Communication orbiters: FCC opts for open sky

The Federal Communications Commission (FCC), after seven years of deliberation and delay, decided last week that, unlike terrestrial telephone communications, domestic satellite communications should not be dominated or controlled by a monopoly (SN: 3/6/71, p. 162). By a vote of four to three, the FCC ruled that all qualified applicants will be allowed to provide domestic communications satellite services. The commission believes the benefits of satellite communications can best be demonstrated by a wide range of carriers and systems. Though the open-sky policy has been generally accepted and was recommended by several administrations, many feared the commission would establish a monopoly. The decision clearly charts the way for open competition.

The decision for "multiple entry" into satellite communications does not mean, the FCC cautioned, "that we have opted for a policy of 'unlimited or unrestricted open entry.'" Applicants must show that they have the financial and technical qualifications to provide proposed services and "must make a sufficient showing of potential public benefit to justify the assignment of orbital locations and frequencies."

A number of corporations, including the American Telephone and Telegraph Co. (AT&T), the Communications Satellite Corp. (COMSAT), and Western Union have already submitted applications, individually or jointly. Recognizing that full realization of the potential benefits of satellite communication will require some departures from conventional standards, the FCC order allows for considerable leeway in the type of system these corporations use, but it does place restrictions on some of them. Fearing that AT&T's dominance in communications might militate against free competition in the satellite field, the FCC limited AT&T's initial use of domestic satellites and rejected a joint proposal by AT&T and COMSAT. AT&T can either operate its own satellite or lease facilities from a carrier that provides services solely for other carriers. COMSAT will be required to form a separate corporate subsidiary for any domestic satellite ventures. All applicants must tell the FCC by July 25 whether they intend to pursue their applications under the specified conditions.

Commissioner Nicholas Johnson, though voting with the majority, would have preferred a pilot project operated by the National Aeronautics and Space Administration or some other Government agency, and criticized the order for making no special provisions for public broadcasting. The three dissenting commissioners were expected to issue a statement later this week. □

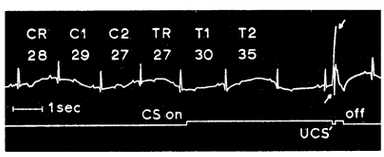
Does the eel use electric fields to navigate?

Many species of ocean fish migrate over large distances. Some of them do so with such extreme accuracy that they can come thousands of miles to return to the stream or area where they were born. Naturalists naturally wonder how they do it.

One of the suggestions is that they use electricity. The motion of ocean currents across the earth's magnetic field generates weak electric fields, and the idea is that sensitivity to these fields may orient the fish.

In the past several species of fish have been shown to be sensitive to fields with the sort of strength encountered in the ocean, but they were not migratory fish. In the June 16 SCIENCE S. A. Rommel Jr. and J. D. McCleave of the University of Maine describe how the "complete lack of data on electrosensitivity of migratory fish species" prompted them to study responses of American eels (*Anguilla rostrata*) exposed to uniform weak electric fields.

The experiments attempted to determine whether a conditioned response, namely a slowing of the heart rate, could be induced in the eels by subjecting them to weak electric fields. Before the tests, electrodes were surgically implanted in the eels so that continuous electrocardiograms could be taken. Only eels for which at least 50 trials were possible before the EKG electrodes pulled out were used in figuring the results.



Science

Electric field (CS) slows eel heart.

Generally the eels showed a sensitivity to fields perpendicular to their bodies, but not to parallel fields. Rommel and McCleave warn that showing this sensitivity exists does not prove the eels use it. But because the fields in ocean currents run across the current, the eel could keep itself oriented with the current by aligning its body to feel the transverse field. If the eel can also sense the polarity of the field, it can tell upstream from downstream.

Vitamin D and the kidney patient

For years people have been taking vitamin D to help the intestine and bone absorb calcium. Yet with the possible exception of vitamin B_{12}, vitamin D has been one of the last vitamins to have its breakdown products pinpointed. Four years ago, vitamin D was found to be broken down by the liver into a metabolite called 25-hydroxy vitamin D. A year ago Anthony Norman of the University of California at Riverside and some other biochemists gained more insight into vitamin D. The liver metabolite of the compound is metabolized still further by the kidney to 1-25 dihydroxy vitamin D, and this compound is the biologically active vitamin D. It helps the intestine absorb calcium 5 to 50 times better, and bone to absorb calcium 5 to 10 times better than parent vitamin D.

Thanks to this discovery, Norman and other biochemists were then able to explain why kidney disease patients, whose lives are now prolonged with kidney dialysis, have developed a secondary condition in which calcium reaches dangerously low levels in the bloodstream. The sick kidneys of these patients cannot metabolize the liver form of vitamin D to its biologically active form. So Norman reasoned that if doses of this biologically crucial vitamin D were given to kidney patients suffering from calcium malabsorption, it might correct the malabsorption.

He first tried the idea on rats with induced kidney disease. Some of the animals received parent vitamin D; some got the liver metabolite of the vitamin, and still others were given biologically active vitamin D. Only biologically active D stimulated the absorption of calcium. Then, in collaboration with Jack W. Coburn of the University of California at Los Angeles Medical School, Norman gave 4,000 unit doses of parent vitamin D to some kidney patients with calcium malabsorption, only 100 unit doses of biologically active D to other patients. Even in those markedly smaller doses the biologically potent D triggered a dramatic improvement in intestinal absorption of calcium and elevation of blood levels of calcium. The far larger doses of parent vitamin D did not.

Norman reported his and Coburn's clinical findings this week in Washington at the Fourth International Congress of Endocrinology. Details of their clinical studies are in press with the NEW ENGLAND JOURNAL OF MEDICINE. In an interview Norman cautioned that the biologically active form of vitamin D must still be synthesized before it can be made widely available to kidney

patients with calcium malabsorption. He is working on this synthesis.

Norman says he doubts that it would be advisable for the normal population to take the biologically active vitamin D rather than parent vitamin D, although the possibility should be clinically tested. He is inclined to believe that the biologically active D would be less satisfactory because it would be rapidly excreted by a person's body unless immediately needed. Parent vitamin D, on the other hand, is probably stored in the body until the body gives the liver and kidney orders to break the vitamin into its biologically effective form. □

Reaching design energy at Los Alamos meson unit

Mesons are physical particles intimately related to the strong force that binds atomic nuclei together. Pi mesons, and sometimes others, are regarded by theory as embodiments of the strong force, the intermediate particles that carry the strong force from place to place. Clouds of pi mesons appear to form part of the outer structure of protons and neutrons.

Because of their relation to the strong force, mesons are very useful as probe particles. They can be used to study the nature of the strong force and the structures of the particles that respond to it. They can be used to study the structure of nuclei either by entering the nucleus immediately or by being captured into orbit to form a short-lived mesic atom. Lately mesons have become interesting to radiobiologists because they can penetrate living tissue and deliver nearly all of their energy at the end of their flight.

All these considerations led physicists to begin about 10 years ago to ask for meson factories. This is a class of proton accelerator designed not for spectacularly high energy but for very high beam intensity. This intense proton beam would then be struck against a target to make a beam of pi mesons.

The decision was taken to build a meson factory at the Los Alamos Scientific Laboratory. On June 9 after four years of construction and the expenditure of $57 million the Los Alamos Meson Physics Facility (to be renamed the Clinton P. Anderson Meson Physics Facility) accelerated its first beam of protons to the design energy of 800 million electron-volts. The next step is to reach the design intensity of one milliampere (1,000 times the intensity of any proton accelerator of comparable energy). The remainder of this year will then be devoted to beam refinement and checkout in preparation for the completion of the experimental facilities, which is expected in 1973. □

Oh (scientific) buoy! First one placed in Gulf

Its yellow and red markings and sensor-laden mast proclaiming its nautical individuality, a 100-ton experimental buoy was towed 220 miles out into the Gulf of Mexico last week and anchored in 8,292 feet of water.

The occasion, marked by dockside ceremonies at the Gulfport, Miss., departure point, was the emplacement of the first in a series of advanced scientific buoys developed by the National Data Buoy Center. The buoys will automatically gather and transmit oceanographic and meteorological data.

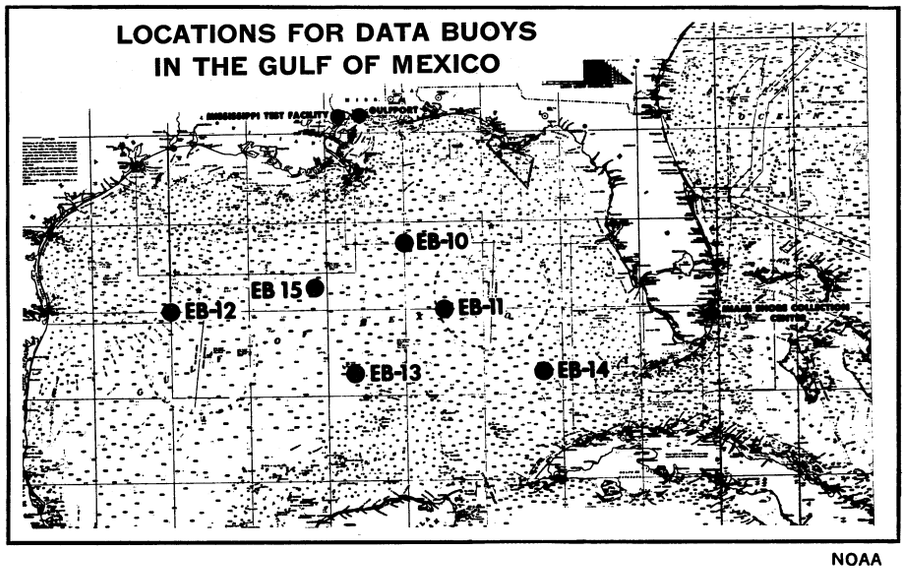
The buoys are admittedly experimental, and the one emplaced last week encountered almost immediate problems. After 2 hours 40 minutes it ceased transmitting, for unknown reasons, and choppy seas caused by Hurricane Agnes to the southeast prevented the Coast Guard cutter Acushnet from returning to check. Seas were subsiding this week, and another attempt was to be made this weekend. Project officials theorized that the problem was with the programming of the on-board computer that analyzes the data and controls the buoy's sensing, transmitting and power-generation systems. They believed the problem could be corrected as soon as technicians were able to reach the buoy.

The inability to obtain regular meteorological data from a variety of fixed points in the oceans has long posed a problem to weather forecasters. A network of sophisticated data buoys was seen as a good way to solve the problem. In 1966 the (then) Interagency Committee on Oceanography suggested that a single national system of buoys be set up. In 1969 the Stratton Commission selected the advancement of buoy technology and deployment of a pilot buoy network as one of six ocean activities deserving national priority, and in 1970 the first funds for the National Data Buoy Project became available. The project is now within the National Oceanic and Atmospheric Administration, and is directed by meteorologist James W. Winchester at the buoy center's facilities at Bay St. Louis, Miss.

Westinghouse

Buoy's mast holds weather sensors.

At the dockside ceremony last week in Gulfport, the mood was one of both celebration and expectation. It marked the completion of the first phase of the project—placing the first of the buoys into operation. But it was only the beginning. The performance of the first seven buoys will be evaluated, and the lessons learned will be applied to later versions. Winchester and others envision someday a global network of automatic data buoys throughout world's oceans, bays, lakes and coastal waters. □



NOAA

A system of six data buoys will be put into operation in the Gulf of Mexico.