European Space Program: It's Half-Speed Ahead

The European Space Conference, held in Brussels in December, mixed the elements of a wake and a christening. The conferees adopted a British proposal to form a new European Space Agency (ESA) to replace the European Space Research Organization (ESRO) and the European Launcher Development Organization (ELDO). Neither has been a brilliant success, and ELDO particularly has been the victim of political wrangles and embarrassments at the launch site. No one knows at this stage whether ELDO will still exist a few months from now.

Since the space age began, cooperative efforts by Western European nations have never really ignited. A little less than half of the $350 million that these nations now spend annually on space goes into the joint European space effort. The rest is spent on national space programs and collaborative projects with the United States.

ESA's configuration is not clear yet. If it is ever created, however, it seems that it will not be a European NASA with a program and a budget to which all member countries will have to subscribe. Member countries would participate in a basic program and would then be free to join other particular projects that interest them. There is little prospect at present of much of an increase in the total spending for space among Western European countries, and there is no sign yet that the enlargement of the European Economic Community could bring more genuine cooperation than at present.

In the following report, Dominique Verguèse of the Paris daily Le Monde *comments on the plans and some of the problems of the European space program in the aftermath of the European Space Conference.—J.W.*

A feeling of bitterness and dissatisfaction now prevails among European countries as they contemplate the past and future of their efforts to build a space program. In the 8 years before 1972, ESRO and ELDO spent nearly $1 billion on space. A third of it went to the successful launching of seven satellites, but the rest was squandered on the development of a rocket that may never put a satellite into orbit. The best ESRO can hope for in the present decade is to build a medium-sized scientific satellite every 2 years, and maybe half a dozen application satellites. These will be launched by American rockets, or maybe by a French vehicle. And there is some chance that Europe will develop a sortie module in cooperation with the American post-Apollo program. As for ELDO, it appears doomed to death sooner or later, as no project is to succeed the present one.

These plans are the outcome of two European conferences on space held in Brussels a year apart, in December 1971 and 1972. The conferences marked a new European emphasis on application satellites and, for the first time, a certain interest in manned flight in cooperation with the United States.

As if to blur the fate of ELDO, the conference planned the merger of Europe's two space organizations, ESRO and ELDO, into a single agency. Originally, this was a British proposal, and, as it cost nothing extra, it was readily accepted by the three member countries of the conference.

Along with ELDO, the December 1972 conference also officially buried Europa-3, a rocket comparable to the American Atlas-Centaur, which was to succeed the less powerful Europa-2 and have the capability of putting a 750-kilogram satellite into synchronous orbit. France, Belgium, and Germany were the only supporters of Europa-3 after 1970, and German enthusiasm has now dissipated because of the rocket's cost—$700 million—and the likelihood that it would not be powerful enough to meet the needs projected for 1980. At the same time, the German government has been growing more interested in the idea of participating in NASA's post-Apollo program.

The fate of Europa-2, which exploded in flight in November 1971 after several unsuccessful launchings, is still pending. Germany, the main participant in the program with France and contractor for the third stage of the rocket, has been responsible for the failure of the last three test flights. Fearful of bearing the onus of yet another fiasco, the German government has shown an increasingly strong determination not to fund the program beyond April 1973, even though the next trial flight is scheduled for the summer of 1973. If Germany decides to drop the project, ELDO will be jobless and will atrophy within a year or so. The Franco-German telecommunications satellite Symphonie would then be launched by an American rocket. If the next flight of Europa-2 took place and was a real success, then France could perhaps persuade Germany to pursue the development of the rocket until the launching of Symphonie in 1974. ELDO's death would be postponed to 1975–1976 and masked by the fusion with ESRO.

This is not to say that Europe will be left with no launching capability after 1975. In spite of all the misfortunes of Europa-2, France is still insisting upon preserving Europe's independence in the field of launchers, and, at the end of last summer, came up with a new project—a three-stage launcher called L 3S. Nearly as powerful as Europa-3, but not liable to improvement, like Europa-3, the L 3S would not require such a large and sophisticated cryogenic second stage, and, as a result, would cost $150 million less. France recently proposed the development of this launcher in collaboration with other European nations. To gain foreign participation more easily, France offered to put up 60 to 70 percent of the cost and to cover any cost overruns. In return, the program would be managed by the French space agency CNES (Centre National d'Études Spatiales), while the rocket would be built by a consortium of European firms.

In fact, France and Germany negotiated a compromise, trading the L 3S for the post-Apollo program, just before the last European Space Conference. At an informal meeting in Paris last November, Germany decided with three other countries, Belgium, Italy, and Spain, to go on with the preliminary studies and further development of the sortie module, provided that, at the end of the first phase next July, the cost does not exceed $250 million. But Germany was, of course, anxious to find other partners and, in December, reached an agreement with France: Germany would pay for 20 percent of the development of the L 3S if France would share in the sortie module. France has yet to find one or more partners to achieve her objective of

30 to 40 percent foreign participation. That could prove difficult, as the French Ministry of Defense may help CNES finance the French share of the project.

The 8-year ESRO program, decided upon in December 1971, was also the result of a hard-fought compromise. Early in 1971, France threatened to leave ESRO unless emphasis was placed on application satellites, and ESRO closed down its plasma laboratory at Frascati in Italy and its sounding-rocket launching range at Kiruna in Sweden. France also contended that, instead of hiring more and more people in its technical center (ESTEC) for new projects, ESRO should try to make use of the national facilities and teams that were available. France insisted that the meteorological satellite Meteosat, which was first studied by CNES and then handed to ESRO, should be built under the supervision of an international team working in the French technical center at Toulouse. A final requirement was that the future program of scientific satellites should be restricted to $27 million each year, while the application program would rise to $70 million in 1974.

Although the member countries of ESRO accepted those proposals, they have had some difficulty starting their threefold application program. They are now actively building the stationary satellite Meteosat, which is similar to the American Synchronous Meteorological Satellite and will also be part of the Global Atmospheric Research Pro-

Briefing

U.S.-Chinese Science: Who's in Charge Here?

The announcement recently by Henry Kissinger that the United States and mainland China will establish liaison offices in each others' capitals to handle scientific exchanges and other features of normalized relations means that control of science contracts between the two nations has now moved to the center of government and out of the hands of semiofficial and private groups, which have until now carried the ball.

The U.S. liaison office in Peking will be organized by Kissinger's staff on the National Security Council and by the appropriate group at the Asian desk of the Department of State: the People's Republic of China and Mongolian Affairs office, whose chief, Alfred Jenkins, accompanied the peripatetic Kissinger to Peking. Spokesmen in that office declined to say whether the United States will appoint a science attaché there, but admitted that something of the sort may be given serious consideration. Kissinger also announced plans for the Chinese to send experts in water conservation, insect hormones, high energy physics, and computer science to the United States; teams of American physicians and scientists will visit China.

As the initiative for such arrangements moves out of the hands of groups like the National Academy of Sciences and the semidissident Federation of American Scientists, will private groups be edged out of the picture altogether? Ethan Signer, one of the first U.S. scientists to visit mainland China, in 1971, thinks not; he notes that Scientists and Engineers for Social and Political Action, the left-wing professional group, had a delegation in Peking at the same time Kissinger was there.

—D.S.

NIH Advisors Advised Penury Is Nigh

Forewarning of a financial crisis for biomedical research was issued on 23 February at a meeting of the committee of advisors to the director of the National Institutes of Health. Institutes will have to cut back on support promised for existing grants in fiscal 1974 in order to fund even a reasonable proportion of new grant applications, the committee was told.

Meeting for the first time in public, the committee discussed the relative merits of the grant and contract mechanisms of research support, mostly to the detriment of the former. (The difference is that under a grant a scientist does what he wants, under a contract, what an NIH administrator tells him to do.)

One member of the advisory committee, Marian Koshland of Berkeley, said she felt that respect for the NIH in the world biomedical community "could be destroyed by one big scandal, and in the present contract system there is the possibility of a future scandal." The problem is particularly serious in the National Cancer Institute, she told the committee.

Challenged by an NIH administrator to cite instances of waste, Koshland said she knew of a scientist who had applied for a $5000 contract to run a mouse colony but was told that this was too small to bother with and he should apply for a $50,000 contract. NIH administrators said they knew of only one instance in which an application rejected for grant support received a contract. The National Cancer Institute is the major, but not the only, dispenser of contract funds.

Koshland also reported criticisms of the contract mechanism made by chairmen of the NIH study sections (the groups of outside scientists who evaluate grant proposals). The chairmen, she said, noted that in some institutes the same people were involved in all stages of a contract, from making an award through having their names on the paper embodying the research results, a situation fraught with possible conflicts of interest. Second, the contracts were inadequately advertised by the NIH (in the *Commerce Business Daily*, which not many university scientists get to see). Third, there was no integrated method of awarding contracts, such as exists for grants.

The study section chairmen, however, had admitted, when pressed by former NIH director Robert Q. Marston, that few good investigators were going unfunded at present, Koshland reported.

This may not be the case in future. Robert Berliner, NIH deputy director for science, told the advisory committee that the National Institute of General Medical Sciences, a principal patron of basic research, will have to cut back on funds promised for existing grants in the remainder of fiscal 1973 in order to find funds for new grants. Even so, only the applications rated 1.5 or better by the study sections (roughly the best 15 percent) were likely to be funded. And in fiscal 1974, Berliner said, all institutes except heart and cancer would be in a similar situation.

The advisory committee members, many of whom are university scientists, probably did not like what they heard. They can do little about it, save offer advice. But at least their frustration was aired in public.—N.W.

gram network in 1976. But they have been unable to reach a final agreement on what their $450-million telecommunication program should be. The objective is still the launching of a 750-kilogram satellite in 1980, but should the predecessor of this spacecraft be a 200-, a 350-, or a 500-kilogram satellite? Should it be derived from Symphonie, from the Italian telecommunication Sirio, or from the British paper study of still another satellite? As for the aeronautical satellite Aerosat, which is to be developed in cooperation with the United States, ESRO is still negotiating with the Federal Aviation Administration (FAA) and the Federal Communications Commission and trying to find an American industrial partner willing to share half of the cost, after two previous agreements with NASA and the FAA were vetoed by the Office of Telecommunication Policy in the White House.

At odds with itself, Europe is no happier in its relationship with the United States. The Aerosat affair proved very disappointing, as did the successive post-Apollo proposals; NASA offered Europe participation first in the shuttle, then in the tug, and finally only in the sortie module.

(As it stands now, ESRO at least has its foot in the hatch in the sortie module project. The module—Europeans call it a "space lab"—would fit into the payload bay of the space shuttle and remain there while the shuttle was in orbit. The module would have a life support system and accommodate scientists and their experiments for several weeks. Recently, Britain and the Netherlands have agreed to join in studies designed to come up with refined estimates of the project's costs. Belgium, Italy, Spain, and West Germany have already indicated they will participate in the module program unless costs are excessive. Results of the study, expected in August, will determine whether ESRO will go on to build the module and, if so, which nations will participate.)

Today, it can be seriously asked whether Europe and the United States will ever reach an agreement on the post-Apollo program. Europe may be reluctant to pour money into the sortie module program if NASA develops its own simultaneously. On the other hand, now that NASA has support of the Department of Defense for the post-Apollo program, it no longer has such a strong need for European assistance.

Europe's new space program was adopted without enthusiasm and amidst the conflicting interests of each nation. No one at the space conference was able to set sensible objectives, establish what the program should do for Europe, or decide what role national programs should play. Will any program born amidst so much dissension and compromise become a source of happiness to its progenitors? And yet, with national and European programs combined, Europe has so far launched 26 satellites and acquired an industrial competence which can easily provide a firm basis for more ambitious projects.—DOMINIQUE VERGUÈSE

RESEARCH NEWS

X-ray Astronomy (II): A New Breed of Pulsars

Radio pulsars were born in supernova explosions that blew out great clouds of gas into space, and then started producing enormous streams of very fast electrons and probably cosmic rays too. Or at least that is the way most astronomers picture them. Sixty or 70 radio pulsars have been discovered, and the fastest pulsar, NP 0532 in the Crab Nebula, radiates more than 100,000 times the energy of the sun. Where does all that energy come from? Thoughts that were just speculations a few years ago are almost certainties now. The Crab pulsar is a neutron star spinning around 30 times per second, and its great luminosity is sustained because the energy of rotation is continually being converted into emissions of radiation and fast particles. After 4 years of observation, astronomers now know that the pulses of the Crab pulsar are not exactly constant. Although the slowing is almost imperceptible, the pause between pulses is growing longer by 13.5 microseconds every year. The energy lost as the pulsar spins more slowly can be calculated simply, and it agrees remarkably well with the energy radiated into space.

But as a result of experiments with x-ray satellites during the last 2 years, a new type of pulsar has been found that does not emit any radio signals. The new objects might be called x-ray pulsars. So far only two such objects have been identified, but the characteristics of the x-ray pulsars are so well-defined and so different from the characteristics of radio pulsars that there is great hope for new knowledge of the underlying phenomenon. One scientist has called the x-ray pulsar an example of a neutron star in a controlled environment, because the x-ray pulsar exists in a binary system. Thus it has been possible in one case to measure the neutron star's mass (*Science*, 23 February 1973). Perhaps an even more important measurement of the x-ray pulsar has already been made, however. After clocking the period of two x-ray pulsars for almost a year, astronomers have found that they are rotating slightly faster than they did when first discovered. This almost certainly means that the x-ray pulsar is gaining energy rather than losing it, and thus scientists are forced to construct very different sorts of models for the dynamics of x-ray pulsars than for their radio counterparts.

X-ray pulsars are not the only unusual astronomical objects that have been discovered with the new telescopes, carried above the earth's atmosphere by the satellites Small Astronomy Satellite-A (named UHURU) and the seventh Orbiting Solar Observatory (OSO-7). With UHURU at least 125 sources of x-rays have now been discovered (Fig. 1). About 80 of these are found in directions within 20 degrees of the plane of our galaxy, and are thought to be located in the galaxy. Among the galactic sources, a whole menagerie of different types is found. Some of the strongest and most regular galactic sources will be discussed in this article, and the source which many scientists postulate might be a black hole will be discussed in a third article of this series. The extra-galactic objects mapped by UHURU will not be discussed, although many interesting ob-