

DOD's new space strategy addresses a realm where all the trends are negative.

Five Roads to Space Dominance

By Robert S. Dudley

Gen. William L. Shelton worries a lot these days about US vulnerability in space. "It's difficult to defend," said the head of Air Force Space Command. He once calculated the size of his theater—the void between Earth's surface and the geosynchronous orbit belt. It worked out to 73 trillion cubic miles.

"How," he asks, "do you protect 73 trillion cubic miles?"

Space, while vast, is also a crowded and dangerous place, teeming with problems. Once, it was dominated by two superpowers; now, nearly 60 nations and dozens of companies operate 1,100 spacecraft up there. The US also tracks 21,000 pieces of lethal, fast-flying "space junk," and that's a fraction of the total. Nations—from Iran to Cuba, from Ethiopia to Libya—can and often do jam satellite links.

Worse, all trends are negative. Officials forecast a tripling of space debris



Left: A Space Based Infrared System satellite is launched aboard an Atlas rocket from Cape Canaveral, Fla. Above: Capt. John Hough (l) sets up satellite communication equipment for a night mission during an exercise. Defense officials are nervous about what they see when they peer into the future of space-based capabilities.

by 2030. In 2015, roughly 9,000 space-based transponders will be drenching a limited radio-frequency spectrum. There will be kinetic “ASAT”—anti-satellite weapons—plus microwave, laser, and cyber weapons. “It may be a pretty tough neighborhood,” warned Shelton. To top it off, the US space industry is sagging.

When USAF, Pentagon, and intelligence officials peer into the future, they don’t like what they see—near-existential threats for a nation whose military power hinges on space-based surveillance, reconnaissance, navigation, communications, and weather systems.

That prompted creation of the National Security Space Strategy, unveiled in February. It directs major changes in how the US handles space problems. The 14-page document gives a high-level view of US space goals and lays out five key “approaches” for sustaining US space power over the next decade.

Since the paper’s release, more details have emerged from the speeches, interviews, and testimony of several top officials. These include Shelton; William J. Lynn III, deputy secretary of defense; Gen. James E. Cartwright, the vice chairman of the Joint Chiefs of Staff; Gen. C. Robert Kehler, head of US Strategic Command; and Gregory L. Schulte, the Pentagon’s senior official for space policy, to name a few.

These viewpoints help fill out the strategy’s five key approaches, which range from “soft power” endeavors to the hardest of hard-power military options.

One: Create Rules of the Road

If the space strategy’s own words are any guide, Washington will emphasize diplomacy to generate multilateral “transparency,” “confidence building measures,” and the like.

The US would encourage other space operators to share spaceflight data, develop space object databases, set global data standards, and warn of space object collisions.

This, it is said, will produce new “norms of behavior” in space, yielding more stability and less selfish behavior by space operators. The specific goals: greater spaceflight safety, less unintentional signals interference,

more-efficient use of crowded orbit slots, less mistrust, and fewer debris clouds.

Who will develop the rules of the road for spacefarers?

Not the US, evidently. Lynn, the Pentagon’s second-ranking official, has on several occasions declared the US is taking a hard and close look at adopting the European Union’s Code of Conduct for Outer Space Activities, now in draft form.

On June 13, the Administration went further. Frank Rose, a deputy assistant secretary of state, said the US would soon decide whether to enter negotiations with the EU on US participation in the code.

That is not a universal view. A group of 37 Republican senators, led by Sen. Jon Kyl (R-Ariz.), demand to know the Obama Administration’s intentions with respect to the code. Their Feb. 2 letter says they are “deeply concerned” that it could be “highly damaging” to sensitive US space programs.

Critics note the code enjoins signatories to “refrain from the intentional destruction of any on-orbit space object or other activities which may generate long-lived space debris.” Nowhere does that passage exempt legitimate cases of self-defense, they point out.



An artist's conception of a satellite being damaged by "space junk." Currently, the US tracks 21,000 pieces of potentially dangerous, fast-flying space debris—and that's just a fraction of what's up there.

Jeff Kueter, president of the George C. Marshall Institute, warned: "If the code is approved by the United States, it is difficult to foresee the United States initiating a kinetic kill or other ASAT program."

Though the code would not have legal force, it can exert de facto influence on US space programs, say the critics.

One who worries about these types of pressures is retired USAF Gen. Bruce A. Carlson, head of the National Reconnaissance Office. He says Washington officials, when asked to take action to protect US space assets, often answer: "Oh, no, can't do that. That would be provocative, or it would be escalatory."

The pursuit of global rules, and especially the EU code, may also open the door to another problem: space arms control.

The US space strategy flatly states: "We will consider proposals and concepts for arms control measures." It adds that agreements must be "equitable, effectively verifiable, and enhance the national security of the United States and its allies."

For decades, presidents and congresses have turned thumbs down on the idea of space arms control, seeing it as a snare that could needlessly encumber a key US advantage.

That danger has not gone away. Russia and China have proposed a comprehensive ban on space weapons. The US rejects it, but some worry Washington, by declaring its openness to space accords, could be dragged into a public debate, with damaging diplomatic results.

Not all of the NSSS safety proposals are controversial. Example: The Pentagon wants US Strategic Command to provide more space situational awareness data to allies and US companies.

STRATCOM, which tracks debris clouds and the course of satellites, has become the world's premier provider of collision warning. It has forged agreements with 19 launch providers and satellite owners.

Shelton, speaking in April at the National Space Symposium in Colorado Springs, Colo., voiced support for steps that help to define and encourage good behavior in space, particularly with respect to the generation of space debris.

"You can't do much with what's there already," he said, "but you certainly can do a lot about minimizing what's going to be there in the future."

Two: Strengthen US Capabilities

Equally important to the strategy: Pentagon plans to acquire improved types of space capabilities, produced in better ways.

The US looks to turn decisively away from practices common in the Cold War and early post-Cold War years. Then, the military built massive spacecraft, often ascribing multiple missions to a single orbital vehicle.

As Lynn observed, "We chose not to let cost restrict our ambitions." This tended to result in a few exquisite spacecraft, at very high expense, frequently delivered years behind schedule.

Today, according to Shelton, that's history. Relying on a few vulnerable

systems has become too dangerous. USAF, he said, will seek spacecraft with "adequate" capability but at lower cost and with—especially—greater "passive resilience."

To Shelton, the key would be a "fault-tolerant" design, meaning one in which single-point failure does not bring down an entire constellation. Ideas include higher orbits, more numerous spacecraft, the distribution of mission systems over linked satellites, and on-orbit spares.

"We can't tolerate loss of mission critical capability," said Shelton.

Others see a crying need for systems flexible enough to meet emerging requirements through rapid infusions of new technologies. The JCS vice chairman, Cartwright, bluntly asserted that new platforms should be designed with lives of no more than 10 years and be produced in larger numbers.

"I don't need the 30-year platform," he said. "I need an 18-month change cycle [for satellites], to be able to adapt these things to what's really facing us on the battlefield."

Carlson, for his part, rejects the notion that launching a few more, smaller satellites adds to security in space. He asked, "Do you think that somebody that's got ASATs, microwave weapons, and lasers is going to worry about whether you have two or five satellites?" Still, his appears to be a minority view.

Plans also call for improvements in launch. The problem is not performance; Space Command has reeled off 76 straight launch successes with the Evolved Expendable Launch Vehicle (EELV) program, using Atlas V and Delta IV boosters. "Unfortunately," explained Shelton, "the costs are going through the roof."

One problem: EELV's second- and third-tier suppliers have difficulty finding parts, pushing up prices. The situation has been aggravated by small, inefficient purchases.

Now, the Pentagon is pushing Congress to approve regular, block EELV purchases, the better to allow contractors to plan ahead and gain economies of scale.

Once, USAF bought single boosters to match up with planned launches of completed payloads. Now, says Secretary of the Air Force Michael B. Donley, USAF has "decoupled" the launcher from any specific payload.

"We can buy the launchers on a more routine basis," said Donley, "and wait longer to make decisions about

which payloads get married to which launchers.”

US officials hope that these steps and others serve one of the strategy’s key objectives: revival of a struggling US space industrial base. It notes that DOD needs a “robust, competitive, flexible, healthy” space industry, one that delivers spacecraft “on time and on budget.”

Today, that definition does not apply. US industry’s share of global space commerce has dropped, in just 10 years, from some 70 percent to about 30 percent.

Air Force programs have been plagued by cost overruns and delays. Failure was epitomized by USAF’s planned transformational satellite communications system, canceled in 2009 after expenditure of \$3 billion.

USAF has proposed a solution it calls “Evolutionary Acquisition for Space Efficiency” or EASE. Principal elements are block buys, fixed-price contracts on mature systems, and a stable engineering line for technology insertion on a regular cycle.

Equally important is the strategy’s push to transform and liberalize US space export policy. “Our system of export control is so prohibitive that it has actually become a selling point for non-US manufacturers,” Lynn observes.

ITAR, the Cold War-era International Traffic in Arms Regulation, is a confused and confusing setup that often needlessly undercuts US sales abroad. The Pentagon wants to streamline and rationalize the process.

Kehler, the commander of US Strategic Command (and former commander of Air Force Space Command), noted that ITAR was meant to protect US security. He warned, “There is a danger here that export controls ... can in fact create the opposite situation, ... where our industry is no longer competitive.”

Three: Create New Partnerships

Nowhere is the strategy’s departure from American space tradition clearer than in its push for US participation in space coalitions and other combinations.

Until now, the US has been pretty much a lone wolf in space, acting by itself or, at best, with a very few close allies. Now, the strategy calls for partnerships with “responsible nations,” “international organizations,” and “commercial firms,” all of which have acquired significant space expertise.

The US would provide access to its space systems. The payoff: reliance on others’ space systems to boost US capabilities and contain its costs while reducing America’s own vulnerabilities.

This is already happening. Example: The US has initiated an effort to change STRATCOM’s USAF-led Joint Space Operations Center at Vandenberg AFB, Calif., into a combined space operations center featuring foreign partners.

“Ultimately, the USSTRATCOM commander will become a coalition commander, just like his counterparts ... at Central and Pacific Commands,” said Schulte.

Kehler, for one, is a big supporter. “We need to build a culture of information

sharing,” said the STRATCOM boss. “There is no way a global command ... can be successful if we limit information sharing. ... We should share information to the point of being uncomfortable.”

To that statement, Cartwright offers unqualified support.

“We are now in the era of coalitions,” he said. “We don’t fight as a country anymore, as a single entity. We are always part of a coalition.”

This effort will entail unprecedented, perhaps painful, change in the handling of classified information, Cartwright warned. “I say to him [a coalition warrior], ‘You watch my flank, but I can’t tell you what’s coming over there, because it’s a secret.’ ... It’s just crazy. You can’t do that.”

Partnerships are possible in mission areas such as communications, environmental monitoring, maritime surveillance, and even missile warning. In store is the exchange of data, services, personnel, operations, and technologies.

Already, Australia has put up money to buy one “ball” in the Pentagon’s six-ball Wideband Global SATCOM constellation, meaning it will be allowed to share in use of the system. USAF has begun negotiations with other allies to do the same thing.

Elsewhere, Secretary of Defense Robert M. Gates has signed groundbreaking statements of principles with three nations—Australia, Canada, and France—for expanding sharing of space situational awareness data. Missile warning data is provided to friends and allies via USAF’s Shared Early Warning System program.

Commercial entities, too, would have a place in the new order. Shelton said the Air Force is giving strong consideration to military payloads hosted on commercial satellites, single-mission small satellites, and military-commercial partnerships in some areas.

For example, the satellite firm Iridium has promoted “hosted payloads,” essentially leasing space on its satellites to customers that include US agencies. Washington also buys Radarsat imagery from a Canadian firm and X Band and UHF Band communications from a British firm.

The coalitions and partnerships, though useful in time of peace, are pointed specifically toward what the strategy paper calls “collaborative sharing of space capabilities in crisis and conflict.” This requirement has led



Gen. Robert Kehler (l), then head of Air Force Space Command and now STRATCOM commander, and Brig. Gen. Trulan Eyre, 140th Wing commander, step to their aircraft. Kehler feels STRATCOM must build a culture of information-sharing between allies.



An artist's conception of "space mines." The space strategy says the US must retain the option to respond in self-defense to attacks on our assets in space.

to calls for creation of combined space doctrine, procedures, and training.

The shift is not without problems. Kehler noted that there are "significant questions" about how best to balance the need to limit access to information with the need to share information, both being vital to national security.

Lynn noted there will probably be core capabilities at "the very high end" that the US will always hold to itself.

Some space officials fret that space partnerships will inevitably expand to bring into the tent more and more nations that are merely US friends or acquaintances, rather than true committed allies, posing concerns about reliability.

That complaint cuts no ice with Cartwright.

"Everybody worries, 'Gee, if I partner with somebody, will they, at some selected time, turn their share of the system off or shut it all down?'" said Cartwright. "I mean, at some point, you have to trust, and you have to put things together."

All signs are this will be a slow and deliberate process. Still, said Cartwright, this nation's fiscal woes have pushed the proverbial horse out of the barn.

"We right now may still want to believe we're going to go it alone," he said. "It's not affordable. We can't do it for all of the things that we expect

as a nation to get from space. We need to start partnering."

Four: Bolster Deterrence

In the new strategy, a critical initiative calls for forging a tougher framework to deter any malefactor from initiating an attack in space.

The threat is real: According to Lynn, some nations have jammed satellites. China and Russia have destroyed satellites in low Earth orbit. Others have technologies such as laser weapons that can disable or damage space platforms.

Worse, some foes might well view space attacks against US targets as low risk in nature, as there would be no visible death and destruction to fire up public calls for retaliation.

The new deterrent structure is four-layered. According to Schulte, each of the first three "approaches" contribute: Global norms establish red lines of behavior. Spacecraft "resilience" increases an attacker's problems. Space coalitions force an enemy to ponder the danger of an attack on many nations, not just one.

These steps alone, however, are deemed insufficient to stop a determined aggressor. For that, explained Schulte, the strategy has a fourth layer: "We retain the option ... to respond in self-defense to attacks on space."

The US has a known capability to shoot down spacecraft. However, few

believe any US response would take the form of tit-for-tat retaliation against a foe's space forces. War in space would create huge amounts of dangerous debris. It could draw in other nations. It would also invite wider attacks on US systems.

"We also need to think differently about deterrence," said Schulte. "We must not assume that attacks in space can or should be deterred by the threat of retaliation in space."

Fortunately, the Defense Department has other options.

Cartwright put it in these words: "It [a threat of response] doesn't mean that you have to respond *in space*, number one. Number two, all of space is not *in space*. There's a large amount of it that is part of the terrestrial systems. ... Those are vulnerable areas."

Further, deterrence comes in different flavors. "There's an in-kind deterrence, which is what space-type deterrence is ... about," he said. "And then there's a broader deterrent strategy, which allows all of the mediums to be part of the coherent strategy."

Translation: Any serious attack on US space-based systems could well attract a harsh US response by air, sea, or land, and at any point on the globe. Indeed, this kind of threat appears more credible than the one narrowly focused on space.

"We retain the right to respond in however we would choose to—whatever we would choose to be the appropriate means," warned Lynn.

"The basic concept of deterrence has not changed," said Kehler. "Mostly, it has to do with uncertainty, if an adversary believes ... the uncertainty too high, or the risk of punishment is too high."

He goes on, "Deterrence is very much operative when it comes to space. I think options are always on the table."

Experts consider it highly improbable that any foe would attempt an attack in space as an end in itself. Rather, it would be a precondition for some larger goal—a conventional attack, say, or an attempt to cow a US ally. Given this fact, say these analysts, the biggest deterrent comes from demonstrating that, even after the loss of some important space assets, the US would still be strong enough to prevail in combat.

Five: Prepare to Win, Period

The strategy's final "approach" can be summarized thus: The United States must prepare itself to absorb a severe attack on its space systems, operate effectively in a degraded environment, and still prevail in combat.



“We must deny and defeat an adversary’s ability to achieve its objectives,” even without a fully functioning space network, asserts the strategy paper. This is a tall order.

One of the simplest and least-expensive tools entails regular training of troops and officials to prepare them for the rigors of operating in such an environment. Lynn said the armed services and government agencies now are holding so-called “day without space” exercises, simulating the loss of certain capabilities.

The objective is to develop workarounds, and troops are slowly learning how to “fight through” impediments.

These preparations, says the strategy, must extend to the people relying on space information, operating space systems, and analyzing space-derived information.

The strategy enjoins space leaders to come up with cost-effective ways to provide some protection for space systems. This may entail hardening of satellites against electronic attack, but the publicly released document, which is unclassified, does not give specifics.

As for land-based space infrastructure, Shelton reported, “We are always looking carefully at our ground stations, trying to determine how vulnerable they are, both to physical attack and cyber attack.” The space commander said, “We’ve taken some steps”—no details provided—“to make them less vulnerable.”

He did say, “I worry more about physical attacks at this point than I do cyber attacks.”

The Pentagon is considering a wide-range of so-called “cross-domain” solutions to compensate for vital space assets. The term refers to mission-effective air, land, sea, or even space alternatives.

The US might seek a significant increase the number of reconnaissance aircraft and terrestrial communication platforms as substitutes for space-based systems.

Already, say Pentagon officials, the US has moved to back up some of its space capabilities with high-flying unmanned aerial vehicles such as Global Hawk. “Space problems do not always require a space solution,” said Schulte.

In many cases, the US will develop multiple ways to do the same job. Take, for example, the Global Positioning System, which delivers position information vital to precision attack. The Pentagon may want to rely on a combination of on-orbit spares, interoperability with Europe’s own Galileo satellite system, and a number of land- or air-based backup systems.

One widely discussed option is the Pentagon’s high-profile Operationally Responsive Space effort. The idea is to develop means to rapidly replace certain critical space systems or provide different types of satellites to meet emerging needs.

Left: Vladimir Putin, then Russia’s president, holds a model of a Soyuz booster rocket after a successful launch of a military satellite in 2004. Above: A Long March rocket launches a satellite from southwestern China. Nearly 60 nations now operate spacecraft.

The ORS office is a four-year-old, joint project based at Kirtland AFB, N.M. It seeks faster, cheaper ways to get space assets on orbit to meet current military needs. Director Peter M. Wegner has declared his intent to make ORS “the focal point” for finding ways “to respond rapidly in a crisis.”

Plans called for launching ORS-1, the project’s first purpose-built satellite, in 2011.

Shelton sees value in the ORS project but says “the jury’s out” on the question of whether it will ease the dangers of space attrition.

“Let’s say somebody manages to knock out my satellite,” explained Shelton. “I’ve got one in ready reserve, and I’m going to launch it. Unless I’ve dealt with what knocked the first one out, I’m just launching into that same environment. That doesn’t make a lot of sense to me.”

Moreover, Shelton has doubts about spending scarce dollars to put into satellites in reserve on the ground. “I think there is still a lot of debate to come on ORS,” he said. “On the overall concept, I think we’re still going to have some debates.” ■

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