

the organization of Soviet science—"monopolism," the "domination of the administrative-bureaucratic system" and the "absence of *glasnost* and democratism." Last and not least, the Soviet scientific community was isolated from "the world scientific process" because of "an incorrect analysis of the laws of scientific development [in the USSR] on the one hand and, on the other, the deliberate policies of certain countries toward us. As a result the world scientific community lost a significant portion of its members. Nor did Soviet science gain anything by this."

Marchuk was in the United States to discuss implementation of a five-year exchange agreement, which the Soviets would like to expand to cover the global environment. Marchuk had to cut short his visit because of the tragic earthquake in Armenia.

New science leadership

Velikhov continues to be one of the nine vice presidents of the Soviet Academy, where he is now joined by Ossipyan. The other newly elected vice presidents are Vladimir Ku-

dryavtsev, head of the Institute of State and Law; Nikolai Laverov, an expert on uranium deposits; Oleg Nefedov, a chemist; and Rem Petrov, head of the Institute of Immunology.

Evidently the Soviet science community will be strongly represented in the new constitutional order adopted by the Supreme Soviet on 1 December, following approval of the plan by the Central Committee a few days earlier. The plan calls for 2250 delegates to be elected next March to a Congress of People's Deputies; 1500 of them are to represent districts, and 750 the governing bodies of party, union, youth, arts and other organizations, including science. The Congress, in turn, will elect a new Supreme Soviet with 400-450 members, which is to be the country's legislature and will meet for two sessions of two to three months' duration each year. The presidium of the Supreme Soviet will be headed by a president, presumably Gorbachev initially.

Sagdeev and Arbatov told PHYSICS TODAY that the science community is expected to be allotted about 75 delegates to the Congress of People's

Deputies and that the Soviet Academy will select about half of those delegates.

One other change could have an important impact on Soviet science policy: During the major reorganization of the Politburo on 30 September, Vadim A. Medvedev was promoted to party secretary and head of the commission on ideology, replacing Ligachev. The ideology post is considered to be more or less the number-two position in the Soviet leadership, and it was Medvedev who met with the press following the shake-up on 30 September to explain the changes.

Medvedev most recently had been the Central Committee secretary responsible for relations with Eastern European nations, but before that he was the secretary in charge of science and technology. A latecomer to party politics who spent most of his career as a professor in Leningrad, Medvedev is considered to be an expert on the management of scientific and educational institutions.

—WILLIAM SWEET,

WITH REPORTING BY IRWIN GOODWIN
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US, EUROPEANS, CANADA AND JAPAN CONCLUDE SPACE STATION AGREEMENT

Meeting in Washington at the end of September, representatives of the United States, Canada, Japan and nine member states of the European Space Agency concluded an agreement to build a permanently manned space station in the 1990s. The agreement caps three years of negotiations, in which the 13 parties argued over complex scientific, commercial and national security issues; during that time, the estimated cost of the project escalated drastically and its proposed schedule slipped well beyond the 1992 launch date originally foreseen (see PHYSICS TODAY, April 1987, page 71). In the end, some of the most troublesome issues were finessed rather than truly resolved.

On the very sensitive question of whether the space station will be made available for work related to national security, such as testing of missile-defense system components, the agreement says the station will be used "for peaceful purposes," but it leaves the definition of "peaceful" to the countries controlling different elements of the station. ESA's four neutral member states—Austria, Ireland, Sweden and Switzerland—are not parties to the agreement, and an Austrian space official has said this is

because use of the station for Star Wars testing is not excluded.

On the question of intellectual property rights, details are to be worked out later, but it is understood that any party developing a process or product through work on the space station will retain rights to it. The laboratory modules planned for the station are expected to be devoted mainly to microgravity research in the life sciences and materials science.

The cost of the space station is estimated now at \$16 billion dollars, exclusive of launch and assembly costs, which will add another \$10 billion or so—making the station about three times more expensive than initial estimates. Each party to the agreement will cover the launch costs for its own components: The United States will build the basic station itself and a laboratory module; ESA will contribute a second laboratory module, an unmanned but human-tended free-flying module and a polar platform; Canada will contribute a remote manipulator; and Japan will contribute a third laboratory module. It is anticipated that a variety of launchers will be used, including the Ariane 5 rocket and Hermès

space plane that the Europeans are developing and the Japanese H2 rocket, as well as the US space shuttle.

Columbus program

While the space station agreement can be seen as a crowning achievement of President Reagan's personal diplomacy (see PHYSICS TODAY, May 1985, page 77), it also represents a triumph for the French, who persuaded the other Europeans—notably the Germans and Italians—to line up behind their major space development projects. In effect, France has persuaded the other Europeans to support development of a stronger aerospace industry, which eventually could help provide Europe with an integrated defense. An odd combination of conditions contributed to France's success, among them: the Reagan-Gorbachev treaty eliminating medium-range missiles in Europe, which has had the effect of convincing Europeans that they need to do more to assure their own defense; an increasingly strong pattern of military collaboration between France and West Germany, extending from military maneuvers to weapons development; and both the successes and failures of the US space program,

which have made the Europeans want to join it—or, better yet, beat it.

In November 1987, following meetings between German and French science officials, the nine non-neutral ESA member states agreed at The Hague to a ten-year program to develop the Ariane 5 rocket, the Hermès space plane and Columbus, the collective name for the European space station components. Ariane 5 is to be a 50 meter long, 550-ton, two-stage rocket equipped, like the US space shuttle launcher, with two giant boosters. Hermès, a space plane roughly the size of a jet fighter, is to be launched on the head of the Ariane 5—not, in contrast to the US shuttle, on the launcher's back.

France will finance 45% of the Ariane 5 development costs, Germany 22% and Italy 13–15%. France also will cover 45% of the Hermès costs; Germany will account for 30% and Italy a smaller share. Germany will have a 38% share in Columbus, however, while Italy will account for 25% and France 14%. The total cost of the three projects is estimated at about \$15 billion.

At the time of the ESA meeting in The Hague, Great Britain refused to go along with the ESA development program, and its officials habitually made condescending remarks about Hermès. Earlier this year, however, Britain agreed to contribute £250 million to Columbus, accounting for about 5% of its costs. In exchange Britain will be mainly responsible for design and construction of the polar orbiter.

Other space news

At the end of November ESA decided to make Cassini, a probe of Saturn's moon Titan, its next major space science project. A joint project with NASA scheduled for 1996, Cassini will consist of a Saturn orbiter built by NASA and a probe, to be called Huygens, built by Europe.

ESA is proceeding with construction of an Infrared Space Observatory, to be built at a cost of nearly half a billion dollars and to be launched on an Ariane 4 in April 1993. ISO, which will be the largest science satellite to be launched by ESA to date, currently is in the modeling phase.

Earlier in November, the USSR invited American space scientists to participate in all upcoming Soviet planetary missions, including the major mission to Mars planned for 1994 (though there is some doubt as to whether the Mars project has been definitively approved). Ten US scientists are contributing to Phobos, the mission to the Mars moon launched

last July, and in return ten Soviet scientists are to participate in the US Mars Observer mission planned for 1992. Soviet teams also are to be

involved in next year's Magellan radar mapping visit to Venus and in Voyager's encounter with Neptune later this year. —WILLIAM SWEET

BRITAIN WILL REMAIN IN CERN; MANAGEMENT REFORMS ADOPTED

At a meeting of the CERN council on 15 December, Great Britain announced its intention to remain a member of CERN beyond 1989. Britain acted in recognition of measures taken by CERN in response to the report issued last year by a management review committee headed by French physicist Anatole Abragam (see PHYSICS TODAY, September 1987, page 71, and February 1988, page 74).

Britain decided to stay in CERN despite the council's reluctance to introduce immediately a new method of calculating the annual dues for CERN member states. The new method, which is to take effect in 1990, was hammered out at a meeting of the council in June. Its near-term effect will be to reduce Great Britain's dues, mainly at the expense of Italy. Great Britain had hoped to persuade the other CERN member states to introduce the new method at the beginning of this year, but apparently failed. A statement issued by the council says, however, that the new director general, Carlo Rubbia, will be asked to raise the question again with the member delegations.

The CERN council has acted on a number of other issues related to the Abragam committee's recommendations. At its meeting in June, the council decided to offer an early retirement scheme with the objective of persuading about 200 CERN employees to leave; 230 early departures have been granted. The council plans to reduce the staff to 2950 by the end of 1996, with provision for recruitment of a minimum of 50 new people each year.

The council rejected the Abragam committee's controversial recommendation to establish two different classes of employees, so that some would be covered by the local social security systems. The CERN management disagreed strongly with the proposal, which could be viewed as unnecessarily insulting to the laboratory's technical staff. The council's statement says that comparable economies will be achieved by a new contract and recruitment plan.

On 1 November CERN established a new "advisory committee of CERN users," with members to be nomi-

nated by an appropriate physics organization in each member country. The council has decided to develop a long-term strategy for the formulation of priorities and to encourage nonmember states to contribute to large new projects. A working group is studying CERN's relationship with associated nonmember states.

Finally, the CERN council bade farewell to outgoing Director General Herwig Schopper. Council President Josef Rembser of West Germany noted that during Schopper's eight-year tenure, LEP was brought nearly to completion; remarkable achievements were made, especially in anti-proton and heavy-ion physics; staff scientists were awarded three Nobel Prizes; and new technology was developed. Schopper noted that the number of users had more than doubled during his years in charge. In recognition of Schopper's contributions, the President of West Germany has awarded him the Great Service Cross of the Order of Merit of the Federal Republic of Germany.

BRITAIN CUTS FUNDING FOR FUSION, BREEDERS

The British government has announced sharp cuts in both fusion research and fast-breeder reactor R&D. Fusion research is to lose £5 million over a three-year period, and as many as 150 researchers at the Culham Laboratory could lose their jobs. The cuts in fast-reactor work are even more draconian: The Atomic Energy Authority has been told to reduce its budget for breeders by £45 million for the next 18 months and to cut up to 2000 jobs.

Britain's participation in the Joint European Torus at Culham is unaffected by the fusion cuts, but virtually all other fusion could suffer, including British planning for the Next European Torus, work on compact torus designs, and research on reverse-field pinch. The budget for fusion excepting JET is expected to drop from about £15.5 million in 1989–90 to about £10.5 million in 1991–92. The