

The proposed Keck outriggers (small domes) are the first planned Mauna Kea project to face litigation. If built, they will, with the main Keck telescopes, make up the world's largest optical/infrared interferometer. (Photograph with simulation of outriggers courtesy of the W. M. Keck Observatory.)

a significant impact—NASA originally concluded that the outriggers would not—an EIS assumes there would be, is more detailed, and involves more public input. “To look at the cumulative impact, we are going to look back at what has occurred, at our project, and at other future projects,” says Kenneth Kumor, NASA’s national Environmental Policy Act coordinator and federal preservation officer.

Consideration of cultural resources will be a fundamental focus of the EIS, Kumor says. “We are looking for environmental and cultural impact. For example, what are the noise impacts for areas considered sacred by Native Hawaiians? How have terrain alterations to site telescopes changed the silhouette of the mountain?” The list also includes studying the impact of traffic; sewage; and increased use of the summit area by astronomers, recreational visitors, and tourists; and the impact on the wekiu bug. The EIS will include a comprehensive look at alternative sites for the outriggers.

NASA is holding its first public meeting for the EIS early this month, and hopes to have a draft ready by summer and a final version in September, Kumor says. “But our first priority is to get the analysis done

right. If it takes longer, we will take that time.” He estimates the EIS will cost \$1–2 million.

In addition to a thumbs-up from the EIS, the outriggers need a land-use permit, on which the state is expected to decide in the next month or so. If all goes smoothly, construction could begin next year and the outriggers could be up and running by early 2007.

The future of astronomy

Whatever happens with the outriggers, everyone involved expects the NASA experience to set the tone for future projects on the mountain. Broadly, astronomers accept the need to show more respect for cultural and environmental issues, but they say compromise should go both ways. As the IfA’s David Jewitt puts it, “Seen in the proper perspective, the delay for the

EIS is a small price to pay. As far as the outcome is concerned, the bottom line is that we are not smelting steel up there, we’re collecting photons. It doesn’t get much cleaner than that.”

“My plan is to do every new project differently than in the recent past. I want to have full community involvement,” says Kudritzki. “Since the difficulties with the outriggers started, people have looked more intensively for other sites,” he adds. A key example is the Thirty Meter Telescope, for which site testing is planned on Mauna Kea, on Mexico’s San Pedro Mártir, and in Chile (see *PHYSICS TODAY*, August 2003, page 22, and December 2003, page 35). Says Kudritzki, “It’s important to get the TMT because it’s the future of astronomy. Without it, the importance of Hawaii for astronomy will decrease.”

Toni Feder



DOE Unveils 20-Year Priority List for Developing 28 Research Facilities

With a level of fanfare that signaled a significant commitment by the Bush administration to basic science research, Secretary of Energy Spencer Abraham used a packed National Press Club luncheon on 10 November to unveil the Department of Energy’s priority list for developing 28 major science facilities over the next two decades. The list, based on recommendations from six advisory panels, was finalized by Office of Science Director Raymond Orbach.

The high visibility of the secretary’s announcement was, in itself, considered important because such speeches are typically cleared by the White House and the Office of Management and Budget before being de-

The US Department of Energy’s Office of Science required that each proposed facility have a projected cost of at least \$50 million, and then assessed each based on the importance of the science it addresses and its readiness to move forward.

livered. Abraham emphasized that the facilities list is not a funding document, but said, “Clearly, this document has implications for the budget.”

Later, in a background briefing, a senior DOE official said that the budget assumptions used in selecting the 28 facilities were based on a 60% increase in Office of Science funding over the next five years and then a 4% increase every year through 2023. That would be a dramatic change in fortune for the office, which has had an essentially flat budget for several years.

Congress recently approved a \$3.2 billion Office of Science budget for fiscal year 2004, a 4.3% increase that is regarded as respectable but is not the dramatic increase that will be needed to realize the five-year, 60% increase envisioned in the facilities plan. Much of the 4.3% increase is for high-performance computing research, domestic fusion research, and 90 congressionally designated earmarks for programs in the Office of Science’s biological and environmental research division.

"This is an outlook," a DOE official said of the facilities plan. "If we were to go to Congress or to the administration and say we'd like an increase in funding, we can say this is what we would do with it. What you have here is a recipe for facilities, were there to be additional funds for the Office of Science." (The facilities report and background documents are available online at <http://www.science.doe.gov>.)

Although the overall funding future of the 28 facilities is hazy, Abraham was not reserved in stating the list's significance: "Nothing of this scope has ever been attempted by our department, or indeed by any other science agency in government. We are not only planning two decades out, but we are prioritizing our facility needs across all fields of science supported by the Department of Energy."

Near-term facilities

The list identifies 12 facilities as near-term, meaning significant activity could be under way within the next six or seven years. Leading the near-term list is ITER, the international thermonuclear experimental reactor project the US recently rejoined after dropping out several years ago because of the high cost. When ITER costs were scaled back, Orbach became a strong advocate of US participation in the project. He has said he believes ITER will lead to usable, clean, fusion-based electricity in about 35 years and may be a significant way to counter global warming. White House officials see ITER as an eventual source of hydrogen for President Bush's hydrogen initiative.

Ranked second on the list is the UltraScale Scientific Computing Capability, a project that Abraham said reflects "our desire to regain global leadership in areas of supercomputing that many believe we have lost." He noted that Japan's Earth Simulator "has the computing power of the 20 fastest US computers combined." The UltraScale project, to be located at multiple sites, is intended to "increase by a factor of 100 the computing capability available to support open scientific research," the facilities report said. A DOE official said the intention is to develop "leadership-scale machines that can do grand-challenge calculations."

Ten other facilities are on the near-term list. The US is interested in advancing its lead in light sources, Abraham said, and the Linac Coherent Light Source, an x-ray free electron laser, would provide brightness that is 10 billion times greater than current light sources. "That would allow researchers . . . to create real-time im-

ages of chemical reactions at the atomic scale," he said. The Protein Production and Tags facility, he said, would build on the Human Genome Project and, working in conjunction with another of the proposed new projects, the Characterization and Imaging of Molecular Machines facility, would help "mass-produce tens of thousands of proteins a year, code them by their DNA, and make them available to researchers around the country."

The Rare Isotope Accelerator, said Abraham, would be "a major addition to [DOE's] nuclear physics program and make a major contribution to stockpile stewardship." The Joint Dark Energy Mission, which would be developed with NASA, is also near the top of the facilities list. The space-based probe "will help us understand one of the greatest mysteries in science today—why the universe is expanding at an accelerating rate," Abraham said.

The remaining near-term facilities and facility upgrades are the National Transmission Electron Achromatic Microscope project; the Energy Sciences Network upgrade; an upgrade of the National Energy Research Scientific Computing Center at Lawrence Berkeley National Laboratory; the Continuous Electron Beam Accelerator Facility 12-GeV upgrade at the Thomas Jefferson National Accelerator Laboratory; and the BTeV, or "B-particle physics at the Tevatron," at the Fermi National Accelerator Laboratory.

Longer-term facilities

The list includes eight mid-term facilities, such as the Linear Collider, which the DOE report said would work at energies comparable to CERN's Large Hadron Collider that is scheduled to come online in 2008. The precision of the Linear Collider, the report continued, "will enable new phenomena discovered at the LHC to be more fully explored." The mid-term list also includes an upgrade for the Spallation Neutron Source and a second target station for that facility.

Eight facilities are listed as far-term, meaning they likely won't be developed until the second decade covered by the list. They include the Super Neutrino Beam facility, which the report said would produce "a neutrino beam 10 times more intense than those available with current accelerators." An Integrated Beam Experiment, a Second Cold Source and Guide Hall for the High-Flux Isotope Reactor, and an upgrade of the Advanced Photon Source also fall into this far-term category.

Burton Richter, director emeritus of SLAC who has worked in Washington to increase the visibility of the Of-

fice of Science, said Orbach did a good job in determining the priorities. "I would have done a few differently, some up and some down," he said. "But for the first time, somebody has done the job of setting priorities across scientific fields."

Four of the 12 recommendations from DOE's High Energy Physics Advisory Panel made the final list of 28 facilities, including the Joint Dark Energy Mission and the BTeV in the near-term category. The Linear Collider facility is listed first on the mid-term list, and that was "the big issue for high-energy physics," Richter said. The top mid-term ranking "is the best it could do," he said. "It's as high on the overall list as it could have been considering its state of readiness."

A thoughtful process

University of Oregon chemist Geraldine Richmond, who cochaired DOE's Basic Energy Sciences Advisory Committee panel, which developed facilities recommendations for Orbach, described the process as "thoughtful." BESAC had to "take a gamble on what [facilities] we thought were the most exciting and had high feasibility," she said. Seven basic energy sciences projects made the list, with two—the Linac Coherent Light Source and the National Transmission Electron Achromatic Microscope—making the near-term list. "The BESAC committee is absolutely pleased with the outcome," Richmond said.

Rutgers University physicist Charles Glashauser, chair of the facilities subcommittee of DOE's Nuclear Science Advisory Committee, said that NSAC completed a report on long-range facility plans in April 2002, so the nuclear science community was "very well prepared for such an exercise." The Rare Isotope Accelerator was the highest new construction recommendation in the NSAC plan and it is high on the DOE list, which also includes four other nuclear physics facilities.

"We are happy to see so many items on the list," Glashauser said. Like others involved in the process, he noted that creation of the list doesn't necessarily mean money will flow, "but the fact that Abraham came out with this and publicized it himself is a positive sign."

DOE officials said the FY 2006 budget will be the first true indicator of financial commitment to the recommended facilities. "This will be in our [budget] request," a DOE official said of the facilities report. "And yes, we hope it will be responded to."

Jim Dawson