National Observatories: Contention Continues

W. Patrick McCray's article "The Contentious Role of a National Observatory" (PHYSICS TODAY, October 2003, page 55) describes the tension between two important individuals as the US national optical observatory system was formed. Some of the reasons behind that tension need to be emphasized—in particular, the influence that NSF had on the money trail. As an astronomer, I worked with Leo Goldberg at the University of Michigan, helped for a dozen years to build a nationally funded observatory, and worked with Jesse Greenstein, who advised me about investments when I was treasurer of the American Astronomical Society; I also am a former director of the astronomy division at NSF. In all these positions, I was privileged to both witness firsthand and participate in NSF's support for astronomy.

In the 1950s, astronomers in the upper Midwest and in the East had access only to small telescopes located in poor observing climates; the large state- and endowment-funded telescopes in the West served small staffs of excellent astronomers who offered little observing time or support to visitors. It was the Midwest astronomers, soon joined by the Easterners, who convinced NSF to provide national funding for moderate-to-large optical telescopes on Kitt Peak. Those facilities would encourage visitors and be competitively available to anyone with a good observing program. Had the large western telescopes been more accessible to visitors, the funding history might well have evolved differently.

Although western astronomers complained that monies that should have gone to them were going to the new national observatory, they soon became board members of the Association of Universities for Research in Astronomy, which manages Kitt Peak National Observatory. But as McCray points out, they often took positions that served to cap further growth of Kitt Peak.

A primary goal of NSF is to assure the scientific health of each sub-branch of each science it funds. Within the constraints of available money, NSF's funding for ground-based astronomy has supported that goal well. Its initial perception that optical astronomers needed more access to larger telescopes prompted the formation of Kitt Peak. Its experience with the reticence of western observatories to open their telescopes to visitors who had excellent observing programs served to stimulate initial federal support for a national optical observatory. Some

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funding was available to build modest national telescopes but not to build still larger telescopes for private and state universities. NSF could not do both, although it was able to fund instrumentation for those observatories.

Up to the late 1970s, there was an unwritten agreement, monitored by the Office of Management and Budget, that NSF would fund ground-based astronomy and NASA would fund US space observatories and the space-oriented programs associated with them. But after the mid-1970s, NASA began to fund construction of ground-based telescopes and provide more broadly defined ground-based support. That shift has tended to erode the role of the ground-based astronomy program at NSF. Any decrease by NASA in funding for ground-based activities without a commensurate increase in NSF's program would have a serious negative effect on the nation's research contributions to astronomy.

Throughout its history, NSF's astronomy program has been responsible for assuring the health of the entire ground-based enterprise in the US by providing a balance among its grantees, its instrumentation programs, its centers, and all astronomical subdisciplines. Moreover, NSF strives to ensure, through cooperative programs with other nations, that the US will remain internationally competitive. To do this, it takes into account the degree of funding from other sources and uses its limited funds to achieve a good national balance.

NSF's purpose was never to make the national optical observatories dominant; the organization has always taken steps to ensure that only excellent research is pursued at places that receive federal funding. NSF officials are still trying with some success to give visitors greater access to those observatories that are not primarily nationally funded.

William E. Howard III
(wehoward@sigmaxi.org)
McLean, Virginia

The article on the history of national observatories makes for interesting reading. The current trend is for these facilities to devote their increasingly pressured budgets to their large telescopes at the expense of smaller ones that historically have been extremely productive per square meter of aperture.

Astronomers who are based at smaller institutions and who pursue modest (but still valuable) research goals are largely being shut out of the game. Few small departments or institutions have the resources or administrative commitment to join a private consortium that would give them access to only a small amount of telescope time each year. Societies and science thrive best under a system of democratic meritocracy in which both private and public support are available.

Cameron Reed
(reed@alma.edu)
Alma College
Alma, Michigan

McCray replies: I am pleased at the interest my article generated. Both William Howard and Cameron Reed bring up excellent points.

As Howard suggests, one feature that distinguishes American astronomy from its counterparts in other countries is its long tradition of private, state, and philanthropic support, which continues to this day. Unlike many other areas of science—nuclear physics, for example—optical astronomy's private patrons continued to provide generous support even after the federal government became an important postwar patron. The complementary and often competitive relationship between the private and public observatory systems in the US continues to be a powerful force in the community. An indication of the importance of that relationship is the ongoing debate over how to fund and build the next generation of giant telescopes (see PHYSICS TODAY, August 2003, page 22). One is struck by the similarity between optical astronomy and the private–public race in the 1990s to decode the human genome.

As J. Merton England's book *A Patron for Pure Science: The National Science Foundation's Formative Years, 1945–57* (NSF, 1982) shows, NSF saw astronomy as an especially promising area in which to invest in large-scale science facilities. Given the monopoly that the Atomic Energy Commission had on the funding of big accelerators for high-energy physics, fields like astronomy and multidisciplinary endeavors like Antarctic exploration and the International Geophysical Year offered a way for NSF to invest in postwar big science.

Although making the national optical observatories dominant may not have been NSF's stated purpose, the decision to not pursue that goal certainly raised eyebrows in the scientific community. It is hard to identify many areas of postwar science in which national research facilities were of lesser size, scale, or power compared with their private counterparts. During numerous interviews for my recent book *Giant Telescopes: Astronomical Ambition and the Promise of Technology* (Harvard U. Press, 2004), astronomers frequently mentioned that, in the 1970s, the national telescope's 4-meter mirror on Kitt Peak was smaller than that in the privately owned 5-meter telescope on Palomar. The situation—indeed, the same ratio—persisted with the two 10-meter Keck telescopes versus the two 8-meter Gemini telescopes.

Reed makes a salient point. Whether to close smaller observatories in favor of building new and bigger facilities is a critical issue in the formulation of US science policy for astronomy. Such decisions are made more difficult by the productivity of smaller telescopes and their role in training students. As Reed notes, perhaps the best system is one that favors "democratic meritocracy." The continuing challenge facing the science community would appear to be how to achieve that ideal.

W. Patrick McCray
(pmccray@history.ucsb.edu)
University of California, Santa Barbara

US Climate Research Plan May Ask Wrong Question

The Bush team's 10-year climate change research plan as discussed in the September 2003 issue of PHYSICS TODAY (page 34) bears an eerie resemblance to the 10-year acid rain research plan instituted by an earlier administration. That plan was also funded by the government, undertaken by numerous laboratories, and continued for the designated decade. However, in the acid rain case, the US Congress surprised many by passing effective legislation to reduce sulfur dioxide and nitrogen oxide emissions, and did so some time before the 10 years had passed and before the research leaders had submitted any report.

Interviews with various participants indicated that the government had set experts to work on the wrong question. Many members of Congress had long known that sulfur in the air was not a good thing, but they did not know how to outmaneuver the politically powerful representatives from large, coal-producing