

**At AFA's Los Angeles symposium,
senior military and industry leaders
talk requirements and programs.**

Challenges Ahead for Military Space

By John A. Tirpak, Executive Editor

SENIOR Air Force and industry space leaders gathered at an Air Force Association symposium in Los Angeles on Nov. 15 to discuss some of the significant challenges and issues confronting military space. They noted particularly the evolution of USAF organizations to implement recommendations of the 2001 Space Commission and the health of the space industrial base.

A launch from Vandenberg AFB, Calif., the nation's West Coast facility.

Gen. Michael E. Ryan (Ret.), former USAF Chief of Staff

The Air Force “can’t afford to be the bank for all space systems,” said retired Gen. Michael E. Ryan. USAF should not have to pay for space capabilities required by other services and agencies, according to Ryan, who delivered the keynote address.

Ryan maintained that the Air Force has for too long been forced to make “corrosive trade-offs” between funding the space requirements of other agencies or services and its



service-specific programs, such as the F/A-22 fighter. In his view, the funding of space systems needs to be rethought and broadened.

He applauded the designation of the Air Force as executive agent for space within the Defense Department, observing, “Unfortunately, there are some who think the definition of executive agent is that the Air Force foots the bill for all requirements.”

Taking money from key Air Force programs to fix other users’ space programs that have been overloaded with requirements or run into technical problems “seems to me to be a fundamental foul,” Ryan said.

He advocated what he called “requirements financing.” In other words, the agency or service that has a requirement helps finance the space system’s acquisition. “We’ll run it—that’s what we do—but they ought to finance the acquisition,” he said.

If that agency or service later adds requirements—a process which forces costly redesigns and program restructures—then, Ryan said, “That service or agency ought to pony up.” He added, “There should be no free bus rides. ... Space is not a welfare system.”

The Air Force ignores this problem at its peril, Ryan said.

“In space systems, we simply have to get a firm handle on additive requirements if we’re going to suppress freeloaders’ appetites,” he asserted.

Ryan revealed that the service briefly flirted with the idea of charging a \$1 GPS user fee on every handheld or vehicle-carried commercial GPS unit. Had it done so, he said, “We would not have much of a funding problem when it came to GPS.” However, the idea was shot down because GPS was already freely available and there were worries that the move would give a boost to Galileo, the rival European system.

In talking about the Evolved Expendable Launch Vehicle, Ryan said the program suffered from faulty expectations about cost and the commercial demand for launch services. Although the Air Force had planned to select just one launch services provider, prudence suggested that two would provide a hedge against failure in maintaining assured access to space.

Although Ryan approves of maintaining the two-provider system, he thinks that approach will “eat up the savings” the service expects to get through reduced operating costs of

the new systems. “I just feel that one coming,” he said.

“We must help keep the two systems active until we get a turnaround on the commercial side, which I think will come,” said Ryan, adding, “but not in the next five years, and also in governmental programs, all of which need to be replaced in the next 10 [years].”

Ryan noted that the newly minted US Strategic Command’s missions are still evolving and recommended that, as with other unified commands, it should have only one USAF component—Air Force Space Command. That would make AFSPC the “conduit to provide air and space Air Force capabilities,” he said. AFSPC would have the authority to task bombers and reconnaissance assets to meet STRATCOM missions, Ryan added.

This arrangement would “require a broadening of scope, maturation of relationships with the other Majcoms, particularly ACC [Air Combat Command],” he said. “It’s nothing more than we ask of other components, when it comes to Air Force capabilities not directly resident in their command.” For example, Ryan said that when US Pacific Command needs bombers, Pacific Air Forces tasks ACC for the aircraft.

“I think it would be a great step forward in support of integration,” he said. “It certainly would be full of challenges and opportunities galore.”

Peter B. Teets, Undersecretary of the Air Force

The nation must prepare now for inevitable conflict in space, according to Peter B. Teets, undersecretary of the Air Force and director of the National Reconnaissance Office.

To do that, the Air Force must begin developing space control capabilities, said Teets, who is also the first undersecretary of the Air Force to serve as the acquisition authority for all military space programs. “I believe we not only need to think about the mission and implications of space control, but it is fundamentally irresponsible for us not to do so,” he asserted.

If the US fails to take action to secure the high ground of space, a competitor surely will, Teets emphasized.

“What will we do five years from now when American lives are put at



Launch of Boeing’s new Delta IV booster, part of USAF’s EELV program, from Cape Canaveral AFS, Fla., the nation’s East Coast facility.

risk because an adversary uses spaceborne imagery collectors—commercial or homegrown—to identify and target American forces?” Teets asked. “What will we do 10 years from now, when American lives are put at risk because an adversary chooses to leverage the Global Positioning System or perhaps the Galileo constellation to attack American forces with precision?”

Although there has not yet been a concerted effort to impair US forces’ ability to use space assets to prosecute warfare, “that will change,” Teets said flatly.

He added that American capabilities in space “must remain ahead of our adversaries’ capabilities, and our own doctrine and capabilities must keep pace to meet that challenge.”

Teets also suggested that, just as airpower progressed from being a supporting military capability to one which is now “arguably the decisive form of combat,” so too will space power evolve to the point where it, too, may someday produce victory singlehandedly.

“This, then, is the principle of applying the capabilities of a new medium—not only integration into other, existing forms of warfare but development of entirely new ones, ones even conceivably capable of winning wars on their own,” Teets said.

“We can no more perceive what such a victory would look like than the military leaders at the dawn of the first World War could envision the Kosovo conflict of 1999,” he continued. “Everything we’ve learned about capabilities in a new medium, especially our own experiences with airpower, tell us that day is coming.”

Teets cautioned that if space is perpetually viewed as an enabler of other kinds of combat, the US will be outmatched in the next major development in warfare.

“If we limit our efforts only to application of space technologies to existing modes of warfighting, we have undershot,” he asserted. Teets said that supplying targeting, navigation, intelligence, surveillance, reconnaissance, and weather data to surface forces will remain a critical function. However, he added, “if that is all we envision that space can do over the next few decades, then we’ve missed the boat.”

Teets noted that the nation must find “ways to get a vehicle rapidly



Operators at their consoles inside Cheyenne Mountain AFS, Colo., supply data to NORAD and US Strategic Command. STRATCOM replaced US Space Command last year as part of the unified command plan reorganizations.

off the pad to any orbit on short notice.”

He said, “It is easy to see how such a responsive capability could be useful for rapid constellation replenishment and sustainment, but I leave it to your imagination ... to find other ways to employ such a capability to achieve desired warfighting effects.”

In addition, he said, the US must, over the next few years, develop a new cadre of experienced, intensely knowledgeable people skilled in applying space to combat.

“We are not talking about the creation of a mere career field or sculpting a field of expertise,” said Teets. “We are talking about an entirely new breed of warfighters, ones who will ultimately transform the power and scope of warfighting in the same way airpower professionals have done in the past century.”

The United States has a “proud history of successfully wielding land, sea, and airpower in the protection of our nation and its freedoms,” he said. “It must be our goal that the United States carry this legacy of success into the medium of space.”

Gen. Lester L. Lyles, Air Force Materiel Command

Space research is becoming the main thrust of Air Force Science and Technology funding, according to Gen. Lester L. Lyles, head of Air Force Materiel Command.

“Our S&T budget is tilted more

and more towards space technologies,” Lyles said.

In 1999, space-related research accounted for \$432 million—or 39 percent—of all Science and Technology investments, he said. By 2005, the Air Force plans to invest \$847 million, or 59 percent.

“That is a 20 percent jump in six years,” Lyles said. “By FY ’07, it will go up even further,” with up to 65 percent of the S&T budget devoted to space-related research.

All in all, this trend represents a “seismic shift” in the Air Force’s technology priorities, he said, adding, “but it is the kind of thing we need to do.”

The money will explore enabling technologies in space control, navigation, intelligence, surveillance, reconnaissance, monitoring of the space environment, information operations, satellite operations, force applications, space transportation, and command and control activities related to space, Lyles explained.

A key area of research will be in nanotechnology, the science of designing, producing, and operating extremely small mechanisms.

“Delving down to the angstrom level or atomic level of systems is really exciting in terms of what they will do for almost every system in the Air Force, but certainly space systems,” Lyles said. The principal benefits for spacecraft will be the achievement of radical weight re-

duction, strength, redundancy, and improved thermal properties.

Lyles predicted that transformational communications, such as data and information transfer by laser, will be another area of intense research. He said the technology could increase the bandwidth available for data transfer and pose a significant leap in the capability to communicate with spacecraft or aircraft. The promise is so great, he said, the Air Force Chief of Staff asked AFMC to “put together a critical experiment in a very short period of time to show how you can use that technology to communicate from air platform to air platform.”

He also reported that AFMC may undertake a restructure that would emphasize an “enterprise focus on acquisition and sustainment” to eliminate “stovepipe management of systems or individual programs.”

Another initiative would be an increased use of pathfinder programs for streamlined and agile acquisition. “We want to reduce the acquisition cycle, the acquisition time by three-fourths,” Lyles said.

Gen. Lance W. Lord, Air Force Space Command

Air Force Space Command will eventually become US Strategic Command’s “one-stop shopping” center for space, missiles, and information warfare, said Gen. Lance W. Lord, AFSPC commander.

“It will take us awhile to get there, but it is a matter of building up trust and relationships based on a solid operational framework that people can depend on,” he said. Air Force Space Command has already begun to work with STRATCOM to develop unified command plan missions for AFSPC’s new functions: computer network attack and computer network defense.

Lord noted that information operations have mushroomed over the last 10 years. He said that, compared to the 1991 Gulf War, Operation Enduring Freedom consumed “10 times the bandwidth, [with] one-tenth the force involved.”

He admitted that it is “probably an unachievable goal” to eliminate bandwidth as a constraint on communications “because bandwidth gets consumed.”

He noted, “What we really need to do is make sure we’ve got good solid

operational frameworks and we do a little bandwidth appetite suppression from the end user in terms of our [concept of operations] and our requirements.”

He emphasized, “We need to focus on the requirements side ... to make sure that, if you come to the table and want theater downlink, ... you need to really have a good, solid operational reason and argument for why you want it.”

Lord said a theater commander should not tell AFSPC how many channels he wants or what he needs in terms of satellite capability. “If you can tell me the effect you want generated, ... we can generate that effect for you,” he explained.

The volatility of requirements, according to Lord, represents the greatest threat to space acquisition

programs under his control. He pledged to put his command to work making certain new projects aren’t overloaded.

“I think the biggest threat to any acquisition is an unstable baseline,” he asserted. “We are going to be the requirements police to make sure ... the folks who are having to build the systems can count on a stabilized program.”

Lord also spoke about personnel exchanges with the National Reconnaissance Office that will support Teet’s push for space program integration within the black and white worlds—the classified and open sectors of space. To further that effort, he said, Air Force Space Command and the Space and Missile Systems Center at Los Angeles AFB, Calif., have developed a new launch orga-

Of Air, Space, and Aerospace

In his keynote address to the AFA symposium, retired Gen. Michael E. Ryan, former Air Force Chief of Staff, closed ranks with his predecessor, Gen. Ronald R. Fogleman, and successor, Gen. John P. Jumper, on a long-simmering dispute: use of the terms “aerospace” and “air and space.”

In 1996, Fogleman, then Chief of Staff, recognized the rising importance of space when he noted that USAF was in the process of shifting from an “air and space” force to a “space and air” force. At the time, Fogleman said he could envision a future with a new, separate service solely devoted to space operations.

Ryan, as the next Chief, disagreed with Fogleman about the prospect of a separate service. He went so far as to rearrange the terminology, touting USAF as the “aerospace force.” Aerospace, he said, better described the “seamless operational medium” in which the service operates and would enhance the integration of air and space capabilities. With publication of a white paper on aerospace integration, a new acronym sprouted: TAF, for The Aerospace Force.

Next up: Jumper. Soon after taking over the top Air Force job in September 2001, Jumper opted to drop “aerospace” in favor of “air and space.”

In remarks to AFA’s Los Angeles symposium on Nov. 16, 2001, Jumper explained his rationale this way: “I carefully read the [2001] Space Commission report. I didn’t see one time in that report, in its many pages, where the term ‘aerospace’ was used. The reason is that it fails to give the proper respect to the culture and to the physical differences that abide between the physical environment of air and the physical environment of space.

“We need to make sure we respect those differences. I will talk about air and space. I will respect the fact that space is its own culture, that space has its own principles that have to be respected. When we talk about operating in different ways in air and space, we have to also pay great attention to combining the effects of air and space because in the combining of those effects, we will leverage this technology we have that creates the asymmetrical advantage for our commanders.”

The Space Commission had been headed by Donald H. Rumsfeld before he became Secretary of Defense. The commission also set the stage for USAF to become executive agent for all military space.

Ryan said Jumper’s terminology switch was an understandable move, adding, “I think he and everybody in this room believes the principal need here is that we integrate air and space capability for warfighting.”

nizational structure that will help not only on the white side of space but also on the classified side.

Lt. Gen. Brian A. Arnold, Space and Missile Systems Center

As the Air Force tackles the role of executive agent for military space, it must face many problems that have plagued space program management, according to Lt. Gen. Brian A. Arnold, the Space and Missile Systems Center commander.

“We are probably at the highest point of risk at any time in our launch business,” Arnold said, noting that the Air Force is in a transition phase where it is using up its older launch vehicles at the same time it is introducing a whole new generation of boosters. This situation requires the simultaneous use of old and new procedures to process satellites and boosters, but Arnold expects eventually to field a more efficient system.

He pointed to the recent 23 launch successes in a row, which he said is “the longest streak of successes that we’ve ever had in our launch business,” as a measure of the “focus and the vigilance” paid to launch.

Additionally, Arnold said, the Air Force is analyzing and fixing long-standing space program problems. He singled out the Total System Performance Responsibility concept as a particular failure in the way it was applied to space systems. TSPR essentially removed the layer of government oversight, placing total sys-



USAF photo by SrA. Christina M. Rumsey

If Air Force Space Command serves as the only USAF component to US Strategic Command, as suggested by former Chief of Staff Michael Ryan, it would task USAF bombers, such as this B-2.

tem integration responsibilities on the contractor. “We dove into it headfirst, without explaining it to our industry partners,” he said. “We paid dearly for that.”

The concept led to confusion between subcontractors and primes as to who really was responsible for what. While TSPR works fine in sustainment programs, it was a failure in development projects, said Arnold, adding, “We will not venture down that path again.”

He said the Air Force is focusing more investment and emphasis on systems engineering, as well. The goal

is to yield more measurable data at every step in a development program and to better achieve desired effects. System engineering “forecasts problems for us so we can be proactive instead of reactive,” said Arnold.

Moreover, the service is still refining lines of responsibility. One of the most significant changes already made gave a second job—program executive officer for space—to the commander of Space and Missile Systems Center. “We had split responsibilities,” said Arnold.

Under the old system, he said, “Everybody could say ‘no,’ but nobody could say ‘yes.’” That has changed, with program oversight now centralized in Arnold’s position.

Another initiative created the Defense Space Acquisition Board as a replacement for the Defense Acquisition Board when reviewing space systems. Teets is the presiding member of the space board.

“I report directly to Mr. Teets for milestone decision authority, and I report to Gen. Lance Lord for organize, train, and equip and all operational issues,” explained Arnold.

SMC is also reorganizing its financial management of space systems. There has been poor estimation of what systems would cost.

“One of the flaws we’ve had in the past,” observed Arnold, “is that we start a program off and we don’t know really what the cost is, and it kind of fluctuates, and we get in big problems, and we start to say this



USAF photo by SSgt. Jessica Kochman

Joint Direct Attack Munitions use GPS satellites to pinpoint targets. USAF wants to develop space control capabilities to ensure adversaries cannot block space use by US forces or use space resources against US forces.

SrA. Pratt Vivekanandan, an engineering journeyman from Malmstrom AFB, Mont., uses a GPS-enabled system to check elevation at a base in the Persian Gulf region.

USAF photo by TSgt. Deborah K. Alvarado



program is overrun.” He said a new “organic cost estimating capability will have high payoffs in the future.”

Arnold noted that he has empaneled an independent team of retired senior government officials to look over the entire space systems development and acquisition business. The group will “see if there is anything ... out there that I really need to pay attention to,” he said.

Albert E. Smith, Lockheed Martin

There is a perception that the space acquisition system is broken and can’t supply needed systems and capabilities in a well-managed way, said Albert E. Smith, executive vice president, Lockheed Martin Space Systems. He added, “I don’t agree with that premise.”

Smith argued that there is cause for optimism in the space industry. Space assets of today are performing brilliantly, he said, and have provided the US with “an asymmetrical advantage, a truly great one.”

However, he acknowledged, “It is ... no secret that there are a number of important space systems that have been plagued by cost growth and schedule disappointments.”

The current problems stem from the transition between legacy production to new systems. That transition encompasses approximately 80 percent of the national security space portfolio, said Smith. Historically, such periods of transition always are attended “by higher costs and schedule risks than production programs,” he explained.

Moreover, Smith noted, space programs have had to get by without management reserves—standby funds to cover unexpected costs and late-added requirements. The lack of reserves “does not recognize the realities of development,” he said. “It is a recipe for program stretches, with inherent increased cost.”

To a great extent, the industry has been a victim of its own success: Satellites are lasting longer than expected, thus reducing demand for new ones. “As satellites lived longer, there were fewer acquisition opportunities, competition increased, and competition became fierce price shootouts with competitors making overly optimistic, and certainly at times unrealistic, pricing assumptions,” said Smith.

He cited launch as operating today at an “especially acute” risk re-

turn level. He said that industry recommendations to a current Defense Science Board task force included funding assured access to space. “We put the whole national security space program at risk if we have an unhealthy business case for launch,” he said.

Another recommendation, said Smith, involved improving and sharing cost-modeling data to put the program budgeting process more on a should-cost basis—improving the ability to anticipate expenses. He also advocated adoption and implementation of a space industrial base policy to provide “stable rules of the road” to sustain industry health.

Commenting on the proposed space based radar, Smith said the name “implies a solution: Let’s do everything from space.” However, he said that applying an effects-based perspective produces a different solution. In his view, the decision about how and when to pursue such a system must await a national rationalization of the “right mix of ground, air-breathing, and space assets.”

Ronald D. Sugar, Northrop Grumman

Space systems are going through a tough time because they are more complex than ever, and there is a need to take risks to deliver more dramatic returns on investment, according to Ronald D. Sugar, president and chief operating officer, Northrop Grumman.

“Over the last five to 10 years, getting these systems built has become even harder,” Sugar said. “The process of getting them built is incredibly complex and frankly is getting more so.”

The cost overruns and delays are the natural by-product “in almost any ambitious space program,” he continued. “That is the nature of the game, and if we didn’t take on these challenges, this nation would not be pre-eminent in war.”

Typically, the most problem-free space programs are those that are direct evolutionary extensions of existing systems, said Sugar. The primary reason: The operators know how to use them and know what they want and expect from them.

“Unfortunately, we can’t progress into the future by simply and always extending existing systems,” he said. “At some point, you have to take

new systems and go through new developments.”

In the drive to produce the low bid, space contractors have been forced to “do a lot of corner cutting,” which has hurt the nation’s space industrial base in the long run, he said. The effort to do space programs “better, faster, cheaper” has usually meant choosing two of the three, Sugar added.

There should be some kind of incentive for contractors to “reveal and fix problems early,” he said.

The Defense Department also needs to constrain the appetite of users who want to constantly add requirements, destroying a steady program baseline that can be properly managed.

“It is very difficult for acquisition executives and, frankly, contractors to say ‘no’ to warfighters who have legitimate reasons to want to put requirements into systems,” said Sugar. However, shifting requirements throw cost and schedule into a tailspin. He also said that unstable funding from Congress causes its own delays and extra expenses.

Getting the requirements process under control would have “enormous leverage on any new system,” said Sugar. He advocated creating a requirements czar to decide between the truly essential requirements and unnecessary add-ons.

Sugar also commented that, during the general drawdown over the last five to 10 years, the number of experienced, qualified program managers and system engineers has “dramatically been reduced.” Government and industry have “a lot of great folks,” he said, adding, “We just need more of them.”

George K. Muellner, Boeing Integrated Defense Systems

The shortage of qualified technical people is an increasing worry for the health of the space industrial base, according to George K. Muellner, a retired Air Force lieutenant general and now a senior vice president for Boeing.

“We find ourselves actually having to move people off of programs, on to new programs, a lot sooner than we would like in many cases, because they are carrying most of the experience,” said Muellner.

“We need to broaden that capability, ... improve that talent base,” he

emphasized, adding, “We’ve got a lot of work to do there.”

He also criticized “requirements creep” and noted that it is the “nemesis of a good, stable program.”

There is almost no willingness to “push back on our customer when they come in and ask for something,” Muellner noted. He encouraged industry people to be brave enough to explain what it will really cost to add requirements that are marginally important and will radically affect cost and schedule.

Muellner also chastised the Air Force for the TSPR debacle, agreeing with Arnold’s assessment.

The government can’t “abandon its role in the process,” said Muellner. “I think that is a key thing that happened here. The government side really tried to walk away. And in some cases, it decimated the very workforce that was capable of providing that off-site, and in some cases adult, supervision that was necessary.”

Muellner criticized industry for being too willing to answer requirements with systems that perpetuate “stovepipes” within the military and challenged his colleagues to move toward the Air Force’s goal of “horizontal integration” of information systems.

“We need to exploit the advantages that information technologies give us to produce more interoperable systems,” he said. “We really need to make our systems network capable from the beginning. We need

to make sure that is part of an acquisition process that in many cases creates these ‘tribal’ boundaries.”

Muellner urged more aggressive work to find a rapid launch system.

“I don’t think we’re ever going to get to that five-minute alert status, although there are some that have solutions in that area,” he said. “We really have to improve over what we’ve got right now, which is neither assured in many cases, nor responsive enough to the warfighter.”

Finally, Muellner advocated a closer working relationship between the Air Force and its industry partners in space.

“What I don’t see is a process of industry and government working together,” he said. “In fact, I don’t even see government working together.” For instance, he said that to achieve success in developing a reusable launch vehicle system, “we all need to get together in the same room” to ensure industry is “maturing the right technologies and that we are pulling these together into operational concepts that are significant to the warfighter.”

There are “a lot of efforts to start up concepts in this area,” Muellner said, “but to me it almost looks like we are resurrecting NASP [National Aerospace Plane].” He added, “After about three years of struggling with the concept, we are going to find out that the long-pole technologies are still not mature enough to go forward.” ■



NASA photo

Orbital Sciences uses its X-34 to demonstrate technologies that may migrate to low-cost reusable launch vehicles. USAF and industry leaders cite the need for assured, lower cost access to space.