generally poor. "A hell of a lot more work is needed to fill the shelf" with new technologies for the semiarid areas, says Hussein.

One bright spot in this region, however, is the recent introduction of a new variety of sorghum into the Sudan. Derived from a cross between a strain from Nigeria and one from Texas A&M University, the new variety produces three times the yields of standard varieties on irrigated soils and almost five times those grown on dry lands. According to Swindale, whose institute developed the strain with support from the United Nations Development Program, the government of Sudan has approved the variety for use, and a crash program is under way to grow seeds in Zimbabwe for planting in the Sudan next year.

All the research directors who spoke with *Science* emphasized that producing new technologies is only part of the solution to Africa's food production problem. Reforming policies to devote more resources to agriculture, making hard political choices on the allocation of scarce inputs such as fertilizer and seeds, and dealing with the problems of inequity that generally arise in any process of technological change will all be required in the years ahead.

All of this will be doubly difficult without a major increase in foreign assistance. The trend, however, is in the wrong direction. According to World Bank estimates, capital flowing into sub-Saharan Africa will drop from about $11 billion a year to $5 billion between 1985 and 1987.

To help turn this trend around, the Bank has proposed establishing a special international lending facility for the region, to which governments have been asked to contribute on a voluntary basis. The goal is to raise $1 billion for the facility to support national programs in Africa, including agricultural research. A meeting in Paris of potential donors will take place on 31 January to 1 February.—**COLIN NORMAN**

SPARX Fly Over U.S.–German Space Venture

A dispute over the application of U.S. laws to foreign companies could affect negotiations on Europe's participation in the space station

Paris. The apparent collapse of a joint U.S.–West German enterprise aimed at commercializing data from remote sensing equipment has left a legacy likely to affect future negotiations over European participation in the planned space station. The enterprise, known as SPARX, became embroiled in a dispute over the application of U.S. domestic law to foreign companies.

SPARX was to have been set up to finance regular flights on the space shuttle of the Modular Opto-electronic Multispectral Scanner, an instrument developed by the company Messerschmitt-Bolkow-Blohm (MBB) under contract from the German Aerospace Research Establishment. It has already been flown experimentally on two shuttle missions in June 1983 and February 1984.

Officials from the National Aeronautics and Space Administration (NASA) say that proposals received from SPARX were unacceptable, since the data were to have been made available solely on a proprietary basis to SPARX's commercial customers. This conflicted directly with NASA's "open skies" policy mandating nondiscriminatory access to all data obtained from U.S.–launched civilian missions.

Discussions are still continuing between NASA and MBB over whether or not a separate venture using the German equipment but respecting the open skies policy will be required to observe the licensing conditions applied to U.S. companies under the terms of last year's Land Remote Sensing Commercialization Act.

Even though SPARX itself seems to be dead, the apparent conflict between its planned commercial activities and current U.S. law is already being used by some members of Europe's space science community—in particular those with reservations about tying Europe's fortunes too closely to those of NASA's proposed space station—as evidence of the concrete nature of their concerns.

As originally conceived by its chairman, space consultant and entrepreneur Klaus Heiss, SPARX Corporation was to have been 60 percent U.S.–owned and 40 percent European-owned, with the major partners being Comsat in the United States and MBB in Europe.

It was to have flown what Heiss has described as the first commercial remote sensing demonstration mission on a shuttle flight originally scheduled for last August. Five more missions operated jointly with NASA were to have been flown in the following 2 to 3 years. SPARX would have eventually flown four missions a year on a purely commercial basis over the next decade, gathering data for customers who were never specified, but are thought to have included major oil and mineral companies interested in geological prospecting from space.

From an early stage, however, it became apparent that the enterprise, as conceived by Heiss, conflicted with NASA's interpretation of its legal responsibilities under the U.S. commitment to the open skies principle. This states that no country can forbid another country from taking photographs or obtaining other data about it from space, and in return, all such data will be made available on a nondiscriminatory basis to anyone interested.

The principle was established in a series of negotiations that took place under the auspices of the United Nations in the early 1970's, and was agreed to by the United States primarily to calm fears expressed by many Third World countries that remote sensing satellites could rapidly become a tool of commercial espionage. As such, in the words of Ray Williamson, project director for a report published last year by the Office of Technology Assessment, any alteration of the policy of nondiscriminatory data sale would be "harmful to U.S. foreign policy interests."

Heiss, however, has sharply contested the way in which the open skies policy has been interpreted by NASA. In evidence presented last year to a hearing on the commercialization of Landsat, held by the science, technology, and space subcommittee of the Senate Committee on Commerce, Science and Transportation, he challenged the U.S. position as being excessively protectionist. "The United States should not impose its interpretation of 'nondiscriminatory' on other nations and other users," he said.

According to reports, Heiss has said that he was quite prepared to go along

with NASA's data policy on any joint missions but demanded the right to a proprietary data policy for any launch paid for on an entirely commercial basis.

According to a NASA official, it was consistently made clear to Heiss that NASA had no intention of abandoning its current policies on nondiscrimination on access to all data from civilian missions. This position was supported by all other commercial witnesses in the congressional hearings on the Landsat commercialization bill, he said, and it was still considered by the Administration as a cornerstone of its open skies policy.

The disagreement between the two sides rapidly became a major stumbling block in negotiations between NASA and SPARX. The negotiations also became more difficult after Comsat announced that it was withdrawing from its position as the enterprise's principal potential U.S. backer. Finally, the SPARX mission that had been planned for the shuttle launch in August was cancelled by NASA when SPARX, citing the agency's refusal to make any accommodation in its data policy, decided not to make the third in a series of progress payments required by NASA that fell due at the beginning of last May.

Even though the SPARX proposal now appears to be dead, the issues it has raised linger on. Indeed, they are widely expected to increase in importance over the next few years as countries such as West Germany that have collaborated with the United States on experimental development of space technology in the past, begin to explore ways in which this technology can be commercially exploited.

Of particular concern to these countries is the extent to which the regulations and other provisions contained in licensing requirements adopted in U.S. legislation—such as the condition in the new remote sensing rules that all licensees should deposit any data obtained in a single, central archive—are likely to be applied to foreign companies who become NASA's commercial customers.

The dilemma is that, while companies based outside the United States resent being made the subject of legislation over which neither they nor their governments have any formal control, both Congress and U.S.-based companies are likely to complain if they feel that foreign companies are being given any advantage by not having to meet the domestic licensing requirements.

In what is being pushed as something of a test case, MBB is now discussing with NASA the further joint development of the multispectral scanner and is as a result exploring the conditions that are likely to be placed on such activities if they become commercial ventures.

"We are in principle still interested in seeing if we can fly a commercial mission with the instruments we have developed, including [the scanner] but if we come back to NASA as a foreign entity, we want to determine if U.S. legislation will be applied to us," says Udo Pollvogt of MBB's Washington office.

According to Pollvogt, the company, unlike SPARX itself, would have "no problems" with NASA's data policy, particularly since it applies only to remote sensing data in its raw form, and does not include proprietary controls on the more valuable enhanced data.

MBB/ERNO

Germany's eye in the sky

MBB's scanner after launch by the shuttle.

"The question for us is whether the U.S. can legally extend its legislation to a foreign company which is not under U.S. jurisdiction," says Pollvogt, adding that, according to the company's interpretation of the legislation passed last year, "if we were to come back to NASA as MBB [that is, as an entirely foreign operation] we would not have to apply for a license."

At present, this interpretation seems to be shared by the Department of Commerce itself, which is responsible for overseeing remote sensing regulations through the National Oceanic and Atmospheric Administration.

Prompted by a request for clarification from NASA, Commerce general counsel Irving P. Margulies replied in a letter dated 7 January that the requirement to obtain a license for remote sensing activities appeared to be limited to "those parties otherwise subject to the jurisdiction of the United States."

According to Margulies's letter, whether a foreign operator requires a license would depend on the nature of the operations conducted and the extent to which they were carried out in the United States. "In general, however, it may be said that a foreign operator whose business operations and contacts within the United States are minimal would, absent distinguishing circumstances, not require a license."

NASA officials have welcomed this ruling, in part because it reduces the chances that potential commercial customers such as MBB would seek alternatives to shuttle launches—in particular Europe's Ariane—in order to avoid U.S. licensing requirements.

They also hope that it will help dispel any impression that they have been unfair in their treatment of SPARX. This, however, is likely to prove difficult, particularly because the SPARX case appears to reflect concern already widely felt in Europe about the dangers of collaborating too closely with the United States on future space projects because of the barriers which may be placed in the way of subsequent commercial exploitation.

For example, an internal planning document produced last year by officials of the European Space Agency as part of their discussions on a new 10-year program for the agency, states explicitly that "the recent difficulties of SPARX illustrate the dangers of dependency."

More recently, George van Reeth, director of administration for ESA, is quoted in the 18 January edition of the newsletter *Space Commerce Bulletin* as claiming that the SPARX project had "ended or at least is provisionally stopped in a highly regrettable way which announces bad news for purely commercial trans-Atlantic cooperation."

Both NASA and MBB officials sharply contest this interpretation. Furthermore, there is a growing feeling in the United States that the German government, which seems to have been sitting on the sidelines during much of the dispute between SPARX and NASA, should become more involved in attempting to balance its expressed desire to see the full commercial exploitation of the space technology it has developed through its support for the multispectral scanner with its own commitment to the open skies principle.

According to Pollvogt, the issues raised by SPARX "definitely need to be resolved over the next 2 years" as European countries discuss whether participation in the space station will make them unacceptably liable to U.S.-domestic laws on the use of any technology that is developed.—**DAVID DICKSON**