

light and remain lit indefinitely. By further modification the element can be triggered to the lit condition by a pulse of voltage superimposed on the holding voltage and, when desired, can then be turned off by another voltage pulse.

Conclusion

As this brief review indicates, electroluminescence is a true frontier in science and technology, now being explored as a

new development in solid-state physics, as a new and useful light source, and as a new tool for development of information displays.

Notes

1. A foot-lambert is a measurement of brightness of a surface emitting light. It is equal to a foot-candle, which is a measure of the light incident on a surface. The usual fluorescent lamps have surface brightness up to 2500 foot-lamberts. Room illumination ranges from 5 to 50 foot-candles.
2. Hysteresis is a phenomenon occurring in the magnetization of steel where the change in magnetization lags behind changes in the field creating the magnetization.

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of the sea's resources, especially in the matter of providing animal protein for the underfed peoples of the world, and a better understanding of the origins and evolution of the planet.

Need for Ships

The ten-year program will require considerable increases in manpower and facilities, the committee reports. Stating that ships are to the oceanographer what cyclotrons or reactors are to the nuclear physicist, the report undertakes to map out a detailed program for the construction of a fleet of research ships which, by 1970, would give the United States a total of 85 oceanographic vessels. The present total is 45, of which number only 25 are classified as "principal oceanographic ships" in an article in *Research Reviews*. The committee's recommendations call for the construction of 70 ships of 500- to 2200-ton displacement between 1960 and 1970 at a total cost of \$213 million. New ships are required, the committee states, because conversion of existing surplus vessels to oceanographic duties has been found to be uneconomical and unsatisfactory. Although not specifically mentioned by the committee, there is a competition under way in the field of oceanographic research vessels. The Russians and the Japanese are continually building to improve their fleets. One comparison illustrates the problem. In 1957, the U.S.S.R. commissioned the *Mikhail Lomonosov*, a fully equipped research vessel of 5960-ton displacement. The largest United States ship in the field is the *Spencer F. Baird*, a converted seagoing tug, built in 1944 and displacing 505 tons.

Need for Men

The committee advocated the broadening of educational opportunities in oceanography for graduate scientists through action by universities, the Federal Government, and the scientific community at large. This might be accomplished, the report stated, by increasing the size of oceanographic faculties, by

News of Science

American Oceanography Survey and Proposals for Ten-Year Program Made by NAS-NRC Committee.

The state of American oceanography today and its needs for the future have been assessed by a committee on oceanography of the National Academy of Sciences-National Research Council. The picture is dark now, the committee reports, and will be black by 1970 unless a major effort—a doubling of our deep-sea research during a ten-year program—is undertaken soon. Such a program would cost \$651.5 million. According to a spokesman for the committee, the program may be expected to be well received on the grounds that oceanography is viewed by top government science planners as one of the three fields of greatest concern in the next decade. The other two are meteorology and nuclear physics.

This information was made public with the release of the first chapter—"An Introduction and Summary of Recommendations"—of an extensive report to be published later under NAS-NRC sponsorship. The report represents the committee's work since its establishment in 1957 by Detlev W. Bronk, president of the Academy-Research Council. Harrison Brown, professor of geochemistry at the California Institute of Technology, is the chairman.

Principal Recommendations

The three principal recommendations of the committee were that the Government should expand its support of the

marine sciences at a rate which will result in at least a doubling of basic research activity during the next ten years; that this expansion should be accompanied by a new program of ocean-wide surveys twice as large as the present one; and that the support of the applied marine sciences should also be expanded, particularly in the areas of military defense, marine resources, and marine radioactivity. These recommendations were coupled with the warning that "action on a scale appreciably less than that recommended will jeopardize the position of oceanography in the United States relative to the position of the science in other major nations, thereby accentuating serious military and political dangers, and placing the nation at a disadvantage in the future use of the resources of the sea."

Reasons for Urgency

A note of urgency runs through the committee's report. In addition to the basic fact that oceanography is an important field that should not be neglected, the committee feels that it will have great bearing on future military and political relationships. It is the committee's view, for example, that "the submarine armed with long range missiles is probably the most potent weapon system threatening our security today." Other benefits of the program, the report states, would be a fuller utilization

affiliating oceanographic research institutions with university faculties, by developing new oceanographic centers at universities with adequate existing faculties, and by creating long-term fellowships tenable at more than one university. The Government would be asked to aid in the financing of the recommended faculty increases to the amount of \$500,000 a year for salaries and other costs associated with the positions. The scientific community would be asked to undertake more active recruiting of prospective oceanographers among undergraduate students of physics, chemistry, biology, and geology.

Need for Money

To meet the cost of its recommended ten-year program the committee has suggested a funding arrangement based on the relative importance of the program to the various federal agencies. The committee's recommendations are as follows: The Navy and the National Science Foundation should each finance about 50 percent of the new basic research activity, except for ship construction. The Navy should finance 50 percent of the new research-ship construction, with the Maritime Administration and the National Science Foundation sharing the remainder. The Navy, through the Hydrographic Office, should finance 50 percent of the deep-ocean surveys, while the Coast and Geodetic Survey should finance the balance. The Navy should sponsor completely all military research and development operations. The Bureau of Commercial Fisheries should finance the greater part of the recommended ocean resources program. The Atomic Energy Commission should finance the major part of the research dealing with the problems of radioactive contamination of the oceans. The National Science Foundation and the Office of Education should sponsor jointly the proposed program for increasing scientific and technical manpower in the marine sciences. Efforts aimed at fostering international cooperation in the marine sciences should be sponsored by the Department of State, the International Cooperation Administration, and the National Science Foundation. Other agencies should take responsibility for certain aspects of the proposed program, particularly the Public Health Service, the Geological Survey, and the Bureau of Mines. Although the bulk of oceanographic research and survey work must of necessity be financed by the Federal Government, the importance of state and private funds cannot be overestimated. Such funds are especially helpful for supporting initial exploratory basic research and for starting new laboratories.

Committee Membership and Support

The committee on oceanography is supported by the U.S. Atomic Energy Commission, Bureau of Commercial Fisheries, National Science Foundation, and Office of Naval Research, and is comprised of the following members, representing varied fields of interest: Harrison Brown, professor of geochemistry, California Institute of Technology (chairman); Maurice Ewing, director, Lamont Geological Observatory, Columbia University; Columbus O'D. Iselin, retired director, Woods Hole Oceanographic Institution; Fritz Koczy, professor at the Marine Laboratories, University of Miami; Sumner Pike, Lubec, Maine, formerly commissioner, U.S. Atomic Energy Commission; Colin Pittendrigh, professor of biology, Princeton University; Roger Revelle, director, Scripps Institution of Oceanography; Gordon Riley, professor at the Bingham Oceanographic Laboratory, Yale University; Milner B. Schaefer, director, Inter-American Tropical Tuna Commission; and Athelstan Spilhaus, dean of the Institute of Technology, University of Minnesota.

Other Events in Oceanography

In September of this year a major conference will be held on oceanography. This is the International Oceanographic Congress, sponsored by the American Association for the Advancement of Science. To be held at the United Nations building in New York, this congress will study all of the marine sciences during a 13-day meeting. In another development, the Scripps Institution of the University of California has begun a major survey of the Gulf of California. Two institution vessels, the *Horizon* and the *Spencer F. Baird*, are participating in the cruise, tentatively designated as the Vermilion Sea Expedition. The study will extend through May.

The Great Challenge

The CBS Television Network has announced that the 1959 "Great Challenge" series of 1-hour symposium-discussions is again directed towards appraisal of democratic institutions in a time of great scientific and technological advance. All programs are broadcast on Sunday afternoons from 2:30 to 3:30 EST. Eric Sevareid of CBS News is the moderator. The first program, which was shown on 22 February, was called "Where Is Science Taking Us?" and included J. Robert Oppenheimer, Detlev W. Bronk, and Jerome B. Wiesner. Other subjects and a partial list of participants follow:

1 March, "Is America Anti-Intellectual?" with Robert M. Hutchins, president of the Fund for the Republic and former president of the University of Chicago; J. Kenneth Galbraith, professor of economics, Harvard University, and McGeorge Bundy, dean, Faculty of Arts and Sciences, Harvard University.

22 March, "Can Democracy Meet the Space Age Challenge?" with Senator John F. Kennedy; Arthur Larson, former presidential adviser and director of the Rule of Law Center, Duke University; and Clinton Rossiter, professor of history, Cornell University.

29 March, "Is American Journalism Meeting Its Responsibilities?" with Barbara Ward Jackson, a former editor of *The Economist* of London; J. Russell Wiggins, executive editor of the *Washington Post and Times Herald*, and former chairman of the Freedom of Information Committee of the American Society of Newspaper Editors; and John Fischer, editor in chief, *Harper's Magazine*.

5 April, "Is the American Public Getting the Information It Needs?" with James Reston, chief Washington correspondent, *New York Times*; Arthur B. Schlesinger, Jr., professor of history, Harvard University; Robert D. Swezey, executive vice president, WDSU Broadcasting Corporation, New Orleans, and chairman of the Freedom of Information Committee of the National Association of Broadcasters.

5 April, "Is the American Public Getting the Information It Needs?" with James Reston, chief Washington correspondent, *New York Times*; Arthur B. Schlesinger, Jr., professor of history, Harvard University; Robert D. Swezey, executive vice president, WDSU Broadcasting Corporation, New Orleans, and chairman of the Freedom of Information Committee of the National Association of Broadcasters.

Soviet Teaching Equipment

Soviet equipment for science teachers has gone on sale in the United States; this is causing quite a stir, for American manufacturers are being substantially undersold. The equipment is being imported by the Ealing Corporation of Cambridge, Mass. (an affiliate of Baird Atomics, Inc.), which had an exhibit at the recent joint meeting in New York of the American Physical Society and the American Association of Physics Teachers. Ealing has selected 24 items out of a Soviet catalog of 96.

According to observers, the equipment, which is mass produced, is unusually well adapted to meet the special needs and problems of secondary-school teaching. On this subject, Sanborn C. Brown of Massachusetts Institute told the *Christian Science Monitor* that there has not been a really new item of high-school teaching equipment in American catalogs since World War II. He also said that many current items in this country date in design to the 19th century. Brown has made a thorough study of this subject, for he is chairman of the AAPT Committee on Apparatus for Educational Institutions. At the time of the