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.

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