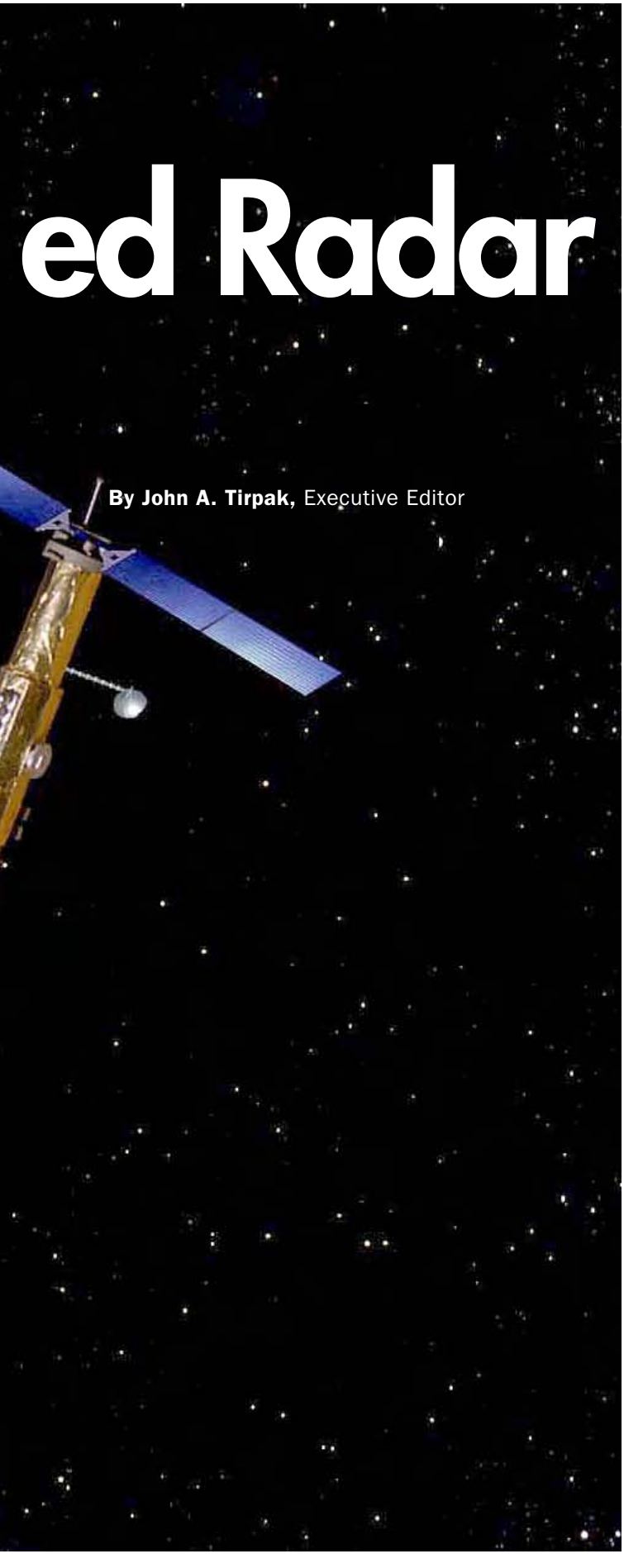
The Air Force now thinks it can achieve an operational capability in 2010.

The Space Bas

Artist's concept illustration by Erik Simonsen

ed Radar Plan



By John A. Tirpak, Executive Editor

THE reorganization of military space around the Air Force might prove to be key in making a new Space Based Radar program work, just as the old, fractured style of space management caused the demise of its predecessor, Discoverer II.

The new arrangement aims to harmonize requirements for space data-collection systems and their acquisition management. This will likely produce a workable SBR capability within the decade. It would be as if Discoverer II simply had gone forward, only with even more capabilities.

Discoverer II would have yielded on-orbit experiments, but it would not have been a particularly useful military tool. SBR as now envisioned will provide battlefield intelligence almost from the moment it goes into orbit.

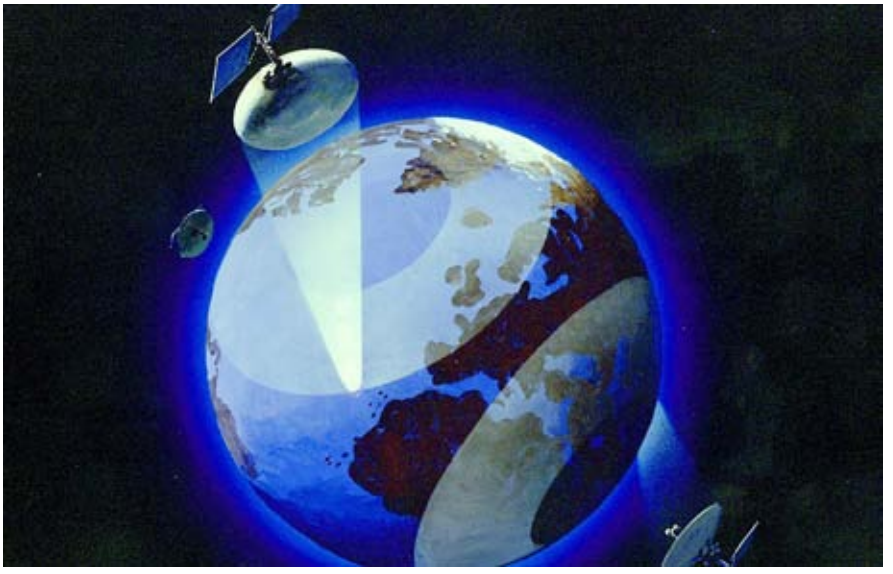
The program aims to achieve an initial SBR capability in 2010. It would give US forces Ground Moving Target Indicator data day or night, in any weather, from orbit. It will augment the GMTI capability in today's fleet of E-8C Joint STARS aircraft. The GMTI can be foiled or undermined by mountainous terrain or heavy foliage.

SBR's value stems from the fact it can look directly down from orbit. An enemy cannot hide behind obscuring terrain features to avoid detection. It will also be able to look deeper into enemy territory than would be possible with Joint STARS. Its use would put at risk no aircrew members or unmanned vehicles, and it would be available in wartime or peacetime. It will have other inherent functions, as well, such as detailed mapping capabilities.

"This system will complement

other manned and unmanned systems," said Lt. Gen. Brian A. Arnold, head of Space and Missile Systems Center, Los Angeles AFB, Calif. "During peacetime, obviously, it would be great for intel preparation of the battlefield. ... During wartime, especially in high-threat areas, it may be the only thing you can get into an area."

Discoverer II was meant to be a technology demonstrator. Plans called for flying two proof-of-concept satellites this decade, to be followed by a full constellation of perhaps 20 SBRs as much as 10 years later. The demonstrators would not have been operational craft and would not have had a system for disseminating the data they collected. Only when the experiment was concluded would work have begun on designing and lofting a working constellation.



Artist's concept

Undecided is whether SBR will be a constellation in low or medium Earth orbit or a combination of the two. Higher satellites provide greater coverage and can be fewer in number; lower satellites use less power and can be smaller.

The Requirements Dilemma

However, there were competing requirements from other branches of the military and the Intelligence Community, and little had been done to fully explore how the system's information could best be forwarded directly to battlefield commanders. Moreover, both the services' leadership and Congress wanted a space based radar capability more quickly than looked possible with the Discoverer approach.

Congress canceled the Discoverer II project in 2000, complaining about uncertain costs and schedule, poorly explained requirements, and a lack of coherent vision for how the system would transition to operational use. However, it gave $30 million to the National Reconnaissance Office to pursue enabling technologies for the concept.

When the Bush Administration arrived and made the Air Force the executive agent for military space activities—and also assigned the USAF undersecretary as the acquisition authority for space systems—plans for a better-thought-out SBR began to take shape.

In February, the Air Force–led Joint Program Office for SBR gave Congress a roadmap for the program. At the end of this month, a midterm report on an SBR analysis of alternatives will be presented to Air Force Undersecretary Peter B. Teets. If all goes as planned, Teets this fall will approve a program go-ahead. The service has penciled in an unofficial goal of awarding hardware contracts in Fiscal 2004–05, with a first satellite to be lofted about 2010.

"The conclusions of the roadmap were that a Space Based Radar in the next decade is feasible," said Col. Robert Shofner, acting director of the SBR Joint Program Office. "Then it laid out some proposed technologies that need to be [developed], the requirements work that should be done, and ... it said that we don't need to go out and fly another Discoverer II."

Technologies deemed necessary for the SBR have been advancing since Discoverer II was killed, and the key ones—active electronically scanned arrays and synthetic aperture radar, to name two—are considered largely in hand, Shofner said. The roadmap declared that the SBR program could begin "in the normal, stepwise fashion of building a satellite program," said Shofner, although "it did not specify a specific solution" to the GMTI requirement.

Shofner went on, "Air Force Space Command said, 'Let's get the requirements right.' OSD [Office of the Secretary of Defense] looked at

USAF photo by TSgt. Jack Braden

SBR's objective will be to provide data in an integrated, seamless way. If the system is set up as envisioned, the user will not be able to tell whether the data he sees came from a satellite, sensor aircraft, or other intel source.

it and said, 'This is all good. We've got requirements work going on, we've got the technology work going on, we believe in SBR. Let's push forward. Let's make it happen.' We delivered a roadmap to Congress in February, we appropriated money in [Fiscal] '02, and we're off and running."

Officials expect the Navy and National Imagery and Mapping Agency to join the JPO in the near future.

From Scratch

Space Based Radar will be the first "clean sheet of paper" concept to enter development since the Air Force assumed executive agent status for all military space programs. The status was conferred last year in response to advice by the so-called Space Commission, an independent panel chaired by Donald H. Rumsfeld. He resigned that position to accept nomination as Secretary of Defense.

In June, Air Force acquisition chief Martin R. Sambur designated SBR as one of five key programs that are deemed to be "pathfinders" for new, innovative, and streamlined acquisition strategies. The goal will be to more rapidly design, develop, and field new capabilities while at the same time lowering technical risk and achieving greater collaboration between designers, contractors, testers, and users of new systems.

Such designated systems are to make maximum use of spiral development, which allows the service to field hardware that meets only 60 to 80 percent of its final desired capability, while it makes incremental improvements toward meeting the full requirement.

Gen. Lance W. Lord, head of Air Force Space Command, said SBR will be developed "in a way that we don't ask it to do too much, too fast," but which in any case is grounded in a solid operational requirement and thinks through the dissemination aspects of the system before any hardware is built.

Notionally, SBR will be a constellation of small satellites, perhaps 20 to 25 in all. Much of the concept work being done now is in trying to decide if they will be in low Earth orbit, or medium orbit, or a mix of the two.

"You don't want the signal to be too far away from the target," Lord said, because of limitations on radar power. Higher-altitude satellites can be fewer in number and require less frequent "turnover" to other satellites as the world rotates below, but require more power and bigger antennas. Low Earth orbit satellites require smaller antennas and less power, but more would be needed for full coverage because of shorter "dwell time" over a target.

Lord also noted that a larger constellation would require more launch capability, driving costs and risks up.

A clear picture has not yet emerged as to what SBR would physically look like, Shofner noted. There is a desire for a large antenna, except "the bigger the aperture, the more rigidity that you need in it," possibly requiring a larger vehicle. Dispersed satellites creating a synthetic aperture are a more likely solution.

"We're looking at a number of different ways," Shofner said, but SBR will definitely fit the label of a small satellite.

Manned, Unmanned, Space

SBR will be the centerpiece of the edict by Gen. John P. Jumper, USAF Chief of Staff, that all new starts must focus on "the integration of manned, unmanned, and space platforms," Lord said. SBR data will be fused with data collected by Joint STARS, Unmanned Aerial Vehicles, and other platforms to present a single coherent picture of an area to field commanders. The Air Force wants SBR data to be piped directly into aircraft cockpits, tactical vehicles on the ground, and ship command centers, as well as to Stateside intelligence analysis hubs.

Jumper told Lord not to get "hung up" on the platform, but on the desired effect.

"The subject of the sentence has been GMTI ... to the warfighter ... as opposed to ... Space Based Radar," Lord said.

Another priority is to make sure the data acquired get to the users and not get stalled in endless analysis, Lord said. Today's intelligence agencies, he observed, are awash in information, but often can't make much sense of it enough to turn it into what Jumper calls "actionable" information.

"We get a lot of data," Lord said. "We're collecting it more and enjoying it less."

Not part of the SBR program per se, but still part of what the program will assess, are the "cost implications for all the exploitation systems on the ground," said Shofner.

"Part of the work we need to do as a department is to understand what the implications are. What do we think this is going to cost other programs? That's something that's just begun." The actual satellite is probably on firmer ground now than "the exploitation part of this," he said.

No one has yet decided how much of the processing of data will be done aboard the satellite itself. One idea is to do much of the processing

Artist's concept illustration by Erik Simonsen

SBR will be the first program to be developed under the new pan-agency space hardware acquisition system now headed by the Air Force. It will employ spiral development, allowing early fielding and rapid improvements in capability.

off-board, then spiral additional processing onto the platform in later versions.

The system will have to be able to "talk" to NIMA computers, as well as the Army's Tactical Exploitation System and Navy ship-based systems. The cost to create this connectivity has not yet been estimated, Shofner said.

The decision to proceed far more deliberately with SBR has to some extent been colored by unexpected and substantial cost growth on the Space Based Infrared System, or SBIRS, said Arnold.

The Stigma

"The space community is suffering from a sort of stigma—that we rush to judgment, and we go out, and before we get complete knowledge of something, we rush in to build these systems, and we misunderstand or miscalculate the complexity of the task," Arnold observed.

"We have an opportunity now to take a lot of the lessons learned on some space systems we've developed recently and apply those in a proper manner. ... We need to go along slowly. And a lot of people want this system right away, but we need to be very prudent in our approach to this system," he added.

"We don't want to create the same kinds of problems for us that perhaps we had on SBIRS High."

Neither radar nor power system nor satellites will be the main challenges of the program, Arnold went on to say.

"Integration has always been the most difficult thing. The other [difficult] thing is ... software."

With so many other major initiatives—SBIRS High and Low, GPS III, and a new "transformational [communications] architecture"—Arnold said one of his main concerns in making SBR work is having enough systems engineering talent available to tie everything together.

Arnold said the JPO will be "really careful about writing an [Operational Requirements Document]." He added, "We don't have a notion exactly what this thing is going to look like, nor do we know what the [concept of operations] are. That's what we're doing right now."

One potential use for SBR concerns missile defense, said Arnold, because "intel preparation of the battlefield ... is the front end of missile defense. ... It could ... provide a source of data for them, and I think it would be useful for them, too."

Artist's concept illustration by Erik Simonsen

Part of the conceptual chore facing USAF is deciding what part of the intelligence picture each system will provide. The Global Hawk UAV will be key in the ISR network but does not compete with SBR.

Arnold declined to say much about the possibility of using SBR as an offensive weapon. With so much wattage available, the satellites presumably could be used as a directed-energy weapon. Current studies are taking into account such possibilities.

SBR does not compete with the Global Hawk UAV or the so-called Common Wide-body Intelligence, Surveillance, and Reconnaissance aircraft, Arnold said. They are "more near-term" than SBR. However, SBR will have to compete with other space systems and prove it will provide true value to earn its way to orbit.

SBR was originally conceived as replacing the E-3 Airborne Warning and Control System as well, Shofner said. That task is too technically challenging at this time. "We see that as several generations away, ... something we really don't envision before 2015, 2020," he said.

Special Problem

Airborne moving targets pose a special problem for a space radar. Shofner explained: "We haven't been able to develop radars that are powerful enough and sensitive enough in space to be able to track fast-moving airborne targets. There's a lot of clutter, a lot of backgrounds you have to sort out. ... It's still a very difficult problem."

While the Defense Advanced Research Projects Agency is working on the problem, no one foresees a solution in time to get it aboard an SBR fielded in 2010, Shofner said.

To meet an on-orbit target of 2010 for the first spacecraft, a formal program must get started about 2004. It would take at least six years to build, integrate, and test such a system, AFSPC officials said.

A single contractor probably would be selected in 2005 in order to have at least two spacecraft built for launch in 2010. Lockheed Martin and TRW were competitors on the Discoverer II program, but AFSPC officials said there was no guarantee they would be involved in SBR. A new competition would likely be structured to demonstrate an SBR in individual pieces and in as integrated a fashion as possible on the ground.

Notional funding profiles suggest SBR could cost some $700 million to $800 million per year by 2008. At that point, spacecraft fabrication would be in full swing and launch services would have to be acquired.

Shofner said he fully expects that users will swoop in and try to hang many more missions on SBR, which could threaten its affordability.

"They absolutely will try," he said, "and we're going to work awfully hard to spiral it in and start slowly, so we can field it on time."

He said he expects Teets and Jumper to watch the program "very carefully," the goal being "to make sure we don't get out of control." ■