SURVEILLANCE DATA

The Defense Department Declassifies the Earth–Slowly

The U.S. military does a lot of inadvertent earth science. Watch a potential enemy's troop movements from Earth orbit, and you can't help noticing long-term vegetation changes. Listen for the other guy's submarines in the North Atlantic, and you will inevitably pick up the sounds of migrating whales and sea-floor volcanoes. Keep an ear to the ground for hints of surreptitious nuclear testing, and you will record almost every significant earthquake around the world. The list of inadvertent earth science goes on, ranging from the shape of the deepest sea floor to the detonation of meteors in the upper atmosphere. Now that the Cold War has ended, earth scientists are eager to open up this treasure trove of secret data on the pulse of land, sea, and air.

The data aren't exactly falling into their laps, however. True, a task force is currently looking into the declassification of data that may be useful for global change studies, and the military itself is actively promoting access to some formerly off-limits data and facilities as it faces mounting pressure to justify its budget. The Navy, for example, is touting "dual use" of its $15 billion network of undersea listening stations, which is enabling a few civilian scientists to study whale calls and underwater eruptions while the Navy continues to monitor submarines (*Science*, 30 July, p. 549). It has also transferred an ultraquiet ship to the U.S. Geological Survey for acoustic studies and ferried civilian scientists under the Arctic ice aboard a nuclear submarine. And on a case-by-case, almost random basis, existing data sets are becoming available, such as the first complete data stream in digital form from the Air Force's Defense Meteorological Satellites.

But researchers keen to get at these data say that cultural barriers often hamper the openness they hoped for in the post-Cold War era. Even when data are technically unclassified, the military is often wary of intrusion by civilian scientists. As a result, says John Spiesberger of Pennsylvania State University, who has worked with undersea acoustic data and the Global Positioning System (GPS), the military network of positioning satellites, "a lot [depends on] personal communication and trust." Science also erects its own barriers to work based on classified surveillance systems: Peers can be reluctant to accept conclusions when they don't know how the data were gathered. And so far, there are few formal mechanisms to put researchers in touch with the military data they need and help them cross these cultural divides.

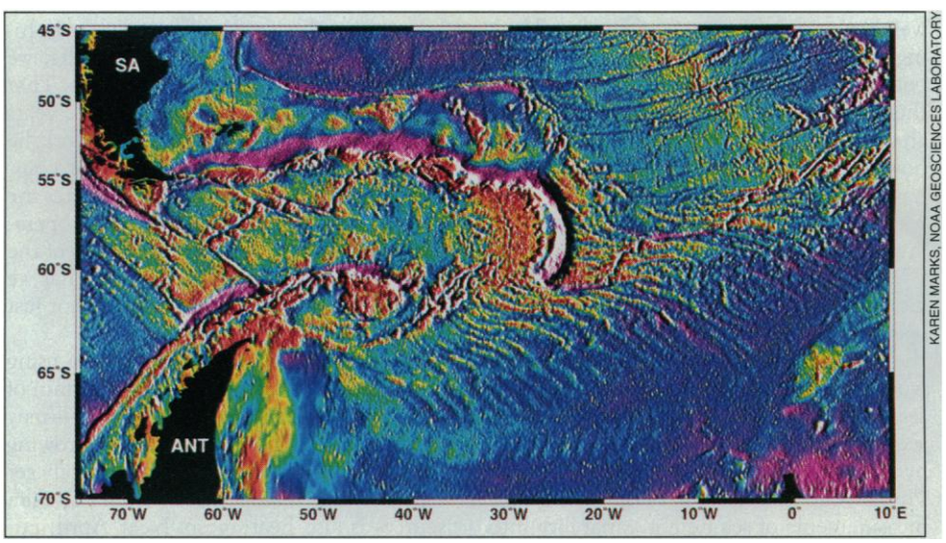
Researchers who succeed find it can be well worth the effort. The military can take civilian scientists—literally or through archived data—where they have never been before, such as beneath the Arctic ice. Military data sets—spy satellite images, for example—often stretch back long before civilian researchers began tracking processes in the same areas, such as vegetation changes. And even when military and civilian data overlap, as they do in seismic monitoring, military observations can fill gaps.

Connections count. The first step is knowing that the data exist, and that isn't always simple, says Harold Geller of the nonprofit Consortium for the International Earth Science Information Network (CIESIN) in Washington, D.C., who studies how unclassified and recently declassified information on global change can be made available. Says Geller: "How do you know it's there in the first place? It's not an easy chore. What you end up doing is traipsing around the country asking 'What have you declassified lately?'" The problem is worsened, Geller thinks, by reluctance on the part of the military, which sometimes fears being overwhelmed by the volume requests. "We hoped to make some inroads [on that problem], but we're finding it a little difficult," says Geller.

Once researchers know what information is available, then comes the challenge of persuading the military to part with it. A personal connection can help. As a graduate student at Cambridge University in 1981, for example, Alfred McLaren wanted to study how the thickness of Arctic ice had changed over the years—measurements only the Navy could have made. Its nuclear submarines routinely made acoustic profiles of the underside of the ice in order to stay out of harm's way. McLaren had a headstart in trying to get the data: He knew they existed because, as a nuclear submariner for 22 years, he had helped make measurements himself. He knew that some of them, strictly speaking, were not even classified. And, finally, he knew how to go about getting them.

"It's always better to go over and talk to people. It's a good idea to start with the scientific community within the military," says McLaren, who is now president of Science Service Inc., in Washington, D.C. "You have to approach it calmly rather than adversarily." Thanks to his perseverance—and his contacts—McLaren is about to publish a comparison of data from a dozen submarine tracks under the ice released to him since 1981, showing no climate-induced change in ice thickness over the past three decades.

Geodicist John Bossler of Ohio State University learned a similar lesson when, from 1988 through 1992, he chaired a committee of the American Geophysical Union (AGU) charged with pursuing the declassification of geophysical data. Bossler's committee had targeted such classified data as readings from the Navy's Geosat satellite, which operated from 1985 to 1990, tracing tiny variations in the height of the sea surface that reflect the gravitational effects of the sea-floor topography below. The details of seamounts, fracture zones, and other topography had eluded researchers in many



A coveted view. Declassified data from the Navy's Geosat satellite reveal ridges, trenches, and fracture zones under part of the Southern Ocean. The satellite's altimeter mapped the shape of the sea surface, which reflects the gravity—hence the topography—of the sea floor.

parts of the ocean, and they were ready to use what leverage they had—mainly public exposure of any military intransigence—to pry the data free into the public domain.

But that approach began to look unproductive, and the committee took a new tack. Bossler was a retired admiral, having been head of the U.S. Coast and Geodetic Survey. The man holding the key to much of the data was the oceanographer of the Navy, also an admiral. Why not just call him up, admiral to admiral?

It worked. The Navy still wouldn't release Geosat data from particularly sensitive areas, where the gravity readings allow weaponeers to adjust for the effects of gravity variations on the flight of submarine-launched missiles. But the committee did coax out data from between 60°S and 70°S (where few missile-subs venture), allowing geophysicists to map the bumps and troughs of the sea floor in that region. Eventually, the Navy released all the data from south of 30°S, unveiling half of the world's sea floor.

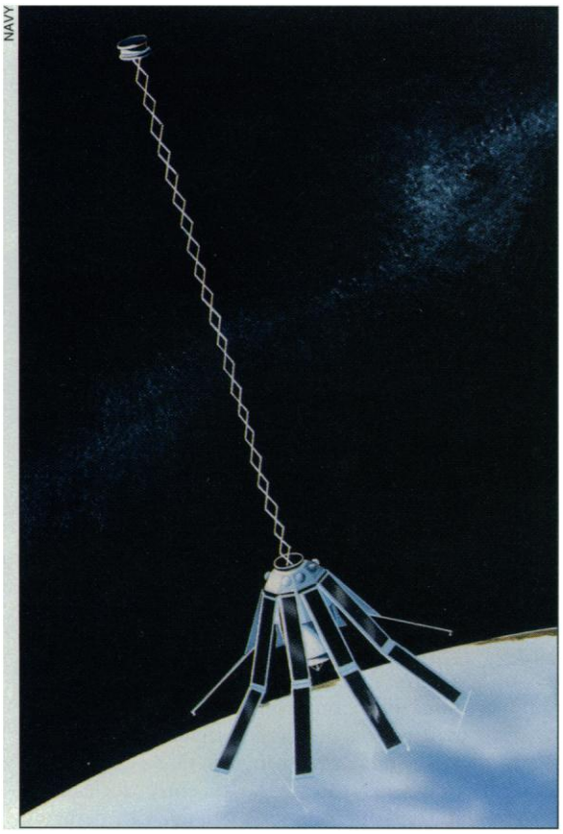
Data with a catch. Even after tracking down scientifically useful military data and making the right contacts, however, civilians often face the problem that the data they covet still have military value. While the military may be willing to declassify certain aspects of the data, the researchers have to convince the military gatekeepers that civilian work won't interfere with the military mission.

Oceanographer Robert Cheney of the National Oceanic and Atmospheric Administration in Silver Spring, Maryland, and his colleagues faced that problem in 1983, when they made an advance request for access to Geosat data. The researchers weren't after the gravity variations, which have lasting military importance, but rather the rapid variations of sea surface height due to changing currents and wind shifts. Such "ocean weather" is crucial to maneuvering and hiding the Navy's stealthy submarines from a potential enemy's sonar, but the data lose their military significance when conditions change. To researchers trying to understand how the ocean works, however, the records have permanent value. Still, the Navy was wary of letting civilians explore the data for any purpose.

After considerable discussion, says Cheney, "the thing that finally sold them was that we explained that we would process the data so that the [gravity] information would be left behind." Cheney had to get a security clearance and analyze the data in a secure environment—a lab run for the Navy by Johns Hopkins University's Applied Physics Laboratory—but he got his global measurements of sea-height variability into the open literature.

Such partial access raises another problem for researchers: convincing their own colleagues in the scientific community that conclusions based on classified data or instruments qualify as real science. Seismologist Michael Purdy of the Woods Hole Oceanographic Institution, for example, will be exploiting the Navy's undersea listening network—recently made available to selected researchers—to pinpoint new volcanic eruptions on the North Atlantic's mid-ocean ridge. As part of the deal, Purdy will probably have to avoid revealing the exact locations of the Navy's listening posts in his papers. "When we publish the results, we [will] have to be innovative," he says. That compromise meant that during the 2 years Purdy spent getting access to the network, he was also "persuading the peer-review community that it's okay." Purdy appreciates the Navy's continuing need for secure operations, but he notes that the guardians of the data "have difficulty understanding that we need to *prove* things" to colleagues, not just state them as matters of fact.

The difficulties researchers face in using military data—gathered behind a curtain of secrecy by others for another purpose—may ease as the military comes under growing pressure to cooperate. Funding will likely get tighter, and competition from civilian sources is also heating up. Next April, Europe's Earth Resources Satellite-1 will shift its mode of operation and begin returning the same kind of gravity data that Geosat yielded, except these data will be unclassified from the start. That could prompt the release of the remaining Geosat data to give U.S. researchers an edge over their European colleagues. Indeed, the Navy already seems to be anticipating such competition: Its Geosat Follow-On mission, which like Geosat will map ocean weather, will be entirely unclassified after its 1996 launch. "It's clear they have the civilian aspect in mind," says Cheney.



In the clear. Geosat, which operated from 1985 through 1990, has been gradually declassified.

Meanwhile, the growing market for space-based images may lure the operators of spy satellites in from the cold. Commercial satellites now return images having a resolution as good as 10 meters, and they are expected to improve the resolution to 1 meter within a few years. But military satellites can do still better. As a result, congressmen, intelligence agencies, and industry have been squabbling over what part, if any, of classified images or imaging technology might be released to keep the United States—and in particular its flagging aerospace industry—in the international competition.

In another area, the military's attempts to keep its orbiting GPS satellites from benefiting an enemy have drawn heavy criticism. By degrading the GPS signals, critics argue, these efforts create what is at best an expensive nuisance for researchers and other civilians. Even the government's own Federal Aviation Administration regularly circumvents the security measures, notes Thomas Herring of the Massachusetts Institute of Technology. Herring and other scientists who use GPS to measure the subtle motions of the crust and variations in Earth's rotation hope that the military will soon see the futility of its ways and allow GPS satellites to transmit undegraded positioning signals for all.

Perhaps the most encouraging sign for civilian researchers has been the formation of the Environmental Task Force (ETF). Set up in 1992 by Robert Gates, then the director of the Central Intelligence Agency, at the request of then-Senator Al Gore, the ETF consists of government representatives and civilian scientists who were given security clearances to review classified data and facilities. Their charge is to identify which of these resources might contribute to a better understanding of global change—and to recommend ways of making them broadly accessible. Earth scientists eager for the spoils of the Cold War can only hope that the report, due out this year, will ease a process that, so far, has often favored the most tenacious and well-connected among them.

–Richard A. Kerr