A Close-Up Look at a Secret Soviet Radar

A visit by a congressional delegation to the infamous Krasnoyarsk radar indicates it would have little value in an ABM system, but probably violates the ABM treaty

EVER since it was first detected by an American reconnaissance satellite early in 1983, a massive radar under construction near the Siberian city of Krasnoyarsk has been a serious irritant in U.S.–Soviet relations. The Reagan Administration has charged that the facility is a clear violation of the 1972 Antiballistic Missile (ABM) Treaty—an assessment backed by both houses of Congress in separate resolutions—and it is likely to cast a long shadow over the process of ratifying any future arms control agreements with the Soviet Union.

Last week, in a move that caught many by surprise, a delegation, including three Democratic congressmen and four congressional staff members,* was permitted to visit the facility for an unprecedented on-site inspection. Their findings do little to rebut the charge that the radar violates a key provision of the ABM treaty. But the visit nevertheless buttresses a contention—long voiced by many arms control experts but disputed by the Pentagon—that the radar has limited military applications.

The facility appears to be designed to provide early warning of missile attack. The visit confirmed what spy satellites had already indicated: the radar faces northeast and its field of view plugs a gap in the Soviet Union's existing network of large early-warning radars (see map). The gap is important because it includes possible flight paths of missiles launched from submarines in the northern Pacific.

To guard against early-warning radars being used to manage illegal ABM defenses, the ABM treaty specifies that they must be built on the edge of Soviet or U.S. territory and they must face outwards. The Krasnoyarsk radar is more than 800 kilometers from the nearest border and it looks out over 4000 kilometers of Siberia. The violation of the treaty, therefore, seems to be clear-cut.

The U.S. Department of Defense has argued that the radar was located at Krasnoyarsk rather than at a permitted location on the coast in order to pass along more complete information on the trajectories of incoming warheads to radars that would guide ABM interceptors—in other words, it is exactly the kind of installation the ABM treaty was designed to prohibit (*Science*, 30 January, p. 524). Others have offered the more benign explanation that the Soviets would probably have had to build two radars on the coast to give adequate coverage, and they would have faced the difficult task of constructing them on permafrost.

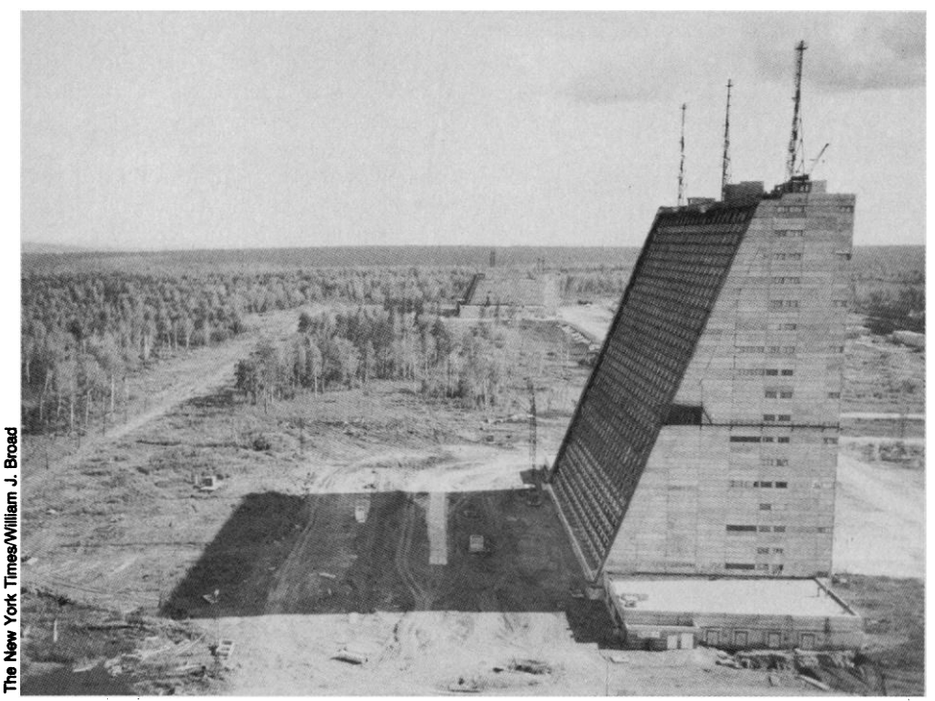
In response to U.S. complaints about the facility, Soviet officials have maintained that the radar is legal because it is designed for tracking spacecraft, a function not covered by the ABM treaty. The congressional delegation found little evidence to support either the Soviet position or the DOD charge, however.

To begin with, the radar is pointing in the wrong direction for tracking many important U.S. spacecraft such as the shuttle and military communications satellites. It would need to face south to pick up those objects. Members of the congressional delegation say they were told by Soviet officials that other radars are tracking spacecraft to the south; Krasnoyarsk is intended to track objects in polar orbit, such as those launched from Vandenberg Air Force Base in California, the Soviet officials claimed. However, the frequency at which the radar apparently will operate is not optimal for space tracking.

Anthony Battista, an electronics expert on the staff of the House Armed Services Committee who accompanied the congressional delegation, estimated that the radar will operate at about 180 megahertz. U.S. intelligence officials have estimated that other Soviet early-warning radars also operate at this frequency. When Battista queried Soviet engineers at the site, they said the frequency is "something like that." Radar experts say that space tracking would ideally require higher frequencies, whereas radars optimized for ABM functions should operate at even higher frequencies, in the gigahertz range.

John Toomay, a retired Air Force major general and an expert on radars, notes that the higher the frequency, the better the ability of the radar beam to traverse the ionosphere without distortion. Radars operating at 180 megahertz would be able to detect distant spacecraft but ionospheric distortion would degrade the accuracy of the tracking data, especially of objects low on

*Congressional members were Thomas Downey (D–NY), Bob Carr (D–MI), and Jim Moody (D–WI).



The New York Times/William J. Broad

Krasnoyarsk radar. *The sloping face of the 30-story receiver in the foreground points northeast, across 4000 kilometers of Soviet territory. The face is currently covered with corrugated aluminum. The 11-story transmitter can be seen in the background.*

the horizon. Battista said at a press briefing after the delegation returned to the United States that Soviet officials admitted during informal discussions that "yes, we agree; it is the wrong frequency for space track."

The Soviets have traditionally built their early-warning radars at this frequency, Toomay says, because they are cheaper than higher frequency radars with an equivalent power. The latest U.S. early-warning radars, known as PAVE PAWS, operate at around 400 megahertz. The United States chose higher frequencies not just for improved accuracy but to mitigate the blackout effects of nuclear blasts outside the atmosphere.

Because such explosions cause extensive ionization in the upper atmosphere, they would make the atmosphere opaque to radar beams. The duration of the blackout is inversely proportional to the square of the frequency of the radar signals, thus "there is a distinct advantage in going to shorter wavelengths," notes Toomay. For that reason, the battle-management radar built at the now-mothballed ABM site in North Dakota was designed to operate in the gigahertz range—a frequency an order of magnitude higher than Krasnoyarsk's.

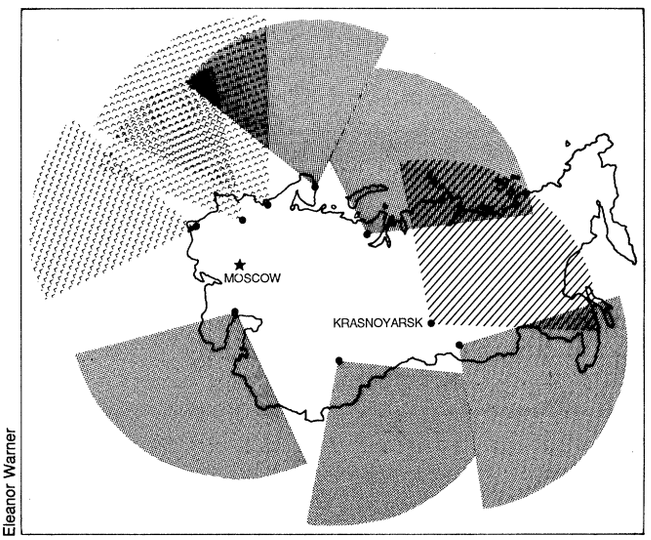
Krasnoyarsk's vulnerability to blackout is one reason why the congressional delegation, in a report to House Speaker Jim Wright (D–TX), states that "we judge the probability of Krasnoyarsk functioning as a battle-management radar to be extremely low." Another is the apparent total lack of hardening of the facility against either blast effects or the electromagnetic pulse caused by high-altitude nuclear explosions.

Unlike similar U.S. facilities, which are made of poured reinforced concrete, Krasnoyarsk is constructed of concrete blocks poorly cemented together. "It looks like a structure that would go over in a stiff windstorm," says one congressional staff member who visited the site. The report to Wright also notes that the construction quality is "shoddy." Moreover, both the radar transmitter and the receiver are built with windows, which would make it impossible to shield the structures against electromagnetic pulse. And the electric cables—many of which were still exposed—were not shielded either. "Given the basic design of the structure, we question whether it could ever be electronically hardened without tearing it down and starting over," the congressmen conclude in their report.

The congressional delegation therefore concluded that the radar is not designed to be part of an ABM system. "This radar, if it were turned on today, would be an early-warning radar—not a very good one either," said Battista. The congressmen said in their report to Wright that such a radar "would violate the letter of the treaty, although not its purpose."

Plugging a gap

The Krasnoyarsk radar fills a gap in the Soviet Union's network of large early-warning radars. The shaded areas indicate the coverage of existing radars; the three with lighter shading in the northwest were discovered by reconnaissance satellites last year. [Source: Department of Defense]



Frank Gaffney, who has been nominated to succeed Richard Perle as assistant secretary of defense for international security policy, repeated DOD's charge that Krasnoyarsk is an integral part of an ABM system at a press briefing 2 days after the congressional delegation returned. The fact that the radar seems to be shoddily built and vulnerable to blast and blackout does not alter this assessment, he said. "This presents the kind of significant military development that fundamentally undercuts, indeed goes to the heart of, the ABM treaty."

Gaffney also suggested that the congressional delegation, which consisted of Democrats who have been active in arms control matters, was shown only what the Soviets wanted them to see. Thomas Cochran, a physicist with the Natural Resources Defense Council (NRDC), who helped arrange the visit and accompanied the congressional delegation, called this allegation "absolutely false."

The delegation visited the Soviet Union primarily to witness seismic monitoring of underground chemical explosions set off as part of a private agreement between NRDC and the Soviet Academy of Sciences to establish a means of monitoring nuclear tests. Although they had previously asked to see Krasnoyarsk, permission was not granted until almost the final day of their trip—and then only after all 14 members of the Soviet Politburo were polled by telephone, according to one Soviet official traveling with the group. The key role in arranging the visit was apparently played by Yevgeniy Velikhov, vice president of the Soviet Academy of Sciences.

The group was first given a tour of the site by helicopter and then escorted through parts of the 11-story transmitter and the 30-story receiver. They were allowed to take as many photographs as they wished outside, but not inside, the structures. The tour took about 2 hours. During dinner in a tent at the site, members of the delegation asked to go back into the buildings to take photographs. The request was granted, and they were told they could choose any floors they wished to see. In all, more than 1000 still photographs and several videotapes were taken. They are being made available to U.S. intelligence agencies for analysis.

The facility is far from complete, with little electronic equipment installed and not much sign of major construction activity taking place, delegation members say. They estimate that it is at least 2 years from being finished.

The face of the massive receiver was covered with a temporary shield of corrugated aluminum and steel. About 9 months ago, U.S. intelligence satellites detected signs that the radar-transparent face of the receiver was being dismantled, which fueled speculation that the Soviets were preparing to mothball the facility. One member of the delegation says, however, that they were told by the Soviets that the original face suffered ice damage and is being replaced.

Why did the Soviets decide to let a congressional delegation see what had hitherto been a secret facility? According to Gaffney, it was simply "a very skillful propaganda stroke."

Others believe that the Soviets have finally decided that the issue of Krasnoyarsk must be dealt with. "They appear to have settled for the lesser charge"—that the facility is an early-warning radar in the wrong place rather than a battle-management radar—says Raymond Garthoff of the Brookings Institution, who was an adviser to the U.S. delegation that negotiated the ABM treaty. ■ **COLIN NORMAN**