Committee on Science and Astronautics, House of Representatives, Washington, D.C.). The report concluded that the geographical distribution of federal research funds is uneven to a "pronounced" degree, and that something should be done about it. It was recommended by the committee that, in seeking to help the have-nots, "particular care must be taken not to detract from or penalize those institutions and areas which, due to their own wisdom and effort, as well as their favorable locations, have built the kind of research competence to attract Federal grants and contracts." And it was pointed out that the concept of "uneven," in reference to geographical distribution, is a complex one. California ranks first in terms of percentage of federal R&D dollars, but on a per capita basis it is third, behind Nevada and New Mexico. Massachusetts, which was third in dollar totals, was ninth in the per capita standings. Ranked in terms of federal research and development funds versus federal tax collections, it turned out that New Mexico received $970 in R&D funds for every $1000 that it paid in federal taxes. California, the envy of the have-nots, got back only $388 for every $1000. These numbers, of course, illustrate the perils of statistics, and the committee went to some lengths to emphasize its appreciation of the complexities. But it couldn't get away from the fact that more than half of the federal government's R&D awards go to three states—California, 38.4 percent; New York, 9.2; and Massachusetts, 4.6—and it appears not to have been happy with these findings.

In telling what it thought should be done about it, the committee recommended, among other things, that the White House call a conference to study the problem, that the National Science Foundation earmark funds for "insuring the existence of at least one major center of excellence in research and technology in each appropriate region of the nation," and that federal agencies, particularly the Defense Department and the National Aeronautics and Space Administration, try to use their expenditures to help promote institutional excellence.

What is perhaps most significant about these recommendations is that they represent additional, and influential, support for getting away from the concept that the federal research agencies should be paying only for research and closely allied matters when they provide funds for the nation's universities. The concept has been quietly eroded over the past few years, simply because of the financial plight of the universities, and the principle of paying for no more than research has been stretched to cover a good many other things. But Congress has traditionally been balky about general support for higher education, and outside of NSF's carefully conceived and cautiously operated Science Development Program, the Congress has withheld its sanction from proposals to put the federal government opening behind efforts aimed at building institutional excellence, rather than simply buying research. The Daddario report represents another step toward changing congressional attitudes in this area. Over the next few years, it is likely that the Midwest, outside the mainstream of federal support but still high in quality and aspiration, will find Washington increasingly attentive to its needs.—D. S. GREENBERG

Comsat II: Commercial System to Avoid Tie with Defense Department; Company Now Faces Other Problems

Complicating, and at times threatening, the Communications Satellite Corporation's recently concluded talks for an international partnership were its simultaneous efforts to work out a joint arrangement with the Department of Defense. From Comsat's point of view, the reason for seeking such a liaison was simple: the Pentagon promised to be a customer whose traffic might bring in as much as $35 million a year. The Pentagon's motives were more complicated and have their roots in the muddled history of the department's attempts to develop a satellite communications network of its own.

Defense Department research in the field of communications satellites began in the Eisenhower administration, around 1958. By the time the Pentagon came under the jurisdiction of Kennedy's defense secretary, Robert S. MacNamara, the decision had been made that a synchronous satellite would best meet the military need for a flexible, reliable, and virtually jamproof communications network. Very late in Eisenhower's term, management responsibility for the satellite project, known as Project Advent, was transferred from the department-level Advanced Research Projects Agency (ARPA) to the Department of the Army. Operational responsibilities were divided among the three services, with the Army responsible for developing communications equipment for satellites and ground stations, the Air Force responsible for launching and maintaining the satellites, and the Navy charged with constructing and operating a shipboard receiving station.

This management arrangement, which was continued by MacNamara, appears to have been one of the major sources of the malaise that afflicted Advent from its inception. Although Harold Brown, Director of Defense Research and Engineering (DDR&E), told a subcommittee of the House Committee on Science and Astronautics that studied Advent in the fall of 1962 that "interservice rivalries in the strict sense are not believed to have been an important factor in the difficulties with the Advent program," a better characterization of the situation is difficult to find. Before the transfer of responsibility from ARPA to the Army, for example, the Air Force had a contract with the Space Technology Laboratories (STL) for systems engineering and technical advice on Advent. After the Army assumed management, it also negotiated a contract with STL, whereupon the Air Force closed out its contract with STL and contracted with the Aerospace Corporation, instead. On another occasion the Air Force refused the Army's request to station representatives of the Army's Advent management group at the General Electric plant where the Advent satellite was being developed under an Air Force contract.

How much the technical problems were the result of the managerial ones, or how much they flowed simply from the highly ambitious nature of the project is hard to say. In any event, the costs rose, the time allotted the program stretched out, and the various components of the project ceased to have sensible relation to each other. Thus, it had originally been planned that the Advent satellite would weigh about 1000 pounds (453 kilograms) and that it would be lifted into orbit by the Atlas-Centaur booster, which was expected to have at least that capacity. But by the spring of 1962 it appeared that the weight of the satellite had increased to over 1300 pounds, while at the same time the boosting capacity of the Centaur had fallen considerably below what had been anticipated. In the end it was this widening gulf between expanding satellite weight and shrinking booster capacity that forced the Department of Defense, after exhaustive studies, to change its plans.

In the spring of 1962, MacNamara announced a "reorientation" of Project Advent so extensive that it amounted in effect to complete termination. At that point the Department had spent $170 million, the largest part of which was considered to be unrecoverable.

Advent's Demise

After the cancellation of Advent, all the management relationships were overhauled and the Pentagon set to work to develop a technically less ambitious system of medium-altitude communications satellites that could fulfill some of its needs on an interim basis. A department-level agency, the Defense Communications Agency, became the project's technical manager, DDR&E took over the supervisory role, and the Army and Air Force, respectively, were charged with work on the ground and space segments of the system.

Having been scorched more than once by what Harold Brown described as the "overblown development programs" that result from "the desire of each service to enhance its roles and missions by developing and acquiring new operational systems . . . long before adequate scientific and technical work has been done on [their] critical components," MacNamara and his advisers took care to see that work on the revised satellite program proceeded very cautiously indeed. Although he authorized a variety of studies and preliminary contracts, MacNamara was reported still to be worried by the apparent inability of the services to do anything on a modest scale, and he kept searching for a simple way to provide the military with its essential communications services without creating another budgetary or managerial monster. In October 1963 MacNamara wrote to Comsat asking whether the corporation might be able to do the job. The corporation—which at that stage had not even issued stock—replied with great enthusiasm, and serious negotiations began, which lasted about a year, leaving the Pentagon's own operations more or less in the air.

What the Pentagon needed was a system to handle not its routine traffic but the specialized segment of its military traffic that goes under the name of "command and control." (The routine communications will, in all likelihood, ultimately be turned over to Comsat anyway, under the same sort of agreement as that through which the Pentagon now leases cable channels from A.T.&T.) Although it did not need a particularly large number of satellite channels, the Pentagon had several unshakable requirements: the system had to be under military control at all times, wholly free of dependence on foreign governments; there had to be simple, transportable ground stations that could be set up in remote areas; the system had to be secure from physical attack and electronic interference; and there had to be frequencies specifically reserved for military use. If Comsat could provide these characteristics, there would be some basis for an agreement.

Why the delusion persisted that a Comsat-Pentagon deal could be made to harmonize with the international commitments Comsat was also trying hard to obtain is something of a puzzle, but persist it did, down to the very last minute. The corporation appears to have conducted each set of negotiations as if the other set simply did not exist. The two efforts were brought to a fairly successful conclusion early last summer, only to collide abruptly. Although in the beginning it was thought that Comsat and the Pentagon might develop a truly "shared system," using the same satellites and the same repeaters, it later developed that the Pentagon would not agree to such a close relationship. For the most part, therefore, what was discussed and planned was a system in which each satellite used for the commercial network would carry a separate repeater for the Department of Defense. The Pentagon also insisted on retaining exclusive ownership and use of its own ground stations, and sought to maintain a veto on a fairly significant number of other matters. This meant that the corporation would therefore be asking its foreign partners not only to relinquish their jurisidiction over whole portions of the satellite network but to agree to utilize satellites that had in them little black boxes labeled "Private—Property of the United States Department of Defense." Quite apart from the fact that certain Pentagon conditions would have meant introducing new and complicated technical factors into negotiations that were already extremely complicated, there was never any indication that the Europeans were willing to suffer the political indignity which Defense Department participation implied. On the contrary, there was some evidence that the three European neutrals—Sweden, Switzerland, and Austria—who were participating in the consortium would have found the Pentagon's company sufficiently compromising to their political positions to necessitate their pulling out of the consortium altogether.

In the end, however, it was the Pentagon and not the Europeans who pulled out. The Pentagon was dissatisfied with certain parts of the international agreement—particularly those which conceded a measure of international control over the choice of a satellite system and other key decisions. Comsat was so anxious to keep the Pentagon as a customer that it was willing to reopen the international negotiations, but the State Department—which had been given the thankless job of chaperoning Comsat officials through their talks with foreign governments—felt that this move would jeopardize an essentially favorable agreement. Finally the State Department position prevailed and the international agreement was signed, but it rested on a very tenuous thread. Within the corporation, resistance to the choice was so great that the chairman had difficulty assembling a quorum of the board of directors to ratify his intent to sign the consortium agreement. Another casualty of the last-minute pressures was the relationship between the State and Defense departments, each of which appears to have thought the other was trying to scuttle what it took to be an important and progressive step.

Pentagon's Plans

Although the corporation is still trying to figure out a way to get the Pentagon back in the picture, MacNamara has now definitely announced that the Pentagon plans to put up an interim medium-altitude system of its own in the first 6 months of 1966. The 24 satellites are scheduled to get "free rides" into orbit on the Titan III-c rocket, which is scheduled to be tested around that time, and the total cost is now estimated to be around $90 million. For his role in promoting the Comsat talks which resulted in delays and confusions in the Pentagon's own program, MacNamara has earned the toughest congressional criticism of a highly controversial Washington career. The Military Affairs subcommittee of the House Government Operations Committee, which recently concluded a thorough study of all aspects of the government's activities in satellite communications, charged that MacNamara had been "too timid and uncertain about exploiting proved technologies" and that he had let "economizing efforts . . . throttle programs essential to the na-

tional security." The whole effort for a military-commercial link was summed up by the subcommittee as "ill-advised, poorly timed and badly coordinated." Although the committee expressed gratification that the Pentagon was finally going ahead with its own system, it complained that "uncertainty and over-economizing" could still be detected, and asked why a "new large element of uncertainty" had been brought into the long-delayed program by the Pentagon's proposal to rely on the unproved Titan booster. The committee recommended that this plan be dropped and a reliable booster utilized instead. So far, however, there is no indication that the Pentagon intends to follow the committee's advice and give up its money-saving plan for free rides on Titan.

Domestic Dispute

Comsat itself, after a respite from its international debut, is again turning its attention to domestic issues. The chief problem currently on hand is the contested issue of who is to own the ground stations located on U.S. territory—Comsat or the communications carriers. Although this was the subject of extensive debate at the time Congress was considering the satellite bill, in the end Congress failed to supply a legislative solution. Instead, the problem was put off to another time and placed under the jurisdiction of the Federal Communications Commission, which was directed to decide between the competing claims of the carriers and the corporation for each station on the basis of which was more likely to "best serve the public interest, convenience and necessity," and "without preference for either."

If there is a surer formula for a free-for-all it is difficult to imagine, and Comsat precipitated one by proposing to the FCC last August that Comsat alone be authorized to construct and own four initial terminal stations on U.S. territory. Comsat's principal arguments, as they have developed, are (i) that "the critical relationship between satellites and terminal stations calls for station ownership and operation by [Comsat]"; (ii) that "competition will be strengthened by placing the maximum amount of control of satellite communication in an entity that has no interest in competing forms of communication"; and (iii) that Comsat "can be most effective as the U.S. representative on the international body governing the global system" if it owns and operates the domestic terminals.

Comsat's arguments set off wide protest among the communications carriers, who, with the exception of one company, Western Union, all dashed off briefs opposing Comsat's claims. Although the objections were phrased in various ways, one common element was insistence that the law directed the FCC to consider applications for *each* ground station separately, and that the commission lacked authority to grant Comsat the blanket ownership requested. This point was raised even by A.T.&T., which, even though it has such a dominant position in Comsat that it could hardly be adversely affected by the outcome, would still prefer to see the awards made on a case-by-case basis.

Fear that Comsat ownership would in effect be a smoke screen for further extension of the communications monopoly already enjoyed by A.T.&T. was implicit in most of the opposing briefs and explicit in several. "Should Comsat achieve the monopoly it presently seeks," said I.T.T. World Communications, Inc., "the end result may well be that the international record carriers will be forced from the field and that two entities, A.T.&T. and Comsat, will completely control United States international communications traffic." This point was also raised by the American Communications Association, a labor union operating in the communications field, which said that the Comsat proposal would "tend to strengthen the already pervasive monopoly control by [A.T.&T.] . . . and would result in loss of employment to employees now employed in the international communications industry." None of the carriers appear to accept Comsat's contentions that ownership of the terminal stations by an entity other than Comsat would produce insurmountable technical and administrative problems, or that the interest of the carriers in other means of international communication would make them less sensitive to the special requirements of the satellite network. And, indeed, since high-level representatives of the carriers are no further away than Comsat's own board room, and since everyone's hands are more or less in the same pocket, it is hard to see why either coordination or "subversion" should be a major problem. Comsat, however, continues to promote its position that the only way to secure sufficient devotion to the interests of the global system is to advance competition by giving Comsat a monopoly.

The principal reason for the intense concern that lies behind the so far rather gentlemanly discussions of principle and "the public interest" is, rather simply, money, for ground stations are the tollbooths through which all communications traffic from the satellites must go, and in this monopoly as in the other, whenever you pass "go," someone is going to collect the $200. Quite aside from the cash angle, however, it is plain that the FCC's decision will have an enormous impact not only on the development of the satellite system and the evolution of Comsat but on domestic relations between Comsat and the carriers and on the tenuous balance of power between the domestic carriers themselves. How the FCC will untangle the confusing claims is still unknown, but it is probable that, however the commission rules, the issue will still find its way into court for final resolution, for it is sufficiently important for all the contenders that none of them is likely to give up gracefully.

—ELINOR LANGER

(This is the second of two articles on the Communications Satellite Corporation.)

Announcements

Boston University's new division of **communication research** is now accepting applications for admission to the graduate program leading to an M.S. in communication research. Research internships are offered between the second and final semesters, allowing interns to work in organized research under the direction of a senior researcher. Further information on the program is available from E. J. Robinson, Chairman, Communication Research Division, Boston University, 640 Commonwealth Avenue, Boston, Mass. 02215.

Formation of an information exchange group for **research on interferon** has been announced by the National Institute for Medical Research in London, and the Laboratory of Biology of Viruses, National Institute of Allergy and Infectious Diseases. It will enable scientists working on interferon to communicate research findings or scientific information to others in the field throughout the world by sending communications to the "center" where duplicate copies will be printed promptly and mailed out. The chairman of the exchange is Alick Issacs of the NIMR in London. Further information is avail-