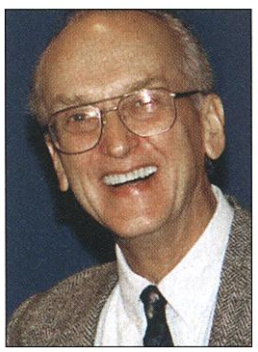
could be made in this century is the discovery of life [elsewhere] in the universe."

Some researchers hope to find a middle ground that recognizes the political value of searching for extraterrestrial life without endangering the credibility of a scientific plan. "Both sides are right," says Jonathan Lunine, a physicist at the University of Arizona and co-chair of the astrobiology panel. "There is a political aspect associated with astrobiology. But we are on the threshold of bringing different disciplines together, and this is an important new endeavor." Hartman thinks that "the debate is couched incorrectly" and that astrobiology should be considered as one driver of the overall program.



Planetary pope? Michael Belton hopes NRC panel can reach consensus.

Policing the future

With the panel's survey now in full swing and Sykes collecting input from hundreds of researchers, participants are optimistic about their chances of coming up with a definitive decade-long plan. "The community is rising to the challenge," says Belton. "And we've been able to communicate with a large fraction" of its researchers. The ultimate audience, however, won't be researchers: "The prime customers are NASA, OMB, and Congress," he adds. It's an audience that scientists can't afford to ignore, Hartman warned the panel: "We're in a fight for scarce resources, a fight we are currently poised to lose."

Sykes says that the ultimate value of the survey would be to provide "long-term cover" for Washington officials like Weiler and Isakowitz, who must make tough decisions on planetary program spending. The community is not likely to respond favorably to threats or scapegoating, he notes, adding that attempts to kill healthy programs—such as Pluto—simply invite scientists to lobby influential backers. A good survey, he says, will do away with much of this tension by carving out a clear path.

Sponberg agrees that the survey will be a critical element in solidifying support for planetary science. But he warned the panel that the report is only a first step—and that maintaining consensus will be a full-time job requiring strong leadership. Sykes is confident that the field is mature enough to take responsibility for its own future. "It has taken 40 years," he says. "But now the community is big enough to do this." **–ANDREW LAWLER**

CREDITS: (TOP TO BOTTOM) NOAO/AURA/NSF; ISAS

SOLAR SYSTEM
JAPAN

Researchers Fear Merger Could Muffle Their Voice

As Japan plans to combine its two space agencies, researchers wonder how they will be heard

TOKYO—Being small has its advantages. For nearly 4 decades Japanese space scientists have been allowed to call the shots on planetary exploration—setting the agenda and running their own missions. And the results have been impressive, including a string of successful probes studying the sun, Halley's Comet, and Earth's magnetosphere.

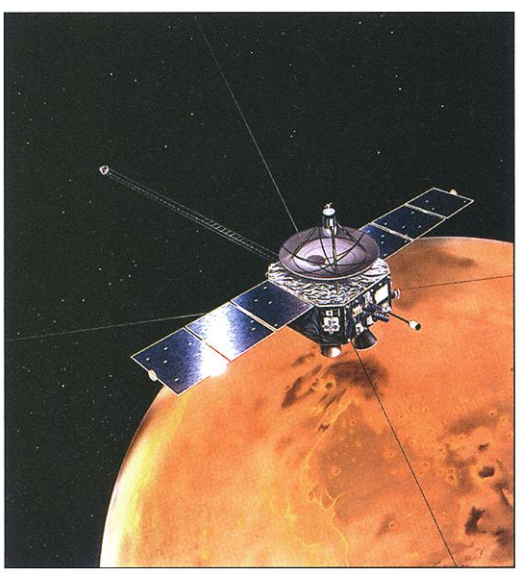
But now the Institute of Space and Astronautical Science (ISAS), whose modest budget has funded the bulk of university-based research in the field, is being merged with Japan's giant National Space Development Agency (NASDA) and the National Aerospace Laboratory (NAL) as part of a sweeping streamlining of the nation's bureaucracy. Although there will undoubtedly be benefits to being part of a larger, more powerful agency, scientists are worried that the loss of independence will put science in the shadow of the more commercial aspects of space.

"We're concerned that there will be a lack of visibility for space science once these organizations are merged," says Takeo Kosugi, who heads ISAS's solar physics program and is also chair of the Space Research Committee of the Science Council of Japan, the nation's largest association of scientists. "We worry that if bureaucrats control the decisions, budget cuts will fall especially hard on space science."

NASDA is a very different beast from ISAS. It develops heavy-lifting rockets for launching weather and communications satellites and manages Japan's contribution to the international space station. It also dwarfs ISAS in size, with a current budget of $1.7 billion and 1090 employees compared with $223 million and 325 staffers for ISAS. Including NAL, whose 410 researchers use its $166 million budget to study fluid dynamics and other more technological problems, the merger will further tilt the new agency toward applied fields.

But more troubling to researchers than NASDA's size is its culture. ISAS's missions are proposed by research groups and reviewed by committees of scientists and engineers. NASDA is run by bureaucrats charged with developing Japan's aerospace industry. NASDA has broadened its vision in recent years, using remote-sensing satellites to study long-term weather patterns and watch for signs of global warming. It is also collaborating with ISAS on the 2005 Selene mission to the moon, which will probe, among other things, its mineral composition, topography, and gravity field. But researchers still view NASDA as an organization whose priorities and missions are set at the top and are aimed at fostering commercial aerospace development.

The merger will certainly provide some new opportunities. ISAS missions will be able to take advantage of NASDA's H-IIA rocket, with four times the lifting capacity of the institute's M-V rocket. Previously, cooperation between the two agencies was extremely difficult because they were affiliated with different ministries, which rigidly protected their turf.



Slow mo. Launched in 1998, Nozomi overcame flight troubles and is set for a 2004 Mars rendezvous.

Kosugi also believes that the merger might be an opportunity to revamp space science efforts. He thinks ISAS has outgrown its committee-based decision-making process, which he says worked well when the agency had just two major research groups, one for x-ray astronomy and one studying magnetospheres. But that con-

stituency has grown in the past 2 decades to encompass radio astronomy, infrared astronomy, the moon, and other planets, each with its own slate of missions. "ISAS has grown to include too many groups and too many missions," Kosugi says. He believes the community needs to agree on priorities in order to make the best use of limited resources. But as yet, it is completely unclear how decisions will be made in the new organization.

Yoshihisa Nemoto of the Space Policy Division of the Ministry of Education, Culture, Sports, Science, and Technology, which oversees both ISAS and NASDA, says ministry officials are aware of the need for balance within the new agency. "Japan's space science, in certain areas, is world-class, and it would be a terrible shame if those efforts were not properly supported," he says. "Discussions are going on over how to preserve the bottom-up process for space scientific research, but there has been no conclusion."

A merger preparation committee was due to release an interim report by the end of December. But no one is expecting it to resolve the fundamental issues. A proposed structure for the new agency is due out in March, with the merger to take place in fall 2003 or later.

–DENNIS NORMILE

With reporting by Andrew Lawler.

SOLAR SYSTEM
EUROPE

Tight Budget Makes for an Uncertain Future

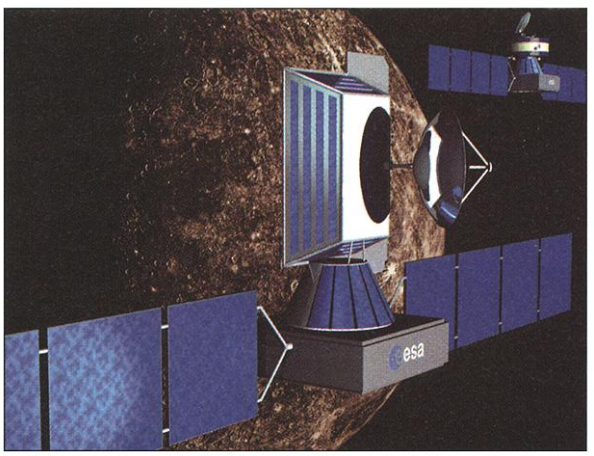
Europe's planetary scientists had grand plans for a series of missions, but politics is getting in the way

PARIS—While NASA struggles to set its priorities for solar system exploration (see p. 32), European space scientists are grappling with a more fundamental question: Will they continue to be major players in the game? Recent budget cuts threaten both ongoing programs and new missions, and cuts are forcing space agency officials to scale back their grand plans for the future.

The European Space Agency's (ESA's) long-term science program includes robotic missions to Mars, Mercury, and Venus. But last November in Edinburgh, at a meeting to decide the agency's budget for the next 5 years, ESA's 15 member governments dealt the agency a double disappointment. The agency's council of ministers declined to boost the science budget—which has lost 15% in purchasing power since 1996—above inflationary levels. They also gave only grudging support to a new program called Aurora, which will map out a series of missions to search for traces of life in the solar system and to develop technology for human expeditions (*Science*, 23 November 2001, p. 1631).

In response, last month the agency's Science Program Committee imposed a 6-month hold on a number of projects still in the pipeline so it can assess how many missions can be done with the allocated funds. "We are going into a period of reflection and analysis," says physicist David Southwood, ESA's science chief, predicated on the assumption that "our budget is now about as high as it is going to be." Among the projects now in jeopardy are the BepiColombo mission to Mercury and the Gaia astrometry mission, which will record the brightness and position of 1 billion stars in our galaxy. At a minimum, Southwood says, the agency will have to reduce the scientific scope of one or both missions.

The budget disappointment comes just as Europe's space scientists were hoping to strike a more independent pose vis à vis their international partners, especially the United States. "We cannot sit and wait for others to decide our role in what they decide to do," says Franco Ongaro, program coordinator of Aurora, an umbrella program that researchers hope will take ESA's solar system exploration to new heights over the next 30 years. One goal, to put a European on Mars by 2025, would require many new technologies, says Ongaro: "We don't today have a credible scenario to put a man or woman on Mars and bring the person back alive."



Hot trip. One European spacecraft will map Mercury, while a smaller companion will examine the planet's magnetosphere.

CREDIT: ESA

ESA members aren't required to contribute to Aurora, which is classified as an optional program. In Edinburgh, for example, nine countries dug up only $12 million for a batch of preparatory studies, some $24 million short of the total ESA requested. Italy withdrew a $16 million pledge made by its previous government, and Germany opted out as part of an across-the-board retrenchment.

The funding shortfall angers many planetary scientists. "It shows a lack of commitment," says atmospheric physicist Alan Aylward of University College London. "Europe has the economy to be an equal partner in space with the U.S., but intergovernmental wrangling and national shortsightedness has always held back space development." André Brack, an origins-of-life researcher at the University of Orleans in France, says scaling back Aurora flies in the face of "a huge interest in the search for extraterrestrial life and life-forms" by scientists and the general public.

Scientists hope that Italy will reconsider its decision. Giovanni Bignami, director of space science at the Italian Space Agency (ASI), says that ASI's president, Sergio Vertella, had just assumed the post before the Edinburgh meeting and did not have time to make his own assessment of Aurora's importance. "For the moment," Bignami says, "Italy's role is very much reduced. It can only improve."

In the meantime, Ongaro says that $12 million is almost enough to fund the first 2 years of the 3-year preparatory period, which will lay down the program's overall strategy and its specific missions. That work, he says, should help to persuade other ESA partners to fund the third and most expensive year, which will focus on development of new technology and specific missions.

The time is running short for ESA to make some definite decisions about current plans. If ambitious missions like BepiColombo or Gaia have to be sacrificed, Southwood says, ESA will "move off the gold standard" of leading space exploration programs. Ongaro agrees that the next step is critical: "We are walking the thin line between having a vision and living an illusion."

–MICHAEL BALTER