

These reports could not have been produced by real rain sounds because of the soundproofing of the cubicle, and besides, often no rain had fallen.

Many subjects reported hearing "muffled engine noises," such as truck engines. It may be that they expected to hear highway noises, since there is a highway near the laboratory. In the same vein, several subjects reported hearing "the school bells"; this again may have been more an expectation than an actuality.

As explained earlier, in the fifth study sound was constantly present during confinement. That sound had no effect upon these reports of auditory phenomena. It did not produce unique auditory hallucinations, and it did not

terminate reports of the kind described above. We feel that the auditory phenomena were probably auditory illusions rather than hallucinations.

Conclusions

At this point in our studies of sensory deprivation we can only conclude that we have yet to ascertain the maximum conditions for the generation of hallucinations. In all of the attempts we have made so far we have failed to obtain the frequency of reported visual hallucinations found in the investigations of others.

We subjected 55 subjects to various degrees of sensory deprivation and

found that only ten of them experienced visual hallucinations. These predominantly negative findings nevertheless lead to some positive statements about sensory deprivation and hallucinations. For example, it appears that absolutely maximum conditions of sensory deprivation do not elicit hallucinations. It also appears that neither continuous homogeneous nor momentary amorphous visual stimuli during sensory deprivation lead to hallucinations. However, because some hallucinations were reported in our studies, we may not assume that hallucinogenic factors were completely lacking. Our continuing program of research on sensory deprivation includes attempts to isolate these critical factors.

Science in the News

Space Communications: The Future Is Not Far Away, But the Major Policy Questions Are Unresolved

The Federal Communications Commission this week brought together a group of representatives of the communications industry and government agencies to begin exploring arrangements for development of an international satellite communications system. The direct issue, as put by John Finney in the *New York Times*, is "who shall sow and who shall reap the first big financial dividends of the space age . . . who shall own and operate a communications satellite system that would open up vast new channels of communications between all the nations of the world."

The FCC does not have the authority to give the definitive answers to these questions. They raise the question of the extent of government participation in the system that may be desirable or necessary, and at least the possibility of outright government ownership. The FCC must work under the

assumption that the system will be privately owned. Any departure from this assumption would have to be made by the White House and Congress.

What the FCC tried to do this week was to make a start toward settling the conflicts among the segments of private industry and to lay the basis for industry representatives to get together and work up a proposal showing what industry feels it can accomplish.

The American Telephone and Telegraph Company has already asked for permission to go ahead with a plan for putting 20 satellites in orbit in order to have a commercial system for transatlantic communication in operation by 1964. A.T.&T. would pay for the satellites and the cost of putting them in orbit. But the Antitrust Division of the Justice Department has come out against any single company's dominating satellite communications, and the assumption behind the meeting this week was that a consortium of corporations in the international communications field should jointly manage any proposed system. But it is far from

settled whether this will be the actual approach decided upon, and if it is, it is only an approach, providing only the framework for the answers, not the answers themselves, to the very complicated problems of how the system should be financed, controlled, and operated, and who should profit from it.

Time Factor

The great significance of the A.T.&T. proposal, with its operating target date of 1964, is the forceful reminder it offers of how quickly difficult decisions must be made if the United States is to take full advantage of the lead it holds over the Russians in the practical uses of space. This was again emphasized in Kennedy's inclusion, in his expanded space budget, of \$50 million extra for fiscal 1962 to speed the development of communication satellites. This more than doubled the \$44 million already requested, and a good part of this speeded-up spending is pointless unless we intend to make prompt use of the satellites once they are developed.

None of the development money would be spent specifically to set up an operating system, but the prototype satellites put up will be usable. The first of the Project Relay satellites, which will receive, amplify, and re-broadcast signals, is scheduled for mid-1962. It will travel in an elliptical orbit ranging from 1000 to 3000 miles above the earth, and will be in sight of stations on both shores of the Atlantic Ocean for 10 to 35 minutes out of an orbiting time of 180 minutes. Conditions will be right for transatlan-

tic communication for three or four consecutive orbits per day.

During these periods it will be possible to transmit live telecasts across the Atlantic. Also, with techniques already available, by using high-speed transmission, the 10- to 35-minute transmission periods may be more than sufficient to transmit a television program that will last several hours when rebroadcast at normal speed, perhaps long enough to cover the 3-hour period until the satellite swings around the world and is in position for another burst of transmission. This does not quite make possible extensive live transatlantic television, since the system, with only one satellite available, will under these circumstances involve several hours' lapse between an actual event and the time it is seen on television screens across the ocean. But either the brief "real time" transmissions or the high-speed transmissions would be a great advance in transatlantic television coverage. The closest thing now available is for the TV networks to charter a plane to fly TV film across the Atlantic. This first step toward an operating satellite system has plain enough commercial value to make only a year away, if the schedule is met, the problem of how the use of this facility is to be allocated, and how much should be charged for its use.

Touchy Questions

The problems involved in this situation are trivial compared with those that will come later, but once again they are a reminder of how soon definite decisions have to be made and policies have to be decided on.

The basic policies and decisions may be extremely controversial. Immense amounts of public money have made these satellites possible, and the national interest is deeply involved in their early development into actual operating systems. The costs of putting up the first full system have been estimated at around \$400 million, and industry estimates have suggested this "business" of world-wide satellite communication will involve tens of billions a year within 15 years.

What kind of voice, if any, should the United Nations or some other international body have in the arrangements under which the system is used and over the rates that are charged? How much should the government attempt to recapture its "investment" in developing these satellites from the

commercial revenues that will result? Does private industry have the capital to develop these systems as quickly as may seem desirable? If not, under what arrangements should the government supply the additional capital needed if the systems are to be privately owned? Should there, indeed, be private ownership, or should the government create and own the system and merely rent access to it to commercial communications companies, as the telephone company rents access to its communication lines?

The last is the central problem. The Eisenhower Administration, in its final days, laid down the policy that "the government should aggressively encourage private enterprise in the establishment and operation of satellite relays for revenue producing purposes." This private enterprise, of course, would be under government regulation, as are all public utilities. The Kennedy Administration has said nothing, one way or the other, about this policy, and so, by implication, it still stands. The FCC invitation to the private communications companies to send representatives to Washington this week followed a preliminary decision by the FCC 3 weeks ago that the first system might be put up by a consortium of private corporations in the field. But that decision was intended to settle the ground rules for private participation rather than to decide the question of public versus private ownership.

The decision indicated that the FCC shares the Justice Department view that no one company should dominate the venture, and it defined the types of companies eligible for participation in the consortium and the rights of other companies with interests in the field, but which might not be members of the consortium. Essentially, it was merely a necessary first step for making the more basic decision over public versus private ownership, since in order to compare the relative merits of the two approaches an arrangement had to be made for industry to present its proposals for developing the new area.

Ownership

The new Administration does not share Eisenhower's strong distaste for new federal activity, and there is strong feeling in the Democratic party that, as a matter of principle, an effort involving as much public money and as deep a national interest as this does not only could, but should, be publicly

owned. If the decision is for private ownership there will be vigorous cries of "giveaway," and if the decision is for public ownership, there will be even more vigorous cries of "socialism."

The central question is whether the national interest in the speed with which the systems are developed and in the way they are operated can be as well served by government-regulated private ownership as by public ownership.

This involves not merely such obvious questions of whether industry has the capital to put up a system as quickly as seems desirable, but as FCC Chairman Minow warned the industry representatives this week, of whether the system meets not only the commercial interests of the participating companies but the national interest in a system that would be world-wide, rather than confined mainly to the more profitable high-traffic areas, principally between North America and Western Europe, and a system which makes participation available to all interested nations, small and large, around the globe. "Any plan," Minow said, "not in the public interest in any respect will not be approved." Any attempt to define the public interest opens a wide area of controversy centering around the extent to which the Administration's view of foreign-policy requirements conflicts with the type of system that would seem best on purely commercial grounds.

Given the Eisenhower Administration's feelings about the evils of public ownership and its desire to keep down the size of the federal budget, its decision in favor of private ownership was almost foreordained. It naturally resolved any doubts in favor of private ownership. The Kennedy Administration has no really strong commitment either way, although if the decision seemed close, it too would resolve its doubts in favor of private ownership, if only because although either decision would be controversial, the decision in favor of private industry would be much less so. On the other hand, with the new Administration there is a real possibility that the Eisenhower policy will be reversed. If so, the Administration may choose to avoid saying anything in public until Congress has finished its current session, lest the controversy hurt the chances of other parts of the Administration program. But any decision involving government participation must eventually

be brought before Congress, since nothing can be done unless Congress is willing to authorize and then appropriate the money to go ahead.

What makes a controversy of some sort inevitable either way is that the problem is more than complicated enough so that it will be easy to make a case in favor of either approach, and nearly everyone will have no trouble convincing himself that the view he would tend to favor in the lack of any evidence is, by some happy coincidence, precisely the view supported by a careful study of the arguments on both sides.

The Test Ban

The Vienna talks were a "success" within the terms set by the Administration at the outset. No false hopes were raised, and the meetings ended with no illusions of accommodation. The meetings gave Kennedy a chance to size up Khrushchev in person, and vice-versa; Kennedy had apparently made a strong impression on the Europeans; and these limited accomplishments were enough to satisfy most observers that the episode had been, as Administration spokesmen described it, "useful."

The meetings, nevertheless, left the Administration with the problem of how to deal with the test-ban talks, and with no longer much hope that the Russians are going to make the decisions any easier. Khrushchev confirmed the Russian interest in merging the talks with the general disarmament discussions to begin later this year, and, according to reports, he vigorously defended the new Soviet doctrine of three-headed control bodies for international agencies, including those to police disarmament, with the Soviet, Western, and neutral blocks each having a veto. To the West, this is like a court in which either of the opposing attorneys can veto the judge's decisions. For the moment, the Administration's negotiators at Geneva continue to press on day after day, even though there no longer seems much to negotiate about, in order to impress on the world our willingness to reach an agreement, if it is at all possible. At home, the United States Information Agency, under Edward R. Murrow, and other agencies are working on the problem of how to minimize the adverse world reaction that seems inevitable should it become necessary, after all, to resume nuclear testing.—H.M.

Announcements

A vehicle designed to do the work of a diver on the ocean floor is undergoing performance trials at the Scripps Institution of Oceanography, La Jolla, Calif., where it was designed. The machine, called a **remote control underwater manipulator**, or RUM vehicle, has a hand-like manipulator which is controlled from shore through a coaxial cable carrying, simultaneously, 38 sets of commands to the machine and two television signals from it.

The vehicle is driven by an electric motor and is able to withstand water pressures of 10,000 pounds per square inch. Two of its television cameras scan the ocean ahead, one searches behind, and the fourth follows the movements of the manipulator. When ready for operation, the vehicle will be used in various oceanographic research projects.

Britain and Russia have signed a 5-year agreement for collaboration on the **peaceful uses of atomic energy**. The first of a series of exchange visits will take place before the end of the year. The agreement was signed by V. S. Emelyanov, chairman of the State Committee for Atomic Energy of the Soviet Council of Ministers, and Sir Roger Makins, chairman of the United Kingdom Atomic Energy Authority.

A new scientific association, the **International Union of Geological Sciences**, was recently formed after a meeting of geologists from 25 countries held at UNESCO House, Paris. The union, now a member of the International Council of Scientific Unions, was formed on the basis of a proposal adopted at the 1960 meeting of the International Geological Congress. J. M. Harrison, head of the Geological Survey, Ottawa, Canada, has been elected president; vice presidents are I. I. Gorski (U.S.S.R.), L. Hawkes (United Kingdom), Teichi Kobayashi (Japan), Lamego (Brazil), Jean Lombard (France), and B. C. Roy (India).

A new **information and analysis center**, to evaluate reports and publications containing seismic information on explosions and earthquakes, has been established by the University of Michigan's Institute of Science and Technology. Supported by a contract from the Advanced Research Projects

Agency (ARPA), the institute's Fluid and Solid Mechanics Laboratory is setting up the VELA Seismic Information Analysis Center (VESIAC). The center will evaluate and disseminate information gathered in the seismic research portion of the ARPA Vela-Uniform program, the national program of research in the detection and identification of underground nuclear tests. It will also be responsible for summarizing current seismic knowledge which may be useful to the program.

Grants, Fellowships, and Awards

Fulbright scholarships for graduate study or predoctoral research in 32 countries will be available to over 800 graduate students for the 1962-63 academic year. In addition, awards for graduate study in Latin America and Ireland will be offered. Requests for application forms must be postmarked not later than *1 October 1961*; applications will be accepted until 1 November. (Information and Counseling Division, Institute of International Education, 1 E. 67th St., New York 21)

Modest grants to assist individuals wishing to study at the Chicago Natural History Museum are available for work in any of the following fields: **anthropology** (with a natural-history orientation), **botany** and **geology** (including paleontology), and **zoology**. An applicant should briefly describe the proposed study, state how long he would like to study at the museum and the amount of money needed, and name one reference. (Chairman, Karl P. Schmidt Fund, c/o Chicago Natural History Museum, Roosevelt Rd. and Lake Shore Dr., Chicago 5)

The National Science Foundation is accepting applications for fellowships under its **postdoctoral fellowship** program *through 5 September*. The awards consist of a stipend of \$5000 per year, dependency allowances, and limited travel allowances. Eligibility requirements include U.S. citizenship, special aptitude for advanced training, and a doctoral degree or its equivalent in education and experience. Fellows will be selected on the basis of ability as evidenced by letters of recommendation and other evidence of scientific attainment. (Fellowship Office, National Academy of Sciences-National Research Council, 2101 Constitution Ave., NW, Washington 25, D.C.)