Redesign Creates Consternation Abroad

While U.S. space station supporters fear that NASA's crash program to redesign the craft may mean the end of the station itself (see main story), the United States' international partners are worrying about their own stakes in the enterprise. Whatever redesign option is chosen, the partners will face increased costs in adapting their laboratory modules and equipment to fit. At worst, they may be frozen out altogether. "We're not happy," says an official of the European Space Agency (ESA).

On 13 May, the space agencies of Europe, Japan, and Canada took the unprecedented step of calling a meeting of the four partners in the Freedom project at the U.S. State Department to voice their concerns about the redesign, and have scheduled another meeting there for 11 June. Most of the unhappiness at the May meeting focused on the most radical of the three possibilities, Option C. Option C would require both ESA and the Japanese space agency, NASDA, to redesign the electrical, thermal control, and data management systems of their laboratory modules—if they could be accommodated at all. With the add-on modules, a complete Option C station would include 136 experiment racks—nearly three times as many as in the original station and far more than could be supported by the station's power supply. In addition, the solar arrays in Option C would block some experiments in the Japanese lab. Option C and a second redesign candidate, Option A, would also require only part of the mobile servicing arm being developed by the Canadian Space Agency.

The best of a bad lot, as far as the international partners are concerned, is Option B, because it deviates least from the current design. But whichever option is chosen, both ESA and NASDA are concerned that NASA, as part of the redesign, may adopt a more highly inclined orbit than originally planned, at an angle of 51.6 degrees to the Equator rather than 28.5 degrees. The higher angle would permit the Russians to reach the station and deliver a Soyuz capsule as a life raft in case of an accident. But it would require the shuttle to burn more fuel and hence reduce its payload. Not only would this necessitate more assembly launches, but at least until NASA developed a new, lighter fuel tank and more powerful rocket boosters for the shuttle, it would mean that the heavy European and Japanese modules could not be launched at all.

–Daniel Clery

port to a "blue-ribbon panel" of independent experts, chaired by Charles Vest, president of the Massachusetts Institute of Technology (MIT). This report will be a decision matrix, according to Goldin, laying out data on three different options, three funding levels, and at least two stopping points for each station. It will also consider putting the station in a high-angle orbit (51.6 degrees rather than the usual 28.5 degrees) so that Russian spacecraft could reach it.

Three days after the Vest committee receives the data from NASA—on 10 June—it's supposed to pick a winner and forward a recommendation to President Clinton. The international partners are planning to meet the next day in Washington to review the report themselves. The White House is scheduled to send its final decision to Capitol Hill on 15 June, to be included in the 1994 appropriation bill for NASA. The fast pace leaves almost no time for the international partners to get into the act, says one European science attaché. "To whom do we take our comments after 15 June," he asks, "to Congress?" This is just one of many issues that trouble Canada, Japan, and the European Space Agency (see sidebar on this page).

Scientists planning to use the station for research, meanwhile, are trying to figure out how much room for science will be left in the redesigned station. The signs aren't encouraging. Bonnie Dunbar, a NASA microgravity science official leading the scientific assessment of the new options, says, "We are cutting capabilities...to the users in all cases." Perhaps the biggest threat to science, says Daniel Hastings, professor of aeronautics and astronautics at MIT and chair of a space station advisory group, will be the inability of two of the three candidate designs to sustain a crew in space for more than 20 days, at least at first. That would restrict researchers' ability to do long-term (6-month) experiments or even to run shorter experiments properly.

Many scientists are concerned that they may not get answers to questions about crew, power, and communications in time to comment on the new proposals before they go to the president. "It's a moving target," says one. That's been true of the space station for the past 9 years, say NASA watchers. But the target only seems to speed up as time goes by. "For someone like me who's watched [NASA] closely for over two decades," says John Logsdon, director of the Space Policy Institute at George Washington University, "it's never been this crazy."

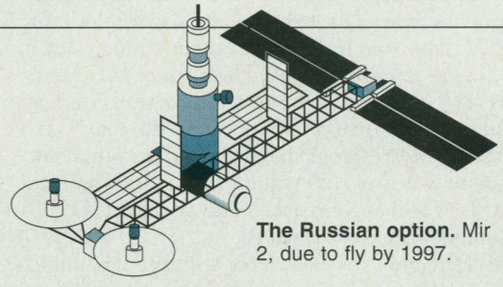
–Eliot Marshall

SPACE SCIENCE

NASA Researchers Eye Mir

Last week, several crystallographers met at the National Aeronautics and Space Administration's (NASA) George C. Marshall Space Flight Center in Huntsville, Alabama to discuss plans for an experiment to grow protein crystals aboard a space station next year. No, they weren't talking about Freedom, the U.S. Space Station that's still on the drawing boards and being redesigned (see story on p. 1228). These scientists had just received the go-ahead from NASA to begin planning an experiment aboard Mir, the Russian Space Station that has been orbiting Earth since 1986.

For years the scientific community has debated whether or not space station Freedom's price tag—currently $30 billion—is justified by the kinds of scientific studies that NASA hopes to conduct aboard it. Fueling the debate has been an argument advanced by some scientists that NASA could do the same work aboard Mir, or on Mir 2, a successor space station that the Russian firm NPO Energia is building and plans to launch in late 1996 or early 1997. Several scientists have approached NASA's life sciences advisory subcommittee, recalls Francis Haddy, a cardiovascular physiologist at the Uniformed University of the Health Sciences who chaired the subcommittee until last November, asking, "Gee, why don't we use Mir?"



The Russian option. Mir 2, due to fly by 1997.

While insisting that research on Freedom would be better, NASA nevertheless has responded to Mir's advocates: Last fall it sent a delegation to Moscow armed with a wish list of joint research projects that might be done aboard Mir, as part of a scientific exchange signed by the United States and Russia last July that will also see a cosmonaut fly on the shuttle this November. After assessing Mir's capabilities, NASA officials have decided in the past few weeks to go ahead with several joint projects, including the protein crystallization

experiment and research on human physiology in low gravity. But not all scientists monitoring space research are Mir boosters: The notion of conducting research on Mir has provoked plenty of criticism, mostly directed at the allegedly low quality of the research environment aboard Mir.

The protein crystallization experiment seems to be the NASA project that's firming up the quickest. Three crystallographers—Marshall's Daniel Carter, the University of California (UC), Riverside's Alex McPherson, and the University of Alabama, Birmingham's Larry DeLucas—will ask 60 of their colleagues to suggest specific proteins to crystallize and protocols to follow. Unlike protein crystallization experiments on the space shuttle, which are limited to 2 weeks in duration, the experiment on Mir is expected to run 5 months. "This gives us a lot more flexibility in the kinds of experiments we can run," Carter says.

The NASA team won't be the first U.S. group to try to grow protein crystals on Mir—a group led by Penn State crystallographer Gregory Farber is gearing up for a third run on Mir in October. Their experiences have led the NASA researchers to keep their expectations modest. "Mir was never constructed to provide high-quality microgravity," asserts UC's McPherson. The problems with Mir are twofold, he says: temperature fluctuations and vibrations that tend to disturb crystal growth. McPherson says these problems will be hard to address before NASA sends up its samples late next year. He adds that temperature fluctuations and vibrations would be expected to pose less of a problem on Space Station Freedom.

An even tougher challenge for NASA scientists will be to design human physiology experiments aboard Mir. The plans for these experiments are still nebulous, but NASA officials say they are likely to be extensions of Russian and U.S. work on questions such as how to counteract the bone and muscle loss that occurs progressively in space. To that end, NASA scientists hope to outfit Mir with Western monitoring equipment, such as bone densitometers and blood analyzers.

But space physiologists aren't sure that Mir will accommodate the kind of controlled human studies they eventually hope to do on a U.S. space station. NASA scientists had designed a centrifuge that would be able to approximate Earth's gravity aboard Freedom and provide a control for low-gravity effects. But "Mir's just a damn tin can" that's far too small to accommodate the centrifuge, says Haddy. "The bottom line is that Mir is not a sophisticated laboratory," he says.

NASA officials acknowledge Mir's deficiencies but point out that the experiments they're planning are essentially freebies, because they fall under the scientific exchange agreement. And some space analysts think that even if the U.S. space station eventually flies, Mir may hold some attractions for researchers. "Mir is going to be permanently occupied and Freedom is not," predicts John Pike, a space policy analyst at the Federation of American Scientists. Therefore, he says, some long-duration human physiology studies could be done only aboard Mir.

Mir 2 is shaping up to be more attractive than its predecessor: Although Mir 2's core module will be roughly the same size as Mir's, NPO Energia has modified the solar panels to provide twice as much power (about the same as Freedom), which would give Mir 2 plenty of capacity to run sophisticated medical monitoring equipment. And if Freedom gets nixed, Mir will be the only game in town. Then it would be even more important for NASA to get in on the action. "Obviously," Pike says, "you'd rather have some data than no data."

–Richard Stone

BRITAIN

Oxford Rebels Protest Women's Status

It has been dubbed the biggest faculty rebellion at Oxford University since academics blocked the award of an honorary degree to then-Prime Minister Margaret Thatcher in 1985. Last week, Oxford's Congregation, the parliament of the university's faculty members, took the unprecedented step of voting to block the creation of about 15 new posts with the rank of professor—a title that, in Britain, is reserved for only the very top tier of academic staff. The reason: Few, if any, women were expected to be among the faculty members to win a promotion.

It might sound like a trivial internal squabble, but last week's 182 to 37 vote—like the anti-Thatcher protest of 1985—has come to symbolize deep dissatisfactions within British universities. It has focused national media attention on the universities' dismal equal opportunity record. Only 4.9% of UK university professors are female and they are paid, on average, $2,300 a year less than their male colleagues. Until now, women academics had argued their case quietly, garnering little attention. But for Oxford neuroscientist Susan Greenfield—a lead campaigner against the new professorships—it was time to make a public stand. "Everyone pays lip service to equal opportunity," she says, "but it should be shifted up the list of priorities."

"Everyone pays lip service to equal opportunity, but it should be shifted up the list of priorities."
—Susan Greenfield

What so incensed many women academics was that the university authorities wanted to spend all of their promotions budget on creating new professors—for the second consecutive year and against the advice of Oxford's own promotions committee. Most women academics are stuck at the lowest rung of the career ladder, with the title lecturer, and Greenfield and her allies argue that the money would be better spent promoting a larger number of academics to the middle-ranking position of reader.

Thanks to last week's vote, Oxford's general board, which manages the university's academic affairs, must now do exactly that. Not everyone is happy with that outcome, however. There is a need for more professors, say academics who supported the original promotion scheme. Last year the government lifted the ban on polytechnics—which have traditionally offered more vocational courses—calling themselves universities. This instantly created 39 "new" universities in Britain and they have been "scattering around [professorships] like confetti," says Oxford chemist Keith McLauchlan. Company executives with money to invest in academic labs are now "constantly assailed" by professors, says McLauchlan, and take some convincing to spend time talking with academics lacking that title.

Nevertheless, it isn't just women who are upset about Oxford's record in career development. David Smith, who heads Oxford's pharmacology department, estimates that one-third of those who voted against the new professorships were motivated by a broad dissatisfaction with the career structure at Oxford. The university's intensive tutorial system, he says, combined with the demands of running a large research group, puts scientists under intolerable pressure. New readerships will help, says Smith, as readers have a reduced teaching load.

The university authorities have now promised a thorough review of Oxford's promotions system. But the victorious protesters want to see rapid action. As a first step, says Greenfield, the university should combat "covert discrimination" by ensuring that there is more than one "token woman" on each of the faculty committees that control academic appointments. "The eyes of the world are on Oxford," she says. "[We] ought to set the trend."

–Peter Aldhous