

installed. It also stepped up work on a potentially more efficient process using lasers that had been under development at the Lawrence Livermore Laboratory. DOE was planning to spend about \$190 million on the two programs this year, with a full-scale demonstration of both of them expected in the late 1980's.

Funding for both technologies is being reduced, however, and the projects are now being revamped so that a choice can be made in the summer of 1985. If DOE chooses to continue with the advanced centrifuge, the new machines will probably be installed in the two completed process buildings of GCEP. According to DOE estimates, a two-building GCEP equipped with advanced centrifuges would be cheaper to operate than the existing gaseous diffusion plants. But with current-generation machines, such

a plant would provide little or no cost savings. Thus, if the laser process is chosen, the future of GCEP would be in doubt.

In view of the fact that some \$2 billion has already been invested in GCEP, DOE's technological choice would seem to be heavily skewed toward the advanced centrifuge. "Yes, that will be a factor," says Brewer. "That's life; you have to live with past decisions." But John Longenecker, the head of the enrichment program, points out that the capital cost of building a new laser plant would be roughly equal to the additional cost of completing a two-building GCEP with advanced centrifuges. Thus the money sunk into GCEP has, in effect, put the two technologies on a roughly equal footing.

Longenecker says that the choice will

be made not only on the expected capital and operating costs of the two technologies but also on their relative attractiveness to private investors. DOE is hoping to get some private capital into the enrichment program as a first step toward turning the enterprise over to private industry. Exactly how the transition would be accomplished, however, is not clear.

In any case, the real key to attracting any investment into enrichment, whether public or private, will be how successful DOE is in hanging on to its customers, and how long the depression endures in the nuclear industry. From now on, claims Brewer, investment decisions in the enrichment program will depend on the market—an elementary business strategy that, he admits, DOE has not followed in the past.—COLIN NORMAN

Will There Be Room on the Arc?

Third World countries are challenging the United States on use of an orbit crucial to communications satellites

International jostling for position on the radio spectrum will resume in public next year at a world meeting to plan the use of geostationary satellites. Under discussion will be access to the orbit directly over the equator and 38,500 kilometers (22,300 miles) from Earth; in that orbit it is possible for a satellite to keep a fixed relation with a particular spot on the surface and maintain communication with it continuously.

Geostationary satellites are carrying a rapidly increasing volume of voice, video, and data traffic and represent a major growth area in telecommunications. Less-developed countries (LDC's) contend that the buildup of satellites in geostationary orbit by the United States and other industrial countries will result in crowding that will exclude LDC's from access to the orbit. When the physical separation between satellites in the same geosynchronous orbit and operating on similar frequencies is insufficient, interference occurs.

The LDC's have sought to ensure their future use of the orbit by reserving space through international negotiations, acquiring what are informally termed "parking" privileges. The issue was controversial enough to cause discussion of it to be deferred during the 1979 major meeting of the World Administrative Radio Conference (WARC) which operates

under the aegis of the International Telecommunications Union (ITU). The matter is scheduled to be taken up in July 1985 in Geneva at a WARC Conference on the Use of the Geostationary-Satellite Orbit and the Planning of the Space Services Utilizing it, mercifully, for short, ORB 85.

In allocating frequencies, WARC has historically run things on a first-come-first-served basis. Since only the industrial nations had highly developed telecommunications networks, the LDC's did not seriously challenge the system. However, the expanding potential of satellite use, particularly for direct television broadcasting, prompted the LDC's to stake their claim to a portion of the radio-frequency spectrum devoted to satellite communications.

The United States has opposed the LDC attempt to reserve space for future use, claiming that such a policy involved a waste of resources and would retard the development of satellite technology. U.S. policy has been to support the present flexible policy and to assume that advancing technology will make it possible to accommodate those who want to make use of the "arc" in the future.

At the 1979 WARC conference, the LDC's major immediate concern was with expanding their use of frequencies

for ground-based, point-to-point broadcasting. What were probably the two most controversial issues—geostationary satellites and high-frequency (short-wave) radio—were both bypassed by relegating negotiations to later meetings.

In respect to actual decisions taken at WARC '79, the United States fared reasonably well. But many American observers saw the meeting as marking a permanent change in the U.S. position in the organization. An assessment of the meeting* by the congressional Office of Technology Assessment noted that "The long-term trends may be running against the United States in the sense that more problems without apparent solutions are foreseen. The United States finds itself increasingly in a defensive mode, trying to minimize losses rather than seeking significant changes to improve its long-term posture."

The issue of crowding remains the one likeliest to cause LDC-U.S. differences to crystallize at ORB 85. The LDC's, aware of the rapidly increasing numbers of satellites in geostationary orbit, continue to express concern that the orbit will be saturated by the time they wish to use it.

An American view that seems to domi-

*Radiofrequency Use and Management (Office of Technology Assessment, Washington, D.C., 1982), 163 pages.

nate in both public and private sectors is that the worst LDC misgivings about crowding are misplaced. If crowding occurs, it will certainly be most severe in the section of the orbit assigned to satellites handling domestic U.S. traffic, the fastest growing segment of the market, and American users would be most seriously affected. The orbit over Africa and Asia could not be used for satellites serving the United States. Although partisans of the U.S. view tend to regard the crowding issue as mainly a political problem, they acknowledge that a number of substantial technical problems are looming. Many of these put the United States at odds with Canada, Mexico, and other Latin American countries that share WARC's Region 2.

Technical advances are expected to ameliorate the crowding problem. Recently, improved technology, mainly in ground stations, made it possible for the United States to reduce intersatellite spacing to 2 degrees, virtually doubling the number of satellites that may be put aloft in one of the most heavily used sections of the spectrum. Conversion to digital transmission and expanded use of higher frequency bands will increase the capacity of the system. And better satellite antennas, in effect, focus beam coverage so that it is possible to reuse frequency bands in the same region.

Even more dramatic relief from crowding problems should be provided by the satellites of the 1990's. Intersatellite links will permit much more efficient use of equipment, and satellite clusters or space platforms could handle a much greater volume and variety of traffic. And the extension of cables using fiber optic technology could allow a major diversion of traffic economically to the ground.

American observers concede that sophistication comes at a cost and some LDC's are already protesting that the new technology could prove too expensive for them to use. The U.S. response is that experience with telecommunications technology has been that technical advance invariably reduces unit costs in the long term, but the issue is sure to be a factor at ORB 85.

WARC negotiations have a large political as well as a technical component. In the case of geostationary satellites as with the allotment of frequencies elsewhere on the spectrum, differences are defined most clearly by U.S. opposition to what is called the *a priori* approach to spectrum management, strongly favored by the LDC's. This denotes a formal, multilateral-planning process in which satellite orbit slots are allocated among

countries without reference to their ability or desire to use them immediately. For the LDC's, whatever assurances may be given about accommodating them, the possibility of reserving slots exerts a powerful appeal. Not only would planning provide a solid guarantee of future access but also offer the possibility of renting or leasing such slots in the interim. A group of equatorial countries have already put forward claims on the portions of the orbit over their territories, but U.N. protocols on the internationalization of space appear to discourage such initiatives.

Reinforcing the LDC preference for *a priori* planning is the LDC's attitude pervading most U.N. negotiations that the industrial countries are exploiting resources that should be, in the current phrase, the common heritage of mankind. Such planning is regarded as a way of achieving fairer shares.



The United States continues to favor a pragmatic or "*a posteriori*" approach, that is of assigning orbital locations and satellite frequencies to those who will use them immediately. The U.S. view is that technical progress will keep pace with demand and that the policy that has served the ITU well for 75 years should continue. U.S. providers of commercial satellite services argue that the *a priori* approach would impose restraints that would hamper efficiency and raise costs. Arbitrary assignment of slots, for example, could push current satellite operators to force technology to meet new constraints rather than follow the natural path of development, thereby driving up costs. Planning in other areas of the spectrum is also said to have entailed early standardization that retarded development.

This view clearly reflects the U.S. preference for competition as a determining principle, that is, for allowing technical expediency and economic efficiency to guide the growth of satellite communications. LDC's complain, however, that the U.S. policy of encouraging free competition among common carriers unnecessarily clutters the orbit.

This U.S. stance seems to guarantee continued tensions with both the LDC's

and, to some extent, with Western European countries and Japan. The latter have government-operated post, telegraph, and telephone services that not infrequently are at odds on policy with the U.S. free-enterprise orientation but also have private sector equipment manufacturers anxious to compete with their American counterparts. In the case of extreme frustration at ITU, the United States could consider withdrawing from the organization and going it alone. Most observers think that this country would shun this option because of the almost certain result of chaos in the spectrum. Satellite communications are increasingly important to the United States for a range of military, commercial, and scientific purposes, and the order provided by the present voluntary system is regarded as too valuable to be risked.

Is a U.S. policy rout inevitable? Recent experience indicates that it is not. Commercial satellite communications are increasingly dominated by so-called common-user systems. The United States was a major founding member of INTELSAT (International Communications Satellite Organization) which now has more than 100 member countries including many LDC's.[†] Power in INTELSAT affairs is proportional to a country's use of its services and, although U.S. views still carry weight, this country is no longer, so to speak, majority stockholder. INTELSAT seems to have heeded the needs of its LDC members, for example, by enabling some 25 LDC's the use of backup satellite capacity at reduced costs. Cultivation of common interests in INTELSAT influences both U.S. and LDC attitudes in WARC negotiations. The consensus among knowledgeable Americans is that U.S. policy at ORB 85 will be grounded on giving practical assurances that countries will have access to the orbit. On the issue of *a priori* planning, the United States is expected to agree to planning that includes the kind of flexibility that both sides at recent WARC meetings decided they could live with.

It is traditional to attribute past troubles the United States experienced in getting its technico-diplomatic act together to the acute pluralism that afflicts U.S. policy-making for telecommunications. Authority and responsibility are distributed among several committees of Congress and the Federal Communica-

[†]INTELSAT is the largest operator of commercial satellites with 17 currently in orbit, about 20 percent of the total. The Soviet Union is sponsor of Intersputnik, a smaller system mainly serving the socialist countries. A new service, Arabsat, organized by Middle Eastern countries is scheduled to begin operations in 1985.

tions Commission (FCC), the Commerce Department's National Telecommunications and Information Administration, (NTIA) and the State Department in the Executive Branch. And the private sector is the repository of much of the requisite technical expertise.

Although the ORB 85 meeting is still more than a year away, the United

States faces a crucial rendezvous this summer at a preparatory meeting in Geneva which is expected not only to define the technical issues for the 1985 meeting but also to set the tone. An advisory committee mustering private and public sector talent was established by the FCC in 1981 and submitted its first report in December projecting de-

mand and laying out technical issues and policy choices. And NTIA is lead agency for an interagency task force working to coordinate the U.S. preparations. But old WARC hands are worried that unless a U.S. head of delegation is named soon to ringmaster the effort, the U.S. side next year could be set back on its a posteriori.—JOHN WALSH

Sleight of Hand with EPA's R & D Budget

The President's support for the environment is less than meets the eye, according to his total budget

"Though this is a time of budget restraints, I have requested for EPA one of the largest percentage budget increases of any agency," President Reagan announced last month in his state of the union address. And with those words, Reagan left many with the impression that the Environmental Protection Agency (EPA), and the environment in general, finally have found favor with the Administration. But a close examination of the budget proposals suggests that the Administration's support for environmental programs is less than meets the eye.

The increase that EPA is to receive under Reagan's fiscal year 1985 proposal is 9 percent, raising the agency's operating budget to \$1.2 billion. But even at this level, the agency's budget would still be 9 percent *less* than when the Carter Administration left office. Elsewhere in the federal government, the picture is worse, for the Administration plans to slash the environmental research budgets of other agencies. Some of the same cuts have been proposed in previous years, but Congress has usually restored the funds. Nevertheless, Reagan keeps trying.

Under his budget proposal, EPA's research and development budget would increase to \$278 million, a boost of 13 percent or \$33 million. But this level of funding is 24 percent less than the FY 1981 budget under Carter. Furthermore, Reagan's proposed increase of \$33 million would be canceled out by reductions in the environmental research budgets of the National Oceanographic and Atmospheric Administration (NOAA) and the U.S. Geological Survey. Depending on how environmental research is defined, the cuts would range from roughly \$50 million to \$90 million. The Department of Energy's division of biological and

environmental research and the research program within the Department of the Interior's Fish and Wildlife Service fare a little better, with token increases of about \$5 million apiece. The environmental budget for the National Science Foundation would increase about 5 percent or \$16 million, but it is unclear whether the additional money represents new research or simply compensates for inflation, according to a budget official at the foundation.

The \$50-million cut in NOAA and the Geological Survey is based on an estimate derived from government figures and interviews with budget analysts at the agencies, who were asked to break out environmental research from the total R & D budget. (Only NOAA and the

The Administration plans to slash the environmental research budgets of other agencies.

Energy Department routinely differentiate environmental research from the rest of the budget.) The \$90-million reduction relies on the assumption that the total R & D budgets of these agencies are, to some degree, environmentally related.

Aside from NOAA, where several programs would be eliminated, no single program within an individual agency bears the brunt of the cuts. In most instances, the Administration is seeking to trim a few million dollars here, a few million there. The most vulnerable programs subject to the Reagan budget ax are the ones perceived to be of regional interest.

For the third year in a row, the Administration is proposing to chop a major portion of NOAA's research and development budget, although Congress has previously blocked such proposals. The agency's R & D money would be cut by 31 percent, from \$242 million to \$167 million. Almost half of the \$75-million cut would result from the proposed termination of the \$36-million Sea Grant program, of which \$20 million is designated environmental research by the agency. The program, which supports university education and research in the marine sciences at 19 institutions, is a big favorite of Congress, however, and the Administration is unlikely to get its way.

Among the other programs threatened with reductions or elimination are the following:

- Marine fisheries research. A \$10-million fisheries research program that provides grants would be terminated, along with a \$5-million aquaculture program. A total of \$20 million would be cut from several other programs related to marine fisheries research.

- Great Lakes research. Reagan said in his state of the union address that "we will take additional action to restore our lakes. . . ." But the proposed budget would eliminate NOAA's \$3.6-million Great Lakes research laboratory which monitors pollution in lake waters and sponsors other types of research. In the past, Reagan has concomitantly tried to abolish Great Lakes research conducted by EPA, but this year he is proposing to leave it be.

- Ocean dumping research. Reagan plans to save about \$2 million in ocean dumping research. According to NOAA's congressional budget analysis, the Administration believes that EPA and the Corps of Engineers fund adequate research in this area. But ocean