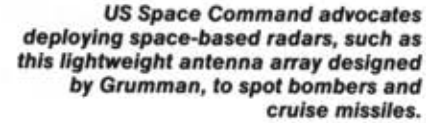
The US cannot see what the Soviets have up in critical sectors of deep space. Now that the USSR has spacelaunch capability from its mobile ICBMs and is about to begin shuttle flights, the problem is becoming worse.

Our Blind Spots in Space



US Space Command advocates deploying space-based radars, such as this lightweight antenna array designed by Grumman, to spot bombers and cruise missiles.

BY JAMES W. CANAN, SENIOR EDITOR

For US space-watching sentries, the Soviet Space Shuttle soon to be flying has sinister implications. From low-earth orbit, it will be capable of launching satellites into deep space on the sly.

The ground-based US space surveillance and tracking system would be hard pressed to detect such surreptitiously launched satellites or identify their payloads, and this is much on the mind of Air Force Gen. John L. Piotrowski, Commander in Chief of US Space Command and Commander in Chief of North American Aerospace Defense Command.

"There is a critical void," he explains, "in our ability to observe deep space over one part of the world. This gap in coverage will become even more critical when the Soviets begin operating their Shuttle.

"If they fly it in a high inclination—say, sixty or seventy degrees to the equator—we will have no ability to see anything that it launches as it goes over the Antarctic and up over the Indian Ocean. With the right kind of technology, the Soviets could place satellites in geosynchronous orbit that we would never know about. They could fill up deep space with things we never knew existed."

So the US must deploy more and better deep-space sensors on land or in space itself, General Piotrowski claims.

He conveys this message just as space takes on greater meaning as a military realm for both superpowers.

The US Strategic Defense Initiative program for defense against ballistic missiles is oriented to space weaponry and to satellites for surveillance and command control and communications. Now Soviet General Secretary Mikhail Gorbachev has conceded that the Soviets, as the Pentagon had long contended, are working on an SDI-type system of their own.

This makes it increasingly urgent for the US to know at all times what is out there in space and for what purpose.

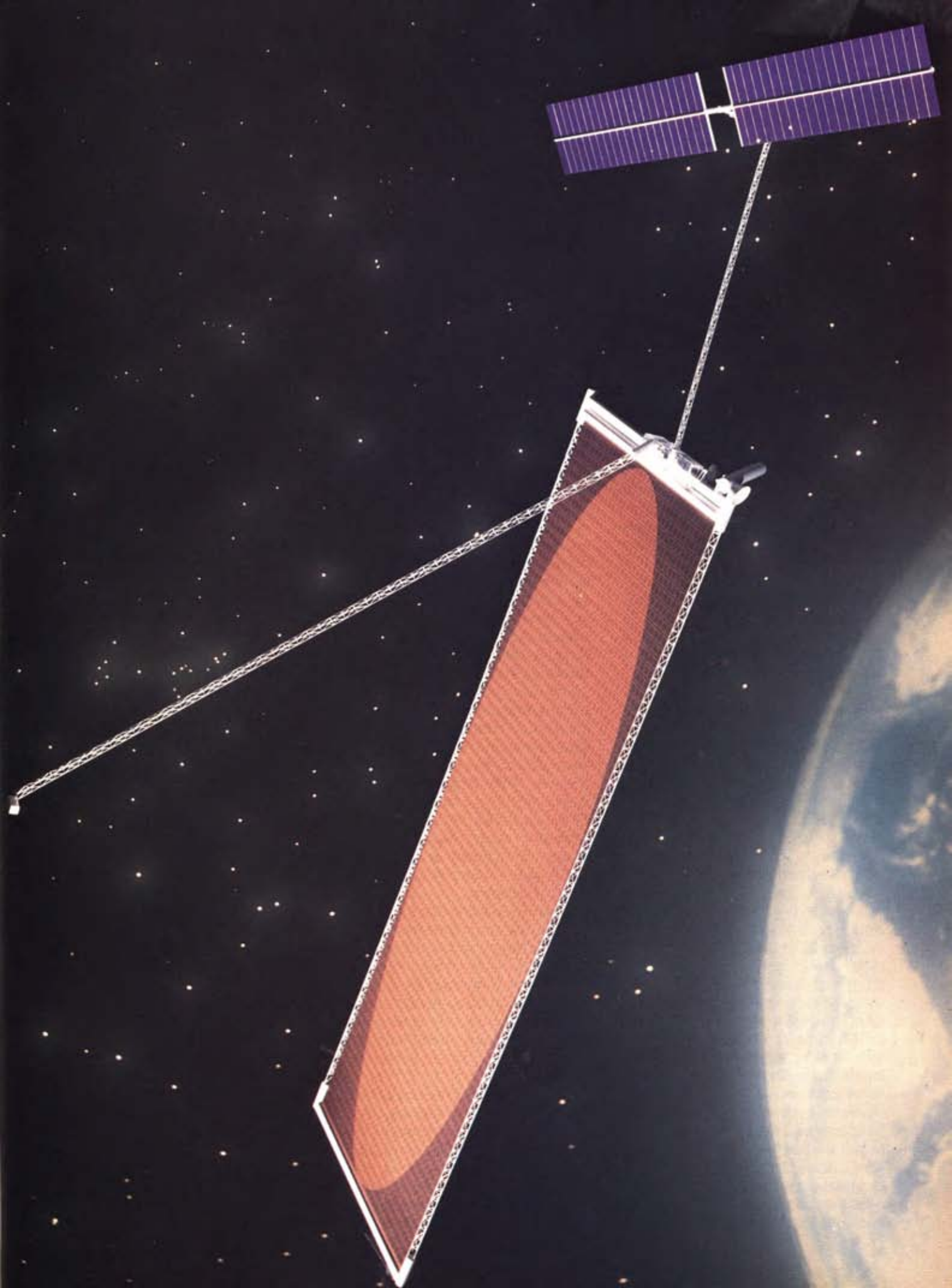
Such knowledge has always been imperative. The USSR, like the US, depends more and more on satellites of all varieties—those for communications, navigation, surveillance, reconnaissance, and early warning—to enable air, sea, and land forces to fight with maximum efficiency and firepower.

Moreover, the Soviet Union, unlike the United States, has had operational antisatellite weapons—in the form of hunter-killer satellites—for many years.

Late last year, as the US and the USSR moved to draw down their nuclear missile forces, it came to light that the threat to the US in space may be even greater than formerly imagined. The Soviet Union is apparently capable of launching satellites—possibly including ASAT satellites—atop its covertly mobile SS-20 and SS-25 ballistic missile boosters.

Caspar W. Weinberger went public with this information before a Washington audience only a few days after having resigned as Secretary of Defense.

The Soviets, he said, "have developed mobile ICBMs with a very clear potential for spacelaunch." Given the Soviets' great emphasis on military space operations and on being able to launch satellites rapidly and profusely, "it would be



foolish," Mr. Weinberger said, "not to assume that they have a covert, mobile spacelaunch capability."

On that same occasion, Air Force Lt. Gen. Leonard H. Perroots, Director of the Defense Intelligence Agency, said that the Soviets could launch a spaceplane, the likes of which they have tested a dozen times in space as a subscale model, aboard their newly operational SL-16 medium-lift rocket booster.

These revelations exacerbate the concerns about US space surveillance capability expressed by General Piotrowski. His concerns extend to looking down from space as well.

In the General's opinion, the US should deploy radars in space to scan the sky below for the increasingly threatening "low flyers"—Soviet Bear and Backfire bombers now in operation and Blackjack bombers in the offing that could attack North America and US warships at sea with long-range cruise missiles.

US Over-the-Horizon Backscatter (OTH-B) radars are expected to be able to catch sight of bombers and cruise missiles out to 1,800 miles. Airborne Warning and Control System (AWACS) aircraft would also do this job, but at much shorter ranges and with questionable capability for collaring relatively small cruise missiles in their radars. The Navy has worked up a multilayered set of surveillance systems and defensive aircraft and missile systems to protect its carrier battle groups.

Help Needed

These systems are worthwhile and necessary, but all need help from space-based radars, General Piotrowski claims, saying: "OTH radar can only tell you that something is out there. We'd still have to fly out a thousand miles to find out what it is and if it's hostile. That's a lot different from having detected it and watched it from space and knowing that it's hostile-by-origin.

"We'd know it was a Bear, for example, because it took off from a Bear base and has Bear characteristics. If the bombers were numerous, we'd know it long before OTH radar picked them up, and we'd have plenty of time to tell the Soviets that we know they're coming and that we'll take action unless they're turned around."

Space-based radars could serve the Navy, which has become extremely wary of air-launched missile attacks against warships, as in the Persian Gulf, in the same long-range fashion and would alert battle groups to movements of enemy ships too.

General Piotrowski's advocacy of space-based radars (SBRs) apparently runs against the tide. It comes at a time when their prospective cost has caused the Air Force to put their development on hold. He insists that those costs would be reasonable and worth paying, however, and he will continue to make the case for the SBRs. He will also press for different ways of doing things in space—all in keeping with his view that US Space Command must fulfill its obligations and exercise its operational prerogatives if it is to come of age as a full-fledged warfighting command.

General Piotrowski took command of US Space Command a year ago, five months after its second anniversary. He praises his predecessor, Air Force Gen. Robert T. Herres, now Vice Chairman of the Joint Chiefs of Staff, for having done "a terrific job" of organizing the command and getting it rolling. This involved meshing Air Force Space Command, now in its fifth year and commanded by Lt. Gen. Donald Kutyna, with Naval Space Command, which includes the Marine Corps and is in its fourth year, and with the Army Space Agency, which was formed in August 1986 and is soon to be renamed Army Space Command.

What US Space Command must now do is "demonstrate our intellectual and operational maturity," its commander says. How? "By coming up with sound requirements for operational systems to do our missions and by arguing convincingly for getting them. Just flailing our arms and banging on tables isn't going to do it."

He believes that making his command fully capable of doing all that it is supposed to do—broadly, operating military satellites, seeing to space surveillance, tending to the early warning system in concert with NORAD, and planning for operational ballistic missile defense—will entail big changes in the structure, readiness, and sustainability of US space forces and resources.

In his mind, such changes come under the heading of "normalizing US military space operations," and this means, for openers, giving US Space Command the same authority over its systems and operations that Strategic Air Command, Tactical Air Command, and all other combat commands in all the services have over theirs.

He is pushing for his command to be put in charge of launching all operational military satellites, an exercise that is now carried out in the main by Air Force Systems Command's Space Division, their developer and producer.

"Space Control"

He also believes that the US must:

- Make much better use of its launchpads at Cape Canaveral, Fla., and at Vandenberg AFB, Calif., in order to be able to launch satellites on shorter notice and, if necessary, in profusion, much as the Soviets have shown that they can do.
- Deploy greater numbers of satellites as on-orbit spares to take over if those in operation fail or are destroyed.
- Build up and maintain "war reserve" stocks of spare satellites on earth.
- Complete the testing and get cracking on the production and deployment of fighter-launched ASAT missiles to protect US satellites against attackers in space and to destroy enemy satellites that abet attacks on US air, land, and sea forces.

All such requirements are germane to US Space Command's ability to do its job of "space control," which its leader defines as "similar to sea control" in "ensuring that hostile forces can't prevent our access to space and our use of space."

"The exercise of space control is US Space Command's warfighting responsibility," General Piotrowski asserts. And so is the command's stewardship of its space systems in support of the other US warfighting commands.

It all begins with surveillance. "Before we can undertake operations in space, we must be able to

see and evaluate all activity in that medium," General Piotrowski declares. And this is precisely why he is in pursuit of new land-based or space-based sensors, to sweep the sky above for Soviet satellites in deep-space sectors not presently fathomable.

To him, though, it is even more urgent that the US deploy radars in space to look down and all around for Soviet bombers bearing cruise missiles bent on savaging the US fleet or such US mainland targets as strategic command control and communications centers.

He has come out strongly for such radars in several forums in recent months, including an Air Force Association symposium last October in Los Angeles, Calif. On that occasion, Air Force Secretary Edward C. Aldridge, Jr., who preceded him at the podium, had bad news.

Taking note of the defense budget drawdown, Secretary Aldridge declared that "the country cannot afford a space-based radar now."

He continued: "I've ridden the space-based radar white horse for five or six years, and I'm probably the strongest advocate [for it] in the Department of Defense. We will continue to study it, because it will have application sometime in the future, when and if we can afford it. But right now, it is delegated to a lower priority. It is not in the cards for another several years."

In an interview following the symposium, General Piotrowski said that he and the Secretary had no quarrel about the operational value of space-based radar. He made it clear, however, that he was approaching the matter from the standpoint of US Space Command's operational requirements and that these could very well necessitate overriding the fiscal constraints that Secretary Aldridge had addressed.

A great deal may depend on analyses of space-based radar now under way. Last July, Space Division awarded contracts of $1 million apiece to General Electric, Grumman, Lockheed, Martin Marietta, and TRW to size up the state of the art in such radars and to determine just what they would be capable of doing and of withstanding while in orbit.

To clinch his case for space-based radars, those studies will have to show, says General Piotrowski, that the radars will be capable of picking out their low-flying targets amid ground-clutter return signals and that they will also be "relatively jam-resistant."

"I think the technologies for doing all that are in hand and can be demonstrated," he asserts. "I also think that the space-based systems would be much more survivable than ground-based [radar] systems. Constellations of space-based radars would do surveillance of air-breathing threats and maritime threats much better than anything else we have now or will have in the foreseeable future."

Protective Panoply

At the same time, land-based radars and AWACS aircraft will always have a place in the protective panoply of surveillance systems, General Piotrowski says, and would be needed to complement and confirm the sightings of the SBRs.

Should the SBRs surmount the fiscal resistance to them, the Air Force would develop and build the satellites, and the Navy would do the same with the terrestrial terminals. In his efforts to persuade the powers-that-be to approve the radars, General Piotrowski is counting on strong support from theater and fleet commanders in chief and on the greater leverage that such CINCs, including himself, have been given in the defense acquisition process.

"I can see all the CINCs favoring space-based radar to give them a clearer picture, a god's-eye view, of the threats," he says. "Over-the-Horizon radar is primarily a North American surveillance system. Space-based radars would serve all the theater and fleet commands. The system would be an AWACS, in effect, everywhere they wanted it to be. In deploying their forces, they would have instant knowledge at all times of what the Soviet air picture was."

What about the price tag? "It would be an expensive program, but not much more expensive, in terms of constant dollars, than the AWACS program. It would cost between $5 billion and $10 billion to put up a constellation of space-based radars that would give us global coverage."

An SBR constellation would comprise as many as nine satellites, or as few as three, in orbits up to 1,000 miles from earth. Ideally, each satellite would be designed to survive attacks from Soviet co-orbital and direct-ascent ASAT satellites by means of shielding and/or maneuvering and from Soviet laser weapons—although this might be much more difficult to achieve.

Soviet land-based lasers at Sary Shagan have been tested and are said to be capable of damaging the structures of satellites up to 300 nautical miles and the power-generating solar panels of satellites up to 1,500 miles.

Soviet lasers can also blind the electro-optical systems of satellites in deep space, including those in geosynchronous orbits where US early warning satellites and communications satellites are stationed.

The possibility that the Soviets may covertly deploy weaponry satellites in space greatly concerns US Space Command. This would daunt its space surveillance network, which is charged with detecting, identifying, and tracking all man-made objects in near-earth orbits and in deep-space orbits—those beyond 15,000 nautical miles. The command relies on this network to keep US satellites from colliding with any of the nearly 6,000 objects now in space, to warn of satellite attacks, and to determine the payloads of "unknown or unfriendly" orbiters.

Spot-Checking in Space

Perhaps contrary to popular belief, the US space surveillance network of ground-based radars and electro-optical sensors does not constantly keep track of all satellites in space. Instead, it spot-checks them, using what is called a "predictive" technique.

The sensors search limited sectors of space to confirm, at any given time, that certain satellites are orbiting through those areas in keeping with computer predictions that they will indeed be doing so. If they are detected, data on their positioning is fed back into a computer, which then updates its mathematical calculations of the satellites' orbital parameters. If they are not detected, which happens, the search pattern is adjusted to try to

catch them the next time around or in some other sector of the sky.

This technique applies in the main to satellites in near-earth orbits—those lower than 3,000 nautical miles—where most Soviet satellites are to be found. These include the Soviet electronic intelligence, photoreconnaissance, and radar ocean reconnaissance satellites (RORSATs) that would be high among the targeting priorities of US ASAT weapons—if they are ever deployed—should war break out. Many Soviet satellites can maneuver, too, which compounds the problem for US space trackers.

US surveillance of low-orbiting satellites is being upgraded mostly by means of computer hardware and software improvements in such sensor systems as the Pave Paws radar at Robins AFB, Ga., and the radar at Kaena Point, Hawaii. The network is being expanded too. For example, a new radar site is in the works for the western Pacific Ocean, where coverage is considered to be critical. Sensors out that way detect Soviet spacelaunches, get a handle on what's aboard and why it's there, and cue other space-tracking sensors elsewhere to keep watch on the payload once it's in space.

Even with upgrading, US surveillance of satellites orbiting relatively close to the planet will still have "significant coverage gaps that could be exploited by a determined adversary," General Piotrowski asserts.

Deep-space surveillance, also deficient, could become downright dismal once the Soviets begin flying their Shuttles on operational, satellite-deployment missions.

They are already depositing more and more of their satellites, most notably those for communications purposes, into geosynchronous orbits. US space trackers have little problem tracking them if they are spotted. Their orbital speeds are the same as the speed of the earth's rotation, and they appear, in consequence, to be stationary in space. But it greatly helps the trackers to know that they are out there in the first place. There are means of "hiding" them from ground-based sensors, should the Soviets decide to build them for such deception. And if they are poised over the eastern hemisphere, such sensors may not pick them out in any event.

"Currently, in order to put anything into geosynchronous orbit, the Soviets throw up the satellite, put it into a parking orbit, and then boost it from there into deep space," General Piotrowski explains. "With our satellite early-warning system, we see that satellite launched. Our surveillance sensors track it. We recognize the activity for what it is."

This would not always be possible, however, in the case of a satellite launched from a Shuttle into geosynchronous orbit over the eastern hemisphere that could, by some means, escape the surveillance of current US systems.

To solve this problem, the US ground-based deep-space surveillance would have to be greatly expanded or a space-based surveillance system would have to be deployed.

It was once believed that a network of five electro-optical sensors positioned equidistantly around the equator would take care of the deep-space surveillance problem. Thus was born the ground-based electro-optical deep-space surveillance system (GEODSS) to detect objects far out in space by spotting their reflections of sunlight.

Four GEODSS sites are operational. The fourth went into action a year ago at Diego Garcia in the Indian Ocean. The fifth is planned for Portugal, but its construction has been deferred for eight years as a result of unresolved negotiations with the government in Lisbon and the rising costs associated with the delay. The protracted Portugal experience is taken by USAF as evidence that expansion of the GEODSS network to more than five sites on foreign territory would be impractical.

Such expansion might not do much good. "Even with the site at Diego Garcia," says General Piotrowski, "there is a critical real-time coverage gap. A number of the Soviet geosynchronous satellites are in this gap, and there are many critical US satellites in the same region."

Sharpening Deep-Space Vision

Some steps have been taken to sharpen US Space Command's deep-space vision. For example, the command now has the part-time use of the National Science Foundation's ultrahigh frequency radar at the Massachusetts Institute of Technology's Lincoln Laboratory and of EO sensors at a military test site at Socorro, N. M.

US Space Command and Air Force Space Division are also looking into developing a land-based deep-space radar that would embody the latest wideband radar technologies best exemplified by MIT's Haystack radar. Other candidates to fulfill Space Command's space-peering requirements are an orbital optical system and the space-based radar being developed for the Strategic Defense Initiative's Space Surveillance and Tracking System to catch Soviet ballistic missiles and reentry vehicles in their midcourse stage of flight.

A champion of the SDI program, General Piotrowski hails it for its potential as a defensive system—one that US Space Command almost surely would have a major or exclusive role in operating—and for its technologies, such as space-based sensors, that dovetail nicely with the command's own requirements for space-control systems in the broader sense.

General Piotrowski finds no fault with space systems now at his disposal. Having been developed by Space Division, they are "very capable, very reliable" systems, and "I'm convinced that the R&D community is putting all the technological capability that this nation can muster into our satellites."

He declares, however: "We've got to step up to some problems. I don't believe we have the space force structure, the combat readiness, and the sustainability that's necessary."

For example: "We've backed away from providing sufficient numbers of on-orbit spares [satellites] and of spares on earth that are ready to be launched—and that can be launched—if we need them. If we put into space a constellation that's important to the National Command Authority, then we should be willing to spend the extra dollars to make sure that we have sufficient spares on orbit so that we won't lose that capability in a conflict. So one of my top goals is to

improve the readiness and sustainability of space systems."

Launching readiness is a big part of that. The US spacelaunch program is showing vigor again following two years of near-dormancy in the aftermath of the *Challenger* disaster and the failures of a few unmanned launch vehicles, most notably the big Titan 34D boosters that boom fairly heavy military payloads into orbits. Now the Titan 34Ds are back in business with a bang, having carried vital classified payloads into space on two recent occasions.

But only a half-dozen or so Titan 34Ds remain in USAF's inventory, and other needed boosters of variegated thrust and purpose are still in development. Moreover, the Space Shuttles, grounded since *Challenger* went down, are not expected to resume flying until late this year—and then only tentatively in terms of operational missions.

Even when the US spacelaunch program is once again a going concern, it will need work, in General Piotrowski's opinion. Noting that the Soviets have twice as many launchpads as the US and can use them for hurry-up launches, he says that the US must figure out how to make the most of its own launchpads in order to shorten its too-lengthy launch-turnaround intervals and to launch, on demand, whichever satellites its warfighting commanders need, whenever they need them.

He explains: "Once we start to prepare for a launch on a given booster, we move it to the pad and tie up that pad for a considerable time. If we need to change direction and launch a different satellite from the pad, we have to move the first booster off and download the whole system.

"We need to find a better way of doing that. We have to build an infrastructure that supports more rapid launching. Perhaps we have to get away from using the launchpads to stack satellites and test systems out. We would have to do that off the pads so that the pads are available.

"We also have to get away from the scientific approach to launching satellites and go to the SAC or the TAC or the MAC approach—and that is, when the need arises for a satellite, we put our act together and go launch it."

Step in the Right Direction

General Piotrowski makes it clear that giving US Space Command control of the launching of all operational military satellites, as opposed to developmental satellites, would be a big step in the right direction—away from such control by "the R&D community" as represented by Space Division, NASA, and their booster and satellite contractors in attendance. He notes that the operational military community has had considerable experience in launching ballistic-missile boosters and others of filial relationship to space boosters, and he claims that it could handle spacelaunches quite handily.

"I see space boosters like I see C-5s," he says. "They're the means of carrying something to a location—in this case, space. And I see more involvement for US Space Command in the entire process, not as hewers of wood and carriers of water, but as true operators."

The space R&D community should transfer control of space launchers to the space operational community just as the aircraft R&D community does with bombers to SAC, fighters to TAC, and airlifters to MAC, General Piotrowski insists.

Within US Space Command, Air Force Space Command has begun working with Air Force Logistics Command on a program aimed at enhancing the maintainability and sustainability of operational satellites. It is likely that Naval Space Command and Army Space Command will team up with those services' logistics commands to do the same with space systems under their purviews, once the two Air Force commands have established a model for doing so.

The Air Force and Navy components of US Space Command ride herd on their respective satellite systems, such as those for communications and navigation. A major role planned for the Army component of the unified command is the operation of the entire Defense Satellite Communications System (DSCS) network for all the services.

In effect, the Army already does this—but under the control of the Defense Communications Agency. The passage of control from DCA to US Space Command, probably later this year, will mark a milestone in the unified command's coming of age.

Air Force Space Command will continue to be US Space Command's agent for controlling all DSCS II and DSCS III spacecraft from operations centers at Falcon AFS, Colo., and Onizuka AFB, Calif.

Just how the Air Force, the Navy, the Army, and the Marine Corps components of US Space Command will continue to work together and at what is being explored in the "Space Campaign Plan" that the unified command is devising. In the process, it has been working for more than a year with all other US unified and specified warfighting commands to identify the capabilities that they require of space systems.

"It is a pioneering effort," General Piotrowski says. "What is beginning to emerge is a picture of all that a space campaign must encompass to support terrestrial and maritime campaigns."

The plan will be, he says, "an essential element of normalizing military space operations and of integrating space capability into combined-arms warfighting plans, just as the Soviets have done."

In this connection, General Piotrowski comes down hard on what he sees as a glaring deficiency in his command's capability for controlling space—the lack of antisatellite weapons. Without them, he says, "our space forces constitute a critical military system that lacks the means to defend its assets," and the Soviets would be "undeterred" in using their electronic intelligence satellites, radar reconnaissance satellites, and photoreconnaissance satellites "to seriously jeopardize our ability to project and sustain US forces and to fight once engaged."

As he summed it up at the Air Force Association symposium in Los Angeles: "Our space forces are not sustainable except in peacetime. If space were to be contested or if our space forces were disturbed by hostile action, they could easily be lost—even in the best of circumstances—at a rate far greater than the rate at which we could replenish them.

"And with their loss would be the loss of critical support to our terrestrial and maritime forces." ■