mr. Parangosky oversaw as chief of the project

[1] *Aircraft designer Clarence "Kelly" Johnson of Lockheed Aircraft Corporation originally called the vehicle A-11, but Lockheed designated the final single-seated CIA reconnaissance aircraft A-12, after substituting laminated plastic vertical tail section fins in place of the titanium originals. This alteration achieved a lower radar cross-section. The Air Force retained the A-11 designator as official cover for A-12 development, and for use in developing a two-seated interceptor version, called the YF-12A. Lockheed later produced for the Air Force the SR-71, a two-seated reconnaissance aircraft, which despite utilizing a smaller, inferior camera to the one deployed in the A-12, enjoyed a much longer operational life than its CIA counterpart.*

office development staff, represented nothing less than a revolution in reconnaissance capability. With the successful mid-air recovery of 3,000 feet of film on August 18, 1960, Corona ushered in the era of space-based photoreconnaissance. By the completion of its second mission, Corona had acquired images of more denied Soviet territory than all the U-2 overflights combined. By effectively managing the collective efforts of the diverse contractor workforce that developed Corona, Mr. Parangosky established a reputation as one of the finest team builders in the CIA's Directorate of Science and Technology (McDonald, 1997).

The Glomar Explorer program served as one of the last major efforts Parangosky headed as a member of the DS&T's Special Projects Staff (SPS) at CIA. Codenamed Project Jennifer, Glomar involved the construction of a deep-water collection vessel to raise a Soviet submarine that had sunk sixteen thousand feet below the Pacific Ocean surface. During the raising operation on August 12, 1974, the submarine broke into two pieces, and the stern section was lost. Despite this, the Glomar vessel's huge claws succeeded in salvaging most of the Soviet sub, which upon resurfacing was discovered to contain several nuclear torpedoes, as well as valuable weapons systems and technology intelligence (Andrew, 1995).

Mr. Parangosky was born in Shenandoah, Pennsylvania. After graduating with a bachelor's degree in economics from Washington and Jefferson College in 1941, he served in the Army Air Force as first lieutenant during World War Two. At the war's conclusion, he continued his education at the University of Pennsylvania and Columbia University School of Law in 1946 and 1947, prior to joining the CIA in 1948. In 1997, the CIA honored him as one of its 50 "Trailblazers" for his work in managing the joint contract team that developed the "world's fastest and highest flying stealth reconnaissance aircraft"—the A-12/SR-71. (CIA 1997, McIninch 1971, Washington Post, 2004).

After leaving the CIA, Mr. Parangosky continued to serve as a consultant to government and industry on reconnaissance programs until the mid-1990s (Washington Post, 2004).

References

Andrew, Christopher. (1995). *For the President's Eyes Only*. New York: Harper Perennial.

Central Intelligence Agency, CIA (1997). CIA to Mark 50th Anniversary, Honor "Trailblazers." (CIA Press Release No. 12-98, 10 September 1997).

John Parangosky Dies; Helped Manage Spy Satellite System. (2004, September 26). *The Washington Post*, p. C11.

McDonald, Robert A. (1997). Corona's Pioneers. In Robert McDonald (Ed.), *Corona: Between the Sun and the Earth—The First NRO Reconnaissance Eye in Space* (pp. 61-74). Bethesda, MD: American Society for Photogrammetry and Remote Sensing.

McIninch, Thomas P. (1971). The Oxcart story. *Studies In Intelligence*, 15(1), Winter, 1-25. [Formerly classified "Secret;" Approved for Release Under the CIA Historical Review Program on 2 July 1996.]

Oder, Frederic C.E., Fitzpatrick, James C., & Worthman, Paul E. (1988). *The Corona Story*. NRO history files.

Pedlow, Gregory W., & Welzenbach, Donald E. (1998). *The CIA and the U-2 Program, 1954-1974*. Washington, D.C.: Documents Expediting (DOC EX) Project, ANA Division/Government Section, Library of Congress.

Taubman, Philip. (2003). *Secret Empire: Eisenhower, the CIA, and the Hidden Story of America's Space Espionage*. New York: Simon & Schuster.

IN MEMORIAM

Mark Morton

National Reconnaissance Pioneer

National Reconnaissance Pioneer Mark Morton died on April 12, 2005, in West Brandywine, Pennsylvania at the age of 92. The National Reconnaissance Office (NRO) honored Dr. Morton because of his pioneering work that developed the satellite recovery vehicle (SRV) for Corona, the first photoreconnaissance satellite. Corona's SRV and other follow-on film recovery satellite systems provided overhead reconnaissance imagery that was vital to U.S. national security during the Cold War.

As General Manager for the Reentry Systems Department at General Electric (GE), Dr. Morton supervised engineering teams that designed, fabricated, and tested the reentry vehicle. The revolutionary idea of returning film images taken from satellites in a reentry capsule might never have been realized without the design that Dr. Morton and his General Electric (GE) team devised. Prior to their work, no satellite recovery vehicle (SRV) had previously been recovered from space.

The Corona SRV needed to gather the exposed film and eject with its own rocket system, maneuvering into a predictable recovery trajectory. The SRV also needed to be able to withstand tremendous heat and deceleration forces upon reentry into earth's atmosphere. After reentry, the SRV would deploy a parachute, controlling its descent enough to allow mid-air recovery by a specially-modified aircraft. This recovery solution demonstrated its viability on Discoverer XIII. This mission successfully returned from space an American flag in the SRV reentry capsule. Following a similar sequence, recovery crews retrieved from mid-air more than 140 capsules with film during Corona's operational lifespan, 1960-1972. The CIA also recognized Dr. Morton for this important contribution to intelligence during a ceremony at CIA in 1985 (Morton, 2000).

Dr. Morton's national reconnaissance work commenced after he joined GE in 1956. He rapidly advanced through the corporate hierarchy, attaining the position of General Manager of the Reentry Systems Department in 1962, Vice President of GE and head of Missile and Space Division in 1968, and Senior Vice President of GE and head of GE's Aerospace Business in 1969. Over this time period, he supervised teams responsible for developing reentry systems for Air Force Ballistic Missile Programs, National Aeronautics and Space Administration satellites, and satellite recovery systems such as the Biosatellite and Earth Resources Satellite.

From 1958 until his retirement from GE in 1978, he worked on a variety of other projects, including global radar systems, avionics systems, environmental and oceans technology systems, and manned space systems such as Apollo and Skylab.

Dr. Morton was present at the command center, Cape Kennedy, in 1968 when Apollo VIII launched to the moon. In 1969, NASA presented him with a Public Service Group Achievement Award in connection with Apollo XI, the first mission to land men on the moon (Philadelphia Inquirer, 2005). Presidents Nixon and Carter both gave Morton commendations separately, in 1970 and 1977 (CSNR files).

Dr. Morton was born 1 January 1913 in Atlantic City, New Jersey. He earned a bachelor's degree in mechanical engineering from the Guggenheim College of Aeronautics at New York University. He received his doctorate in aeronautical engineering from Rose-Hulman Institute of Technology in Terre Haute, Indiana (Philadelphia Inquirer, 2005).

From the late 1930s through the Korean War, Dr. Morton developed pilotless aircraft, guided missiles, and special classified projects as an engineer with the Naval Air Development Center. He received many US Navy commendations for outstanding service during World War II (Philadelphia Inquirer, 2005).

Throughout his career, Dr. Morton lectured about the importance of science programs in public school education. He received many awards for his community activism, including, in 1973, the Opportunities Industrial Center's Pathfinder Award for his work on behalf of minorities and the disadvantaged (Philadelphia Inquirer, 2005). His championing of educational programs never abated.

A year after being honored as a pioneer, Dr. Morton donated to the NRO the bottom portion of a Corona film return bucket. This artifact, which is on display in the Visitor's Center at the NRO Westfield's complex, stands as further testimony to the dedicated career of this national reconnaissance pioneer.

References

Downey, Sally A. (2005, April 14). Mark Morton, 92; Led Space Technology. T*he Philadelphia Inquirer.* Retrieved April 14, 2005, from http://www.philly.com/mld/inquirer/news/obituaries/11387664.html.

Morton, Mark. (2000). The Struggle to Recover Corona Film. In Robert McDonald (Ed.), (2002), *Beyond Expectations—Building an American National Reconnaissance Capability: Recollections of the Pioneers and Founders of National Reconnaissance* (pp. 139-145). Bethesda, MD: American Society for Photogrammetry and Remote Sensing.

IN MEMORIAM

General Andrew Goodpaster

Presidential Adviser and Contributor to National Reconnaissance

U.S. Army General Andrew J. Goodpaster died May 16 at Walter Reed Army Medical Center. He was 90 (Washington Post, 2005). As White House staff secretary during the Eisenhower administration (1953-1961), Goodpaster proved indispensable as a liaison between the President and the covert group of scientists and program managers who developed the first high-altitude and space-based reconnaissance systems. The 1950s collaboration among the White House, the Central Intelligence Agency, and engineers in private industry culminated in the development of the U-2 high-altitude reconnaissance aircraft, the Corona photoreconnaissance satellite, and, in 1960, what would become the National Reconnaissance Office (Pedlow & Welzenbach, 1998). Goodpaster's essential supporting role in these developments figured prominently at the NRO's celebrations of Corona. He gave one of the featured talks when the NRO observed its 35th anniversary at the Smithsonian Institute in May 1995.

Known during his White House years as Eisenhower's alter ego, Goodpaster arranged and attended Oval Office meetings with luminaries like Edwin Land—inventor of the Polaroid instant camera and member of the Technological Capabilities Panel—James Killian, who chaired the President's Science Advisory Board, and U-2 Project Manager Richard Bissell (Pedlow & Welzenbach, 1998). Drawing on his World War Two and postwar reconstruction experiences, Goodpaster advised his commander in chief on matters of national and military security. At the beginning of national reconnaissance's modern evolution, Goodpaster contributed to many discussions about new capabilities. Specifically, he briefed Eisenhower on Corona's development. His memoranda often constituted the only official record of decisions made in Oval Office discussions. The Corona project was such a closely held secret, and Eisenhower was so desirous to retain plausible deniability of his knowledge of its existence, that when Bissell submitted the final project proposal in 1958, Goodpaster's memorandum for the record—rather than an official signature—confirmed the President's approval (Oder, Fitzpatrick, & Worthman, 1988).

Andrew Jackson Goodpaster was born February 12, 1915, in Granite City, Illinois. He originally desired to teach math, but money difficulties forced his withdrawal from McKendree College in Lebanon, Illinois, and he subsequently secured an appointment to the US Military Academy at West Point, New York. After being commissioned in 1939, he served in an engineering battalion in World War Two, earning the Distinguished Service Cross for leading his soldiers over a minefield under enemy fire. When the war ended, he returned to the US and enrolled at Princeton University, where he earned master's degrees in engineering and international relations, as well as a doctorate in international relations. He became special assistant to the chief of staff of Supreme Headquarters Allied Powers Europe (SHAPE) from 1950-1954. At SHAPE, Goodpaster assisted Eisenhower, the NATO commander during some of those years, beginning a close working relationship that carried through Eisenhower's two presidential terms and beyond (Washington Post, 2005).

After his years at the White House, Goodpaster served on the Joint Chiefs of Staff in the 1960s, advocating for a stronger U.S. military presence in Vietnam. In 1968, he advised a six-person U.S. team at the Paris peace talks with North Vietnam, and finished the year as General Creighton W. Abrams' deputy commander of U.S. forces in Vietnam. For the following five years, Goodpaster oversaw NATO forces as the supreme allied commander before retiring in 1974. He later returned to active duty to take the commandant post at West Point, his alma mater. In 1984, he received the Medal of Freedom (Washington Post, 2005).

In recent years, General Goodpaster held academic and research center appointments at the Eisenhower Institute in Washington, the Institute for Defense Analyses in Alexandria, and St. Mary's College of Maryland (Washington Post, 2005).

References

Berstein, Adam. (2005, May 17). Gen. Andrew Goodpaster; Presidential Adviser, Dies. *The Washington Post*.

Oder, Frederic C.E., Fitzpatrick, James C., & Worthman, Paul E. (1988). *The Corona Story*. NRO history files.

Pedlow, Gregory W. and Welzenbach, Donald E. (1998). *The CIA and the U-2 Program, 1954-1974*. Washington, D.C.: Documents Expediting (DOC EX) Project, ANA Division/ Government Section, Library of Congress.

IN MEMORIAM

General Bernard A. Schriever

Contributor to National Reconnaissance

USAF General (ret.) Bernard A. Schriever, considered the father of US military space and missile development, died 20 June 2005 at his Washington home. He was 94 (Aviation Week, 2005, p. 20). Through his stewardship of Intercontinental Ballistic Missile (ICBM) development in the 1950s and 1960s, Schriever furnished the national reconnaissance community with the space launch vehicles used for boosting the world's first reconnaissance and communication satellites into orbit (Space News, 2005). At a time when US intelligence indicated a growing Soviet missile threat, Schriever reinvigorated the Air Force's ballistic missile development effort that had been slowed by excessive regulation and budgetary cuts, to produce four major missile systems—the Thor intermediate range ballistic missile (IRBM), and the Atlas, Titan, and Minuteman ICBMs—years ahead of schedule (Estrada, 2005). Schriever provided the management and technical infrastructure for the Air Force's Weapons Systems (WS) 117L program; one project under WS-117L for a film return satellite later provided the framework for the covert activity that resulted in the development of Corona, the world's first photoreconnaissance satellite (Hall, 1998). Schriever's imposition of a technique termed "concurrency"—the simultaneous undertaking of development tasks that would ordinarily be conducted sequentially—changed the way military programs were administered (Boyne, 2000; Estrada, 2005), and, with his other managerial innovations, contributed to a legacy of technological and programmatic advances throughout the Air Force and the national reconnaissance community (Neufeld, 2005).

Even before the Soviet missile threat materialized, Schriever advocated for the development and deployment of missiles for US security. In August 1954, he assumed command of a new agency under the Air Force Air Research and Development Command, the Western Development Division (WDD), to manage the creation of an ICBM force outside of the traditional Air Force bureaucracy (Neufeld, 2005). The initially separate efforts to field missiles capable of delivering nuclear warheads and to produce reconnaissance satellites converged under Schriever's leadership (Hall, 1998). The production and testing facilities and the launch sites constructed for ICBM development, served as the infrastructure for WS-117L activities, even as WS-117L activities established the programmatic framework and provided a basis for cover for the future covert development of Corona (Oder, Fitzpatrick, & Worthman, 1988). The research and development on propulsion, guidance, and structural techniques that fostered ICBM development led to research into orbital mechanics and attitude control that enabled space-based reconnaissance (Hall, 1998).

Beginning with his management of WDD, Schriever instituted processes for developing complex technologies that were widely adopted within the Department of Defense. Through frequent Capitol Hill visits to brief Congress on space and missile programs, Schriever secured funding at levels that sometimes exceeded what the president had appropriated in his defense budgets (Space News, 2005). Aviation Week noted that "Schriever was a master at managing large, complex development programs, and renowned for cutting through red tape" (2005, p. 20).

Born in Bremen, Germany, where his father served in the merchant marine, Schriever arrived in the United States when his family emigrated in 1917, settling in a German-American community 30 miles north of San Antonio, Texas. Schriever became a naturalized US citizen in 1923. After graduating from Texas A&M University with an architectural engineering degree, he joined the Army, receiving a commission in the field artillery. He enrolled in the Army Air Corps Flying School at Kelly Field, Texas, and flew airmail missions. In 1941, The Army Air Forces sent him to Stanford University to study for a master's degree in aeronautical engineering, which he earned in June 1942. After his promotion to major, Schriever joined the 19th Bombardment Group as a B-17 pilot, operating in the Southwest Pacific theatre. Before the war's end, Schriever flew 33 combat missions (Neufeld, 2005).

After retirement from the Air Force, Schriever consulted for several presidential administrations, serving on the President's Foreign Advisory Board under Presidents Reagan and George H.W. Bush. He also advised the Air Force and the Department of Defense, frequently without fee. On June 5, 1998, the Air Force honored Schriever's lifetime of achievements by renaming its base ten miles east of Colorado Springs, Colorado, Schriever Air Force Base, an unprecedented honor for a still living individual (Neufeld, 2005). Commander of Air Force Space Command, Gen. Lance Lord acknowledged the country's debt to Gen. Schriever when he wrote,

> Future historians will look back upon the Cold War and point to Gen. Schriever as a decisive factor in our victory…Where would we be without General Schriever? Technologically, it's accurate to say we would be decades behind where we are now (Lord, 2005, p. 19).

References

Boyne, Walter J. (2000, October). The Man Who Built the Missiles. *Air Force Magazine*, 80-87.

Estrada, Louie. (2005, June 23). Bernard Schriever Dies; General Led Missile Development. *The Washington Post*, p. B7.

Hall, R. Cargill. (1998). Postwar Strategic Reconnaissance and the Genesis of Corona. In *Early Cold War Strategic Reconnaissance: Four Articles by R. Cargill Hall*. Chantilly, VA: NRO History Office.

Lord, Lance W. (2005, June 27). Appreciation: We Walked with a Legend. *Space News*, p. 19.

Neufeld, Jacob. (2005). *Bernard A. Schriever: Challenging the Unknown*. Washington, D.C: Office of Air Force History.

Obituary. (2005, June 27). *Aviation Week & Space Technology*, p. 20.

Oder, Frederic C.E., Fitzpatrick, James C., & Worthman, Paul E. (1988). *The Corona Story*. NRO history files.

Singer, Jeremy. (2005, June 27). 'Missile-Man Schriever' Left His Mark. *Space News*, p. 15.

PIONEERS OF NATIONAL RECONNAISSANCE

M. Sam Araki (2004)
James G. Baker (2000)
C. Lee Battle, Jr. (2000)
John T. Bennett (2000)
John W. Browning (2000)
Jon H. Bryson (2000)
A. Roy Burks (2000)
Frank S. Buzard (2000)
Cornelius W. Chambers (2000)
Vance D. Coffman (2002)
Harvey Cohen (2004)
John O. Copley (2000)
Donald L. Cromer (2001)
Robert H. Crotser (2000)
John J. Crowley (2000)
James C. de Broekert (2000)
Robert E. Eisenhauer (2005)
Carl L. Ferdensi, Jr. (2003)
Gary S. Geyer (2000)
Thomas O. Haig (2000)
Lee M. Hammarstrom (2002)
A.J. Iorillo (2001)

Robert Kaemmerer (2004)
Frederick H. Kaufman (2000)
Robert J. Kohler (2000)
Ellis E. Lapin (2000)
Lloyd K. Lauderdale (2000)
Richard S. Leghorn (2000)
Walter J. Levison (2000)
Howard O. Lorenzen (2000)
Frank J. Madden (2000)
James T. Mannen (2000)
Roger C. Marsh (2005)
Paul W. Mayhew (2000)
Reid D. Mayo (2000)
James W. McAnally (2004)
Edward A. Miller (2005)
James E. Morgan (2000)
Mark N. Morton (2000)
Alden V. Munson, Jr. (2000)
Charles L. Murphy (2000)
Frederic C.E. Oder (2000)
John Parangosky (2000)
Robert L. Paulson (2002)

Julius P. Peline (2000)
Robert M. Powell (2000)
Wayne L. Proffitt (2005)
David Raspet (2003)
Edward H. Reese (2000)
Osmond J. Ritland (2000)
Lee W. Roberts (2000)
Vincent S. Rose (2001)
Charles R. Roth (2000)
Robert W. Roy (2000)
Charles P. Spoelhof (2000)
Forrest H. Stieg (2000)
Marvin S. Stone (2000)
James W. Stoner (2003)
Don F. Tang (2000)
Charles C. Tevis (2003)
John Walton (2001)
Albert D. Wheelon (2000)
Peter G. Wilhelm (2000)
Roy H. Worthington (2000)
Robert W. Yundt (2000)

FOUNDERS OF NATIONAL RECONNAISSANCE

William O. Baker (2000)
Merton E. Davies (2000)
Sidney D. Drell (2000)
Richard L. Garwin (2000)

Amrom H. Katz (2000)
James R. Killian, Jr. (2000)
Edwin H. Land (2000)
Frank W. Lehan (2000)

William J. Perry (2000)
Edward M. Purcell (2000)

DNROS, DDNROS, AND PROGRAM DIRECTORES OF NATIONAL RECONNAISSANCE

Edward C. Aldridge, Jr. (DNRO)
Bernard L. Bailey (Program D)
Thomas C. Betterton (Program C)
David D. Bradburn (Program A)
Dennis M. Brooks (Program C)
Julian Caballero, Jr. (Program B)
Joseph V. Charyk (DNRO)
Charles W. Cook (DDNRO)
Robert T. Darcy (Program C)
Leslie C. Dirks (Program B)
Carl E. Duckett (Program B)
Martin C. Faga (DNRO)
Dennis Fitzgerald (DDNRO)
Alexander H. Flax (DNRO)
Eugene B. Fluckley (Program C)
Leo Geary (Program D)
Robert K. Geiger (Program C)
Robert E. Greer (Program A)

Donald L. Haas (DDNRO)
Keith R. Hall (DDNRO)
Keith R. Hall (DNRO)
Frederick J. Harlfinger, II (Program C)
Jeffrey K. Harris (DNRO)
Frank W. Hartley, Jr. (Program D)
Robert J. Hermann (DNRO)
Jimmie D. Hill (DDNRO)
R. Evans Hineman (Program B)
Ralph H. Jacobson (Program A)
Eugene P. Kiefer (DDNRO)
Donald M. Kerr (DNRO)
David Kier (DDNRO)
William G. King (Program A)
John E. Kulpa, Jr. (Program A)
Jack C. Ledford (Program B)
Allen Lew, Jr. (Program A)
Nathan J. Lindsay (Program A)

Vernon L. Lowrance (Program C)
Hans Mark (DNRO)
John L. Martin, Jr. (Program A)
John L. McLucas (DNRO)
Brockway McMillan (DNRO)
F. Robert Naka (DDNRO)
Lee Roy Patterson (Program C)
James W. Plummer (DNRO)
James Q. Reber (DDNRO)
Thomas C. Reed (DNRO)
Clason B. Saunders (Program D)
Herbert Scoville, Jr. (Program B)
Huntington D. Sheldon (Program B)
Robert D. Singel (DDNRO)
Jay W. Sprague (Program C)
Rufus L. Taylor (Program C)
Peter B. Teets (DNRO)
Grover M. Yowell (Program C)

CENTER FOR THE STUDY OF
NATIONAL RECONNAISSANCE

200505645

ISSN 1557-0304