disappear, scientists leave, and paper records get lost. At that point there is no history except memory."

"It's not an exaggeration to say that I have my job because of the AIP study," says SLAC archivist Jean Deken. The study grew out of Warnow-Blewett's earlier look at DOE national labs, and that's where it's had the most impact so far. Not only does SLAC now have a full-time archivist—and Lawrence Livermore National Laboratory is seeking one—but DOE's new rules for identifying and saving R&D documents were influenced by AIP's findings, including requiring that projects be ranked. "This shouldn't be radical, but it was. Before, nobody ever took the project-by-project approach," says Deken. "A Level 1 project is groundbreaking, it has international significance or alters the direction of research—all significant documents are kept permanently for these projects. Level 2 is important, it increases the scope of knowledge, but is not earth shattering—records are kept for 25 years. Everything else goes into Level 3, and records are kept for 10 years." The BaBar detector and PEP-II storage ring at SLAC, and the National Ignition Facility at Lawrence Livermore, for example, are Level 1 projects. "The beauty of ranking," says Deken, "is that scientists respect and understand it immediately."

DOE keeps the best records, says Warnow-Blewett. "It could be used as a model for other federal agencies—which haven't come to terms with the importance of documenting the science they're in the business to do."

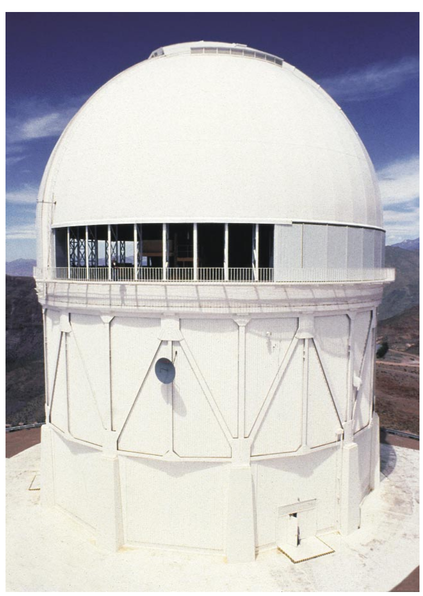
Toni Feder

US Panel Nixes Astronomy Move

Astronomers in the US gave a collective sigh of relief when a National Academy of Sciences (NAS) panel rejected a proposal outlined in President Bush's 2002 budget to move ground-based telescopes from NSF's to NASA's auspices. Nor were NASA officials disappointed by the outcome: "The proposal came as a total surprise," says Edward Weiler, the agency's associate administrator for space science. The NAS panel did, however, shine the spotlight on some weaknesses of NSF's stewardship, and recommended in a report that the foundation create its own long-term strategy for astronomy, improve the management of existing projects, and consider competitive bidding for building new facilities.

Both financial pressure and concerns about the future of US astronomy spurred the White House Office of Management and Budget (OMB) to discreetly arrange for NSF and NASA to call for the NAS study this past spring. But the 11-member panel, headed by Norman R. Augustine, a former CEO for Lockheed Martin now at Princeton University, nixed the proposed move to NASA. The panel, dominated by university astronomers, concluded that giving NASA oversight of US ground-based observatories would cause so much upheaval that it would "seriously weaken the intellectual roots of the discipline." The panel cited the advantages of having astronomy in an agency closely tied to the academic research community. But it also pointed out that NSF will have to negotiate with private institutions and form more international partnerships to afford the next generation of large instruments.

Ground-based astronomy at NSF faces many problems: a stagnant budget, a lack of political support for future projects, NASA's growing influence over astronomy, and demands by independent facilities such as the Keck Observatory for new NSF-funded instruments. These problems are all intertwined in a complex relationship, explains William Smith, president of the Association of Universities for Research in Astronomy, which manages the national optical observatories for NSF. NASA and NSF together fund about 90% of all US astronomical research, but NSF's share has dropped from 60% to 30% over the past decade. The rest of the funding is from private sources and universities. And NASA now funds nearly three-quarters of individual research grants in astronomy.



NOAO

Ground-based observatories such as the Blanco 4-meter telescope in Chile will stay with NSF, not be moved to NASA.

In evaluating whether ground-based astronomy should remain at NSF or be clumped with NASA, the NAS panel solicited comments from hundreds of astronomers. In addition to providing opinions on the NSF move, astronomers complained about the lack of support for research areas that overlap the two agencies, such as balloon-based observations. Many cited a slow erosion of the US lead in astronomy. "For the last 30 to 40 years, the US has dominated optical astronomy," says Riccardo Giacconi, president of Associated Universities Inc in Washington, DC (which operates the National Radio Astronomy Observatory) and former director-general of the European Southern Observatory. "Now there is strong competition from Europe and Japan."

"Several staff members in the executive branch and in Congress conveyed to the [panel] their perception that NSF does not manage large projects well," says the NAS panel, but "we did not find evidence" that NSF had "significantly more" management problems than other federal agencies. Their report suggests that NSF develop a more comprehensive accounting system for each project and improve its communication with Congress, the White House, and the public. "NSF can do a better job of bringing science to the public," agrees Weiler. "NASA has, and I am quite proud of that. If you don't get that science translated into a form that real Americans can understand, you are not doing the job of a federal agency."

But astronomy's biggest problem is funding. "By a substantial margin, the NSF does not have the resources to keep US ground-based optical and infrared astronomy at the world level," the panel's report says. The only solution, it continues, is to develop "systematic, comprehensive, and coordinated planning" between the agencies and private facilities through a high-level joint advisory committee run by the OMB and the White House Office of Science and Technology Policy.

This suggestion is controversial and many astronomers doubt that the new advisory committee would be successful. "The National Academy does an outstanding job in setting priorities for astronomy," says Weiler, "and clearly identifies areas for NASA's and NSF's attention. Personally, I do not support yet another advisory group." Smith believes that such a committee will face a daunting challenge in matching the different agencies' priorities and cultures in a "scientifically productive" manner. In any case, the community must find a way to get past its differences and unite on the national level, says Giacconi. "We must develop a United States of Astronomy."

Paul Guinnessy

NSF Centers Stimulate Research at Physics Frontiers

Cosmology, gravitational wave physics, ultrafast physics, and particle physics are the topics that triumphed in NSF's first annual competition to form Physics Frontier Centers. Four inaugural centers will get up to $3 million a year each for five years, with home institutions chipping in at least 15% more. The money will be for research, conferences, visitors, postdoc and graduate student salaries, equipment, and outreach activities.

The new centers are intended to support physics on a scale bigger and costlier than an individual or small group can typically undertake, but smaller than in major collaborations. Unlike many of the private and public research centers that have cropped up in recent years, these step back from the trend to require interdisciplinarity and ties with industry or government, and physicists are free to dream up center organization for themselves. "These centers are targeted to get at physics frontiers," says Jack Lightbody, executive officer of NSF's physics division. "They are not designed to fill some scientific or political niche. They will have some outreach and educational activities. But the principal objective is cutting-edge science where there is potential for breakthroughs."

First frontiers

Like all the new centers, the Center for Cosmological Physics at the University of Chicago builds on existing research strengths. "The frontier that we're proposing to explore is, to my mind, the ultimate frontier because it delves into the laws of physics governing the entire universe," says director Bruce Winstein, a recent convert to cosmology from particle physics. The center's founding members meld particle physics and astrophysics, theory and experiment. Initial activities include spearheading a study of galaxy clustering to probe dark energy—which appears to be responsible for accelerating the universe's expansion; participating in Auger and Veritas, detectors of high-energy particles from space, with the goal of homing in on dark matter; building an instrument to measure polarization of the cosmic background microwave radiation; and setting up a data analysis hub for the Sloan Digital Sky Survey. NSF awarded this center $3 million a year.

A host of gravitational wave detectors is on the verge of collecting data—LIGO in the US, VIRGO and GEO in Europe, and TAMA in Japan are ground-based projects set to start next year, and an international space-based project, LISA, is slated for launch later this decade. The mission of the Center for Gravitational Wave Physics "is to help crystallize and develop the emerging field of gravitational wave phenomenology," says Sam Finn, director of the Pennsylvania State University-based center. "The science sits at the interface of the astrophysics and gravitational wave communities. Relativity theory has been developed in the absence of experiment. There is no experimental culture. That is a bridge that needs to be built," Finn says. The center has founding members at nine institutions, and will get $1 million a year from NSF. Its three main thrusts are astrophysical interpretation of observations, testing general relativity, and contributing to the design of source-specific gravitational wave detectors.

CHUCK LONG/HAMPTON UNIVERSITY

MicroCOSM: Hampton University student Don Arnold's research on a gas-handling system for CERN's ATLAS detector now falls under the umbrella of the Center for the Origin and Structure of Matter (COSM), one of NSF's four initial Physics Frontier Centers.

At the Center for the Study of Frontiers in Optical Coherent and Ultrafast Science (FOCUS), research will span a huge energy range, from creating relativistic plasmas with high-energy laser pulses, down to manipulating quantum states in optical lattices or Bose–Einstein condensates, says Philip Bucksbaum, director of the center, which is a partnership of scientists at the University of Michigan and the University of Texas, Austin. "Controlling decoherence is the recurring theme," says Bucksbaum. FOCUS won $3 million a year from NSF. Its biggest single undertaking will be to take Michigan's existing terawatt laser and, for about $2 million, power it up to petawatt capability.

Rounding out the first batch of NSF Physics Frontier Centers is the Center for the Origin and Structure of Matter, led by Hampton University in Hampton, Virginia. COSM physicists are involved in strangeness physics at Jefferson Lab, including leading PRIMEX, an experiment that will look at decay of π^0 mesons to explore quantum chromodynamics at low energies. And for the Large Hadron Collider at CERN, outside Geneva, they are building part of the ATLAS detector, which will hunt for, among other things, charged Higgs bosons. On top of the physics, COSM aims to create a network among particle and nuclear physicists at historically black colleges and universities. Three are on board so far—Hampton, Norfolk State University, and North Carolina A&T State University, says COSM director Keith Baker. "I have been doing physics for more than a decade," Baker says. "This is what I've been building toward." COSM's $1 million a year has been approved by NSF's physics division, but must still wind its way through the foundation's bureaucratic maze.

Toni Feder

Secondary, Undergraduate Physics in Crisis in UK

The refrain is familiar, but the volume is up: UK secondary schools desperately need physics teachers, and university physics departments should broaden their reach in under-