SCIENTIFIC FACILITIES

NSF Fits In New Projects Despite Squeeze on Funding

What does a federal science agency do when its construction dreams are bigger than its budget? For the National Science Foundation (NSF), the answer is to funnel requests into a queue and fund them a few projects at a time, in a way that doesn't threaten the flow of small grants to individual investigators. Three years ago, NSF set up such a system to conduct this big science–small science balancing act, and it is about to be put to the test. Next week, *Science* has learned, NSF will ask Congress, as part of its 1998 budget request, to approve starting two new projects: the Millimeter Array (MMA) and the Polar Cap Observatory (PCO).

The foundation has always been wary of funding costly construction projects because its primary mission, unlike other federal agencies, is to support fundamental research at the nation's universities. But several years of rising budgets in the late 1980s and early 1990s allowed NSF to say yes to such major scientific facilities as a $300 million laser interferometer gravity-wave observatory (LIGO) and twin, $175 million Gemini telescopes now nearing completion. Then came a budget crunch. NSF was faced with trying to accommodate the demand for cutting-edge facilities in an overall budget that is struggling to keep up with inflation. With anxiety levels rising among its small-science clientele, NSF created a new budget category, called the Major Research Equipment (MRE) account, to fund big science in an orderly manner.

When it set up the MRE account in 1994, NSF grandfathered LIGO and Gemini into it. Last year, it added $25 million for repairs to the existing Amundsen-Scott Station at the South Pole. Now comes a full-scale test of whether new facilities and small grants can fit under one roof. NSF's 1998 budget will request $85 million for MRE spread over four projects: a down payment on the $200 million millimeter array, a set of 40 telescopes to be built in either Hawaii or Chile (*Science*, 17 January, p. 300); the entire $25 million for the polar observatory, a giant radar that will probe the upper atmosphere from a site inside the Arctic Circle (*Science*, 24 January, p. 467); $26 million to complete LIGO; and $25 million to begin replacing the 25-year-old Antarctic station (see table).

The new projects are the first to complete a long process of consensus building intended to ensure that each facility ranks at the top of the relevant discipline's wish list and that NSF can afford to operate it once it comes on line. "When budgets were growing, we didn't have to be as conscious of new starts," says John Hopcroft, dean of engineering at Cornell University and chair of the programs and plans committee of the National Science Board, NSF's oversight body. "Now, we have to shut something down [before we can start a new project]." The MMA and polar observatory got their chance in the 1998 budget because Gemini has been fully funded and NSF hopes this year's request for LIGO will be its last.

The proposed facilities are too large to fit within the budget of a single NSF division or discipline, typically costing at least $25 million. The proposals come to NSF as requests from the community and undergo the usual peer review. Once they pass muster within a program and directorate, they are kicked upstairs to a committee of senior NSF officials. At that level, they face their first hurdle, says Anne Petersen, former deputy NSF director, now at the W. K. Kellogg Foundation, when officials ask: "Is this really cutting-edge? And is there any other way of doing the research?"

But scientific excellence isn't enough to carry the day, she adds. The relevant division is expected to make annual and rising contributions to the cost of construction from within its own budget, with the final year's contribution equal to the projected first year's operating funds. In astronomy, for example, that means almost $10 million a year for MMA by 2005; for the geosciences, it's about $2 million a year for PCO by 2001. The exercise forces officials to make a realistic estimate of the lifetime cost of each facility, says Hopcroft. "Even if it can't be done well, raising the question focuses attention on the issue," he says.

Not surprisingly, reaching consensus within NSF takes time. The National Radio Astronomy Observatory submitted a proposal in 1990 to build the MMA, but it was not until 1994 that the science board gave a thumbs up to proceed with a development plan. "And we make it clear that step doesn't mean a commitment to fund it," adds Hopcroft. A preliminary version of PCO was first proposed in 1993. Last year, NSF sought board approval for both projects, Hopcroft says, but the prospect of a tight 1997 budget prompted the board to delay them for a year.

NSF officials say the process of selecting projects for the MRE account seems to be working well and that it will be used on proposals already in the pipeline once MMA and PCO wind down. But the mechanism will protect individual-investigator awards only if the total MRE account itself is kept on a tight rein. Indeed, a White House official worries that NSF is underestimating the real cost of such projects in anticipation of being "bailed out" in future budgets. Agency officials insist that their projections are sound, however, and that the MRE account won't grow at the expense of other NSF programs.

Hopcroft, for example, says he thinks the level being requested for next year is about right: "We're comfortable with that figure, although it's hard to say exactly why. If it dropped to $60 million one year, we'd probably wonder if we were making the proper investment in new facilities." But he notes that each new start represents a fateful decision. "Every time you approve a project, you're foreclosing an opportunity to do something else," he says. "We simply can't do all the good science that's out there."

–Jeffrey Mervis

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SOURCE: NSF

NSF'S BIG-PROJECT WISH LIST FOR 1998

Project	Location	Total cost/ 1998 request	Description
Millimeter Array	Hawaii/Chile	$200 million/ $25 M over 3 yrs.	40 telescopes for long-baseline interferometry
Laser interferometry gravity-wave observatory (LIGO)	Washington and Louisiana states	$300 million/ $26 million	2-site interferometry to measure gravity waves
South Pole station	Antarctica	$180 million/ $25 million	Replace and upgrade scientific capability
Polar Cap Observatory	Resolute Bay, Canada	$25 million	Radar scattering, other instruments to probe upper atmosphere

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Head of the class. In 1998, NSF wants Congress to fund these four projects—two new starts and two continuing activities—from its major research equipment account.