

PHYSICS COMMUNITY

Congress Chills Hopes for Polar Cap Observatory

The National Science Foundation's plans to build a Polar Cap Observatory were set back last summer when Congress insisted it be built in Alaska instead of in the Canadian Arctic—a demand that conflicts with the scientific goal of siting the facility near a geomagnetic pole. Despite ongoing discussions between NSF and the Senate Appropriations Committee, prospects look bleak for getting the observatory up and running in time to make radar and optical measurements of the ionosphere and upper atmosphere during the next peak in solar activity, around 2001.

A porthole view

The main aim of the PCO is to study the effects of the Sun on the structure and dynamics of Earth's atmosphere. "Earth acts like a load collecting energy from the solar wind, and the energy goes to the magnetic poles," says Cornell University geophysicist Michael Kelley. Observing the atmosphere from near one of the two magnetic poles would be like having a "porthole" on interplanetary space, he adds, because only there do field lines extend outward; elsewhere they connect to conjugate points on Earth, so that data collection is limited to local electromagnetic effects.

To get the "porthole" view, the PCO needs to be located inside the polar cap—the dynamic oval region around the magnetic pole devoid of major auroral activity. NSF wants to build it at Resolute Bay, on Cornwallis Island in Canada's Northwest Territories. (The southern magnetic pole was ruled out because of the harsher antarctic climate and greater transportation costs.) Resolute Bay has a small Inuit community, an existing scientific presence (including American and Canadian optical and radar instruments), clear weather and transportation facilities (there are several flights weekly and a ship calls once a year). "We picked Resolute because it's the best site," says Kelley. "You can see a vast part of the convection patterns of the upper atmosphere—almost the entire polar cap."

If built at Resolute Bay, which is at lat. 84° N magnetic and lat. 75° N, 95° W geographic, the PCO would com-

The gap in NSF's hemispheric chain of atmospheric observatories is not likely to be closed before the millennium.

plete and complement a chain of similar observatories that dot the 70th meridian from the equator northward—in Jicamarca, Peru; Arecibo, Puerto Rico; Millstone Hill, Massachusetts; and Sondre Stromfjord, Greenland. Data from the Resolute Bay site would also benefit scientists using the new European–Japanese radar facility on Svalbard, Norway, at the edge of the polar cap. "The central polar cap is still a real gap," says Richard Behnke, who heads NSF's upper atmosphere research section. "The entire international community of space scientists is

participate in all research, both on-site and by remote control, says Kelley, who plans to use the observatory to study noctilucent clouds, which form in the polar regions in the summer at about 85 km altitude. "They don't seem to have been here last century," he says. "It's fascinating. They may be a global-change marker."

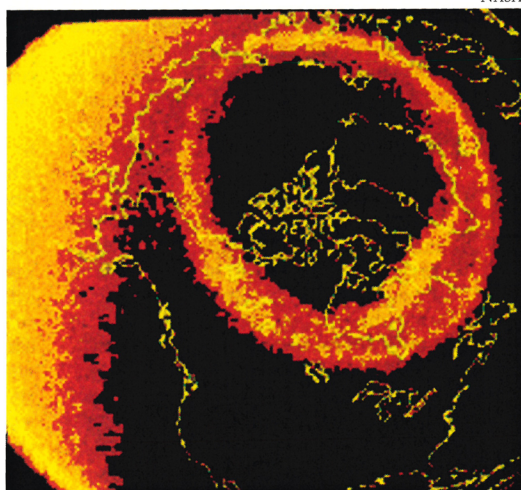
A suite of optical and radar instruments is planned for the PCO. The centerpiece would be a 3 MW incoherent scatter radar, which backscatters radio waves from electrons to measure a host of atmospheric parameters, including plasma density and composition, temperatures of electrons and ions and bulk motions of the ionosphere. The PCO's incoherent radar would have 4428 phased-array elements and be electronically and mechanically steerable through all angles down to about 8° above the horizon. It would be able to probe altitudes from about 85 km to 1000 km.

In limbo

"Things were going swimmingly," says Kelley. "We went through all the struggles and slowly percolated up in priority at NSF." The foundation's fiscal year 1998 budget request included \$25 million for the PCO. "We thought we had it," says NSF's Behnke. "But the Senate Appropriations Committee had questions about siting the facility in Canada." Last July, the committee insisted that the PCO's incoherent scatter radar be built at an existing Department of Defense (DOD) ionospheric research site in Gakona, Alaska—the home state of the committee's chair, Republican Ted Stevens. This demand was later rescinded, but Congress

asked NSF to justify both the PCO's science and the chosen site, which it did in January. The PCO was nevertheless struck from NSF's FY 1998 budget, and plans to go ahead with the facility have remained stalled ever since.

On the face of it, combining the two ionospheric research sites makes sense, since money would be saved if one radar could serve both research communities. And putting that one radar in Alaska would keep money in the US. But, as Paul Kossey, program



SCIENTISTS WANT TO BUILD THE POLAR CAP OBSERVATORY at Resolute Bay, which is located in the Canadian Arctic within the polar cap, the region encircled by auroral activity in this satellite image.

waiting for this gap to be filled."

The PCO would play a key role in the National Space Weather Program—helping to understand large-scale magnetic storms such as the one that cut off electric power to about a quarter of all Canadians in 1989, or thought to have destroyed AT&T's Telstar 401 satellite last year. And the PCO's capabilities would complement satellite studies of the atmosphere and ionosphere. Several hundred scientists a year would use data collected at the PCO, and students would par-

director for the DOD site, explains, "the basic instrument could in many ways be the same [for DOD and NSF], but the location needs are different. We want to operate an incoherent scatter radar in conjunction with a high-frequency transmitter, and the two need to be within about 10 miles of each other." And NSF, in its site-justification report, argues that the planned science can be done only from inside the polar cap. Pointing out that no site in Alaska "does more than brush against the region of interest," Kelley says the research community "didn't consider Gakona for a microsecond." Ironically, he adds, the incoherent scatter radar now in Greenland was moved there about 25 years ago from Alaska to align it longitudinally with NSF's other radars. "It didn't make sense then [for NSF] to have a radar in Alaska, and it doesn't make sense now."

Scientists involved with the PCO suspect that the Senate Appropriations Committee missed the crucial importance of placing the observatory near the magnetic pole. They also fear that the PCO has become mixed up in US-Canadian politics. In particular, they note that a crossborder dispute over salmon fishing was heating up last summer, just when the Senate committee was questioning the need to build the PCO at Resolute Bay. But a Senate insider doubts that an incoherent scatter radar would provide much leverage in the fishing wars. NSF hasn't made a convincing case for why the incoherent scatter radar couldn't still be shared by NSF and DOD by locating it somewhere between Gakona and Resolute Bay, he says, nor for why Canada isn't contributing more to the project. (Canada's main contribution would be the site at Resolute Bay.)

The hope, says Behnke, is to get Congress's blessing to use \$5 million from the foundation's FY 1998 geosciences coffers, and to try to "get back on track for the next budget cycle." Half of this initial funding would be for engineering studies, and half for getting the site ready, Behnke says. But that hope slipped another notch in mid-June, when a Senate appropriations subcommittee reportedly struck the PCO from NSF's FY 1999 budget request.

Whatever the reason for the Senate's reluctance to fund the PCO, it has meant missing this year's ship to Resolute Bay. "There is a severe danger that the PCO won't be operational" in time for the next solar maximum, says University of Saskatchewan atmospheric physicist Donald McEwen. "That doesn't make it lose importance, but it loses some of its impetus."

TONI FEDER

Nuclear Waste Shipments Halted in Europe

In May, several European countries suspended all nuclear waste transport in response to revelations of contamination of the shipping containers and their transport vehicles.

Up to a third of the spent fuel shipments that nuclear power companies have sent over many years to Cogema's reprocessing plant in Cap de la Hague, France, have had loose surface radioactivity above the legal limit of 4 Bq/cm², with instances recorded of more than 3000 times that. The contaminated trucks, railcars and spent fuel casks have the gamma-emitter cobalt-60 on their exterior surfaces. Government officials in France, Germany and Switzerland, the countries where most of the contaminated shipments originated, claim to have learned of the violations only in recent months, but Cogema and utility operators admit that they've known of them since at least the mid-1980s.

Public outcry over the contaminated shipments has been intense in the countries involved, and particularly in Germany, where the topic has been front-page news since the story broke on 6 May, in the French daily newspaper *Libération*. Germany's federal and state governments have sharply criticized the nuclear power companies, its police and railway workers complain that they have been exposed to radioactivity despite having been reassured otherwise, and the Green and Social Democratic parties are calling for the federal environment minister, Angela Merkel, to resign. Perhaps the scandal's biggest impact—everyone from Greenpeace to Cogema agrees—is the betrayal the public feels, and its consequent loss of trust in the nuclear industry.

"The problem was not kept hidden," insists Catherine Tissot-Colle, of the

Cogema subsidiary Transnucléaire. Transports are checked upon arrival for reprocessing, and "each time a discrepancy is found, the customer is informed. We are working with the utility companies to find the best way to stop the contamination," she says. "We treat it as a technical problem because the levels measured have no impact on the public or the environment."

National safety authorities and the International Atomic Energy Agency agree that the excess radioactivity on the transports probably did not pose a health risk, with the possible exception of inhalation or ingestion. But others warn that the risk has not yet been properly assessed. Even Jean-François Lacronique, who heads the Office de Protection contre les Rayonnements Ionisants, the French government body in charge of radiation protection and health issues, says that there is no scientific basis for claiming negligible risk—particularly regarding possible long-term health effects. "We must be prudent. It's a matter of reconstructing doses, and this must still be done," he says.

French National Railways reacted to the news of the contamination by stopping all nuclear waste shipments, and the governments of Germany and Switzerland have banned them. Spent fuel shipments to Europe's other major reprocessing plant, in the UK, at Sellafield, have been found to be similarly contaminated. And shipments from The Netherlands and Belgium have also topped accepted surface radioactivity levels, but the problem in those countries is minimal, as they produce very little nuclear waste, according to André-Claude Lacoste, who heads the Direction de la Sûreté des Installations Nucléaires (DSIN), the government body that oversees civilian nuclear

SPENT FUEL
en route to
Cogema's reprocessing plant in
La Hague,
France—before
the ban was put
in place.



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