DEPARTMENT OF ENERGY

Fusion Plan Gathers Steam

Stunned last year by a massive cut in the U.S. fusion budget, advocates have rallied around a plan to preserve the field at a price not much higher than current spending levels. And the campaign seems to be paying off: This week the White House asked Congress for a $21 million increase for the program in the 1997 fiscal year that starts on 1 October.

The $244 million fusion program is a small part of the overall $2.6 billion research budget for the Department of Energy (DOE). But its plight is a good example of the hard realities of today's budget climate, in which trade-offs have replaced add-ons in government funding for science. "There's been an awakening in the community," says Michael Knotek, the Pacific Northwest Laboratory manager who chaired the advisory group that developed the new plan. "We were hit with a hammer, and focusing on new goals is our step to recovery."

In the past few weeks Knotek has joined DOE managers, industry officials, and university researchers in buttonholing lawmakers, congressional staff, media, and senior DOE and White House officials. The goal is to win support for a plan that would sustain the domestic program, step up the search for alternative technologies, and maintain a foothold in the planned International Thermonuclear Experimental Reactor (*Science*, 2 February, p. 592). The plan comes with a minimum annual price tag of $250 million—just $6 million more than the 1996 level. Last month dozens of lawmakers from both parties signed a letter backing the report's strategy.

The president's 1997 budget has requested $265 million for fusion, just enough to keep the Tokamak Fusion Test Reactor (TFTR) at the Princeton Plasma Physics Laboratory operating until 1998. If Congress approves a budget below $250 million, the panel recommends that DOE shut down TFTR rather than make cuts in other parts of the program. House members who have endorsed the report say that a $275 million budget is needed to keep the United States firmly in the fusion game at a time when Europe and Japan are spending twice as much.

None of the numbers approaches the $366 million the program received in 1995. But some congressional skeptics may want to see even more belt-tightening. "Forty years and $14 billion," scolded Representative Dana Rohrabacher (R–CA) at a 7 March hearing of the House Science Committee's energy and environment panel, which he chairs. "If we keep shoveling money out of the back of the truck, nobody is going to get more efficient."

Despite those comments, Rohrabacher did not propose making drastic cuts to the program. Neither did the scientists testifying at the hearing, although they offered several ways for DOE to get more bang for its buck.

Fusion researcher William Drummond, of the University of Texas, Austin, would like to see a greater emphasis on basic research. He criticized the current effort as a "narrow developmental program" that has strangled the work of theorists. George Miley, director of the fusion studies laboratory at the University of Illinois, Urbana, called for more analysis of where the program should be headed. John Perkins, who works on the magnetic fusion energy program at Lawrence Livermore National Laboratory, recommended that one fourth of the fusion budget go toward alternatives to tokamaks. And Clifford Surko, a physicist at the University of California, San Diego, warned that the lack of small-scale university fusion experiments is keeping young people from entering the field. None of these critics, however, agreed on a clear alternative to the new DOE plan.

Knotek and Robert Conn, an engineer from the University of California, San Diego, who chairs DOE's Fusion Energy Advisory Committee, insist that the report pays heed to all these concerns. Five percent of the budget would be set aside for basic research, Conn told the committee, while there would be a shift from large-scale to small- and medium-sized experiments. In addition, the search for alternatives would be reopened after a decade-long hiatus.

DOE's new plan is the only coherent blueprint for a scaled-down fusion program currently on the table. But its backers insist that its success depends on a minimum budget of $250 million: If Congress fails to come close to what the Administration is asking for, the strategy breaks down. And despite warm words of encouragement from supporters, Knotek knows that it's much too early to predict the program's final budget. "At this point, you can't get numbers out of anyone," he says.

–Andrew Lawler

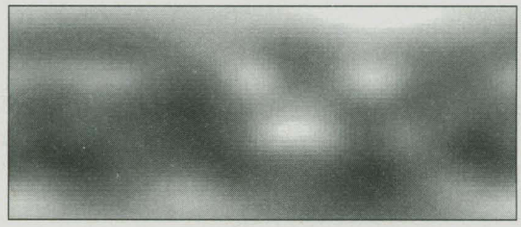
ASTRONOMY AND ASTROPHYSICS

Crunch Ahead for Space Science

This year should be the busiest in history for U.S. space science, with a launch scheduled nearly once a month and existing missions sending back a slew of astronomical data. It may also be a high-water mark for the field. "There is not enough money to support brand-new missions," says Wes Huntress, who heads the $2 billion space science program at the National Aeronautics and Space Administration (NASA). "We expect a declining budget."

This week the president asked for $175 million less in 1997 for the program, which now spends $1.1 billion on physics and astronomy missions, $672 million on planetary programs, and $230 million to launch spacecraft. But what troubles Huntress is an even steeper decrease over the next 5 years as NASA's budget, like other areas of government spending, continues to get squeezed by the arithmetic of eliminating the federal deficit. "We see the writing on the wall," says Anneila Sargent, an astronomer at the California Institute of Technology and chair of NASA's space science advisory committee. "The outlook looks very bleak."

Some scientists say the cut over the next 7 years could be as big as 30% in inflation-adjusted dollars. Their concern is shared by lawmakers, who worry that space science will be the sacrificial lamb as NASA's overall budget continues to fall. "[Space science] has been the crown jewel of the American space program since Apollo," says Representative James Sensenbrenner (R–WI), who chairs the House Science Committee's space panel. "We must ensure it does not fall out of the equation." Especially vulnerable, says Huntress, are proposed missions such as Fire and Ice, spacecraft that would probe the extremes of the solar system, from the sun to Pluto. If the Pluto mission does not materialize, he adds, it would cast doubt on the future of the Jet Propulsion Laboratory in Pasadena, California, which has specialized in planetary probes.



JPL

Fleeting image. The surface of Pluto as seen by Hubble telescope; plans for a visit are in jeopardy.

The problem is that space science must compete for fewer dollars at a time when some programs are untouchable, others are expanding, and still others are already earmarked for heavy cuts. The space station's $2.1 billion annual budget is protected by an agreement between the White House and Congress, for example, and the life and microgravity science

programs that will use the station must also be funded adequately. Supporters of the space shuttle warn that astronaut safety could be jeopardized if further cuts are made, and the constellation of environmental monitoring satellites known as EOS and its complex data system are being built for launch over the next 6 years. NASA's other major expense is salaries—and the agency has already factored in a sizable reduction in its work force over the next 5 years.

But that coming drought is hardly evident in the flood of activities planned for this year. Jupiter data from Galileo are heading toward Earth, two Mars probes are slated for launch later this year, and a host of small astrophysical missions are being prepared. However, Huntress warns that this busy schedule is a "bow wave" from past spending, coupled with the smaller and cheaper satellites pushed by NASA Administrator Daniel Goldin in recent years. Goldin maintains NASA can do more with less, but Huntress says it will be difficult to sustain the wave with fewer dollars.

In the meantime, Huntress faces a range of unpleasant options. During the past few years, the space science office has restructured every major program under its control—radically scaling back the size and scope of the Advanced X-ray Astrophysics Facility, postponing other observatories, and chopping funds to operate a host of missions. In addition, the space science office at NASA headquarters has cut its own work force by half. "The space science office has reduced costs, scaled back development times for missions, and is seeking new technologies," says Sargent. "But at some level they have not gotten credit for it." University of Maryland space physicist Glenn Mason warns that money for analyzing data and operating spacecraft is already being drastically reduced. "This will roll through the community like a tidal wave," he says. "People better wake up."

If the plight of space science is attracting political attention now, it's at least partly because of doubts expressed by House Republicans about NASA programs like EOS. Science Committee Chair Robert Walker (R–PA) and Sensenbrenner have expressed concern that its growth will come at the expense of space science efforts that are NASA's traditional strength. Sargent, Mason, and Huntress don't savor the prospect of a mudslinging match between the earth and space science disciplines. "Pitting one part of the agency against another is not the way to deal with the problem," says Huntress. "The problem is the declining budget of the agency."

But such infighting will be hard to avoid unless Congress goes along with a budget that lifts all of NASA's boats. "So far it's been a gentlemanly affair," says Mason. "But somebody is going to lose."

–Andrew Lawler

EUROPEAN SPACE SCIENCE

Budget Freeze Nips Comet Camera

Last October, the European Space Agency (ESA), faced with the increasing cost of the international space station and financial squeezes in some of its 14 member states, froze the budget of its science program for the next 5 years (*Science*, 13 October 1995, p. 224, and 27 October 1995, p. 571). This funding crunch, both at ESA and within member states, is now beginning to bite, and it has prompted a crisis over a proposed camera for the Rosetta spacecraft that will shadow comet Wirtanen next century.

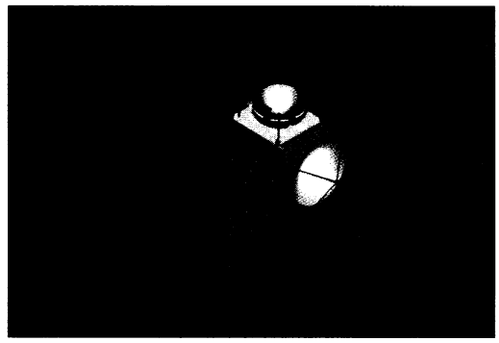
ESA wants a science camera on the mission, but no one seems to want to pay for it. Earlier this month, the agency, unable to pay for the camera itself, gave cometary physicist Uwe Keller of the Max Planck Institute of Aeronomy in Lindau, Germany, until the end of April to find funds from member states for a camera he proposed to ESA last summer. If he cannot, ESA will make a new call for proposals to see if another design can win financial support and bring to an end a complicated political game. "There is more politics, much more politics than you can believe," says Keller. "It's a poker game," adds David Southwood of London's Imperial College, chair of ESA's Science Program Committee.

Rosetta will fly in tandem with comet Wirtanen for 2 years as the comet heads for its closest approach to the sun in 2013. This cosmic pas de deux promises to be a spectacular follow-up to ESA's Giotto mission to Halley's Comet in 1986. From its experience with Giotto's photographs of Halley's Comet, ESA is well aware that space pictures captivate the general public and so wanted Rosetta to carry a camera for publicity as well as science.

But ESA's charter specifies that subscriptions to the agency pay for spacecraft and their launches—the scientific instruments they carry should be proposed by the research community and paid for out of national space budgets. Last spring, ESA invited researchers to put forward proposals for instruments for Rosetta. Keller, who headed Giotto's camera team, assembled researchers from Italy, France, Germany, Belgium, and the United Kingdom and made a proposal, called Osiris, for wide- and narrow-angle cameras working across the spectrum from ultraviolet to infrared—the only proposal for a science camera put forward.

ESA's Space Science Advisory Committee (SSAC) evaluated Osiris during the summer and recommended that it cover only visible wavelengths, because the ultraviolet and infrared were being covered by spectrometers. ESA also took the unusual step of sounding out member governments while Osiris was still being evaluated, to ensure it had financial backing. Germany would be expected to make a major contribution because of Keller's involvement, but according to Southwood, Germany said it could not fund the camera.

Then another player entered the fray: ESA's own research center, known as ESTEC, in the Netherlands. Germany had long been trying to persuade ESA to take some pressure off national space budgets by developing generic technologies common to several instruments. Taking this as a cue, ESTEC put together a proposal to upgrade the navigation camera ESA was providing as part of the spacecraft so that it could also provide publicity shots and some of the high-quality images needed for science. Under this scheme, this multipurpose camera would be built and paid for by ESA, but designed with input from scientists like Keller. But Keller says Germany was not keen on this plan. According to some observers, it preferred a reverse arrangement in which a science camera could also perform the navigation if ESA contributed to the cost. "There was a lot of confusion," says Southwood.



ESA

Last month, however, the SSAC squelched any such plan. It decreed that a proposal for a science camera should come from the scientific community, not from the agency. And it said the Rosetta spacecraft should not exceed its budget of $800 million, thus ruling out ESA paying for the science camera.

And so the spotlight has shifted back to Keller. Earlier this month, the Science Programme Committee decided that Keller should have until the end of April to salvage Osiris. Roger Bonnet, head of space science at ESA, says that Keller must now "descope the camera and look for new partners" elsewhere in Europe or outside it. Bonnet and Southwood both believe this will be possible. If not, the saga of Osiris may prove a bad omen for ESA's future as the funding freeze extends to other science missions.

–Helen Gavaghan

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