U.S. and Partners Sign Space Station Agreement

Nearly 3 years in the making, it could be a model for other cooperative ventures; the basic principle: everybody shares, and everybody pays

ON 29 SEPTEMBER 1988, while the attention of the world was focused on the launch of the space shuttle Discovery and the end of a 32-month hiatus in American manned space flight, an event of almost equal significance for the space program was taking place in Washington: high-level representatives of the United States, Canada, Japan, and nine European nations signed the basic cooperative agreement for the permanently manned space station, now scheduled to begin construction in the mid-1990s. The main question now is whether Congress will continue to meet the rapidly growing costs of the project.

It was an agreement nearly 3 years in the making. "The space station is the world's largest international cooperative venture—and the most complex," said State Department spokesman Richard Smith. Trying to balance the goals and constraints of multiple partners predictably led to multiple headaches, perhaps most notably with regard to national security uses of the space station. Nonetheless, participants in the signing at the U.S. State Department declared themselves well pleased with the results.

"This cooperation is unique in the field of science and technology, in terms of challenges, funding requirements, and long-term international commitments involved," said Heinz Riesenhuber, West Germany's Minister for Research and Technology, and chairman of the European Space Agency (ESA) council. "We have many other large tasks ahead of us—fusion research, high-energy physics, climate research. I hope that this agreement can be a model for future cooperation."

As encoded in the new agreement, the essential deal is simple. Everybody shares, and everybody pays. The complications, as always, are in the details. Some highlights:

■ **Hardware.** The allocation of who builds what is still in accord with a previous agreement reached in the spring of 1985. The United States will contribute the basic infrastructure of the station; the power, communications, and environmental systems; and the habitation module where off-duty astronauts will sleep. The United States will also contribute one laboratory module and one unmanned platform to make remote sensing observations from a polar orbit. The total cost will be some $16 billion in 1986 dollars, exclusive of launch costs.

ESA will contribute its own laboratory module, based on the European-built Spacelab; a free-flying laboratory module that will not be manned; and a second polar platform. Taken together these three elements are known as the Columbus program. The hardware cost will be some $4.2 billion.

Japan will contribute a third laboratory module, which will cost $2 billion. And Canada will contribute a $1-billion remote manipulator arm, a more sophisticated version of the one it built for the Shuttle.

The laboratory modules will be primarily devoted to zero-gravity biology and material science research. However, the station will also have facilities for repairing and maintaining free-flying satellites.

The space station is now scheduled to begin construction in the mid-1990s.

■ **Launch.** Each partner will pay the launch costs of its portion of the station. The National Aeronautics and Space Administration (NASA) currently estimates that assembling the station will require about 20 shuttle flights at roughly $250 million to $500 million per flight. The agreement explicitly allows for the use of such vehicles as the Japanese H2, the European Ariane 5, and the European Hermes space plane, all of which are now under development.

■ **Operations.** The partners agree to share the ongoing cost of operating the station after it is complete, according to a formula based on usage.

■ **Sharing of resources.** Each member will own the facilities it builds, and will have the right to choose their own crew members. However, as the Japanese delegate said at one point in the negotiation, "We're all in one big boat up there."

■ **Management by consensus.** There will be various committees for operating the station, with NASA taking a lead role. But fundamentally, the station will have to be operated by consensus among the partners.

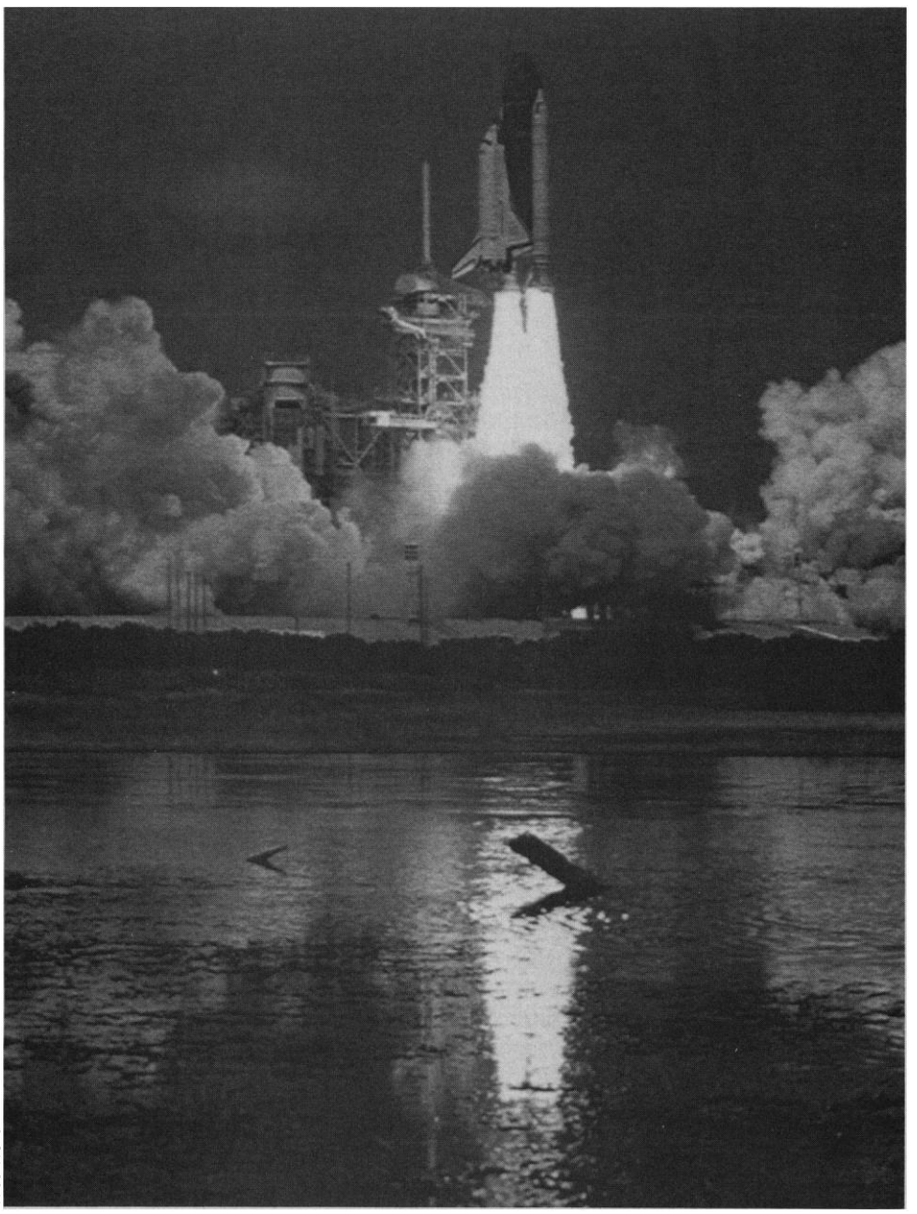
Management by consensus means that the partners will have to rely upon the very careful attention paid in the agreement to settling potential areas of contention beforehand. "The best agreement is one that you sign and then put on the shelf and never have to look at again," said Riesenhuber.

One potential area of contention is intellectual property. The details of this are to be worked out later. But the partners basically agree that anyone who develops a new process or product on the space station will retain the patent rights to it. Again, this approach has to be grounded in good will: it will be hard to keep any real secrets when everyone is working and living for months on end in the same four-module complex.

Another, much knottier area of contention is the question of U.S. national security activities on the space station. This has always been a concern among the non-U.S. partners, and it was exacerbated in 1987 when then Secretary of Defense Casper Weinberger tried to reserve the Pentagon's right to do defense-related research on the station. Even in West Germany, the largest single contributor to ESA's Columbus program, there was considerable political opposition to participating in the space station. And ESA's four nonaligned members—Austria, Ireland, Sweden, and Switzerland—are not participating at all. As Professor Johannes Ortner, managing director of the Austrian Space Agency said in an interview with *Science* last summer, "We are not participating in Columbus because Austria is a neutral country, and because no one has said that Columbus will not be used for SDI [Strategic Defense Initiative]." On the other hand, none of these countries has tried to veto ESA's participation in the station, although any one of them could have done so.

The negotiators of the agreement attempted to defuse this controversy by reiterating that the facility will be a civilian space station used only for peaceful purposes in accordance with international law and treaties. However, this does not actually preclude national security-related activities so long as they meet those criteria. Experiments on satellite reconnaissance for arms control verification might be considered "peaceful," for example, whereas a test of Strategic Defense Initiative hardware would presumably not be.

In any case, each partner has final say as to what can and cannot be done in its own facilities. ■ **M. MITCHELL WALDROP**



Wide World

Liftoff. "America returns to space as Discovery clears the tower," came the voice of launch commentator Hugh Harris, as the launch of the space shuttle Discovery on 29 September ended a 32-month hiatus in the American manned space program. The lift-off itself was 98 minutes late—ironically, because the winds aloft were peculiarly light for that time of year; ground controllers needed the extra time to make sure that the shuttle's on-board computers, which had been programmed for much stiffer winds, would not send the spacecraft off course. But when the launch finally came at 11:37 a.m. EDT, it was picture perfect. In the aftermath of the Challenger explosion of 28 January 1986, the National Aeronautics and Space Administration had made hundreds of major and minor design changes in the shuttle in an attempt to improve its margin of safety; the flight of Discovery seemed to show that the effort had not been in vain—and that it had not introduced some disastrous new problem by accident. The nation seemed to breathe a particular sigh of relief at the 2:04 minute mark, when the 46-meter solid-rocket booster jettisoned on schedule and fell away toward the Atlantic. It was a flawed booster rocket that triggered the Challenger explosion, killing all seven astronauts on board and shutting down the shuttle program for more than 2½ years.

Less dramatic, but still important to the program, was the successful delivery of Discovery's main cargo: a Tracking and Data Relay Satellite. Joining a similar satellite already circling Earth in the 35,900-kilometer geosynchronous orbit, this new spacecraft will allow ground controllers to keep in constant contact with missions in low Earth orbit—a category that includes not only the shuttle missions themselves, but scientific missions to come such as the Hubble Space Telescope.

■ M. MITCHELL WALDROP

U.S.S.R. to Set Up Fund for Basic Research

The Soviet Union is to set up a special fund to finance fundamental research projects which will be open to competition among individual scientists and laboratories and allocated through a system of peer review, according to Guri Marchuk, president of the Soviet Academy of Sciences.

The new fund is part of a broad attempt to put scientific research in the U.S.S.R. on a competitive basis by by-passing the traditional system under which research has been financed through block grants to the directors of institutes, and allocating the funds instead directly to laboratory directors.

It bears some similarities to an initiative introduced 2 years ago by the Hungarian Academy of Sciences (*Science*, 15 May 1987, p. 770). In the U.S.S.R., a competitive approach has already been applied in deciding which group should receive funding for research in high-temperature superconductors, an experiment which is being generalized across the research spectrum.

Marchuk is quoted by the Soviet news agency Tass as saying that the system of financing institutes was being replaced by one of financing projects. A move in this direction has long been seen as necessary for increasing the quality of Soviet research.

Where the proposed research project is directed toward the solution of a particular technological problem, applications must detail how the results will help to lead to the resolution of the problem. Applications will be assessed by a committee, which will make decisions by secret ballot.

In addition, Marchuk has announced that the special funds being set aside for funding basic research are intended for projects "where results are difficult to forecast." These funds will also be allocated on a competitive basis.

The news agency also reported Marchuk as saying that the modern research workers should show greater "initiative and enterprise," pointing out that at present, only the Siberian Branch of the Soviet Academy of Sciences has the right to market its discoveries and technical developments in foreign countries.

More work was needed, he said, to speed up the introduction of the results of research into large-scale production. In particular, said Marchuk, "there should be a 50% increase in support for building new facilities in this area, primarily pilot production projects."

■ DAVID DICKSON