no mechanism to transfer intellectual property to the private sector," Ohtaki says.

Neither is it easy to hold joint patents on collaborative work. Although such arrangements are possible, says an official at the Ministry of Education, Science, Sports, and Culture, the procedures are cumbersome and not well known. The ministry is now studying ways to help universities benefit from intellectual property and work with the private sector. In the meantime, Murakami says he hopes academics will be willing to act as unpaid advisers to the new companies.

The biggest benefit of the new ventures for existing companies may be to stimulate their own human genome research efforts. A director of research planning at one of the participating drug firms, who requested anonymity, said his company sees participation as a step in developing "an infrastructure of genome research." The company plans to assign its own researchers to the consortia temporarily and then use them as the nucleus of the firm's own genome research team when they return. The consortia will focus on very basic work, he adds, leaving drug development in the hands of individual companies.

That arrangement is fine with Murakami, who sees such collaboration as the key to success. "If the tasks are separated in a well-organized manner, the new company could produce substantial [results] in conjunction with genome labs at each participating company," he says. The joint activity, he adds, could also contribute to global efforts.

–Dennis Normile

POLAR RESEARCH

Pressure on Budget Triggers Review of Antarctic Program

This month, under the brilliant 24-hour-a-day sunlight of high summer, a team of physicists at the U.S. South Pole station is drilling half a dozen holes deep into the ice as part of an experiment to flag down elusive cosmic neutrinos. Not far away, astronomers are peering into the cosmos with newly installed infrared and millimeter-wave telescopes that take advantage of the pole's high, dry, frigid environment. Other areas around the base are also a buzz of activity, as geophysicists, atmospheric scientists, and geologists probe the workings of Earth and its climate, both ancient and modern.

All this work is supported by the U.S. Antarctic program as part of a $195-million-a-year effort run by the National Science Foundation (NSF). It's by far the largest and most productive scientific presence on the continent, accounting for 40% of the roughly 3000 people working on the continent on any given austral summer day, by NSF estimates. But size is not always a virtue during times of fiscal austerity: The program has caught the attention of Congress, which has asked for a thorough review of U.S. policy in Antarctica.

At issue is whether the country still wants—and can afford—such a dominant effort. Last week more than a dozen federal officials gathered at the Old Executive Office Building to kick off the review, which could decide not only the future of these ongoing scientific activities but also the fate of NSF's plans for a $200 million replacement for its South Pole station. The review, requested by the Senate appropriations subcommittee that oversees NSF's budget and endorsed last month by the House, could also affect research by other countries that are partners in joint activities and whose own efforts are coming under closer scrutiny (see box).

The trouble is that Antarctic research doesn't come cheap. The current program—three year-round stations, two research vessels, and the world's only fleet of planes capable of landing on the ice—eats up 9% of NSF's overall research budget and requires $5.50 in logistical support for every dollar spent on research. Both figures will increase if the government replaces the 20-year-old Amundsen-Scott Station with a new structure that NSF officials say must be built in the next 5 to 7 years to meet the scientific, health, and environmental needs of those working at the South Pole (*Science*, 24 June 1994, p. 1836).

Hot spot. NSF hopes to avoid a meltdown of its plans to rebuild South Pole station.

Congress wants federal officials to think about ways to trim costs, including making the new station an international effort and operating it for only part of the year. And it's asking the Administration to look at these issues in a broad context: "It's not [just] how much money you can save," says a congressional aide who follows the issue closely, but "the rationale behind why you're there." The White House has assigned the job to a task force of the Committee on Fundamental Science, one of nine panels that make up the president's National Science and Technology Council, which includes 20 federal agencies with an interest in science. The Senate subcommittee wants a report by 31 March, in time to review NSF's 1997 budget request, which could include a downpayment on a new station.

Polar scientists seem confident that the research portfolio can withstand scrutiny by federal officials. "I've been going there since 1959, and the science is better now than it's ever been," says Robert Rutford, a geologist at the University of Texas, Dallas, and the U.S. representative to the international Scientific Committee on Antarctic Research, which coordinates the various national programs. "NSF rolled the dice when it decided to build a new station," he says, "and now it needs to be able to defend the value of the whole program."

But the debate is not just about science. Although the 1959 Antarctic Treaty binds the 26 signatory nations to peaceful scientific activity, the U.S. government long viewed Antarctica as an important outpost in its campaign to contain Soviet expansionism—a role underscored by the use of military personnel for logistical support. In addition, seven countries continue to hold territorial claims that the treaty puts in abeyance and that a U.S. station at the South Pole serves to blunt.

Those strategic concerns have helped NSF survive past reviews, and Cornelius Sullivan, head of NSF's Office of Polar Programs, says the fundamental issues haven't changed. "Is there something wrong with our policy over the past 40 years, or is it basically sound?" he wonders. In 1982, after soaring fuel prices threatened to curtail the program, the Reagan Administration endorsed "an active and influential presence" in Antarctica with the existing complement of facilities. A review early in the Clinton Administration, part of a 1994 directive that remains classified, cited along with science the importance of protecting the environment, cooperating with other countries, and preserving the region's living resources.

R. Tucker Scully, director of the department's office of ocean affairs and a veteran of Antarctic policy debates, is convinced that the current policy is correct. "I would be quite surprised if the task force concluded that our fundamental interests in Antarctica have changed, because I don't think that they have," he says.

However, NSF may have fewer allies at a time when budgets are shrinking, national

Europeans Make Room for Ice-Core Project

The U.S. Antarctic program isn't the only national effort coming under scrutiny from budget-conscious politicians. Both France and Italy, leading members of a 10-nation European effort to drill two 3500-meter-deep ice cores on the Antarctic plateau to uncover 500,000 years of climatic history, are asking polar scientists to justify the additional expense for the $60 million project. At the same time, two other major partners, Britain and Germany, have reshuffled their Antarctic programs to make room for the new project in a tight budget.

The two-core European drilling project, known as the European Program for Ice Coring in Antarctica (EPICA), hopes to test whether the findings from Europe's recently completed Greenland Icecore Project apply on a global scale. Drilling will begin in December 1997, in a region influenced by the Pacific and Indian Ocean, while the second phase will drill in an area affected by the South Atlantic Ocean.

In France, the debate is focused on plans for a $28 million year-round national station, Dome Concordia, at one of the two drilling sites. "Of course other scientists are interested in the money we will be spending at Dome C," says Roger Gendrin, director of the French Institute for Polar Research and Technology in Brest. "The criticism is based on people asking if it is really necessary to maintain a winter presence there and carry out continuous measurements at the site. We think the answer is yes."

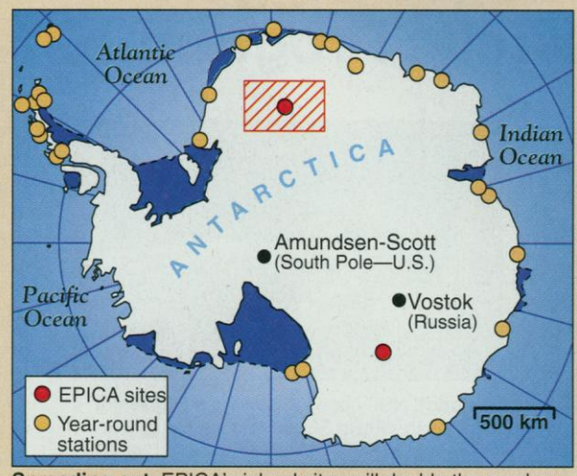
When completed in 2000, Dome Concordia will host research in astrophysics, medicine, meteorology, seismology, and other disciplines. It is likely to be only the second year-round station, after the U.S. South Pole station, operating on the Antarctic plateau. (Winter operations at the inland Russian station at Vostok were suspended after the 1993–94 austral summer to save money, and the station, although it stayed open last year, is scheduled to close again at the end of the current summer season.) France currently operates one year-round coastal station, Dumont d'Urville.

In Italy, legislators are debating whether funds from Antarctic research would be better spent closer to home, on studies of the Mediterranean Sea. "Fortunately," says Mario Lucchelli, manager of Italy's National Program for Antarctic Research, "the program has lots of friends who know how important it is for Italy to be part of high-quality international research." Italy's only station, at Terra Nova Bay, is highly automated and is staffed only during the austral summer.

The EPICA project is already spurring some changes in Britain's and Germany's programs. Among other things, the British Antarctic Survey (BAS) is cutting two of its four year-round stations. Signy Station in the South Shetland Islands will close its winter operations next year, says BAS Director Peter Heywood, and in February Ukraine will take over operations at Faraday Station, on the Antarctic Peninsula. "We decided we wanted to put our money elsewhere, and we had to make some hard-nosed decisions," says Heywood.

Germany is also shifting resources to accommodate the drilling project in a tight budget. "We're trying to cut down on the number of winter-over people at Neumayer Station [Germany's sole year-round facility] by seeing how much of the work we can automate," says Max Tilzer, director of the Alfred Wegener Institute in Bremerhaven, which runs the country's Antarctic research program. The institute has shifted some money into Arctic programs to fund joint expeditions with Russia, and it is also in the process of dismantling a 10-year-old Atlantic station, Georg Forster, inherited from the former East Germany.

–J.D.M.



SOURCE: SCIENTIFIC COMMITTEE ON ANTARCTIC RESEARCH

Spreading out. EPICA's inland sites will double the number of year-round stations not located along the Antarctic coast.

security is being redefined as economic competitiveness, and environmentalism is under attack. Although one important player, the National Security Council, has so far remained neutral in the debate, it has never been a big booster of the research program. And a few influential senators, led by defense appropriations panel chair Ted Stevens (R–AK), believe that a slimmed-down Defense Department should focus on areas of greater strategic importance than Antarctica. Last summer, for example, Stevens proposed that no military units be allowed to provide logistical support to the region, even though NSF reimburses the Pentagon for its use of military personnel and equipment. The language was modified by House-Senate conferees, but it spurred NSF to step up its effort to reduce its historic reliance on the military.

NSF's environmental research agenda may also be a harder sell. "If Congress doesn't believe in ozone depletion and global warming, then it's hard to get them to understand the importance of the work going on there," says Beth Marks, head of the Antarctica Project, a Washington, D.C.–based environmental group that closely follows U.S. activities in Antarctica.

But even if the review reaffirms the program's value, NSF's supporters also wonder if the agency is savvy enough to avoid getting hit in the crossfire in upcoming budget battles. "The problem with the South Pole station, for example, is that there were several options, and they picked the most expensive one," says Marks. "I don't think they realize what could happen to them. If Congress says cut [the overall NSF budget] and they don't have a fallback position, then they are out of luck."

In response, NSF's Sullivan says there is a plan to carry out the South Pole renovation in phases, putting safety and preservation of the environment first and delaying an upgrade of research facilities if money is tight. But he says that wholesale trade-offs involving the rest of NSF's budget would violate language in the 1982 review declaring that other NSF programs should not be taxed to pay for U.S. activity in Antarctica.

For Antarctic researchers, the unique science they are doing is ample justification for the program. Still, they will be anxiously watching Washington in the months ahead for clues to whether the sun will continue to shine on their projects.

–Jeffrey Mervis