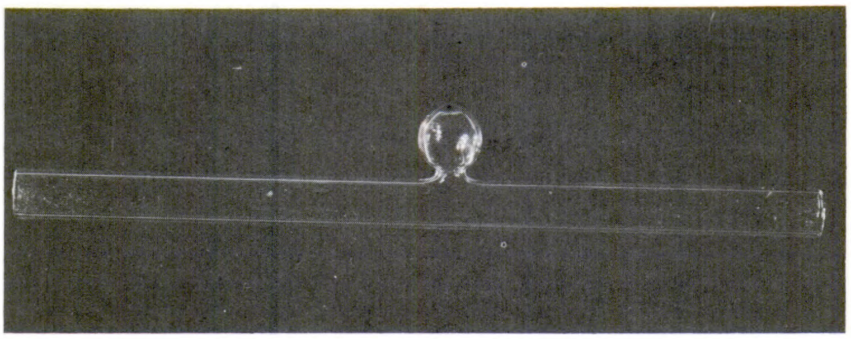
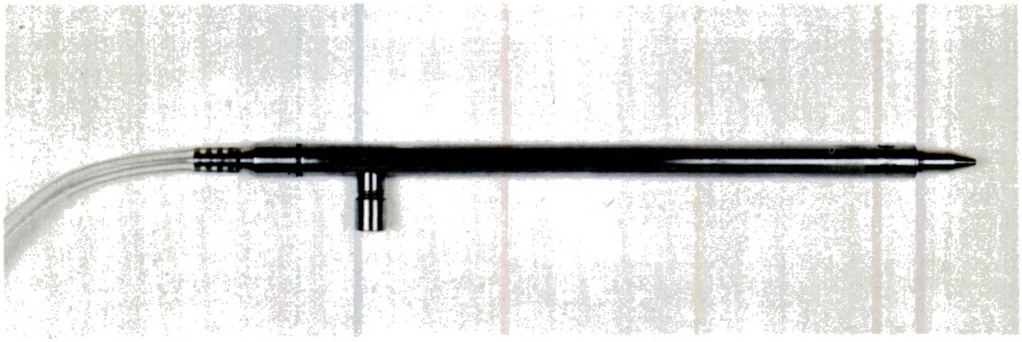


Figure 1.--Glass model representing an artery on which an aneurysm has formed.

Figure 2.--High-power magnification of mammalian hair, showing shingling effect (along top of photo).

Figure 3.--Air jet gun devised by Naval Research Laboratory.



A New Method for Obliterating Dangerous Aneurysms of the Brain

Mammalian Hairs "Shot" Into Lesions with Navy-Developed Gun

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A new surgical technique for obliterating aneurysms of the brain has been developed at Georgetown University Medical Center under a contract with the Office of Naval Research. Aneurysms are bubble-like deformities that appear in the walls of arteries at weakened points (Figure 1). In time, these bubbles or sacs begin to leak and eventually to rupture—with fatal results. The new procedure for dealing with them utilizes an air gun devised and built at the Naval Research Laboratory by Harrison P. Hagemeyer. This instrument propels a shaft of mammalian hair into the deformity, causing the blood in the interior to clot and permanently close the opening.

Aneurysm of the brain is a common condition in man, about 100,000 cases being encountered every year in the United States alone. The deformity may occur in any artery of the body, but when it occurs in the brain, it is generally located at the base of that organ and involves only a single large vessel. If it should rupture, the intracranial cavity becomes flooded with arterial blood.

Aneurysm seems to develop almost always in the adult years and is rarely found in children. However, the present evidence indicates that the weakness in the wall of the artery that eventually leads to the formation of an aneurysm is derived from birth, or in other words, is congenital. No information is available regarding its occurrence in other mammals. As a rule, the existence of such a weakness goes undetected until it begins to leak. Before the final rupture, several preliminary leaks occur, causing severe prostrating headache, stiff neck, and signs of blood to appear in the cerebrospinal fluid.

The clinical diagnosis is confirmed by X-ray visualization of the arteries of the brain. This is achieved by the injection of a radio-opaque substance into the arteries supplying the brain (carotid and vertebral arteries). The injection is made where the arteries pass through the neck. As the radio-opaque dye is introduced into these vessels, simultaneous X-ray pictures are made of the arterial circulation of the head and brain. When an aneurysm is present, its size, position, and parent vessel of origin can be shown.

In time, the repetitive pounding of blood in the artery thins out the wall of the aneurysm. Eventually, the dome of the sac begins to leak. At first, only small amounts of blood issue from it, and several episodes of this bleeding may occur before a disasterous rupture results. The patient's life is in a precarious position during this period, because the flow of blood from the dome of the aneurysm is restrained by only a tiny clot in the opening. Any acute rise in arterial blood pressure or any direct mechanical stress on the weakened sac is fraught with disaster.

In the past, aneurysms of the brain have been treated by the application of a tiny V-shaped silver clip around the neck of the sac. The clip is so placed that the main stream of the artery on which the aneurysm is situated is not interrupted. This method of handling an aneurysm frequently has been successful. However, in a significant number of cases, closure of the clip around the pulsating neck of the aneurysm causes the artery wall to break at that point. When this happens, the surgeon has no choice but to arrest the hemorrhage by occluding the parent vessel on either side of the aneurysm. In some cases, this has led to fatal swelling of the brain, and in others, to paralysis of the extremities on one half of the body. Still another problem arises when treatment with clips is attempted: manipulation of this treacherous lesion, in order to find its neck, can easily dislodge the tiny clot plugging the opening in the dome.

It is for these reasons that such techniques as lowering the patient's body temperature to critical levels (hypothermia), dropping the blood pressure to critical levels (hypotension), and shutting off the circulation to the brain for short periods (extra corporeal pump) have been devised in recent years. These radical measures tend to make the treatment of intracranial aneurysm a little safer, but some of them require rather formidable and expensive equipment.

The ideal surgical objective, then, is to destroy the aneurysm without manipulating it. The generation of a clot inside the aneurysm by the insertion of a foreign body, such as a hair, has seemed to be a positive answer to the problem.

All mammalian hair, including human hair, has a rough, horny exterior, resembling the scales of a fish (Figure 2). The scales, or projections from the hair surface, are pointed up toward the tip of the hair. It was postulated that the introduction of a hair into an artery or vein would cause the blood around the hair to clot immediately. After several days, scar tissue was expected to invade the clot and anchor it in place permanently. However, manual introduction of such a foreign body into an aneurysm might move it and cause rupture. Consideration was given, therefore, to the possibility of delivering the hair under high velocity by an air gun. In the preliminary designs of the gun, the size, internal instrumentation, proper distribution of weight along the instrument, and the need for almost total dissipation of recoil when the gun was fired were all brought under scrutiny. When these matters were settled, an instrument barely larger than a pencil and capable of shooting a hair under controlled conditions was built at the Naval Research Laboratory (Figure 3).

In the preliminary stages of the project, a search was made for suitable hair. Stiff hair from the heads of Oriental subjects was tried first and found to be unsuitable. Coarse hair from human eyebrows was tried next; it seemed a little more satisfactory. Finally, the discovery was made that horse hair and hog hair were stout enough for efficient use in the air gun.

Next, attention was given to modifying the physical factors inherent in the air gun with respect to penetrating forces. For testing, fresh arteries obtained from human autopsy material were used. By altering the air pressure supplying the jet force to the nozzle of the gun, it was possible to control the force with which a shaft of hair was delivered so that the hair would enter the artery but not pass completely through it. The nozzle of the gun was made so that it would receive a hair 1/4 inch long (6 mm.) and 5/1,000 inch in diameter. For power, a tank of air under pressure was used, with a plastic hose connecting the tank and the gun. The use of pure oxygen rather than air in such a tank was thought to be too dangerous in a surgical operating room owing to the possibility of explosion. Because of the orientation of the scales (pointed toward the tip of the hair) the hair had to be inserted into the gun tip-end first.

The opportunity to test this new surgical concept came in June 1962. A middle-aged white male was admitted to Providence Hospital in Washington, D. C., with the symptoms of a leaking intracranial aneurysm. X-ray studies revealed the presence of a large aneurysm located on a major artery at the base of the brain on the right side (Figure 4). The intracranial cavity was opened under general anesthesia and the frontal lobe of the brain elevated, exposing the aneurysm, situated just above the optic nerves (Figure 5). The jet gun was loaded under sterile conditions with a hog hair. Previously, this hair and others to be used in the operation were prepared by washing in a detergent solution and by immersing for one week in 70-percent ethyl alcohol. The air gun and its connecting hose were sterilized in an autoclave in the operating room.

When everything was ready, the tip of the gun was placed gently against the wall of the aneurysm, and the first hair was fired into the sac. At the moment the hair penetrated the aneurysm, a single drop of blood oozed out on the surface to mark the point of entry. At this time, portable X-ray equipment was brought into the operating room, and an arteriogram was made. The X-ray pictures, made about 15 minutes after the entrance of the first hair, showed a definite reduction in size of the aneurysm and indicated an active clotting process in its interior. Because of the large size of the aneurysm (about 10 times the diameter of its parent vessel), a total of six hairs was shot into it. In all, five arteriograms were made during the operation to follow the progressive course of the clotting mechanism. Measurements showed that in one and one-half hours the aneurysm had been reduced to less than one-third its original size (Figure 6).*

*At the time this issue of Naval Research Reviews went to press, Dr. Gallagher had just performed another operation utilizing the procedure described here--this one on a 71-year-old woman patient. The operation was a complete success.

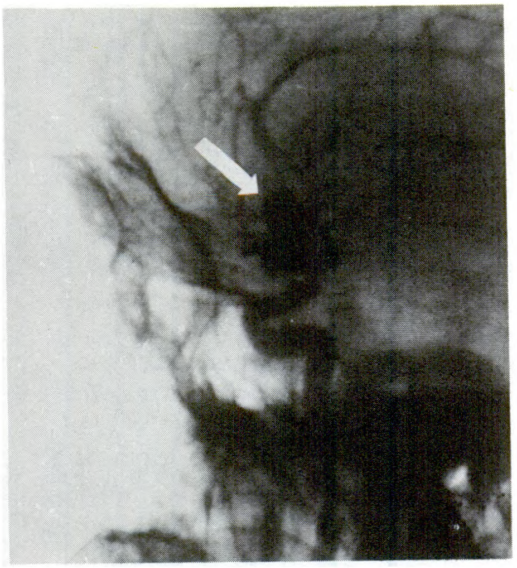


Figure 4.--Bulb-like aneurysm at base of brain, before operation (arteriogram).

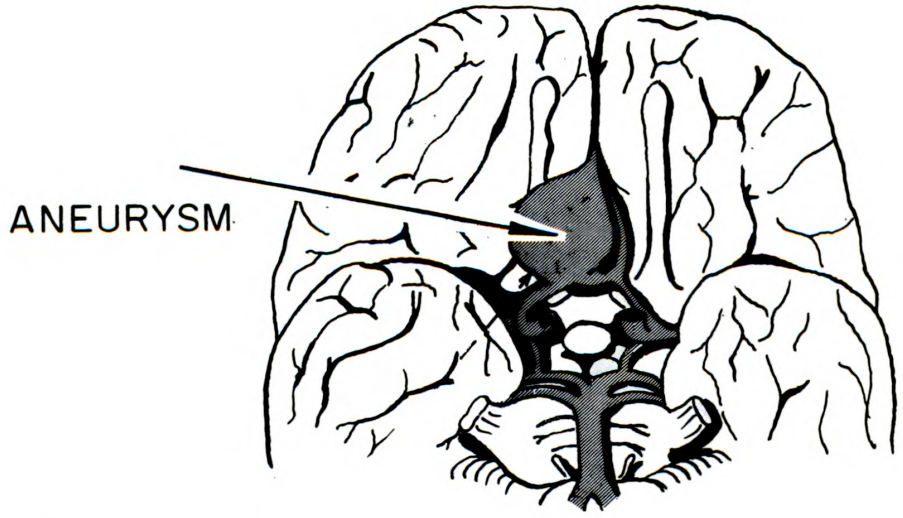


Figure 5.--Diagrammatic sketch of aneurysm found during operation.

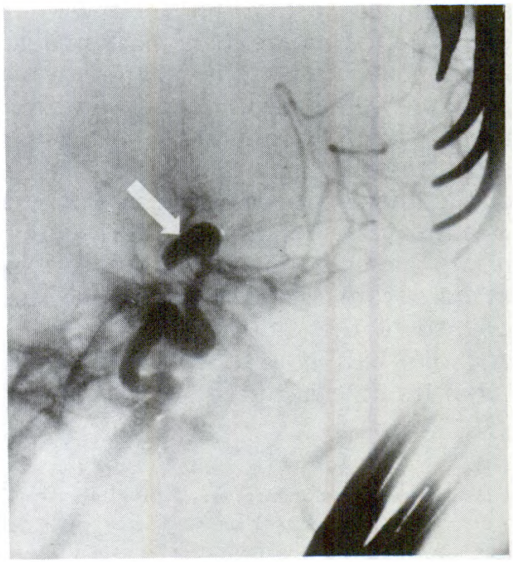


Figure 6. Arteriogram made during operation, showing marked reduction in size and change in shape of aneurysm 1-1/2 hours after hair shots.

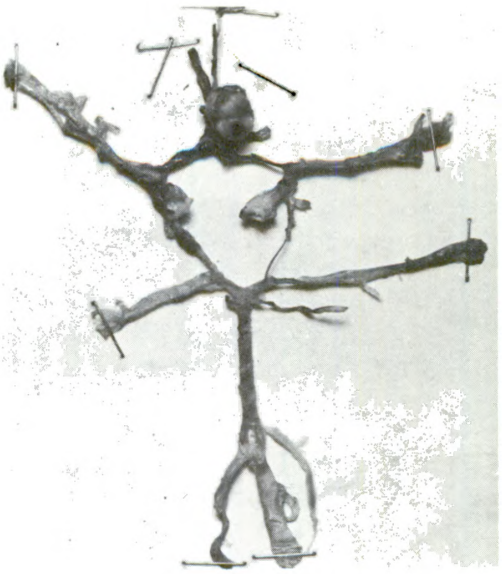


Figure 7.--Arteries at base of brain, removed at autopsy, showing aneurysm (at top).

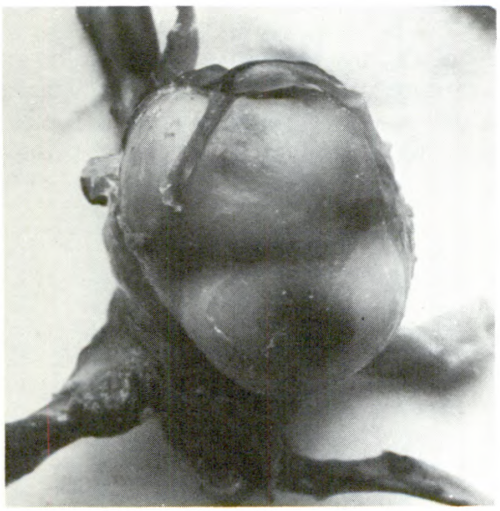


Figure 8.--Close-up view of aneurysm removed from patient.

Figure 9.--Hemisection of aneurysm, showing solid blood clot.

The patient exhibited a normal recovery after surgery, but then he suddenly died. An autopsy revealed that the unexpected death was not related to the aneurysm or to the method of treating it.

Critical attention was given to the treated aneurysm, which was removed, along with the entire arterial tree (Circle of Willis) from the body (Figure 7). Palpation of the aneurysm showed that it was very firm and apparently filled with a solid blood clot. Several dark blue spots marked the surface, apparently indicating the points of penetration by hair shafts (Figure 8). The specimen was fixed in 10-percent formalin solution for several days, then hemisected. An examination with the naked eye showed that the aneurysm was fully occupied by a solid clot (Figure 9).

Thus there seems to be substantial evidence that shafts of mammalian hair propelled into an aneurysm of the brain will initiate a clotting process that will obliterate the aneurysm. Considering that the procedure can be carried out with facility—by use of the NRL air jet gun—it appears to hold great promise for saving many lives in the future.

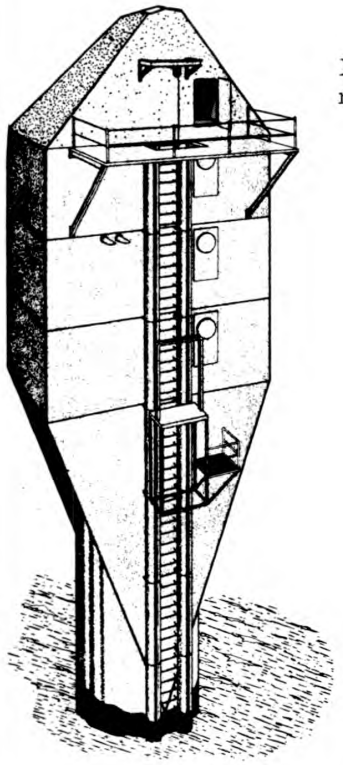
The author is grateful to the many individuals who made this project possible, including Dr. Joseph Saunders, Head, Medicine and Dentistry Branch, Office of Naval Research; CAPT Bradley Bennett, Director of Administration, Naval Research Laboratory; and Mr. Henry Birmingham, Head, Engineering Psychology Branch, NRL.

High Awards Given to NRDL and NEL Scientists

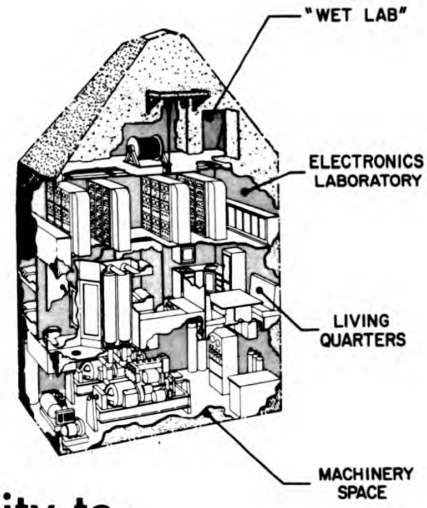
• The Secretary of the Navy's $5,000 Award for Distinguished Achievement in Science has been given to Dr. Edward L. Alpen, head of the Biological and Medical Sciences Division of the Naval Radiological Defense Laboratory, San Francisco, California. The citation accompanying the award said that Dr. Alpen "has brought to bear a wide knowledge of ionizing and other radiations. By his exhaustive studies of energy dependence of biological effects and clarification of mixed radiations and their effectiveness, and the culmination of a new doctrine for radiological hazard evaluation he has accomplished scientific achievements of extraordinary importance..."

• The highest award the government can bestow on a civilian employee – the President's Award for Distinguished Civilian Service – has been given to Waldo K. Lyon, head of submarine and Arctic research at the Navy Electronics Laboratory, San Diego, California. Mr. Lyon was cited as having been "singularly responsible for the pioneering development of the knowledge, techniques, and instruments that made it possible for a submarine to operate under the ice cap in the Arctic...."

Four other President's Awards were made. They went to Llewellyn E. Thompson, Jr., retiring Ambassador to Russia; Robert R. Gilruth, director of NASA's Manned Spacecraft Center; Dr. Donald E. Gregg, chief of the Department of Cardiorespiratory Diseases, Walter Reed Army Institute of Research; and J. Stanley Baughman, president of the Federal National Mortgage Association.



Four-story compartment on FLIP's bow.



Giant Manned Buoy Brings Stability to Deep-Ocean Research

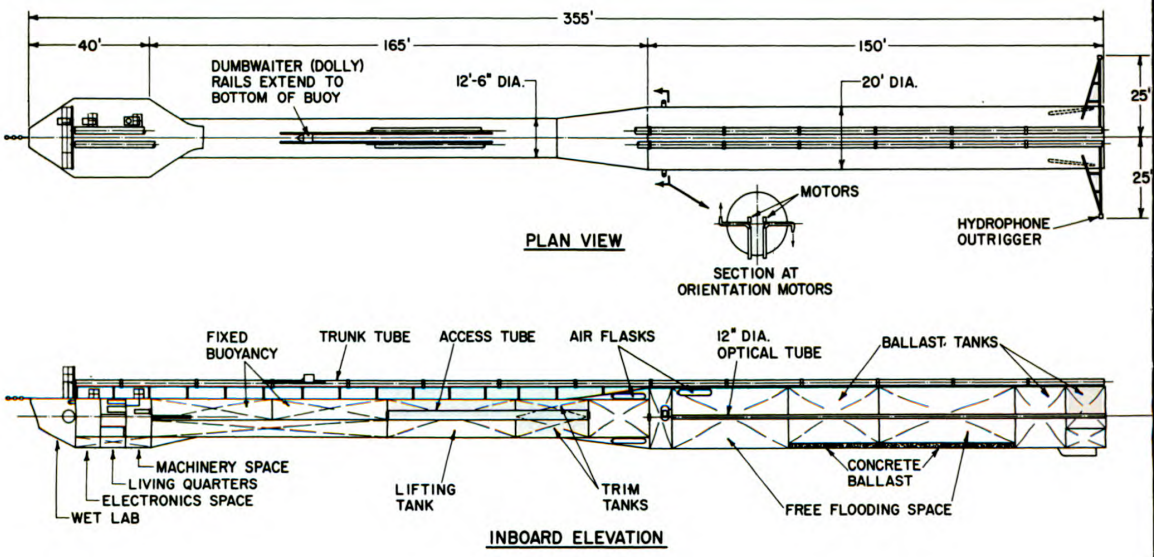
An enemy surface ship or submarine coming within range of a Navy ship's sonar system could slip by undetected—or appear to be where it is not—if the sound waves from it are distorted enough by the ocean medium through which they travel. Thus far, scientists have been unable to learn much about the details of this phenomenon in the open ocean.

In general, the bending of sound waves is caused by inhomogeneities of the medium, just as the twinkling of stars occurs as the result of differences of the atmosphere through which the light waves pass. "Acoustic twinkling" in sea water presents a difficult problem because the ocean is an ever changing medium and because so many factors are involved, such as variations in temperature, salinity, and currents. Also, very exact measurements are needed. Ships are ordinarily used to obtain data of this type, but because of the accuracy required for sound-wave studies, they are not sufficiently stable. The station obtaining these measurements must be virtually immovable.

For a platform to remain nearly motionless relative to the water in the constantly moving sea, even during storms, a large amount of its weight must be situated at considerable depth. Ideas for creating a structure having this characteristic originated about 15 years ago. One suggestion made was to upend a submarine, placing sufficient weight in the stern so only a small portion of the bow would protrude from the ocean surface. But steps were not actually taken to build a stable platform until March 1960. That was when FLIP (FLoating Instrument Platform) was conceived at the Scripps Institution of Oceanography's Marine Physical Laboratory in San Diego, California. This huge cylindrical structure was to be so designed that it could be towed on the ocean surface in a horizontal position, then upended by flooding special ballast tanks in the stern; the small portion of the buoy remaining

above water was to contain laboratories, living quarters, and an engineering space. High-pressure air was to be used to blow water out of the ballast tanks for flipping back to the horizontal position prior to the buoy's return to home port or movement to another station.

MPL's Dr. Philip Rudnick made a theoretical study of some of the more critical features. The initial design for the platform as a whole was worked out by M. Rosenblatt & Sons, naval architects, and the final specifications and working plans were completed by Larry R. Glosten, also a naval architect. Finally, construction of the platform was turned over to the Gunderson Brothers Engineering Co. in Portland, Oregon. Throughout the designing and building stages, financial support for the



project was provided by the Bureau of Weapons through the Naval Ordnance Laboratory and the Office of Naval Research.

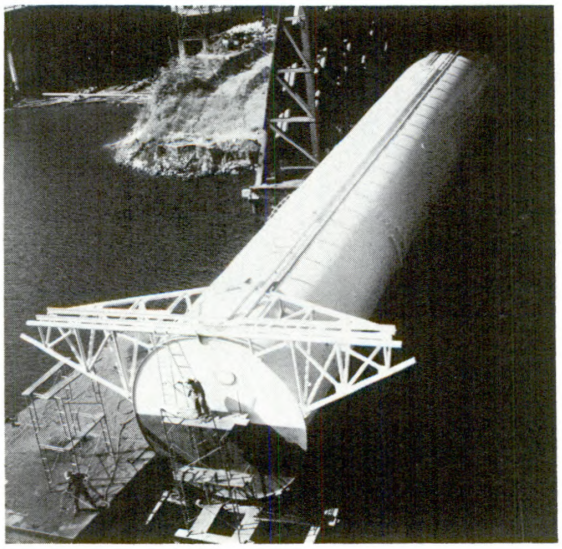
Late last month FLIP was launched at Portland, and as Naval Research Reviews goes to press she is undergoing acceptance trials at the Dabob Bay facility of the Keyport Naval Torpedo Station near Seattle, Washington. Upon completing these exercises, she is scheduled to be towed to San Diego, California, to be instrumented and put through further trials to determine, primarily, the degree of stability actually achievable in the Pacific Ocean.

What does MPL expect in the way of stability? In a heavy sea, with waves 30 feet high, she should oscillate less than 3 feet up and down, and should move from side to side only slightly more than 1 degree. In normal seas, she will heave only a matter of inches, and her lateral movement will be negligible. Movement in the vertical plane, which is related to wave height and periodicity, is the most difficult of these motions to control. Lateral movement is due primarily to the horizontal component of ocean action against the structure, and also to the effects of wind force and direction. In FLIP, the length, shape, weight, and distribution of weight were all determining factors in the design to

minimize both vertical and horizontal movement and achieve a stable floating platform.

FLIP is 355 feet long and weighs about 600 tons, 70 of which make up the buoy's long, horizontal keel. The research laboratories, living quarters, and engine room are located at different levels above the water line—when FLIP is vertical—in a compartment roughly rectangular in cross section, 14-1/2 by 25 feet. This "cabin" is divided into four parts, one on top of the other. The lowest, 15 feet above the water line, houses two 60-kilowatt diesel-driven generators which supply electric power for air conditioners and other electrical equipment; this machinery is mounted in trunnions to permit operation in both the

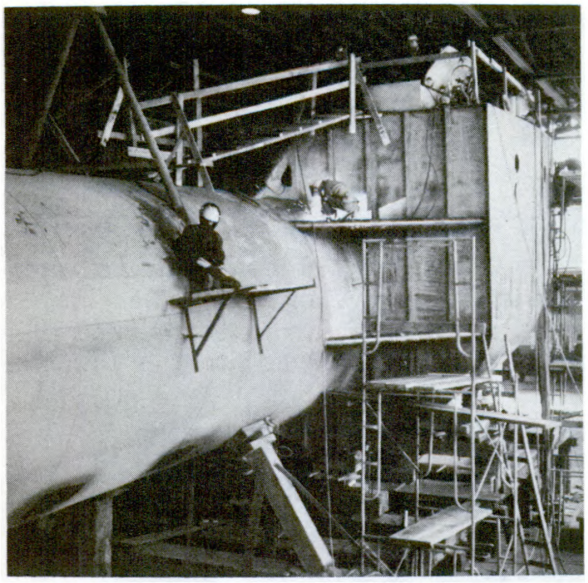
Plan view and inboard elevation of FLIP.



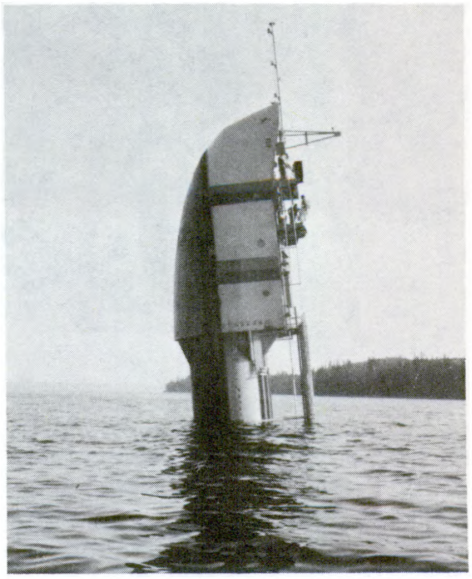
FLIP's stern with hydrophone outrigger attached.

horizontal and vertical positions of FLIP. On the next higher level are the living quarters, which are spacious enough to accommodate four people for two weeks without support from the outside. Still higher is the research laboratory, which contains the electronic equipment required for acoustic investigations. Outside of this laboratory, about 30 feet above water, is an open-grill platform which will be used for outside observations, for handling small boats alongside, and as a safety station during the flipping operations when the buoy is ballasted and deballasted by the crew. The topmost level is also used as a laboratory, and to it, as below, is appended an open-grill platform. From this highest platform, equipment can be lowered through a trunk tube, 2 feet in diameter, the entire length of the FLIP cylinder without danger of its becoming entangled with the buoy or with gear mounted externally. Two other tubes extend from the cabin downward through the cylinders to an ocean depth of 150 feet. They are watertight and equipped with ladders which will enable the crew to descend to carry out certain phases of scientific investigations or to check on the operation of the buoy.

Supporting the cabin and extending 100 feet beneath the ocean surface is a steel cylinder, 12-1/2 feet in diameter. Joined to its bottom



View of underside of FLIP's bow compartment (when buoy is in vertical position). This compartment, which is roughly 14-1/2 by 25 feet in cross section, contains research laboratories, living quarters, and engine room.



The buoy is flipped to vertical position in test at Dabob Bay, Washington. Only the bow compartment rides above the surface of the bay.

is a cone-shaped section which flares outward and downward for another 50 feet in transition to a cylinder having a diameter of 20 feet. This larger cylinder continues downward to the full draft of 300 feet. The 60-percent reduction in area within the buoy which occurs between the two cylinders gives the platform a natural period for heaving of about half a minute. When FLIP is in the vertical position, about 1,500 tons of sea water occupies the 20-foot cylinder; of course, the effect of this water was taken into account in calculating the natural period.

Owing to the great vertical distance spanned by FLIP—355 feet—the buoy is subjected to considerable stress, not only as a result of the varying pressure between the surface and the 300-foot level, but also because of torsional forces brought to bear, which also vary, resulting in a greater amount of twist near the surface than at depth. Another

stress—one which caused some concern while the early design was being worked out—occurs when FLIP is changed in position from the vertical to the horizontal. As the ballast water is forced from the stern compartments, the bow is pushed rather high in the air. The center portion of the buoy presses on the ocean surface, like a lever on a fulcrum. The bow then begins to settle down and the stern to sweep upward through the water. The extent of the force acting against FLIP at this "fulcrum" point was discovered while tests were being made with a model 1/10th the size of the finished buoy. This force was found to be so much larger than expected that an additional 100 tons of steel—over what had been planned originally—had to be built into the buoy to give it adequate strength.

The deep draft of FLIP when in the vertical position, with the research laboratory above water, will enable its crew to maintain visual, radar, and radio contact with surface ships at the same time it is measuring sound waves well below the surface. Hydrophones will be attached to a special hydrophone outrigger on FLIP's stern and at several other locations on the buoy for listening to sounds transmitted from a source lowered at a known distance from the buoy—generally from the mother tug. To position the buoy properly in relation to the sound source, the crew will switch on small orientation motors mounted on the 20-foot cylinder. These characteristics—particularly the vertical range over which measurements can be made, both above and below the ocean surface—have not before existed in oceanographic vessels or platforms suitable for deep-ocean use.

Research in many scientific fields can be conducted advantageously aboard FLIP—for example, studies of wave motion at different depths and of marine biology. As the platform is used for longer and longer times, it is expected to be found essential for many experiments not now envisioned. Most of this research, both in acoustics and the other fields, will be financed by the Office of Naval Research.

The Navy's Bureau of Ships has released the tug YTB375 from the reserve fleet at San Diego for use by MPL as a towing vessel for FLIP. This ship was redesignated YTM-375 and is now being readied for its new service. In the meantime, another Navy tug will bring FLIP down the West Coast to its permanent berth in San Diego. The crew of this tug will then train the crew, to be provided by Scripps, for the MPL towing vessel. When these preliminaries have been completed—probably in the fall—the buoy will be towed a few miles off the West Coast and flipped into its operating position for trial runs on the conduct of scientific investigations aboard her. Later—if major changes in the platform are not required—she will be taken 100 miles or more out to sea to begin carrying out the acoustic studies for which she was built.

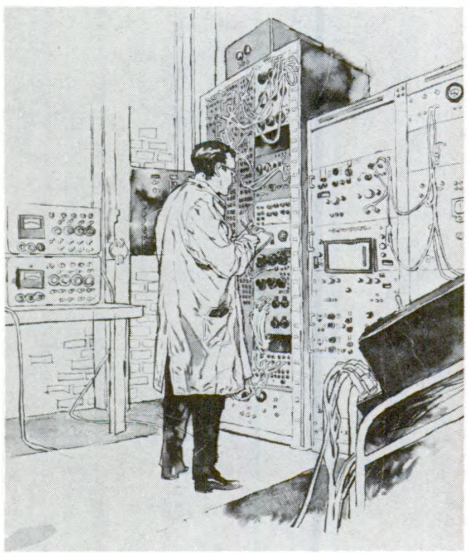
Much hope goes with the new buoy on these cruises. As Senator Warren G. Magnuson of Washington indicated at FLIP's launching, the oceans are extremely important in our future—in terms of defense and peacetime uses, in supplying food for the world, as a source of new minerals, and in many other ways. In relation to this need to know, our knowledge of the oceans is far too scant. FLIP should help us learn more.

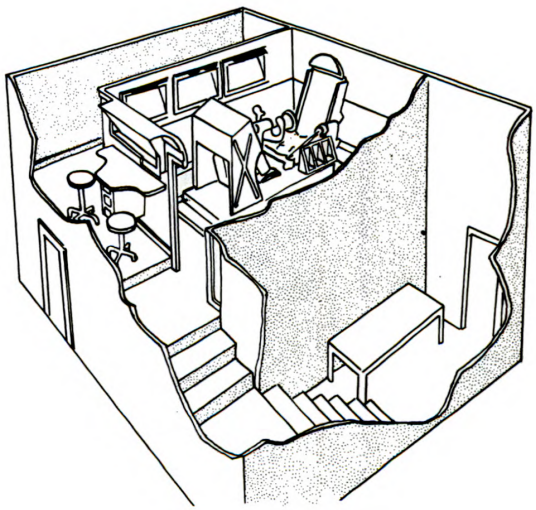
A Study of the Effects of Vibratior

While making a series of low-altitude test flights of B-47s a number of years ago, The Boeing Company's Wichita Division discovered that its flight crews were occasionally shaken up severely by turbulent air "on deck." In view of the emphasis then being placed on low-level bomber penetration, it appeared that the shaking (or vibration) might impair crew performance to the point of seriously reducing bomber penetration of enemy defenses.

As a supplement to the B-47 investigation, Boeing's human-factors specialists mounted an aircraft seat on an electro-mechanical vibrator and explored the effects of various vibration frequencies and amplitudes on the ability of flight-test personnel to perform a simple tracking task using an aircraft-type control column. Although the methods used were somewhat crude, the investigators acquired enough data to convince them that further experiments were desirable. To carry out the tests, they established performance requirements for a "human vibration facility," which was to provide vibration at the very low frequencies which appeared to be most detrimental to human performance. At this point—September 1959—the Physiological Psychology Branch of the Office of Naval Research began supporting the research.

Although the ONR-Boeing research has been and continues to be directed primarily to vibrations arising in aircraft, it is intended to provide data general enough to be applied to a wide range of vehicles which travel at high speeds through or over rough water and on rough land, as well as in the air. Vibrations resulting from such operation have a frequency of less than 30 cycles per second and occur primarily in a vertical plane. Not only can this shaking be severe enough to render crewmen incapable of doing useful work, but it can also result in severe physical injury.





ɔn Human Performance

J. E. Beaupeurt

Human Factors Chief

Military Aircraft
Systems Division

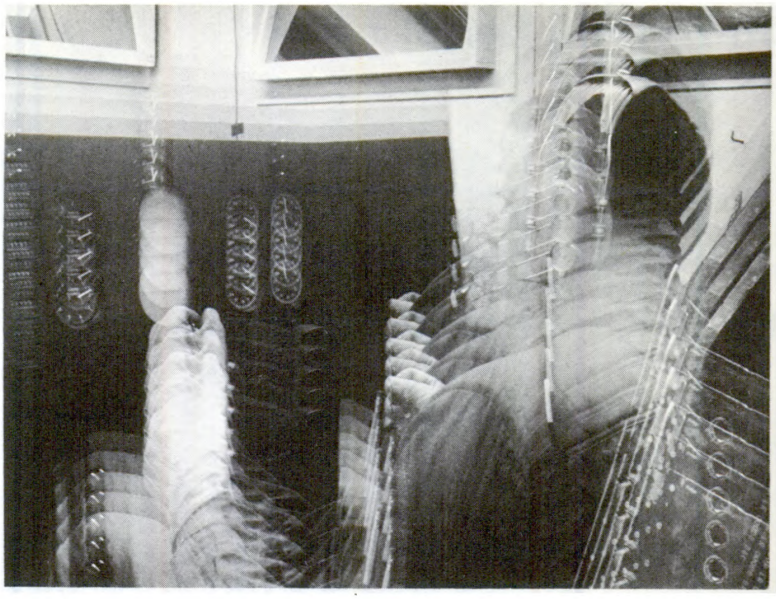
The Boeing Company

Horizontal and angular vibrations also occur under such conditions and can have significant effects on crews. However, since these vibrations are slight compared with the vertical movements, they will be investigated at a later date and are not discussed in this article. Nor will other vibrations be considered here; for example, those generated by rotating machinery in high-precision equipment. Such movement is of a very low magnitude, is generally high in frequency, and is relatively easy to isolate.

Although a number of investigations have been made of low-frequency vibration, their purpose for the most part has been to determine man's physiological limits of tolerance. The purpose of the ONR-Boeing investigation, on the other hand, has been to identify specific frequencies and other characteristics of these vibrations which hinder or prevent crews from doing their jobs. Armed with such information, the investigators will be able to suggest ways of reducing these effects.

For conducting the experiments, a special facility was designed and built at the Boeing plant in Wichita, Kansas. It consists basically

Views of vibration facility and associated equipment. At far left, an operator monitors electronic devices which record data on tests; next, cut-away view of facility, showing test chamber, observation area, doctor's and experimenter's stations, and examination room; next, experimenters observe a subject during a test; above, a subject on vibration platform in position for testing.



Multiple exposure photo showing a subject being vibrated over a vertical distance of about 5 inches.

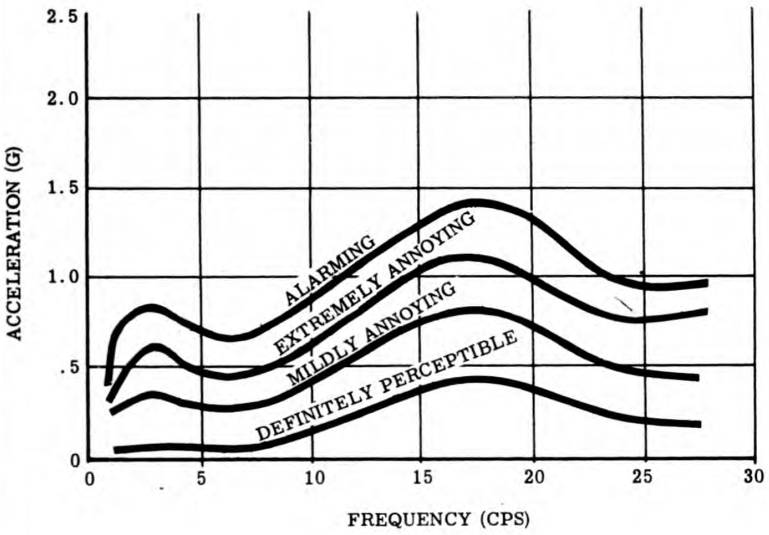
of a vibration platform which can be moved up and down through a maximum of 20 inches by a double-acting hydraulic cylinder. The hydraulic flow is controlled through a servo valve to regulate the vibration frequency between 0 and 27 cps. Provisions for "random" vibration and for a variety of arrangements of equipment on the platform have been included in the design. For the current tests, the platform holds an aircraft-type seat, instrument and control panel, control pedestal, aircraft control column and wheel, and foot pedals.

To eliminate irrelevant factors, the vibration platform is located in a sound-insulated chamber with controlled lighting, temperature, and humidity. During testing, the subject is alone in the chamber, observed by the experimenters and medical monitors through one-way-vision windows. An intercom system provides convenient communication between subject, experimenters, and the technicians operating the facility and recording data.

To achieve consistent results, all tests are pre-programmed and presented to the subjects by automatic equipment. The data are recorded automatically, too—by strip chart and magnetic tape recorders. Regular and high-speed motion pictures can be taken also, for the study of details of vibration effects. Supplemental data are obtained directly from the subjects through questionnaires, interviews, and from checklists.

Subjects were selected for testing from volunteer employees, including flight test pilots, navigators, and engineering personnel—some of the latter with and some without flight experience. Many men volunteered, but after a rigorous physical examination, their number was reduced to 17. Six are still in the program, the remainder having dropped out because of changing work schedules, transfers, personal reasons, and reduced test-subject requirements.

Not one subject has shown evidence of any physical or physiological damage as a result of undergoing the tests. Of course, every effort



Frequencies and accelerations at which subjects identified vibrations as "definitely perceptible," "mildly annoying," "extremely annoying," and "alarming."

FOUR LEVELS OF VIBRATION

is made to assure that this will be the case. For example, frequent and thorough physical examinations are given to detect as soon as possible any injuries that might occur. And a limited physical examination—checking of heart rate, blood pressure, reflexes, etc.—is given each subject immediately before and after each session on the platform. Furthermore, during the entire period of vibration, the subject's heart action is monitored continuously by electrocardiogram sensors. Finally, to guard against the possibility of a subject receiving inadvertent extreme accelerations in vibration, he is provided a "dead man" switch, which stops the vibration instantly upon being released. The experimenter, the medic, and the equipment operator likewise have emergency stop controls.

The initial experiment accomplished on the vibrating platform provided a standard frame of reference for determining the effects of various intensity-frequency combinations, at frequencies between 1 and 27 cps, to be applied to future tests. Based on evaluations made by 16 subjects after a total of 255 test runs, four curves were drawn by the investigators, one for each of four intensity ranges. Each of these ranges included vibrations that were defined as "definitely perceptible," "mildly annoying," "extremely annoying," or "alarming."

The procedure followed for each test began with the subject seating himself on the platform in a "chair" cushioned only by a hard felt pad, 3/4-inch thick. The relatively thin padding minimized variations in the transmitted vibrations. With his body held firmly in position by a standard lap belt, he grasped the control wheel in front of him and placed his feet on floor pedals, thus assuming a comfortable position, ready to begin the test. Vibration was started at a low, imperceptible amplitude, and it was increased at a very slow, constant rate. As soon as the subject became aware of the vibration, he pressed a signal button. This established the "definitely perceptible" level. As the increase in amplitude continued, he indicated successively when, in his opinion, the vibrations became "mildly annoying" and "extremely annoying."

When they reached an "alarming" level, he stopped the movement of the platform by releasing the "dead man" switch.

The mean result of all subjects' reactions is defined by the graph on page 15. One of the most significant characteristics of the curves is the pronounced drop through the frequency range between approximately 4 and 8 cps, which reflects the greater discomfort experienced in this range.

The next step in the program was to investigate the vibration effects on human performance—specifically, vision, hearing, speech, and motor skills. These were examined individually and then in combination.

In the visual acuity test the subjects were required to read five-digit counters with figures ranging in height from 1/20th to 1/5th of an inch. The numbers were changed in a random fashion, and the subject called out each number as he saw it. The task was accomplished in identical fashion for different levels and frequencies of vibration, as well as for a period of no vibration. Although acuity was definitely affected, the degree was such that figures as small as 1/10th of an inch were read at the 28-inch viewing distance with only small increases in error attributable to vibration. Another visual task identified the rate at which an instrument pointer must be moving for the motion to be noticed by the subject.

Brief exploratory studies of the effects of vibration on speech and hearing indicate that although a subject's voice is not as clear when he is undergoing vibration, it is not significantly less intelligible. Hearing is not greatly affected, either.

Tests of manual activities were designed to provide information about the subject's ability to actuate and adjust controls of various kinds. In this experiment, the subject regulated the pointer on a dial by adjusting six different types of controls, including a wheel, knob, levers that moved vertically and horizontally, and thumb wheels. The forces required to operate the controls were varied between control movements.

The next experiment of the series will provide the "missing link" in a great deal of data. Specifically, it will reveal how performance is affected when tasks are integrated. It will do this by combining the many manual and perceptual tasks into a single, complex task. This effort, which is just getting underway, is expected to be the most valuable one of the program, and also the most difficult to accomplish—from the standpoint of determining the experimental design, establishing performance criteria, and completing the analysis of data.

When this "missing link" has been inserted, it will seem, perhaps, that the entire human-vibration problem has been examined. But such will not be the case. All of the testing described thus far has relied upon sinusoidal, or regular-period, vibration. In the operational situation, however, vibration is usually complicated by irregular, or "random," disturbances. Thus it does not lend itself to precise laboratory

research, which requires exact duplication of variables and conditions. But even this "random" vibration has underlying patterns with regular-period characteristics. Therefore, correlation of the effects of sinusoidal and "random" vibrations may be feasible.

The ONR-Boeing study indicates that the problem of determining the effects of low-frequency vibration on human performance is a broad one and that the solutions found to it will have far-reaching implications in the design and use of many systems. As has already been implied, precise, detailed data were not sought in the program described here. Nevertheless, some concrete data were obtained and are now helping guide the designs of certain new systems. Furthermore, the studies have gone a long way toward defining the fundamentals of the problem and the areas in which future research can be concentrated to be of the greatest immediate value.

Dr. E. R. Piore

NRAC Elects New Chairman

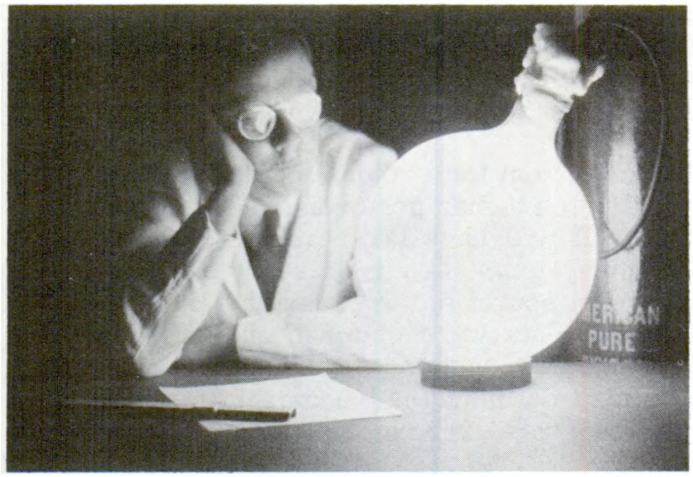
Dr. E. A. Walker

At its 54th meeting, held on the 11th and 12th of July at Norfolk, Virginia, the Naval Research Advisory Committee elected Dr. E. R. Piore and Dr. E. A. Walker as its chairman and vice chairman, respectively, for one year beginning July 12. Dr. Piore succeeds Dr. Frederick Seitz, who assumed the presidency of the National Academy of Sciences on July 1.

Dr. Piore served with the Office of Naval Research for more than a decade, which included four years as its deputy chief scientist and chief scientist. He left ONR in 1955 to accept the position of vice president at AVCO. About one year later, he joined the International Business Machines Corporation as vice president for research and engineering, the position he now holds.

Dr. Walker, president of Pennsylvania State University, begins his third consecutive year as vice chairman of NRAC. He also has a long and distinguished record of service and contributions to the Navy's technological effort.

NRAC has a total of 15 members, all appointed by the Secretary of the Navy. They are scientists or engineers of international reputation who occupy top positions in industry, academic and nonprofit institutions, and government. The committee is thus particularly fitted to translate the requirements of naval science into progressive naval research and development policy.



The Navy's Research Program in Hydrobiology

Photograph taken by light produced by bioluminescent bacteria.

The Navy, through the Office of Naval Research, is one of the principal sponsors of fundamental hydrobiological research in the United States. As one of the major consumers of this information, the Navy is vitally interested in maintaining a vigorous, healthy national research effort in this field of scientific endeavor.

Hydrobiology, like the closely related field of oceanography, is not a single scientific discipline. Rather, it is a multidisciplinary effort including taxonomy, ecology, physiology, biochemistry, biophysics, and the other modern disciplines of quantitative biology. Also, hydrobiological research draws heavily upon information from modern chemistry, physics, mathematics and the earth sciences. As described here, the term hydrobiological research refers to studies conducted to identify and characterize the biological components of marine, estuarine, and fresh-water environments, and to ascertain the interrelationships of these components and the physical, chemical, geological and other related factors of their environments. The Office of Naval Research program of basic research in this field has a two-fold objective:

- To assess the impact of the biological components of the marine environment on naval operations.
- To obtain the basic information necessary for developing the means to recognize and cope with the hydrobiological causes of naval problems.

BIOLOGICAL DETERIORATION

One specific problem confronting the Navy is the prevention and control of marine biological deterioration and fouling. It has been conservatively estimated that the annual cost to the Navy for the protection and maintenance of ships, waterfront structures, and outboard equipment against such deterioration is approximately 100 million dollars. Rather than applying the trial-and-error approach to the development of protective agents, the Navy's research program stresses the importance of

understanding the vital processes which govern the life cycles and behavior of the organisms that cause deterioration and fouling. By characterizing the "weak links" in the chain of vital processes—in other words, those basic functions which are susceptible to external control—the Navy hopes to be able to develop control agents which can be "custom tailored" to protect specific equipment or systems.

UNDERWATER ACOUSTICS

Another area of Navy interest is the prediction and control of biological particulates interfering with the propagation of acoustic signals underwater. Ever since it was discovered during World War II that the false bottom echoes or "deep scattering layer" being picked up on sonar was due to marine organisms, the Navy has been vitally concerned with learning more about the role of marine biological particulates in the transmission and reception of sound. Marine animals may produce noises which greatly increase the ambient sound level, as in the case of snapping shrimp, barnacles, etc., or they may emit sounds which may be confused with those produced by surface ships or submarines. Also, sedentary marine organisms—fouling animals and plants—may either camouflage a target, rendering it less susceptible to acoustic detection, as in the instance of soft fouling masses covering a bottom mine, or they may increase the acoustic target strength of an underwater object, as in the case of barnacle and mussel growth on rubber- or plastic-covered equipments.

The immediate objective of the Navy's research program in this area has been to provide information to enable the prediction of the degree and type of marine biological interference which is likely to be encountered in any environmental and geographic locality of present or potential operational interest. A major problem has been obtaining data on deep-ocean biological sound producers. However, this problem is being overcome by the recent establishment of the world's first permanent underwater bioacoustic station which includes an underwater television system. Both the acoustic and video pick-ups, located in the Florida Straits on the Gulf Stream bottom, are cable-connected to the Lerner Marine Laboratory, Bimini, Bahamas, and enable scientists to monitor and record sounds produced by animals living in relatively deep water.

POISONOUS, VENOMOUS, AND CARNIVOROUS ANIMALS

The Navy continues to be confronted with the problem of control of and protection against poisonous, venomous, and carnivorous marine animals. Underwater swimmers as well as persons having to abandon ships or planes at sea must be protected against sharks, barracuda, moray eels, and other animals that can wound and kill. Also, it is necessary to warn naval personnel against sea life that is poisonous to eat and against other forms that are venomous to touch. In addition to gathering information on the seasonal and geographic distribution of obnoxious marine creatures, investigators engaged in research in this area are conducting physiological, biochemical, and pharmacological investigations to develop means for repelling or deterring dangerous marine forms as well as to evolve therapeutic measures for treating

personnel injured by such animals. A number of compounds and techniques have been discovered which show promise of aiding in the control of this problem.

MARINE BIOLUMINESCENCE

In some geographic areas during certain seasons, there occur tremendous growths of marine plants and animals which emit visible light when stimulated mechanically. Thus, when surface vessels and submarines operate in these localities, and when mine fields are situated there, the light emitted by the plants will make the vessels and mines detectable from the air. In addition to gathering data on the geographic distribution, type, and seasonal occurrence of bioluminescence, the Navy is seeking to establish the biochemical and physiological mechanisms of the phenomenon in order to develop means for controlling it.

Close-up view of a piece of wood riddled by marine organisms. Sample was submerged 240 days.

Other hydrobiological problems of interest to the Navy include:

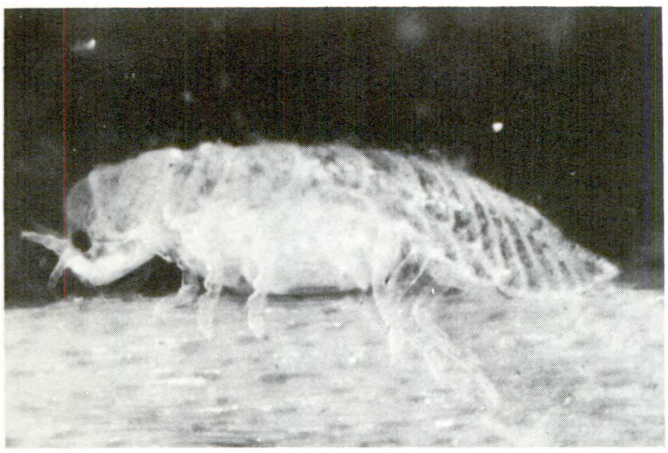
- Studies of movements and distribution of plankton and other minute organisms and their effects on the physical behavior of water, the distribution of chemicals therein, and on the structure of bottom sediments.

- Prediction and control of populations of fishes of commercial and sports value which occur in Navy underwater acoustic or explosive testing grounds and of marine organisms which could be susceptible to radioactive contamination as a result of exposure to underwater nuclear explosions.

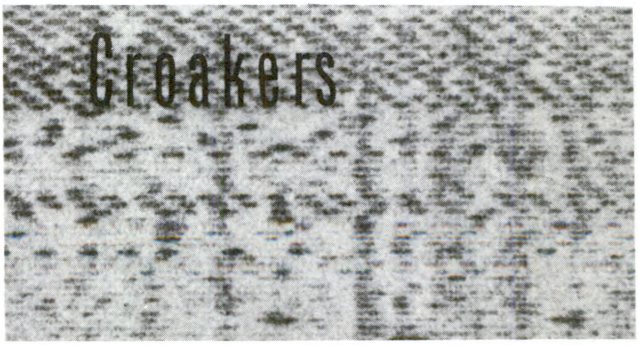
Another major objective of ONR's hydrobiology research program is to provide the Navy with means for utilizing or emulating marine biological forms insofar as they may lead to the improvement of materials, components, equipment, personnel performance, and systems. Certain phases of this program are listed below:

- Studies of the hydrodynamic characteristics and boundary-layer control of marine animals in order to obtain basic information

Biological deterioration of wood pilings.



Limnoria, or wood gribble, a distant cousin of the shrimp and one of two most important marine animals causing deterioration. The other one is the Teredo, or shipworm.



Fathometer tracings of various marine animals.

which may prove to be of value in the design and construction of new hull types for surface ships and submarines.

● Research on propulsion mechanisms of marine animals. These studies have indicated that many such systems are both highly efficient and silent, thus presenting a minimum of hydrodynamic turbulence.

● Research on the inter-communications of and navigation by marine animals has established that many sea dwellers are able to detect and identify targets and "navigate" toward these targets over great distances with extreme accuracy. Further, it has been ascertained that some forms—porpoises, for instance—are able to engage in underwater communication exchanges. The data obtained from these studies may lead to the evolution of new concepts of target identification, long-range underwater navigation and underwater communications.

● Physiological and biochemical evaluation of deep-diving abilities of marine animals may prove to be of value in developing means for protecting divers and underwater swimmers against the bends and other diseases common to these occupations.

● Studies of the ability of large marine animals to thrive in deep water that is supposedly almost devoid of dissolved oxygen, because this ability indicates that these animals may have low metabolic requirements or highly efficient gas-exchange mechanisms for extracting oxygen from the water and disposing of carbon dioxide. Efforts are being made to characterize these systems to a point where they may be evaluated as a basis for the development of artificial gills.

● Observation of marine biological substances which are utilized either to repel other biological forms or inhibit their normal physiological activities. Many of these substances are being examined in terms of their biochemical composition and their physiological and pharmacological characteristics with the hope that some will prove to be of value as shark repellents or deterrents, antibiotics, marine preservatives, etc.

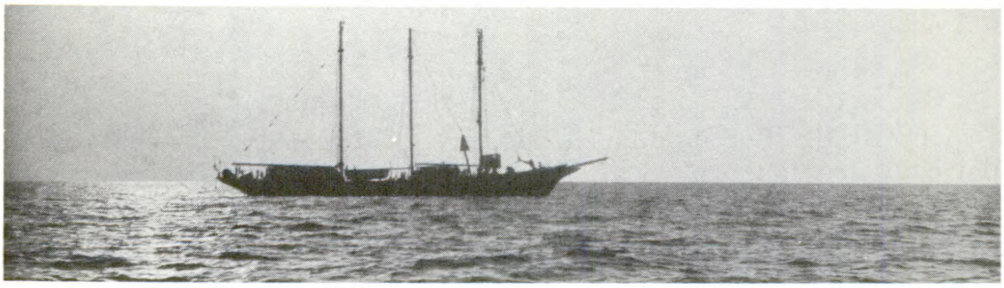
The fundamental data which have been and are being obtained from the Navy's hydrobiological research program may be expected to provide new concepts leading to new and better equipment and techniques of direct benefit to the Navy.

Two Navy captains departed and two others arrived to take over their commands recently at important research establishments in the Washington, D. C., area.

CAPT Robert E. Odening, USN, recent commanding officer of the USS NORFOLK, has assumed command of the Naval Ordnance Laboratory, relieving CAPT Walter D. Coleman, USN, who is retiring.

CAPT T. S. Baskett, USN, has been appointed superintendent of the Naval Observatory. He relieved CAPT A. W. Slayden, USN, who is retiring. CAPT Baskett was formerly on the staff of the Industrial College of the Armed Forces.

U. S. Participation in the International Indian Ocean Expedition*



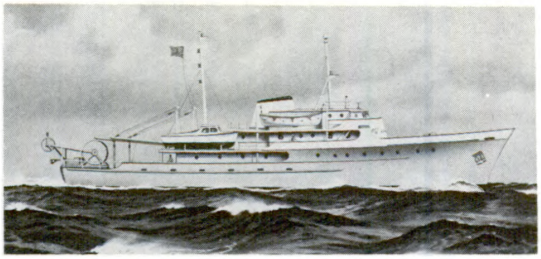
The International Indian Ocean Expedition is a cooperative effort planned by the International Council of Scientific Unions through its Special Committee on Oceanic Research and directed toward the investigation of a relatively unknown part of the earth's oceans. Beginning in 1962 and continuing through 1965, the expedition will involve 25 nations and a total of about 44 vessels.

United States participation will be effected by a large number of Federal Government agencies and many educational and scientific institutions, with the National Science Foundation and the Office of Naval Research assuming most of the financial burden. Other agencies taking part are the Coast and Geodetic Survey, Coast Guard, Fish and Wildlife Service, Navy Hydrographic Office, National Oceanographic Data Center, National Aeronautics and Space Administration, Weather Bureau, Air Force, and the Smithsonian Institution.

Scientists representing more than 100 colleges and universities will carry out most of the research planned as the United States contribution. The expedition will be conducted, however, by a few institutions experienced in the logistics of ship operation. Thus, the biology program is being coordinated through the Woods Hole Oceanographic Institution; the physical program will be managed by the Lamont Geological Observatory, the Narragansett Laboratories of the University of Rhode Island, Scripps Institution of Oceanography, and the Woods Hole Oceanographic Institution; and meteorological efforts are under the direction of the University of Hawaii, cooperating with the Universities of Michigan and Washington and with Woods Hole.

The aim of the expedition is to obtain knowledge of a limited and unique portion of the world's oceans, thereby contributing to the solution of many basic problems in oceanography and leading to a deeper understanding of the natural environment. This knowledge should also prove to be of material benefit to the countries surrounding the Indian Ocean, and ultimately to the benefit of all mankind.

*A condensed version of a report prepared by the National Science Foundation.



The U. S. effort is divided into three major programs—biological, physical, and meteorological.

THE BIOLOGICAL PROGRAM

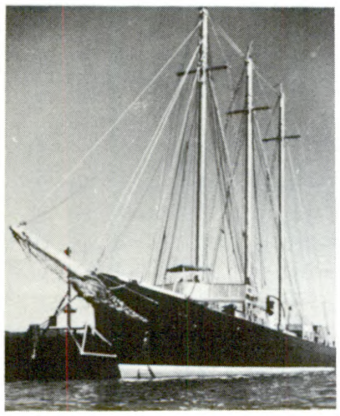
The goal of the biology program is to increase our knowledge of the abundance and distribution of living organisms of the Indian Ocean so as to obtain a better understanding of its biological resources. The first step toward achieving this objective will be to make an extensive biogeographical survey; this will be carried out aboard the USS WILLIAMSBURG (Naval Research Reviews, June 1962). By informal agreement with the scientists of other participating nations, the U. S. biologists will concentrate on the western half of the Indian Ocean, making observations and collecting specimens from 25°N. to 40°S., and from 20°E. to 80°E. longitude. The WILLIAMSBURG will make nine 2- to 3-month cruises, occupying oceanographic stations at 2-degree intervals. At each station various physical and chemical parameters will be measured, and samples of the biological populations will be collected. On half of the cruises the operations will include exploratory fishing (in cooperation with the Bureau of Commercial Fisheries), trawling, and bottom dredging.

Further in support of the overall objective, special research programs will be carried out on shipboard concerning such subjects as the culture and biochemistry of marine microorganisms, feeding behavior of zooplankton, and survival and behavior of deep-sea animals. In addition, shore parties will make ecological studies on various Indian Ocean islands and coral atolls.

THE PHYSICAL PROGRAM

The physical program consists of three major fields of investigation: chemical and geochemical, geophysical (including geological), and physical oceanography.

The chemical studies involve the composition of water and sediments and the distribution of carbon dioxide, oxygen (including isotopes), tritium, carbon-14, and certain rare gases. These studies are designed to enhance our knowledge of air-sea interactions, water composition at various depths, and geochemical cycles in the marine environment. The Lamont Geological Observatory, Woods Hole Oceanographic Institution, and Scripps Institution of Oceanography will direct this work.



ONR-sponsored ships participating in expedition. Left to right, ATLANTIS II, ARGO, VEMA, HORIZON, and CHAIN. The new AGOR ship is not shown.

The geophysical investigations, which will be directed by the same three institutions, will add to the understanding of the nature of the sea floor and the crustal structure. They will consist of precision bathymetry measurements, seismic refraction studies, magnetic surveys, gravity surveys, heat-flow determinations, bottom sediment and rock sampling, and sea-bottom photography.

The solution of specific problems concerning the physics of water motion, including oceanic circulation and tides, will increase our knowledge of the mass transport of oceanic waters, which affect both climate and marine productivity. The circulation of water in the Indian Ocean will be investigated by means of standard hydrographic stations and by current measurements taken with drogues, buoys, Swallow floats, and other means. These studies are being coordinated through Lamont, Woods Hole, Scripps, and the University of Rhode Island, each of which will expend a major effort in this field.

In addition, the U. S. Coast and Geodetic Survey plans to install, operate, and process the data from eight tide gauges in the Indian Ocean.

All of the physical oceanographic data collected will be available to the scientific community through the National Oceanographic Data Center.

THE METEOROLOGICAL PROGRAM

Supported by NSF, the Weather Bureau, Air Force, ONR, NASA, the World Meteorological Organization, and possibly the Coast Guard, an extensive meteorological program will go into effect in early 1963 and continue for two years. Standard wind and weather observations will be made from ship and shore stations and from two special Weather Bureau aircraft. About 60 U. S. meteorologists will take part in the effort; their studies will be supplemented by hundreds of land-based observers in all Indian Ocean countries.

Through the cooperation of the Weather Bureau, U. S. ships taking part in both the physical and biological programs will be equipped with meteorological instruments and personnel. The Weather Bureau and the Air Force will help staff the Expedition's Meteorological Center in Bombay, and the former will operate the weather aircraft. In addition, the Coast Guard is expected to operate two weather ships in the region. The Office of Naval Research is making available the first production model of NOMAD, a new device capable of making automatic recordings of tides and other oceanographic and meteorological parameters at the sea surface. And NASA plans to launch many meteorological rockets, some carrying NIMBUS satellites. The satellites will travel in polar orbit, passing directly over the Indian Ocean to take advantage of the best equipped set of observing stations yet established for this method of weather observation.

In addition, the Instruments Section of the Weather Bureau is now testing a new balloon-tracking radar, developed by the Bendix Corporation. The new apparatus is expected to be applicable to many oceanographic problems, but particularly to the study of winds aloft. If the usefulness of the radar is borne out by the tests, the new instruments will be manufactured within a period of 6 months and sent to expedition ships capable of handling them.

These many projects will yield the most extensive meteorological data ever taken in this important area of the world.

SHIP SCHEDULES

United States vessels to be involved in the International Indian Ocean Expedition during calendar years 1962 and 1963 are as follows:

WILLIAMSBURG (NSF)	January 1963—December 1964
ATLANTIS II (WHOI)	June—November 1963
CHAIN (WHOI)	September—December 1963
VEMA (Lamont)	June—July 1962 and 3 months in early 1963
New AGOR ship (Lamont)	3 months in late 1963
ARGO (SIO)	July 1962—May 1963
HORIZON (SIO)	October—December 1962

Two weather ships may be added to this list.

One more U. S. vessel, the schooner TE VEGA, recently acquired by Stanford University for use as a research and graduate training ship in biological oceanography, will back up the WILLIAMSBURG and the biology program. The TE VEGA will spend about six months in late 1963 and early 1964 in the Indian Ocean in support of the island shore and coral atoll studies. Besides providing logistic support for field ecology, the TE VEGA will provide the necessary laboratory space for physiological experiments on shallow water organisms.

OTHER U. S. CONTRIBUTIONS

The United States is making a large effort to enable other nations to participate in, and benefit from, the expedition. For example, U. S.

biologists will be joined in their program by about 50 foreign scientists. Also, groups of students from India and other Indian Ocean countries will be taken aboard the USS WILLIAMSBURG for short training cruises. The WILLIAMSBURG's schedule includes ports of call in India, Pakistan, Ceylon, Aden, Kenya, Tanganyika, Mozambique, Union of South Africa, Madagascar, Mauritius, and Burma; in each of these places contacts are being made with local scientists and university people to arrange visits, seminars, and public lectures.

The United States will also provide assistance to the International Taxonomic Center at Cochin. It will help train the technical personnel who will work at the Center, it will deposit plankton collections there, and it will undertake (through the U. S. National Museum) the taxonomic study of collections of replicate plankton and of all seaweeds, deep-sea animals, fishes, and benthic invertebrates not deposited in the international center.

To encourage the international meteorology program, the U. S. will establish a center in Bombay and provide scientists, from the Weather Bureau and the Air Force, to help train local personnel who will process the data. Also of considerable value to all nations will be the new balloon-tracking radar. And the international implications of the NIMBUS program are obvious. As a matter of fact, the entire meteorological program has been developed through American initiative and leadership.

The National Oceanographic Data Center, whose services are being provided by the United States, will receive and process much of the data obtained by scientists of many of the participating countries, and it will make the data available to the world scientific community.

In addition, the National Science Foundation has been supporting the activities of the Office of the Coordinator for the International Indian Ocean Expedition through the National Academy of Sciences-National Research Council.

Quantum Electronics to be Discussed in Paris

The Third International Symposium on Quantum Electronics will be held at the UNESCO Palace in Paris on February 11-15, 1963. It is being sponsored by the Office of Naval Research, The Institute of Radio Engineers and The Societe Francaise des Electroniciens et des Radioelectriciens. It is also receiving support from the Federation Nationale des Industries Electroniques, which will hold an exposition of apparatus pertaining to quantum electronics during the same week.

The symposium will deal with such topics as masers, lasers, coherence, optical pumping, atomic clocks, and applications of spectroscopy, magnetism, and relativity. Emphasis will be on basic physical principles rather than on engineering.

Scientists desiring to present papers should submit abstracts in triplicate before October 1, 1962, to The Third International Symposium on Quantum Electronics, 7 Rue de Madrid, Paris 8, France. Papers may be presented in either French or English. Simultaneous translations from one language to the other will be made.

On the Naval Research Reserve

All hands were given Marine-guided helicopter tours of the Dahlgren area.

The Dahlgren Seminar

Fifty-five Reserve officers from the Fourth and Fifth Naval Districts attended a three-day seminar jointly sponsored by ONR and the Fifth Naval District, May 25-27, which was rated as the best of the three held to date at the Naval Weapons Laboratory, Dahlgren, Va. The host station seemed to provide a magic touch to all aspects of the weekend training duty, which featured current developments in RDT&E work at Dahlgren, plus demonstration hops in a helicopter provided by the U. S. Marine Corps Schools, Quantico, and, as the principal feature, a presentation on Operation Deep Freeze.

In the opening session on Friday evening, CAPT Robert F. Sellars, USN, commander, Naval Weapons Laboratory, welcomed the visitors most hospitably. He assured them that they would obtain an authoritative glimpse of the research and development work being carried out on the weapons of today and the future, and expressed the hope that they would get something of the thrill that he does in seeing new developments at first hand. Friday's session concluded with a discussion of Research Reserve affairs by CDR R. N. Jennings, USNR, and CDR Eleanor F. Kehoe, USNR, both of the Research Reserve liaison office, ONR.

Saturday the reservists were literally off to a flying start, with brief aerial circuits of the Dahlgren area by helicopter being provided for all hands. The experience was a "first time" for virtually everyone. The Dahlgren members of the group were particularly interested in seeing how the Laboratory's test facilities looked from above. Presentations on HERO (Hazards of Electromagnetic Radiation to Ordnance) and CAD (Cartridge Actuated Devices) rounded out the morning program. Co-host CAPT J. J. Glancy, USNR, skipper of NRRC 5-12, and CDR E. J. Council, USNR, also of 5-12, helped present the CAD program—a sort of busman's holiday for them, since CAPT Glancy heads the CAD Division and CDR Council is his technical assistant.

Following a steak luncheon, CDR H. K. Butcher, USN, air operations officer, Task Force 43, gave a comprehensive presentation on the programs and objectives of the U. S. Naval Support Force, Antarctica. His comments and films were extremely well received, the seminar

hosts finally having to terminate the question-and-answer period in order to get the group back on schedule. A tour was made of the Main Battery and its related facilities, during which CDR D. C. Sloan, USNR, a member of NRRC 5-12, presented a stimulating picture of late developments in conventional weapons. Saturday's formal program ended with demonstrations and discussions of warhead developments, presided over by CDR W. W. Meyers, USNR, of the local company, with particular emphasis being given to the Bullpup A and B missiles.

Held over from the previous day because of changes in the test schedule was a spectacular underwater blast of several tons of high explosive in the Potomac River. This event, which was not planned as part of the program, was witnessed by a number of reservists and Dahlgren residents from the waterfront adjacent to NWL's administration building. The explosion lifted a huge sheet of water more than 1,500 feet straight up, supplying quite convincing evidence of blast and shock effects for the spectators.

Sunday morning was devoted to a presentation on the Space Surveillance System by LTJG E. H. Piepmeier, USN, deputy head of the Orbit Computation Division, NAVSPASUR; a review of computer applications to weapons-systems problems, chaired by CAPT W. A. Kemper, USNR, and Mr. R. E. Harshbarger, both of NWL's Computation and Analysis Laboratory; and a tour of the major computational facilities.

The smooth manner in which the weekend program was conducted reflects much credit on NWL's support of the seminar. In charge of these details was CDR W. A. Wright, USN, host for the seminar. Billeting, transportation, meal service, and recreational arrangements matched the excellence of the technical sessions.

Training Device Seminar

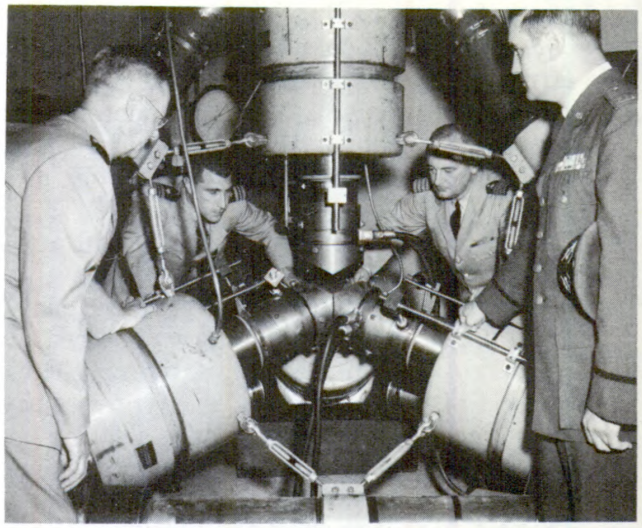
Eighty-five Reservists attended the Eleventh Annual Research Reserve Training Device Seminar at the U. S. Naval Training Device Center, Port Washington, N. Y., from June 10-23.

The objective of this year's seminar was to show how the naval operational problem has been affected by recent political, military, and technological developments, and what training assistance the Naval Training Device Center is provided to help solve this problem.

Speakers included Dr. Saul K. Padover, New School for Social Research, New York City; LTCOL F. P. Jones of the U. S. Military Academy; Dr. E. S. Lamar of the Bureau of Weapons; CAPT C. R. Stephan, USN, CAPT A. G. Russel, USN, and CDR J. M. Manherz, USN, all of the Office of the Chief of Naval Operations; and CAPT G. F. Britner, USN, and CAPT R. R. Sparks, USN, of the Bureau of Naval Personnel.

In addition to the classroom sessions, field trips were made to the SAGE installation at Stewart Air Force Base; the Fleet ASW Tactical School, Norfolk, Va.; the ASW School, Fleet Training Center, Norfolk, Va.; and the United Nations in New York City.

Seminar at ONR Boston



Reserve officers inspect Air Force Cambridge Research Laboratory tetrahedral anvil press used to make synthetic diamonds. The press can exert a pressure of 1.5 million pounds per square inch.

Twenty-three Naval Reserve officers of the First, Fourth, and Fifth Naval Districts participated in a two-week seminar at the ONR Branch Office, Boston, commencing June 10. The session was the third that the Boston office has sponsored in as many different years. It was under the direction of CDR Franklyn L. Jones, USN, executive officer and assistant for Research Reserve, ONR Boston.

CAPT W. C. Hilgedick, USN, commanding officer of the branch office, opened the seminar with a welcoming address, and CDR Jones outlined the training and other objectives of the two-week session.

Field trips were made to many research and development activities in New England, including the Research Laboratory of Electronics, the Nuclear Reactor, Computation Laboratory, Instrumentation Laboratory—all at M. I. T.; the Quartermaster Research and Engineering Command, Air Force Cambridge Research Laboratory, Lincoln Laboratory; as well as a visit to the USS HISSEM (DER-400).

CAPT J. W. Jockusch, Jr., USNR, special assistant to the Chief of Naval Research (Research Reserve), discussed the Research Reserve Program. He was joined in further discussions of the Naval Reserve by CAPT Hilgedick and CAPT P. Brockerick, USN, assistant chief of staff for Naval Reserve and training, First Naval District.

Nuclear Power Symposium

More than 60 Research Reserve officers from five different research companies in the Twelfth Naval District participated in the Nuclear Power Sympsoium organized and sponsored by Naval Research Reserve Companies 12-1, San Francisco, and 12-5, Berkeley. The symposium, held June 16 and 17, demonstrated the utility of atomic energy applied to civilian and military power-generation problems and the rapid practical adaptation by both groups of this complex new technology.

General Electric and Pacific Gas and Electric Companies co-sponsored the commercial power session, which convened at GE's Atomic Power Equipment Department, San Jose, and concluded at the Vallecitos Atomic Laboratory. Mr. Jack Spease, manager of industrial relations, Atomic Power Equipment Division, briefed participants about GE's San Jose operation and the elements of commercial power reactors. Then he conducted the group through the facilities for fuel fabrication and mechanical and electronic control construction.

The afternoon was spent at the Vallecitos installation, where the experimental program was described in detail and an area tour was made. Officers visited the control room of the world's first commercial power reactor; the Materials Laboratory, equipped with remote handling equipment; and were able to look into the core of a swimming-pool-type test reactor operating at a power level of 30 megawatts.

Nuclear power utilization by the Navy in the present and future was the keynote of the second session at Mare Island Naval Shipyard, Vallejo, Calif. Dr. Albert Kirschbaum, Lawrence Radiation Laboratory, Livermore, presented an unusually lucid and complete explanation of reactor principles, which included elements of design, materials of construction, distinguishing features of various types, and rationale of reactor operation. Following the lecture, CDR R. F. Wilkinson, USN, ship superintendent (nuclear), outlined the scope of the Navy's propulsion program from its inception to the present-day fleet operations and established the important role of the Mare Island Naval Shipyard in the nuclear submarine program.

A tour of Mare Island, which included visits to a wooden scale-model mock-up of an SSBN-class submarine, close-up examination of the nearly completed Polaris submarine USS ANDREW JACKSON (SSBN 619), the health physics laboratory, and the dockside viewing of the soon-to-be-commissioned USS PLUNGER (SSN 595), completed the symposium.

General arrangements for the two sessions were made by LCDR Paul F. Deisler, USNR, LTJG Carroll H. Hill, USNR, and CDR Guido J. Rosati, USNR, of NRRC 12-5, and CDR John S. Walsh, USNR, of NRRC 12-1.

National Commanding Officers Conference

Commanding officers of Naval Reserve Research companies throughout the United States met for a national conference at the U. S. Naval Training Center, Great Lakes, Ill., June 24-28, 1962. One hundred commanding officers or their representatives of the 117 companies in the Research Reserve Program participated in the first national meeting in six years. Also present at the conference were members of the Research Reserve office in Washington, D. C., and reserve assistants of ONR branch offices.

The conference was convened by CAPT J. W. Jockusch, Jr., USNR, special assistant to the Chief of Naval Research (Research Reserve),

who introduced the first speaker of the conference, RADM Ira H. Nunn, USN, commandant, Ninth Naval District. In his remarks RADM Nunn emphasized the needs of the Navy for a strong reserve program and made special mention of the Research Reserve. CAPT R. C. Gossom, USNR, deputy chief of staff for Naval Reserve, Ninth Naval District, followed with a further discussion of the various reserve programs and their objectives. On the afternoon of the first day of the conference, CAPT Jockusch discussed the many personnel matters that are of particular interest at this time to Research Reservists, and CDR Eleanor Kehoe, educational specialist (Research Reserve), outlined the current mobilization plans of the Program.

The next day's sessions was opened with a panel discussion by reserve assistants of ONR branch offices on the subject "Recruiting." Participants were CDR A. Brandt, USNR, moderator, New York; LCDR N. L. Fish, USN, Pasadena, and LCDR W. F. Cooper, USNR, San Francisco. A review of the training program was presented by CDR R. N. Jennings, USNR, training officer (Research Reserve), and an outline of "Records, Files and Reports" was presented by CDR L. P. Hoskins, USNR, reserve assistant, ONR Chicago. For the afternoon session, conferees met in individual groups with the reserve assistants of their particular areas to discuss matters of local consideration.

The last day of the conference opened with a morning session devoted to the technical aspects of ONR. CAPT A. H. Healy, USNR, Head, Contract Administration Department, ONR Branch Office, Boston, and commanding officer of NRRC 1-1, opened the session with a presentation on "Contract Administration." Dr. S. Silverman, research director, Office of Naval Research, outlined the research programs of ONR. He was followed by detailed discussions of these programs by the scientific department of the ONR Branch Office, Chicago, presented by Dr. A. R. Dawe, chief scientist; Dr. L. A. White, physical sciences coordinator, and Dr. M. A. Chaszeyka, physical sciences coordinator. The afternoon session, which concluded the conference, was devoted to the leadership program and was led by CDR H. H. Sullivan, USN, senior officer, Leadership Field Team, Great Lakes.

In the evening, following formal adjournment of the conference, a buffet dinner was held at the officers' club. Impromptu comments were made by several of the officers attending. CDR J. E. Wadsworth, USNR, commanding officer of NRRC 6-6, Chapel Hill, North Carolina, read a humorous letter to the "home folks" concerning the conference. This letter concluded with the statement, "Our host officers are the most efficient and helpful gentlemen I've ever seen. They call this area the Ninth Naval District, but to all of us it rates FIRST."

Selections for Promotion

Thirty-seven officers of the Research Reserve Program were among 2,869 Reserve officers of the line selected for promotion to the grade of lieutenant by the selection board, which convened April 10, 1962. The names of those selected are as follows:

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E. C. Bell	1-1	R. E. Murch	4-6
L. E. Bryant, Jr.	8-9	H. A. Nelms	6-3
R. J. Cielnicky	12-3	R. L. Nelson	4-7
J. P. Citron	6-6	A. Nyman	11-3
R. S. Collier	9-17	F. W. Paine	12-3
W. E. Dahl	9-7	R. A. Pedrick	5-8
E. J. Dragon	5-11	R. Reboussin	9-20
J. H. Duncan	3-5	M. L. Reuss, Jr.	5-9
J. N. Fiske	1-1	H. F. Smith	3-5
W. M. Greenlee	9-20	J. W. Smith	3-6
D. R. Hedrich	9-3	R. L. Smith	9-22
L. P. Kane	1-1	J. A. Snow	9-8
W. G. Kern	1-2	C. A. Trunzo	6-1
J. G. Kneuer	3-6	G. A. Van Horn	4-4
A. W. Lauritzen	12-7	R. F. Wall	1-2
C. G. Lindsey	11-6	D. A. Waterman	12-5
W. R. Meyer	6-16	J. D. Webster	3-12
A. L. Miller	9-21	R. D. White	4-2
M. T. Mills	9-20		

Some statistics have been drawn from the records of the Research Reservists selected for promotion:

Date of Rank	Designator	Year of Birth
Earliest 1-1-46	1105 - 30	Earliest 1920
Latest 12-4-59	1355 - 4	Latest 1937
Median 5-1-59	1405 - 3	Median 1934

Also selected were three officers from the staff corps:

Medical Service Corps		Supply Corps	
J. C. Curtis	1-2	R. S. Robinson	1-1
W. H. Laurence	8-4		

Selections were announced for the grade of lieutenant commander in the staff corps. These members of the Research Reserve were listed on the promotion lists:

Medical Service Corps		Civil Engineer Corps	
W. J. Hausler, Jr.	9-19	S. R. Keim	11-3
		G. H. Hetzel	3-8
		L. C. Neale	1-5
Medical Corps			
L. S. Van Orden	3-5		
A. L. Mooney	5-4	**Dental Corps**	
G. M. Kurzon, Jr.	9-3		
A. D. Heggie, Jr.	4-8	N. P. Baker	5-6
W. H. Helvey	3-9	N. E. Wilson	6-3

IN THIS ISSUE

NAVAL RESEARCH reports highlights of technical progress in research by Navy laboratories and contractors and the development of important naval research facilities. The magazine is listed for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. Subscription price: $1.50 per year in U. S. and Canada; $2.00 per year, foreign; $0.15 per individual copy. Changes of address should be sent to Code 740, Office of Naval Research, Washington, D. C. The issuance of this publication approved by the Secretary of the Navy on 1 March 1961.

FLIP is launched. This unusual oceanographic platform is described on pages 7-11.