Terrestrial Issues Steer Orbital Reconnaissance

The key to the future overhead may lie at our feet.

By Robert K. Ackerman, Signal Magazine, October 2008

The National Reconnaissance Office has come down to Earth with a new emphasis on ground-based systems for delivering its remote sensing to users. This new focus on the ground infrastructure that supports space systems may be the only way the office can keep its orbital assets in step with the high-technology revolution raging unabated on Earth.

The office is not relinquishing its primary task of placing advanced sensing systems on the high frontier. Nor has it waned in its efforts to continue to provide valuable data from existing on-orbit platforms. Rather, this new emphasis addresses the needs--and opportunities--introduced by networking technologies that are linking a more diverse community of NRO product users, including the individual warfighter.

These information technologies also are driving requirements for the next generation of reconnaissance satellites. More diverse users are wanting more diverse information from overhead surveillance assets. And, the wireless revolution has created new demands for signals intelligence (SIGINT). These changes are taking place amid demands for intelligence against new types of adversaries.

"We have a very different target set than we had during the Cold War," points out Scott F. Large, director of the National Reconnaissance Office (NRO). "The Cold War targets have not gone away, but our mission set has expanded." Small, fleeting targets characteristic of the Global War on Terrorism may be easy to kill, but they are hard to find, he says.

Large cites three NRO priorities. The first is to continue supplying data to its end users, including coalition partners. Above all, the NRO must disseminate data more rapidly than before. Large states that the office is striving to stay within the decision timelines "of the most dynamic user, at the most remote location in the world," to provide the data that this user needs. "If they can't get [the data] in time, then we somewhat become irrelevant," he says.

The second priority is for the office "to regain its acquisition excellence." Describing this as "recovering from acquisition reform," the director explains that earlier attempts to change the NRO's acquisition system led to many of the programmatic problems that seemed to characterize the office around the turn of the century.

Large explains that these well-intentioned initiatives from the late 1990s impelled the office to adopt many practices that did not work in its particular acquisition environment. One of these was giving free rein to contractors, in some cases not even giving them specifications. Now, the NRO is re-inserting the discipline that it lost with those processes. The office will be a good customer to its industrial base by becoming more

involved in the process, particularly through oversight of its prime contractors. "The NRO must return to the point where it can be innovative with its hand firmly on the rudder," Large says.

A new position of chief operating officer has been created to focus on the day-to-day execution of acquisition programs and processes. With the NRO facing substantial criticism over its space system acquisition, this officer is tasked with keeping processes and people in place with accountability. Large notes his office or the chief operating officer has sent letters of instruction to direct reports outlining duties and accountability.

"What we're talking about here is the ability to let people know what's expected, how they're going to be evaluated and what they're accountable for," Large says.

The consolidations among defense contractors that characterized the 1990s have limited the number of contractors and has put at risk second- and third-tier suppliers, Large says. The NRO has issues with space-qualified parts that also affect NASA and the Air Force, so the three organizations are working closely on sustaining those second- and third-tier vendors to keep the industrial base healthy, he reports.

A director's innovative initiative program allows companies and small organizations to submit proposals for low-level funding. The largely unclassified effort aims to leverage innovations for the NRO's business area. Some ideas already have been applied to spacecraft design or ground assets.

The NRO needs industry to tell what it requires to deliver the challenging and complex architectures that will define the NRO for the foreseeable future, Large says. The goal is to establish the right governance process without becoming overburdened with documentation.

The third priority is to be innovative, particularly in terms of providing the new reconnaissance capabilities that are in demand from decision makers to warfighters.

Developing satellites that provide new capabilities is only part of the innovation challenge. The NRO must be able to deliver satellite data to its users, and this can require considerable long-range planning--something that can be anathema to the information age march of technology.

Large relates that the office has gone through cycles where it swings from building long-lasting satellites to sending up short-term orbiters. "It is clear to me that there is an optimal design life for these systems that allows you to do a number of things," he says. "One is to address industrial base issues and create a production pipeline, but equally important is to allow technology insertion in that process so that you can keep the satellites' capabilities moving forward.

"What that exact design life will be is debatable," he continues. "It may vary for different disciplines--imagery versus SIGINT--but one of the things that we are trying to

understand is whether you can structure programs to take advantage of a specific defined lifetime, and don't over-design the vehicles to last longer than intended."

This problem is more acute with SIGINT. The wireless environment has become highly mobile, and its targets are fleeting. These low-power targets pose a different challenge than traditional high-power fixed transmitters.

And wireless technologies are changing so quickly that even the commercial marketplace can barely keep up. By the time a SIGINT satellite is designed and launched, several generations of wireless communication devices have come and gone. The NRO cannot hope to keep ahead of cell phone technology, so it must try to plan accordingly. The solution may be to shift some SIGINT tasks to airborne platforms, Large suggests.

Reconnaissance requirements are changing constantly, Large observes. They may be driven by the laws of physics, the number of satellites in a constellation, available data bandwidth or even a particular phenomenology. Designers must take them into account as they plan to develop new technologies. Yet, because the NRO does not have the set of requirements it needs to design its future, it does not know yet what the next generation of vehicles will be.

The NRO underwent a major reorganization that began last fall and concluded in March. It included a consolidation of its ground activities into a single ground development organization, along with the consolidation of different disciplines into a single operations entity. The goal of this reorganization was to address those three priorities, Large notes.

A key aim is to improve end user access to the data produced by NRO systems. This activity must be engaged in concert with the office's mission partners--the National Security Agency (NSA) and the National Geospatial-Intelligence Agency (NGA). As the analytical houses for intelligence products, the NSA and the NGA provide the taskings for NRO reconnaissance collection. With the recent reorganization, the NRO now can interface directly with its mission partners. It even has embedded NSA and NGA personnel in senior management positions.

Large emphasizes that the NRO wants end users--including the NSA and the NGA--to be able to access the data that they need from NRO systems. While this may seem mundane, the NRO is in a unique position to help users beyond their immediate requests because it knows which users are requesting information.

By using a metadata approach, the NRO can allow an "Amazon.com" type of service, he offers. Being able to integrate and correlate tasking data enables the NRO to help determine a user's needs to a greater degree. Knowing data characteristics such as why it was collected and who tasked it provides the NRO with the ability to develop merged/tagged/correlated metadata, which gives the office a new capability for information management.

This is part of the NRO's new efforts on the ground. While many people are enthralled by the NRO's potential future orbital assets, a substantial near-term payoff can be realized through improved ground capability integration, he notes. And the flexibility inherent in these ground capabilities will add value to existing and future orbital reconnaissance platforms.

"This is not a matter of compelling need because something was broken," Large clarifies. "It is a matter of compelling opportunity."

Being able to tag and correlate information into metadata is value-added to the users, he states. If one user wants an image of a particular target for which another user has requested SIGINT, the NRO can tell both users about the existence of each other's data. The information technologies that enable this capability already are in use in the commercial sector. With the development of a new ground architecture, this capability should be applicable to any data regardless of future satellite designs.

A large element in the ground reorganization involves providing an environment in which the NRO can leverage information technologies such as service-oriented architectures and common service layers, Large continues. These will enable ground flexibility to introduce new processing capabilities that can take advantage of existing as well as future systems, he declares. The NRO can obtain more data from its current orbital systems by emphasizing ground capabilities to a greater degree.

The challenge is to keep up with what constitutes "ground" technologies--communications and information systems. The development cycle for these technologies is extremely short, as anyone familiar with consumer technologies can attest. The NRO's development for ground capabilities has been tied to its spacecraft development, which is at least several years. Large notes that the NRO is trying to match ground technology cycles of 18 to 24 months. This will allow it to insert new capabilities on the ground to take better advantage of the data it continues to generate from orbit.

First, the NRO must develop a common set of computing platforms. Then, the office would drop mission-specific applications onto those platforms. This would remove the need to recapitalize those processing units if a new type of satellite were to be developed and launched. Instead, the office would add a mission-specific application to the processors that suits the new satellite capabilities. Large predicts that service-oriented architecture would be the strongest approach to achieving this goal.

The transition from the existing ground architecture to a new one must be a measured change, he allows. "First, do no harm" is the office's philosophy when it comes to moving data to its customers, and this is key in that transition to an information technology-based architecture. While the enabling technologies remain to be determined, the ground architecture will entail a Web-based approach without customized graphic user interfaces, Large says.

Pete Rustan, former head of the office's advanced systems and technology directorate, is the new director of ground enterprises. Large states that Rustan's task will be to define the path for putting innovative capabilities on the ground. Rustan is doing this within a framework defined by the NRO's corporate system engineering organization. He already has identified elements that can take advantage of specific information technology capabilities soon to emerge in the commercial sector, Large reports.

This ground element embraces what Large describes as the focus for the future--moving NRO data down to the warfighter. Over the past five years, the office has worked to be more effective at moving data forward. This includes leveraging systems wielded by other groups such as the Defense Department. The NRO continues to support all of the Defense Department's data broadcast services, and the office plans to leverage the department's Distributed Common Ground System (DCGS) architecture to meet standards for delivering data to the warfighter. "We see DCGS as a backbone of where we're trying to go with our interfaces," Large says.

The NRO has taken on new missions as the military transforms and the nature of warfare changes. The NRO has been working with the Joint Improvised Explosive Device (IED) Defeat Organization, or JIEDDO (SIGNAL Magazine, July). Large allows that the NRO has been "very effective" at countering IEDs in some cases.

Space protection is a high priority for the NRO, which has created a joint space protection program with the Air Force Space Command. The program director is Gen. C. Robert Kehler, USAF, commander of the Air Force Space Command, and Large is the associate director and lead for the intelligence community. The program is designed to provide strategies, assessments, analyses and frameworks for understanding space threats.

"We have some planning that has to be done," Large says of space protection. "It is clear to us that the threats are real and are evolving. We need to understand our vulnerabilities, and more importantly we need to be able to match the threat with the vulnerabilities. The trick becomes one of what kind of threat response engineering do we need to do?"

The NRO and the Air Force Space Command have signed a memorandum of agreement that identifies the framework of the space protection organization and its personnel assignments. "There is work to be done--I won't deny that--and we're working very hard to do that," Large says.

The threat to space-based capabilities is evenly split between orbital and ground assets, Large offers. It is harder to attack space-based assets, but they also are more vulnerable to an attack. The aggressor often has the advantage in space, but attacks on ground assets can be more insidious, he warns. In this arena, the Air Force works with the U.S. Strategic Command to determine that threat.

SIDEBAR STORY:NRO Embraces Injured Veterans

The National Reconnaissance Office (NRO) is tapping the expertise of wounded war veterans with a program that introduces them into its workforce. The NRO's Wounded Warrior program brings in recovering veterans from area military hospitals to serve as interns during their recovery period.

NRO Director Scott Large relates that the office has held a couple of job fairs for these veterans that he describes as "incredibly successful." Given their limited target group, these fairs have not drawn huge numbers. However, many young men and women have come to the fairs. Large notes that while some attendees had the necessary clearances, the NRO found ways to clear those who lacked clearances.

Veterans were able to work at the office on its mission during their recovery. Many of these military personnel were able to see how the NRO's work applied directly to their compatriots who were still in theater, Large observes. Whether these veterans stay with the military or are discharged, the NRO offers them jobs. "It's tremendously effective," Large reports, adding that a number of people already have transitioned into the office. Even if these interns opt not to stay at the NRO, the office helps them find a job with other elements of the community, particularly its mission partners--the National Security Agency and the National Geospatial-Intelligence Agency.

"It's the least we could do with these folks, given all the sacrifices they have made," Large declares. "Some of these kids who have come back have incredible spirit despite the challenges that they face now and in the future."