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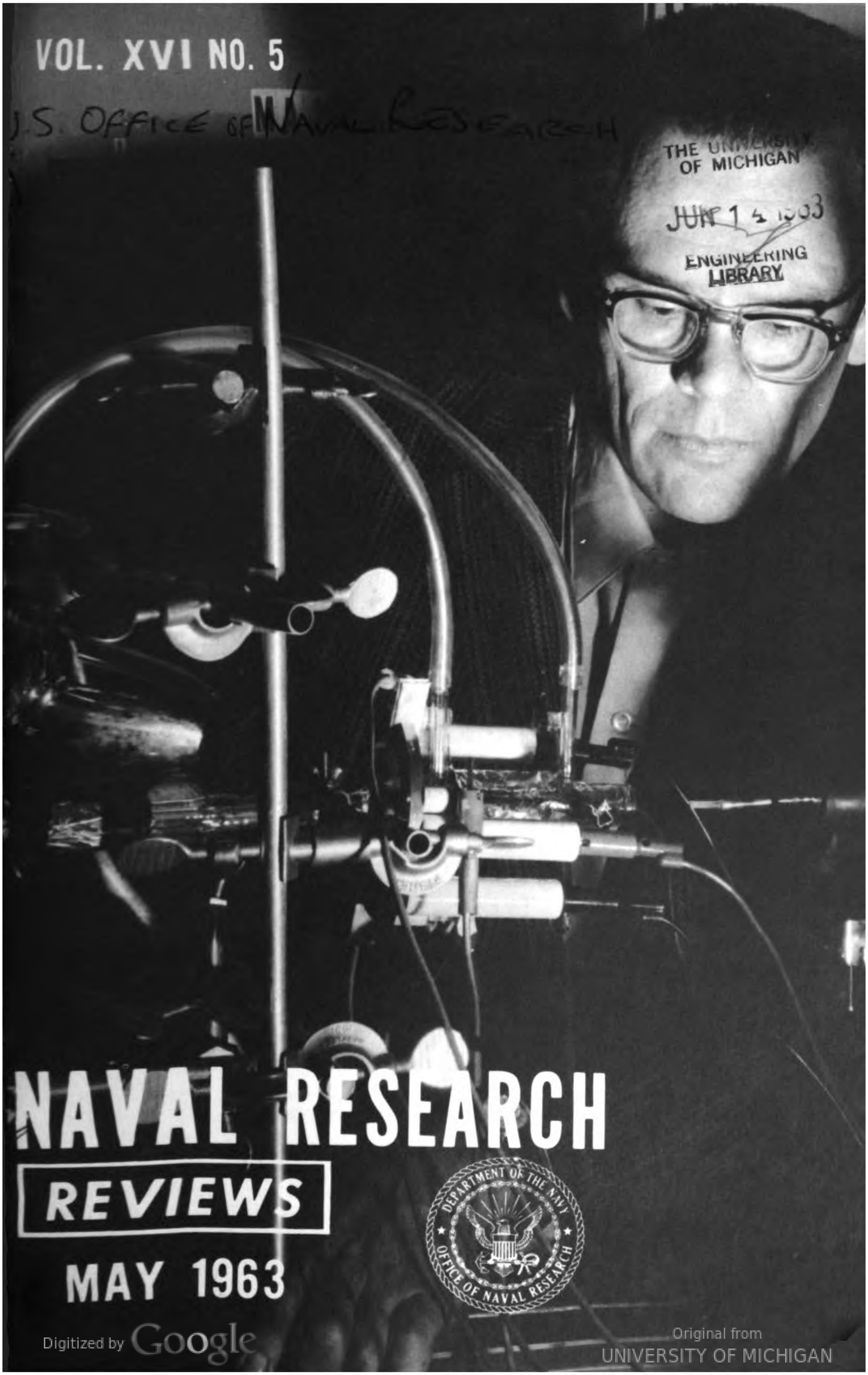

NAVAL RESEARCH REVIEWS

MAY 1963

DEPARTMENT OF THE NAVY
OFFICE OF NAVAL RESEARCH

Report from Point Mugu

- To the Australian aborigine, "jindivik" means "the hunted one." To scientists and technicians at the Pacific Missile Range it meant exactly the same thing last month when they referred to a 23-foot-long remote-controlled aircraft that they were evaluating. "Jindivik" is the name that has been given to the aircraft--and most appropriately so, for the vehicle was designed and developed in Australia specifically to be hunted. It was evaluated at PMR for use as a target for Fleet surface-to-air missiles.

Last month, 20 Jindivik flights were made for the benefit of U. S. Pacific Fleet ships on the sea test range of PMR.

The principal difference between Jindivik and American target aircraft is its method of take-off and landing. U. S. target aircraft are normally dropped from a mother plane, catapulted from a launcher, or they take off on a runway. Jindivik, on the other hand, utilizes a tricycle trolley to become airborne. The trolley accelerates down a runway and, when sufficient speed is attained, automatically releases the Jindivik. The aircraft can take off or land in a distance of 2,500 feet or less, it can operate above an altitude of 60,000 feet, and it can fly at about the speed of sound.

- The second target vehicle to be evaluated for other Free World nations at PMR is being put through its paces this month. It is the French CT-41, a low-cost recoverable vehicle intended for use in the development of both surface-to-air and air-to-air missiles.

The aircraft is about 34 feet long, measures nearly 12 feet from wing-tip to wing-tip, and weighs 6,650 pounds, including booster and hardware. It can attain a speed of about 1,790 miles per hour and an altitude of 80,000 feet.

A single operator on the ground controls the vehicle's turns, climbs, dives, speed variations, and recovery. The latter operation is effected in several steps--first by the jettisoning of fuel, then the separation of the CT-41 into three sections, and finally the opening of parachutes, which bring each section down gently.

- Another step has been taken at PMR toward perfect voice communications between astronauts orbiting the globe and ground tracking stations around the world. It is the development by a Navy electronics engineer, of a Voice Operated Relay Box, or "VOX." The VOX switches the voice communication received from the astronaut via UHF to a Single Side Band transmitter for broadcast back to ground tracking stations in Hawaii and on the west coast of the United States. Voice communication from the tracking station to the astronaut is also switched to UHF by the VOX.

The device has been installed in aircraft and tracking ships assigned to stations on the ocean testing range. These aircraft and ships provide telemetry, range surveillance, communications relay, and recovery assistance.

- The Navy's first space satellite command, the Navy Astronautics Group, located at PMR, marked its first anniversary on April 10. NAG's mission is to maintain and operate astronautics systems, such as the Navy Navigational Satellite System, which was designed as a navigational aid to ships at sea. NAG utilizes a computer center, an operations control center, and satellite tracking facility, all at Point Mugu, and additional tracking stations at Winter Harbor, Me., Minneapolis, Minn., and Oahu, Hawaii.

On the Way to Everest

Climbers' Reactions to Stress Watched by Navy

An expedition member practices with rope, pitons, ice axe, and crampons prior to the assault on Everest.

One day in June, 39 years ago, N. E. Odell, a member of the third British Mt. Everest expedition, paused in his climbing high on the rugged slopes of the world's tallest mountain and scanned the wild realm of snow, rock, and cloud above him. Somewhere up there, he knew, two men were at that moment laboring toward the summit. Suddenly the wind tore away the clouds that concealed Everest's pyramidal top. Odell saw something move—the tiny, distant figures of George Mallory and Andrew Irvine, silhouetted against the sky about 800 feet beneath the summit—and they were still struggling very slowly upward.

Seconds later the clouds swept back over the peak, swathing in mystery forever the fate of the two men who had climbed higher than anyone else before them and who were destined to retain that distinction for decades to come. Whether or not Mallory and Irvine actually reached the top is not known, for they never returned, and their bodies were never found.

In spite of this and other Himalayan mountaineering tragedies, man's overpowering urge to conquer Everest has not subsided. More than a dozen expeditions have made the attempt—almost all of them since the fateful British climb—and only two have made it to the top. In the course of these ascents, men were killed or maimed, and all of the climbers experienced hardships which—beforehand—they would not have believed themselves capable of enduring. In view of the dangers and hardships involved in these ascents, one is inclined to ask why men make them. Mallory once said that men strive to reach the high summits simply "because they are there." But what is perhaps more important to understand than the motivation for climbing—at least from a practical point of view—is what happens inside a man in the act of climbing.

STRANGE BEHAVIOR UNDER STRESS

Consider what a mountaineer experiences high on the sides of Mt. Everest. To succeed in his grand objective, he must work very hard, often for long hours at a time, in spite of the fact that oxygen is scarce, the temperature lingers between 30 and 40 degrees below zero, and the wind slams against him at gale force. Aside from these gruelling physical punishments, he is likely to suffer psychologically, too. For example, no matter how stable he is ordinarily, he may now become "lost" in hallucinations: He may confuse the person on the other end of the rope with an old acquaintance or even a dead relative, or he may show concern for the "extra man"—a delusion which causes him to stop climbing and wait for an imaginary companion to catch up with him. And he may become exceedingly irritable, refusing to speak for long periods even to his best friends.

Nevertheless, Everest beckons as temptingly now as ever before—a fact borne out by the departure last winter of yet another climbing party for her summit—the American Mount Everest Expedition, the first large, organized group of American climbers to make the assault. By late May these men will have climbed as high as they could—perhaps to the mountain's top. They are 19 strong—many of them scientists—backed up by 36 Tibetan Sherpa guides and 500 porters.

Unlike most other Himalayan expeditions, the American group has a special interest in the rigors of the climb—one not concerned strictly with gaining the summit. It is to learn as much as possible, first hand, about man's responses to prolonged severe stresses. Ultimately, the knowledge gained will be applied to the stressful situations man often encounters, out of necessity, while defending his country—in submarines, in the Arctic, in space, and in other environments.

A PSYCHOLOGIST JOINS THE CLIMBERS

This research, which is being sponsored by the Office of Naval Research, is being performed by Dr. James Lester, Director of Psychological Services for the Los Angeles Orthopedic Hospital. Dr. Lester began working on the project last year at the University of California at Berkeley by making preliminary evaluations of the personalities of the expedition members. With the help of a staff of research psychologists, he put the men through three days of psychological testing, interviews, and other forms of personality study. Although the data are still awaiting analysis, an impression obtained during the testing was that the expedition members have unusually artistic inclinations. Dr. A. S. Levine of ONR's Psychological Sciences Division has said that it appears that the group has the same drives that lead some men to paint pictures or compose music, except that the climbers use their muscles more vigorously to express their creativity. "Climbing mountains for these men is a profound aesthetic experience," he says.

Some interesting personality characteristics of the climbers that were revealed by Dr. Lester's tests are a remarkable freedom from worry, which involves the ability to throw off psychic tensions very readily; sound sleeping and very little dreaming; and a tendency towards exalted, mystical experiences while climbing mountains. Although scientists believe that mystical states of consciousness are triggered by oxygen deficiency at high altitudes, they acknowledge also the possibility that men having artistic personalities may be more prone to such experiences.

Dr. Lester is now on the mountain observing the attitudes of the expedition members as they meet a variety of difficult situations. By prearrangement, the climbers are keeping diaries, recording as accurately as possible their own innermost feelings for work, environment, and associates. Upon the expedition's return this summer, Dr. Lester will examine these personal accounts very carefully, as well as make further psychological studies of the men in the "laboratory." He will then analyse his complete set of records, making whatever determinations he can about the reactions of the men to the punishing conditions they encountered.

As the climbers ascend and descend Mt. Everest, they are being scrutinized from other points of view also. A University of Cincinnati sociologist is observing communication patterns which the climbers establish among themselves. As the sociologist—Dr. Richard Emerson—has explained, "a casual comment by only one member can trigger premature elation or depression in the entire group. These attitudes have doomed many climbs." Dr. William Siri of the University of California will direct a program that will look at the men from still another point of view: in terms of their physical deterioration during the climb.

The scientific program on the mountain is being rounded out by investigations of Himalayan glaciers, geologic features, and meteorology, and by observations of cosmic and infrared rays and solar storms—the latter taking advantage of the mountain's high elevations to avoid interference by a large part of the earth's atmosphere. Sponsors of the scientific work, in addition to the Office of Naval Research, are the National Geographic Society (the expedition's major sponsor), the Atomic Energy Commission, the Air Force Office of Scientific Research, and the National Science Foundation.

From the Diary of James Ramsey Ullman

The American Mount Everest Expedition left Los Angeles, California, on January 14, travelling by way of Honolulu, Manila, Tokyo, Hong Kong, Calcutta, and Darjeeling to the Himalayan foothills at Kathmandu in Nepal. Here, as reported by James Ramsey Ullman, the expedition's chronicler, are some of the highlights of the long journey to the mountain. These excerpts from the account begin as the expedition prepares to leave Nepal's capital city.

Then came February 20th—the date set more than a year ago for the beginning of the trek to Everest. And miraculously it all came off on schedule. The day before, Jimmy Roberts [the transportation officer—a retired British Colonel] most of the Sherpas and all the loads had gone off by truck to Banepa, which marks the end of the road at the eastern end of the Valley of Nepal. And on the morning of the 20th the rest of us followed. The scene that followed in an open field beyond Banepa was something straight out of the imagination of the late Cecil B. DeMille. The expedition members were there. The Sherpas were there. Hundreds of seer-offers were there, all armed with cameras and good wishes. Most essentially, our army of porters was there - Sherpas and Nepalese; men, women and children - and for upwards of two hours they filed past in endless procession...

The final figure was 909 porter-loads. Each load weighed some 60 pounds. Total: 54,540 pounds, or more than 27 tons.... And now at last, slowly but surely, all those tons began to move.... In single file, bent under their loads and headstraps, our armless army moved out of the field at Banepa onto the trail beyond, in a procession so long that it took two hours to pass a given point. Among the porters, spaced at wide intervals, were the members of the expedition: turning, waving, calling goodbye; then turning to the east and disappearing among the terraced hills. The adventure on which we had come was no longer a dream. It was a fact.

The day's trek took some three hours for the faster walkers, about four for the slower; and by the time we stragglers arrived at Panchkhal, camp was already pitched beside a network of converging streams. For acres around, the cook-fires of the porters were burning. In the center of things five expedition tents had been pitched; and in the center of these—looking highly improbable in the wild Nepalese landscape—had been set our gaily colored, garden-party-type tables and chairs.

We had tea. What seemed like a few minutes later we had supper, both professionally prepared and served by our Sherpas. The sun set in glory; the stars came out; and presently we were snug in sleeping bags on our air mattresses—with the hardships ahead almost impossible to imagine.

Kathmandu is at 4423 feet elevation. Our first goal—acclimatization camp, a few miles southwest of Everest—is a bit over 14,000 feet. But the 180 odd miles in between are by no means 10,000 feet straight uphill. For two weeks the Expedition's progress has been up and down, down and up, from valley to ridge; ridge to valley through the Himalayan foothills. It has been a roller coaster in slow motion.

In the beginning, sore and blistered feet were the order of the day, but these have gradually healed and hardened. And health and spirits have been all that could be hoped for. Some days' treks, to be sure, were harder than others—notably the third day out, which featured a continuous and killing upgrade from 2000 feet at Dololghat to more than 8000 at Choubas. But always eventually—and mercifully—the earth would then level out or fall away, and the going would be easier.

In spite of the tremendous advance preparations, there were of course contretemps and minor crises. For the Coleman lamps, used for night illumination, burners, mantles and kerosene showed up in their proper loads—but no lamps. They had temporarily vanished.... The smokers were horrified to discover that, instead of the expected 60,000 cigarettes, there were only 6,000; and everyone knows you can't climb a mountain on that little nicotine. Additional supplies were sent from Kathmandu—at a pretty price.... Then there was a toilet paper crisis, with one lone roll (which managed to get itself regularly lost) serving all members' needs for each day. But loud yelps of distress soon brought about a more generous distribution.

More serious - but, luckily, not too serious, was the breaking of a chain bridge across one of Nepal's numerous rushing rivers, while the

Expedition was crossing it. No team members were on it at the time, but several porters fell into the torrent and were swept downstream. Happily, all eventually struggled or were pulled out, with no serious injuries.

Then, in the village of Junbesi, came a pathetic encounter—with a Sherpa woman who had been terribly burned a few days before in trying to rescue her yak from a shed that had caught fire. The Expedition doctors gave her treatment on the spot; and then—it being obvious that she could not survive without hospitalization—a radio message was sent out for one of Nepal's two helicopters to fly her out and bring her in to Kathmandu. This was effected the next day, and the last reports were that the woman was on her way to recovery. (Incidentally, the most astonishing part of this incident was that the radio message sent out by Al Auten did not reach Kathmandu directly, but was picked up by a HAM operator in Australia, no less, who then relayed it all the way back through India to Nepal.)

A few days later there came an even more sinister encounter: with smallpox. The first reports of the Nepalese and Indian press indicated that it was some 35 Expedition porters that had been stricken. But fortunately this was not the case; the epidemic was in a village near the Expedition route. Again word was sent back to Kathmandu, and vaccine was soon being sent in from various points of the compass, both for the villagers and Expedition porters. For, unlike the sahibs, few if any of these had had any immunization.

It was not all crisis, of course. Mostly day followed day, smoothly and pleasantly; the complicated machinery of the march in—hiking and camping, hiking and camping, hiking and camping—functioned on all cylinders; and life's major components of food, shelter, and transport were all under control. Gradually the Nepalese-Hindu world of the valley sank away behind, and in its place appeared the Sherpa-Buddhist world of the mountains. Sacred mani walls lined the trail; prayer flags fluttered on the ridges; and sometimes at night the Expedition camped in the courtyards of lamaseries, falling asleep to the sounds of priestly gongs and cymbals. Solu Khumbu, the homeland of the Sherpas, was now close, and from the high places on the trail the mountains behind it loomed, high, white, and enormous. Only Everest itself was missing, still hidden behind lesser peaks. But it would appear soon now. Very soon.

As the expedition moved deeper into the Himalayas, and the mountain slopes steepened and whitened, an event occurred which stunned the entire party. On March 23, John E. Breitenbach of Jackson, Wyoming, was buried alive by a large mass of ice--part of an icefall--that gave way as he was trying to establish a path for the expedition over the barrier. He had been working out of the 18,000-foot-high base camp which the mountaineers had set up three days earlier.--Editor.

REPORT OF MARCH 30

To fill in a few further details of the accident . . . Gil Roberts, Dick Pownall, and the two Sherpas, who were with Jack at the time, received only superficial bruises from falling ice and are now perfectly fit—as are all other members of the team. First they, then the team as a whole, investigated all possible methods of recovering the body, but it was found impossible. At an inquiry held the next day at base camp it was determined that the accident was not due to negligence or inexperience, but was simply and inexorably "an Act of God."

After a pause of a day or two the expedition drew a deep breath and moved on. On March 27th an advance group reached the top of the Khumbu Icefall, where the Western Cwm begins [a long snow valley directly under Everest's southwest flank]. The next few days have been spent in improving the route: cutting steps, fixing ropes, bridging crevasses, etc., so that both sahibs and Sherpas can come up with loads. And it is expected that by March 31 the next camp above base will have been established at about 21,000 feet in the lower section of the Cwm.

The next step will be to establish Advance Base Camp near the center of the Cwm at about 22,000 feet. And the going to this point should be far easier than in the Icefall, for the snow here is smooth and the slope gentle. Beyond Advance Base, it has been decided, the team will split into two parties: one to move along the traditional route toward the Lhotse Face and the South Col; the other to reconnoiter the possibilities of a new route up Everest's West Ridge.

REPORT OF APRIL 6

The happy news from the front is that progress during the past week has been truly remarkable. Camp 4 on the Lhotse Face [has been established] at a height of about 24,500 feet. [However, this does not mean that] the summit, or even the South Col, will be reached any minute now . . . . a vast amount of work must still be done, in bringing up manpower and material, before the teams can push much higher. At present the expedition is spread out over several miles and some 6,500 vertical feet. Some climbers and Sherpas are still at Base Camp at the foot of the Khumbu Icefall; some at Camp 1 at the top of the Icefall; some at Advance Base in the Western Cwm; some at Camp 3, at the upper end of the Cwm near the base of the Lhotse Face; and some, as stated above, at Camp 4 on the Face. The essence of operations is constant movement between these camps, as the routes are improved and the loads carried up. And the identity of the "top men" will vary, as the advance guards come down for a breather at lower altitudes and fresh men move up to take their place.

By the time this issue of Naval Research Reviews is distributed, some members of the American Mt. Everest Expedition may have climbed to the top of the world's highest mountain. Or they may have had to turn back short of their goal. Not even with all the modern equipment available in 1963 was success guaranteed. Climbers still must meet the mountain pretty much on its own terms--just as Mallory and Irvine did in 1924. They cannot avoid the hardships and the dangers.

Naturally, the Office of Naval Research wants to see the expedition succeed. But it is in the trying that ONR is interested especially. From the Navy's point of view the undertaking will be a success--barring further tragedy--even if it "fails."

The Information Transfer Chain*

One of the biggest technical problems of our era is the retrieval of information--the task of finding the needle of wanted fact in the huge haystack of technical data published every year. The Department of Defense has asked all three military departments to make a thorough survey of their information processing systems. ONR is coordinating the task within the Navy.

The following essay, extracted from the superbly written analytical report of the Panel on Scientific Information, President's Science Advisory Committee, seems to hit at the core of the problem.

The basic scientist, the technologist, and the administrator see the dimensions and nature of the scientific communication problem differently. Most basic scientists confine their interests to one or a few rather narrow specialties; the extent of each specialty is largely determined by the effectiveness of the scientist's communication system. If communication with a neighboring field becomes too difficult, the basic scientist imperceptibly narrows his interest to those matters on which he believes he can keep himself informed. Thus the information dilemma appears relatively remote to the basic scientist. But even in basic science, narrowing of the scientist's interests is a dangerous course. As we have already said, science is really indivisible; if it fragments into a host of wholly unconnected specialties, each specialty narrowing and the number of specialties increasing with time, science as an instrument for probing nature will be greatly weakened. Moreover, in spite of the obstacles to proper communication, modern science tends to become more and more interconnected. Though a scientist chooses to narrow his specialty, science itself creates an ever-increasing number of potential points of contact between the scientist's narrow specialty and the surrounding fields. As time goes on, successful pursuit of a narrow specialty requires effective contact with more and more diverse parts of the literature.

The technologist is at the other extreme from the basic scientist. He cannot afford the luxury of accommodating the size of his field of interest to what his information system can handle. His job is to design a rocket or a communication system or a reactor, and his customer will not be satisfied with inadequate design because some knowledge was out of his field. He must be receptive to cues from all fields of science and technology. He ignores related art at great peril, especially when the hardware that he creates is expensive. The problem of information access falls upon him more heavily than it does upon the basic scientist.

The information needs of the technical administrator overlap those of the scientist and the technologist, but the emphasis is different. He too must encompass large segments of technical information; yet the manager needs not only the technical results of a given investigation

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*Extracted from "Science, Government, and Information," a report of the President's Science Advisory Committee, U.S. Government Printing Office, January 10, 1963.

but also knowledge of what is being done by whom, and who is available for doing what. This kind of information we shall call "scientific intelligence." At every level of management, either in Government or in a research organization, scientific intelligence is used by the administrator when he draws up a research program, proposes a new project, or decides to cut back on an old one.

In a sense, every individual scientist or technologist is a research manager. At the beginning of a new research he must decide on his strategy (including allocation of his personal resources); he must even decide whether or not to do the research. In making such judgments, he too uses scientific intelligence; since these judgments are divided among so many more people than those made by the full-time research manager, his needs for scientific intelligence, though equally important in the aggregate, are not so clearly felt.

THE INFORMATION TRANSFER CHAIN

The information process comprises separate steps or "unit operations": generation, recording and exposition, cataloging, storage and dissemination, retrieval and exploitation by the user. Since the steps are linked in the sense that the later steps depend on the earlier, the entire information process is chainlike; we shall call it the Information Transfer Chain. The first two steps in the chain—generation, and recording and exposition—are performed by the technical man and the organizations that support him, the later steps by the professional documentalists and the organizations that handle information, as well as by the users.

The information chain operates like a switching system. The ultimate aim is to connect the user, quickly and efficiently, to the proper information and to only the proper information. But perfectly precise switching is neither possible nor desirable. One cannot define in advance exactly what information is proper; the switching system must always allow for some browsing in neighboring areas. Moreover the capacity of the user to absorb information limits the system. Evidence is accumulating that the amount of scientific literature the user will pay attention to is limited; one survey conducted by Biological Abstracts suggests that on the average a biologist can scan journals or titles or abstracts involving 5,000 papers per year. Thus the information switching system, to be effective, must be more than a passive switch: it must select, compact, and review material for the individual user so that he actually assimilates what he is exposed to, and he is not exposed to too much that is unimportant or irrelevant. Its fundamental task is switching information, not documents.

Most of what is written about the information problem is concerned with the later steps in the information transfer chain; that is, analyzing information for the purpose of identification, placing information in its proper place in a classification system, storing information, alerting, and matching stored information with requests for information. The elaborate automated systems described in the popular press and the art and science of librarianship are concerned exclusively with these later steps in the handling of information already generated and not at all with the initial generation of information. It is our belief that the information problem is aggravated by this separation between what is done by the documentalist and what is done by the author: that the earlier and later steps in the chain are not as separate as tradition holds them to be, and that improvement in the former, especially with a view toward subsequent retrieval, would undoubtedly ease the latter.

THE INFORMATION PROCESS AS PART OF THE RESEARCH PROCESS

Carrying further the thread of argument of the previous paragraph, we come to perhaps the most essential attribute of the information process: the information process is an integral part of research and development. Research and development cannot be envisaged without communication of the results of research and development; moreover, such communication involves in an intimate way all segments of the technical community, not only the documentalists. The attitudes and practices toward information of all those connected with research and development must become indistinguishable from their attitudes and practices toward research and development itself. This is the central theme of our report.

We place special stress upon what seems an obvious point because, in the early days of science, the problem of communication could be managed casually. Each individual scientist could work out his own private communication system, suitable to his own needs, and, since the requirements were relatively small, the whole matter could be treated rather incidentally. But with the growth of science a casual attitude toward communication can lead only to insufficient communication. Scientists individually, technical societies, agencies supporting research and development, will have to recognize that adequate communication no longer comes free. Communication cannot be viewed merely as librarians' work; that is, as not really part of science. An appreciable and increasing fraction of science's resources, including deeply motivated technical men as well as money, will inevitably have to go into handling the information that science creates.

Science can ultimately cope with the information expansion only if enough of its most gifted practitioners will compact, review, and interpret the literature both for their own use and for the benefit of more specialized scientists. The Panel believes that such activities may eventually achieve a position in the science of the future comparable to that of theoretical physics in modern-day physics. Recognition of the importance of such scientific middlemen is discrenible in the proliferation of the so-called specialized information center where information is digested and interpreted. The Panel views the specialized information center as one key to ultimate resolution of the scientific information crisis.

Dr. Gerald M. Clemence will retire from the post of Scientific Director of the Naval Observatory late this summer after 33 years of service there. He will become Senior Research Associate and Lecturer in Astronomy at Yale University. His principal activity will be in the ONR-supported Research Center for Celestial Mechanics.

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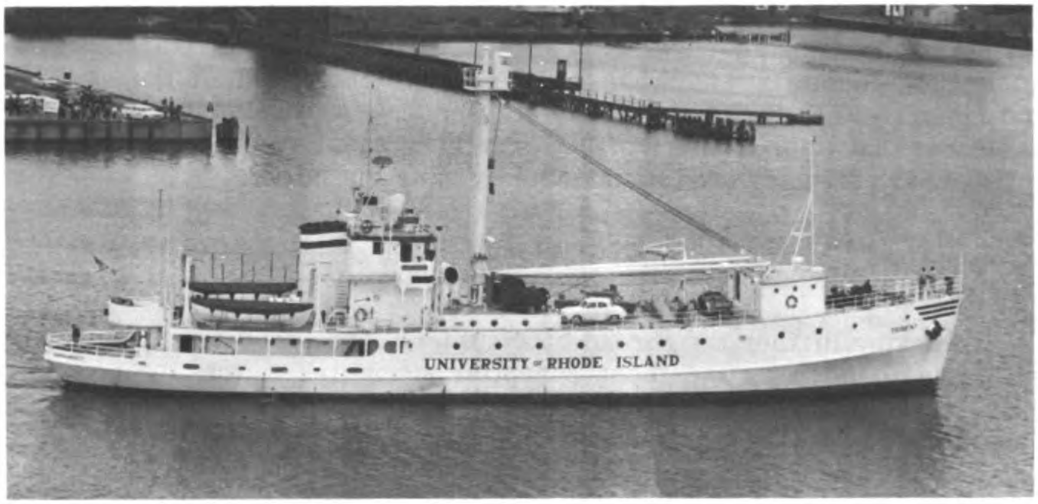


TRIDENT and Transition

"This is a very big day for the University of Rhode Island and the Graduate School of Oceanography. Today signifies the transition from a marine laboratory, with its efforts concentrated in Narragansett Bay, to an oceanographic laboratory which can work on problems anywhere in the world's oceans."

So spoke Dr. John A. Knauss, dean of the University of Rhode Island Graduate School of Oceanography, upon the commissioning of the research vessel TRIDENT into the school's service last November. Now—six months later—the 180-foot converted World War II Army freighter is off exploring a distant ocean, demonstrating that the transition from local to world-wide oceanographic interest has indeed been made. For the Graduate School of Oceanography, more so than for other marine institutions that have broadened their horizons in this way, the event is unusually gratifying. Dr. Knauss explains why:

"When I first arrived in Rhode Island in February 1962 to take over as the Dean of the Graduate School of Oceanography, I spent some time rummaging through the early files to find out more about the history of the laboratory. It is a history of great expectations coupled with heart-breaking frustrations. For instance, the laboratory was started in 1937 by Dr. Charles J. Fish with the use of a small vessel and a small laboratory building located at Fort Kearney, the site of our present laboratory. A year later, the laboratory and the ship were demolished in the 1938 hurricane. Within two years, Dr. Fish was able to persuade the College and the state legislature to put up funds for another laboratory building, this time on higher ground, and a start was made again. Within two years this country was at war, Dr. Fish was in the Navy, and the laboratory was inactive. He reactivated it in 1948, and by 1950 it had grown to such a size that it was necessary for most of the staff to move from its small 1940 building into a larger stone building some 100 yards to the south. On January 6, 1959, this building was completely destroyed by fire, and all of its records lost.

THE OFFICE OF NAVAL RESEARCH ARRANGES FOR THE CONVERSION OF A WORLD WAR II ARMY FREIGHTER INTO A RESEARCH SHIP FOR THE UNIVERSITY OF RHODE ISLAND.

At left and right, the TRIDENT sails up Narragansett Bay to its new home port in Rhode Island

"Such a history of disappointments would be sufficient to make most men give up, but Dr. Fish prevailed, and today, we have the Charles J. Fish Laboratory at Fort Kearney, a fine, modern structure; a graduate school of oceanography with some 33 graduate students; and now a new research ship—TRIDENT."

The Office of Naval Research has considerable proprietary interest in both the Laboratory and in its new ship, for ONR has assisted the university's oceanographic program for 14 years. As Dr. Knauss points out, "It is no secret that this record of continuous institutional support—along with the Navy's announced ten year oceanographic program (TENOC)—was an important factor in the University of Rhode Island's decision to commit a substantial portion of its resources to an expanding graduate program in the marine sciences. At a time when many major universities are facing up to an "agonizing reappraisal" of federal support of science, I am happy to be able to pay tribute to the oceanographic program of the Office of Naval Research.... Their continuous support of our group...has provided the solid foundation on which is based much of the growth in the marine sciences we see occurring in Rhode Island today."

ONR's most recent contribution to this growth was $350,000 that went into the conversion of the TRIDENT to a research ship. The white-painted vessel, named for the three-pronged spear borne in the hand of Neptune, was built originally in 1944 at a cost of $1,200,000 for use as an Army maintenance and supply ship. She was overhauled at San Diego, Calif., in 1961, and towed to Rhode Island last fall. Her first research cruise was made late last year to the coastal shelf off New England to obtain core samples of the ocean bottom.

TRIDENT, which displaces 850 tons, has about 2,000 square feet of laboratory space. Of considerable value also is her 90-foot length of unrestricted deck space. In addition, she has 15,000 cubic feet of easily accessible cargo space for the stowage of scientific gear. The ship's "wet" laboratory is contained in a small cabin on the foredeck, and its "dry" laboratory on the deck just below—the two compartments being connected by an elevator. Among the ship's mechanical furnishings are a hydrographic winch, a trawl winch, radar apparatus, and communications equipment. More gear will be added as time goes on. According to Dean Knauss, these facilities will permit expansion of the University's research program "to include not only biological oceanography, but oceanographic research in the widest sense—geological, chemical, and physical."

TRIDENT can carry a maximum of 22 scientists and a permanent crew of 18 men, including a chief engineer, first and second assistants, a chief mate and second mate, radio officer, six seamen, three oilers, and a cook.

The new research ship sailed from Kingstown on its first scientific cruise on March 22. AFRAM, as this voyage is called, stands for "Africa" and "Ram," referring to the region of investigation and the official university mascot. African waters, specifically those off the coast of West Africa, were selected for study because they cover a large area about which little is known oceanographically. On board for the trip are a crew of 20 men and a party of 11 scientists. Fifteen tons of oceanographic equipment were carried along, including a multiple plankton sampler, special winches, corers, dredges, an echo sounder, magnetometer, and several thousand gallons of distilled water.

The expedition is being conducted in four stages. The first portion of the work, under the direction of Dr. Charles J. Fish, concerns the upward movement of zooplankton in the Sargasso Sea, southeast of Bermuda. Dr. Robert L. McMaster heads the second phase, which deals with geological studies along the continental shelf from Dakar, Senegal, south to Freetown, Sierra Leone. Topography, sediment distribution, and plant and animal assemblages are being investigated in order to discover the sources of the shelf sediments and the geologic and oceanographic processes responsible for their distribution.

After a short layover at Monrovia, Liberia, Dr. David R. Schink will take a series of large water samples at various depths and extract silicon from the samples. Studies of the natural radioactive isotope silicon-32 will be made with regard to the "age" of the sea water and the marine chemistry of silicon. During the last leg of the voyage, deep-sea geological and geophysical studies will be made northwest of Sierra Leone along the Guinea shelf and continental slope. This work will be directed by Dr. Dale C. Krause.

TRIDENT will return to Rhode Island about the middle of June.

When Dr. John Knauss was appointed Dean of the Graduate School of Oceanography at the University of Rhode Island last year, he commented that the University's marine laboratory could be built into one of the major oceanographic institutions in the world. With the acquisition of the TRIDENT and the dispatching of the ship on the AFRAM expedition, a long step has been taken toward realizing this dream.

Perfecting Navy Countermeasures

If there is ever a "next" war large enough to involve the United States in fighting on and under the seas, many of the enemy's "shots" will be fired by mines placed in the expected paths of our ships, and many others will be delivered in the form of torpedoes by submarines lurking in the vicinity. The tactics are not new, of course. During World Wars I and II, the approaches to almost all strategic ocean locations were littered with small, lethal packages suspended or held just beneath the surface—unseen and unheard until it was too late. And as one will readily recall, German U-Boats torpedoed literally hundreds of Allied ships on the Atlantic crossing.

During the "next" war, torpedoes, mines, and other undersea weapons will pose a far more serious threat, for they will be produced in greater variety and will employ more effective triggers, guidance systems, and other mechanisms. Avoiding their devastating effects will require the perfection of highly sophisticated countermeasures equipment.

The problem is a continuing one. To find the answer, the Navy's Bureau of Ships has established a research and engineering laboratory specifically for countermeasures studies. Appropriately, it is called the Mine Defense Laboratory, or MDL. It is located in an area well suited to year around sea operations in an acoustically and magnetically quiet environment—on St. Andrew Bay on the northwestern coast of Florida.

At Panama City, on the shore of St. Andrew Bay, a scientific staff versed in the physical sciences and technologies, including magnetics and electromagnetics, acoustics, mechanics, and hydrodynamics, plans the complex and diversified investigations to be conducted offshore. Mine Division 81, a detachment of five minesweepers from COMINLANT, and the U. S. Naval Air Mine Defense Development Unit, which operates helicopters, support many of the activities at sea.

For most mine and torpedo countermeasures investigations the systems approach is taken. First, systems analyses are made to define the characteristics which the countermeasure devices and their components must have to best serve the Fleet. Then the methods, techniques, and hardware needed to achieve these characteristics and studied. Eventually, prototypes are built. As a back-up for all of this work, an independent, fundamental research program is conducted to expand the foundation of knowledge upon which all countermeasures activities are based, as well as to explore new ideas.

Although much of the work done at MDL must for obvious reasons be kept secret, some of the interesting problems faced and the investigations made to overcome them can be reported. Here are a few:

The most formidable threat in modern mine warfare is posed by influence ground mines, which contain firing mechanisms that react to the magnetic, acoustic, or pressure influences, singly or in combination, ①

GLIMPSES OF
FACILITIES AND PR

1 Laboratory building
grounds.

2 Ships of Mine Divis

3 Swimmer Support

4 Underwater tow veh

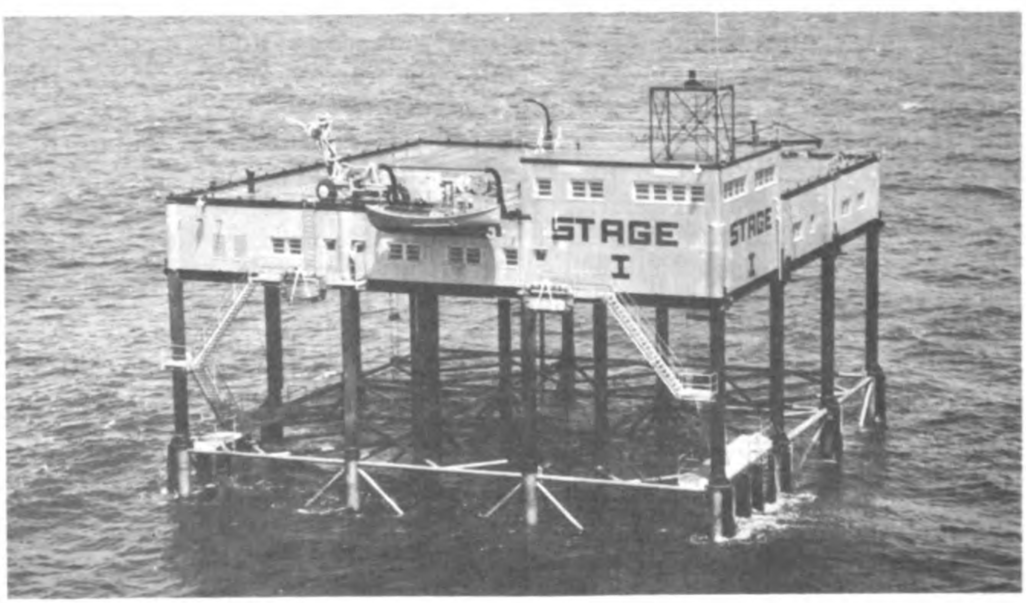
5 Automatic navigatio
puter and plotter.

6 The Stage I offshor
form.

④

③

⑥



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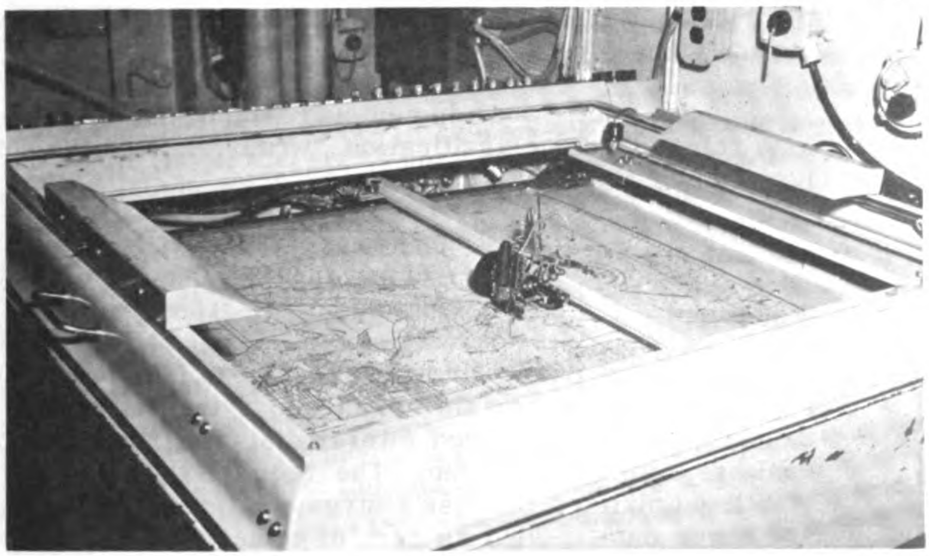


of ships passing overhead. These devices are planted on the sea bottom in shallow water—in from 3 to 30 fathoms, which means that much of MDL's work is conducted at these depths. As a result, the Laboratory has developed over the years proficiency in shallow-water oceanography and oceanometrics as will be shown in examples below. Two large off-shore platforms located near Panama City provide excellent bases for this work—one reason being that they permit the use of many instruments that can be best operated from a permanently fixed platform. The towers are now being shared with the A & M College of Texas and Florida State University.

Mines and torpedoes are affected by the oceans in many ways—by the movements of the waters, by pressure, plant life, and so on. Thus, MDL has made a number of studies of these effects. The objective of one such project is to study refraction and shoaling effects by means of an array of pressure pickups which will permit resolving directional spectrum of ocean swell. Incidental problems are surface-to-bottom transfer function and effect of fetch. Another study, arranged cooperatively with Texas A & M and Florida State, was made to determine the characteristics of internal waves and to correlate the findings with large-scale phenomena in the Gulf of Mexico such as the diurnal tide which occurs in this geographic area. These studies were made by means of an array of bathythermograph stations which took repeated readings over several complete tidal changes.

In order to develop effective countermeasures against modern acoustic mines, supporting research is required in shallow-water sound propagation over a wide frequency band. In this connection, experimental and theoretical studies have been made to determine the types of waves (such as longitudinal, shear, and surface) generated by an underwater noise source. To generate suitable noises, MDL has explored many novel methods for underwater use. The sound-propagation work has also included the study of a theory, recently proposed, concerning the propagation of explosive acoustic energy along the water-bottom interface. Through this study, MDL was able to show that the theory is quite accurate for predicting the types of waves that occur at the interface.

Most of the new equipment and techniques developed at MDL must also remain under classification "wraps." But here, too, a few examples can be given.

First, meet a most unusual family—a group of underwater vehicles of various shapes and carrying capacities designed to be towed behind a ship and operated by remote control. These vehicles can be "flown" to any desired location within towing ranges—to the side, up or down, and they can be put on automatic control to maintain, by means of ultrasonic "feelers" a certain height above the sea bottom. The vehicles can also be kept at a fixed lateral distance from each other when several are towed at one time. The vehicles thus provide an underwater stabilized platform to house instrumentation for gathering oceanographic and other data needed as part of mine-countermeasures studies—for example, information on the bottom contour in an area.

In mine-infested waters, accurate navigation is vital. This is true for the ships engaged in countering the mines as well as for all ships using the swept channels and sea lanes. Accuracies of continuously plotted ships' position required for mine-countermeasures operations are many times higher than those required for normal near-shore navigation. Exploratory development thus encompasses on the one hand such sophisticated equipment as AUTOPLOT—a fully automatic navigational computer and plotter for mine-hunting systems, and on the other hand, MINIBUOY, a miniature, expendable, easily handled styrofoam float and anchor for the closely spaced marking of narrow paths through heavily mined waters. The buoy can be equipped with an automatic flashing light which switches itself on at night, as does a similar light provided for its "big brother," the MDL Master Reference Buoy—a high-endurance mine countermeasures buoy with radar reflector and long range day-and-night visibility, now being used by the Fleet. A simple semi-automatic portable steering device containing an analog computer, now under advanced development, is intended for use on mine countermeasures ships as well as all ships using swept channels through mine-infested waters. It will lighten the burden for the helmsman in keeping the ship accurately on the prescribed course.

Certain jobs that need to be done on and under the ocean's surface can be accomplished best by swimmers, working either singly or in teams. Also, swimmers are used in the prosecution of MDL's technical program to observe experimental mine countermeasures gear in operation, to obtain operational performance and oceanographic data, and to gain knowledge about the behavior of gear in the ocean environment. MDL has been called upon, therefore, to assist in the development of swimmer equipment. One example of such hardware is the MDL Swimmer Support Craft, a small, low-cost, light-weight boat designed for general use by the swimmer crews. Another quite different piece of equipment developed at the Laboratory is an emergency breathing apparatus for helicopter pilots. A pilot is not able to get out of a helicopter that has crashed in water until the rotor has stopped turning. A mixed gas breathing apparatus provides him 15 minutes to exit from the aircraft and in addition, gives him the necessary buoyancy to wait for a pick up.

The work in this area is carried out by physicists and engineers qualified for diving by the Navy, and by an engineering demolition officer (EOD) and divers assigned to the Laboratory. A decompression chamber is available for their use. The combination of these "scientific divers" and excellent clear water in this area provides a unique capability in underwater photography. This capability is exploited not only in observing mine countermeasures gear in operation but also in actual design, development and proof testing of UDT (underwater demolition team) and EOD swimmer equipment.

Finally, there is the very serious business of protecting ships from torpedoes. The problem here is that the modern torpedo is wakeless and therefore difficult to detect, that it may come seemingly from "nowhere," but actually from great distances or depths, and that it is capable of homing in on its target by means of complex guidance systems. MDL has developed not just one, but many methods and devices to keep the "fish" away. They include tactical schemes, such as planned maneuvers to evade the missiles; the use of decoys, jammers, and maskers; the use of explosives to destroy the attacking missiles; and the application of other means to deflect or otherwise prevent torpedoes from reaching their targets.

MDL has been engaged in research, development, and engineering programs on an ever increasing scale since 1946, when it was called the U. S. Navy Mine Countermeasures Station (the name was changed to MDL in 1955). The Laboratory now employs approximately 500 people, of which about 140 are scientists and engineers. It covers more than 450 acres. Its operations take place over a large portion of the Gulf of Mexico. It utilizes numerous, highly specialized research facilities and tools. But in terms of its overall effect if there is a "next" war, this outlay is surprisingly small. In time of crisis, the Laboratory's products will help in large measure to shield from destruction all of the Navy's ships wherever they may be in the world.

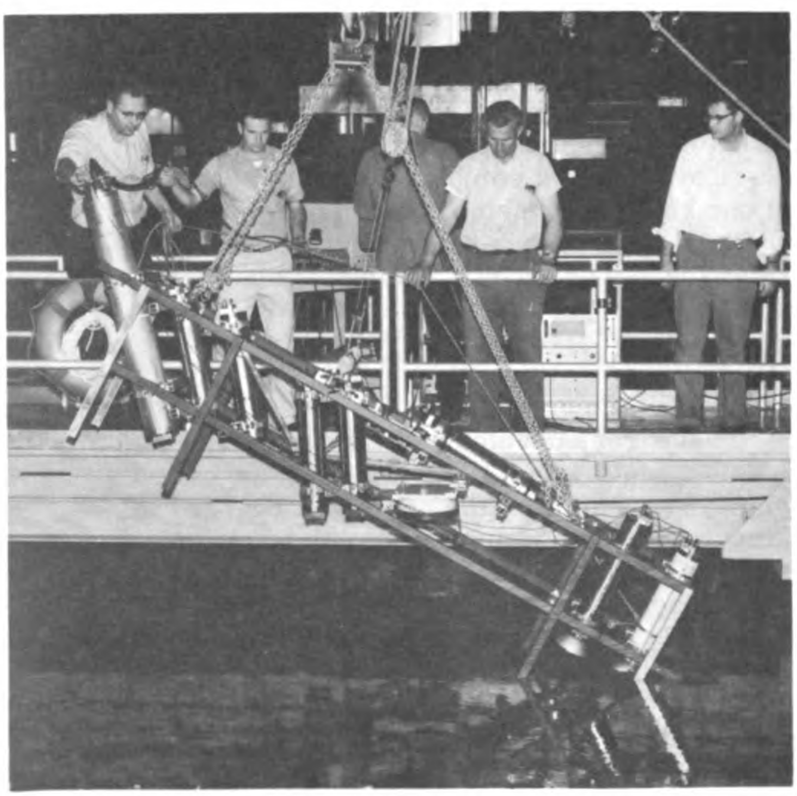
Some In-House Projects Bear Fruit

TV in Very Deep Water

The standard way of finding out the composition of the sea bottom at great depths is to drop a corer from an oceanographic ship to bring up a sample. In a precise coring operation, such as the preliminary phases of Project Mohole, oceanographers have often wished they could see how the corer was working or failing to work. A novel TV system, assembled at NRL, not only will enable visual scanning of coring operations but observation of deep-sea life as well.

The TV camera is a midget—a transistorized, slow-scan vidicon that takes pictures at one frame every 2 seconds. It is synchronized with a powerful stroboscope photo-lamp which flashes every 2 seconds. Both instruments are encased in pressure-resistant containers and have been tested to operate at depths of 10,000 feet or more. The slow-scan reduces bandwidth requirements, making it feasible to return the TV signal over an extremely long, single-conductor, oceanographic cable. In the laboratory, successful pictures have been transmitted over a 4-mile length of such cable.

With some added sophistication, the system can be made into a bottom scanner or a sunken-object viewer. For instance, the instruments on the rack pictured here include a pinger to measure distance to bottom, twin strobe lights, and twin stereoscopic underwater cameras in addition to the vidicon camera.



Underwater TV camera system, with elements added for video bottom scanning, being tested in the NRL reactor pool.

The Corrosion of Stainless Steel

In spite of the fact that it has been shown conclusively that stainless steel corrodes in sea water, this material continues to be specified for structures intended to be immersed in the ocean. Stainless steel is apt to dissolve in "crevices," such as along the many bunched strands of a wire rope, and perforation of sheet structures can occur in a very few weeks, even under the tiniest fleck of dirt. Experiments conducted recently at NRL and at the Laboratory's Canal Zone Corrosion Laboratory have demonstrated that the potential afforded by an iron, zinc, or aluminum anode is sufficient to prevent crevice corrosion in several types of stainless steel. These experiments are continuing.

Rough Road Simulator

A new facility brings into the laboratory the bumps and chuckholes of the Nation's poorer roads, so that engineers may study their effects on electronic equipment installed in, or transported by, land vehicles. This facility has been appropriately named a Rough-Road Simulator.

Undoubtedly, the most elegant design for this apparatus would have been several hydraulic actuators, each programmed to provide the desired motion to a suitable structure. The cost of such a system, however, would have been prohibitive. NRL, having completed a study, at the request of the Bureau of Ships, of ways to simulate this environment within a laboratory building, recommended a much more economical method of achieving the desired conditions.

The Bureau of Ships, after coordinating this work with other Services, adopted the Lab's recommendation and contracted to have the equipment built. It has been installed and is in operation at NRL.

The Rough-Road Simulator is comprised of four steel drums (see diagram) installed in a pit in such a manner that their peripheries serve as a roadbed, onto which may be driven various land vehicles for testing. The two drums on the left are driven in tandem via a V-belt by one hydraulic motor, and the two on the right are driven in the same manner by another hydraulic motor. This arrangement permits a variation in left and right drum speeds; also enough slippage occurs in the belt drive to create a random and variable relationship between the fore and aft drums. When the drums are fitted with suitable "bumps" and the speed of the drums are properly controlled, the duplication of natural rough-road environments is practically limitless.

The hydraulic motors, in driving a 2-1/2-ton (6 x 6) military truck, operate at a pressure of 1500 psi and produce a maximum average drum speed of 380 rpm, which corresponds to a motor speed of 1265 rpm, estimated horse power of 28.5 per motor, and a land speed of 38 mph. Normal vehicles, depending on their weight and load, can be driven at speeds equivalent to 40-50 mph. Trucks may be driven at greater speeds if their engines are used to boost the driving power of the hydraulic motors.

Fracture Safe Design of Steel Structures

Until recently it was impossible for design engineers to predict, with any degree of exactness, the point at which a given lot of structural steel would fail under stress. Therefore, steel structures had to be designed with a very large safety factor. Even so, ships sometimes broke apart at sea, or pressure vessels exploded catastrophically because the estimated safety factor was not large enough or because the steel used was not up to standard.

As a result of cumulative metallurgical research at NRL a procedure has been developed that eliminates most of the guesswork. It is now possible to predict the fail point of a given batch of steel and thus to establish standards for specifications in structural steels used in Navy designs. The procedure is based on the concept of a "fracture analysis diagram" which consolidates the available knowledge concerning flow size, stress level, and temperature requirements necessary to initiate catastrophic fractures in the structural steels. The practical use of the diagram is based on the determination of a simple parameter, the nil-ductility transition (NDT) temperature of the steel to be used. The NDT temperature, for any given steel, can be determined by a drop-weight test, also worked out at NRL.

The procedure has been adopted as a Navy standard by the Bureau of Ships, and as a standard by the American Society for Testing Materials. Thus, it is anticipated that the Navy method for specifying structural steels will become widely used in American industry.

Quick Recharging of Dry Powder Fire Extinguishers

The use of highly efficient, free-radical quenching, dry chemical powders for fire extinguishing has always suffered heavily because of the difficulty of quickly and easily recharging batch-type extinguisher containers larger than 30 pounds in weight. Present methods are wasteful, inefficient and messy.

Engineers of the Fire Research Laboratory at NRL have recently developed a simple, inexpensive system for filling large dry chemical fire extinguishers now in daily use at all Naval Air Stations. By the use of an ordinary industrial vacuum cleaner, coupled with an ingenious powder-air separator head, which fits the fill cap threads on the extinguisher's top surface, a 400-pound capacity dry chemical powder extinguisher can be refilled from shipping containers in approximately 6 minutes, instead of the 46 minutes or more previously needed for the job. Using this system there is no flying powder nuisance or loss of chemical. The powder-air separator head is cheap and simple to fabricate, and the vacuum cleaner can be used for other purposes at the fire station.

One of the five outstanding papers of the 81 presented at the Society of the Plastics Industry's Annual Technical Conference was "The Compressive Strength of Parallel Filament Reinforced Plastics - The Role of the Resin," by N. Fried of the Navy Material Laboratory.

Research Notes

Results of Stratoscope II Observations of Mars Announced

Stratoscope II scientists have lowered the upper estimate on the amount of water vapor existing in the atmosphere of Mars. This was revealed in a paper read at a recent meeting of the American Astronomical Society, describing the scientific results of the flight of the balloon-borne telescope launched from Palestine, Texas, on March 1. The Stratoscope II program is supported jointly by the Office of Naval Research, the National Science Foundation, and the National Aeronautics and Space Administration.

The astronomers from Princeton University and the University of California at Berkeley have completed their analysis of the data on the infrared observations obtained in the successful flight. They "detected no water with certainty" and have concluded "that the amount of water vapor in the Martian atmosphere is certainly less than 4/1000 and probably less than 1/1000 of that in the earth's atmosphere." Earlier calculations and theoretical treatments have indicated that the water content might be between 1/1000 and 1/50 of the content in the earth's atmosphere. The new findings indicate that the amount is in the lower portion of that range.

This additional evidence of the planet's extreme dryness lends weight to the theory that the Martian polar "ice caps" are in fact extremely thin layers of hoar frost, perhaps less than 1/100 of an inch thick. It is now estimated that if the atmosphere of Mars were wrung completely dry, the resulting liquid water would form a layer less than 1/1000 of an inch thick on the planet's surface. Explained in another way, the total water vapor in the Martian atmosphere apparently constitutes less than 1/2 cubic mile of liquid water—scarcely enough to fill a small lake.

The Barnacle's "Secret" Weapon

An animal one would assume to be among the most helpless things in the world—the minute, feebly swimming young of the marine barnacle—may have a built-in "secret" weapon in the fight for survival. Before it attaches itself to a solid object, such as a ship, a rock, or a whale's back, the barnacle spends a part of its life as a tiny, crab-like creature that is carried by the currents. But evidence suggests that some species of barnacle at this stage of life are able to eject a poison that enfeebles and kills creatures that might be likely to eat it. If this proves true, the fact would have significant bearing on an understanding of life in the sea. Peter B. Taylor, graduate student at the University of California's Scripps Institution of Oceanography, has just received a fellowship from the National Science Foundation to go to England to study these poisonous infants at the Laboratory of the Marine Biological Association, Plymouth.

Conference on Marine Bio-Acoustics

The study of sounds made by undersea animals—from the clicking of shrimps and crabs to the highly specialized sonar signals of porpoises—was the subject of an interdisciplinary conference held April 11-13 at the Lerner Marine Laboratory of the American Museum of Natural History located at Bimini in the Bahamas. The Symposium on Marine Bio-Acoustics, as the meeting was called, brought together more than 80 scientists, including biologists, physicists, acousticians, and psychologists, from research institutions and universities in this country, Canada, and Europe. It was sponsored by the Office of Naval Research and the American Museum of Natural History.

One of the demonstrations given was of the underwater acoustic-video system developed by the Institute of Marine Science, University of Miami, under Office of Naval Research sponsorship, and located at the Lerner Marine Laboratory. This shore-based installation, which consists of underwater listening devices and underwater television, is intended to give information on the occurrence of sonic organisms and to aid in the identification of hitherto unknown sound producers. (See NavResRev, Nov. 1962.)

The ocean is not a quiet place, according to a group of speakers who discussed biological sound producers in the sea. In addition to the noise of the moving waves at the surface, myriads of small creatures, such as shrimp, crabs, barnacles, and even mussels, produce a constant crackling clamor of background noise. Fishes gnash their teeth as they feed, and many species can also vibrate their swim bladders with specially developed muscles, producing grunts, pops, hoots, and wails. Some of these fish sounds appear to be related to spawning or schooling, but the reasons the majority of them are made are not known. Many instances were described in which the identity of the sound source was unknown, and speakers emphasized the need for more research in this direction.

Another group of scientists spoke of the methods by which fish and other aquatic animals detect sound. The hearing of fish was described as consisting of a dual set of organs. The inner ear of fish is capable of its best hearing in the range of frequencies from 300 to 800 cycles per second, and most fish cannot detect sounds higher than 2000 cycles. Fish are also supplied with a system of small sound detectors on the surface of the head and sides of the body. Unlike the ear, these lateral line organs respond to very low-pitched sounds or vibrations—so low, in fact, that they can detect minor currents of water produced by the movements of various objects, including other fish.

The remarkable capability of sonar, or echo-location, in porpoises received much attention. The click-like sounds of porpoises are emitted by a complex series of air sacs within the nasal passages. These clicks, which are often made in long series and which sound like the creaking of a rusty hinge, are directed forward, partially as a result of a large mass of fatty tissue on the forehead. It is believed that this "melon" of fat and oil acts as a sound lens to beam the echo ranging signals. In addition, the porpoise skull is constructed so that these high pitched sound pulses tend to be reflected and directed forward. The returning echoes from objects, fishes, or other porpoises enable the animal to locate itself in turbid water or in the dark. High-pitched whistles and squeals are also emitted by porpoises, and some evidence was presented that these signals may serve as a means of communication, much as does the singing of birds.

The large whales also emit sounds, several speakers reported, but these are low moans and groans, and some are almost below the audible range of the human ear. One such species, the fin-back whale, is thought to be the source of mysterious, powerful sound pulses that have had a disturbing effect on coastal underwater listening stations for many years. The sound pulses have a frequency of about 20 cycles per second and can be picked up by listening gear over distances of miles. (See NavResRev, April 1963, for a discussion of "Whale Music.")

Pneumonia on the Decline

Medical scientists and technicians of Navy Medical Research Unit No. 4 at Great Lakes, Ill., are helping to bring about a marked reduction in the number of cases of pneumonia occurring among Navy men at the Great Lakes Training Center. Ever since the base opened 56 years ago, pneumonia has been a serious problem there, primarily because many of the men who report to the base for training come from warmer areas and are not prepared for the below-freezing cold and wind that grip Lake Michigan every winter. Thus they become easy prey for the germs causing pneumonia.

NMRU-4's medical researchers have discovered that occurrences of serious respiratory diseases can be cut down in several ways—by delaying immunizations to the last half of a recruit's training period, by allowing longer intervals between "shots" than were allowed previously (so as not to lower the recruit's resistance suddenly), and by the use of bicillin, a form of penicillin, and adeno-virus vaccine.

As a result of adopting these practices, the number of cases of pneumonia occurring at the base declined from 2,500 in 1961 to about 2,000 last winter with approximately the same number of recruits under training.

Awards

THE NATIONAL ACADEMY OF SCIENCES, at its 100th Annual Meeting in Washington, D. C., honored three members of the "ONR Family:"

- Dr. Maurice Ewing, internationally known geophysicist and Director of Columbia University's Lamont Geological Observatory, received the Academy's Carty Medal, awarded for noteworthy and distinguished accomplishment in any field of science coming within the scope of the charter of the Academy. This award, made in recognition of his leading role as an interpreter of the earth's structure and of the million-year epoch before recent geological history known as the Pleistocene

Period, further honors Dr. Ewing in that he is only the tenth recipient in the 33-year history of the award.

- Dr. Richard Tousey, of the Naval Research Laboratory's Atmosphere and Astrophysics Division, received the Academy's Draper Medal, awarded for investigations in astronomical physics. This Medal was awarded to Dr. Tousey for his achievements in solar spectroscopy, a principal source of information about the chemical and physical structure of the earth's own star. Dr. Tousey became the 34th Draper medalist since the establishment of the award in 1886.

- Dr. Roger Revelle, Director of the University of California's Scripps Institution of Oceanography, was presented the Academy's Agassiz Medal for outstanding achievement in oceanography. Dr. Revelle, who became the 30th Agassiz medalist since the establishment of the award in 1911, was cited for significant contributions to the understanding of oceanic processes and the geology of the sea floor, and for the stimulus he has given, through his own research and special efforts, to the advance of scientific oceanography throughout the world.

Dr. Revelle returned to academic life in February this year after a leave of a year and a half to serve as science advisor to the Secretary of the Interior.

Nuclear ASW Weapon Studies

If Navy ships and planes ever have to use nuclear ASW weapons—depth charges and such—operationally, there is a strong likelihood that the delivering vehicle may be damaged by the shock wave or radioactive materials. A series of explosion tests has therefore been initiated at the Naval Ordnance Laboratory, Silver Spring, Md., as a preliminary to developing means for protecting the ships and planes from their own weapon. The test results are expected to provide a foundation of knowledge particularly useful to weapons designers and operational commanders who are concerned with obtaining maximum effectiveness from nuclear ASW systems while maintaining optimum safety.

Despite the nature of the study, no nuclear charges were detonated during the field tests. Instead, conventional explosive charges weighing up to two tons were used to predict phenomena of nuclear magnitude. This involved the application of scaling laws and present knowledge of the differences between conventional and nuclear explosives. The immediate objective was to measure airblast pressure at various altitudes, and along the water surface, resulting from underwater blasts. To make the measurements more meaningful, simultaneous measurements were made of underwater pressures and surface effects.

Analysis of the pressure changes during the explosion provided data which helped determine the shockwave effect as well as the shielding of the explosive gases by the water column. It also revealed whether the explosive gases were ejected into the atmosphere when the bubble ruptured. This "blowout" results in a dense cloud containing a high level of radioactive material. When the pressure of the gases in the explosion bubble is less than atmospheric at the time of the rupture, "blow-in" occurs. In these cases, the explosion residue in the bubble will remain underwater and be much less of a hazard to the vehicle delivering the charge.

On the Naval Research Reserve

General Excellence Award

Characterizing its performance as a "clean sweep," Assistant Secretary of the Navy (Research and Development) James H. Wakelin, Jr., had highest praise for Naval Reserve Research Company 3-9, Upton, Long Island, New York, when he presented the coveted Naval Research Reserve General Excellence Award on April 16, 1963. During the preceding year this company won the A. Hoyt Taylor Award for scientific accomplishment.

"The competition for the two plaques was instituted only two years ago," the Secretary said. "You won the A. Hoyt Taylor Award for 1961 and now you have earned the General Excellence plaque. Truly you have earned distinction. We in the Navy are not only proud of the Research Reserve—we depend on it to fill vital needs in the areas of research and development during any future mobilization."

In presenting the award to LCDR Wilmer H. Poulson, Jr., USNR, Commanding Officer of NRRC 3-9, Secretary Wakelin also paid tribute to the leadership of CDR Jere C. Austin, USNR, who commanded the unit during 1961 and 1962.

Among the guests for the dinner were Dr. Maurice Goldhaber, Director of the Brookhaven National Laboratory, Dr. Clark Williams, Deputy Director; CAPT H. H. Kait, USN, Commanding Officer, Office of Naval Research Branch Office, New York; CAPT Joseph R. Waldman, USN, Assistant Chief of Staff for Third Naval District; CDR Donald McKinlay, USNR, Research Reserve Program Officer; Mr. Milton Shaw, Special Assistant to Secretary Wakelin; and the Secretary's Naval and Marine Corps Aides, CAPT W. J. Moran, USN, and MAJ H. E. Roland, USMC.

CAPT J. W. Jockusch, Jr., USNR, Special Assistant to the Chief of Naval Research (Research Reserve), served as master of ceremonies. He pointed out that Secretary Wakelin, a former Research Reserve officer, originally conceived the idea of nation-wide competition among the 116 Research Reserve companies. He paid high tribute to the Secretary for his personal and official support of the Research Reserve Program.

Argonne Symposium

A Symposium on Nuclear Capability was held at Argonne National Laboratory (ANL) near Chicago on March 30, 1963. The symposium was arranged by Naval Reserve Research Company 9-23, Forest Park, Illinois, and conducted by ANL. LT Mahlon D. Burkhard, USNR, Commanding Officer of NRRC 9-23, served as symposium chairman. Representatives of all of the Research Reserve companies in Illinois, Wisconsin, Michigan, and Indiana, and of an Army Unit from Michigan attended.

The morning session was opened with remarks by Mr. A. B. Kriscuinas of the Laboratory Director's office. The remainder of the morning was spent touring facilities of the Laboratory. ANL facilities include an algae farm where fully deuterated algae are grown, computers, one of the world's largest mass spectrometers, the CP 5 research reactor, and the $47 million Zero Gradient Synchrotron (Z. G. S.), which, when completed, will provide the most intense beam of any of the multi-billion volt protron synchrotrons.

After luncheon, the symposium reconvened to hear more about the Z. G. S. from the Associate Director of the High Energy Physics Division of ANL, Dr. Martin. Dr. B. I. Spinrad, Director of the Reactor Engineer Division of ANL, spoke on advanced reactor concepts and speculated on some possible reactor types for spacecraft. Dr. Dawes, Chief Scientist, ONR Branch Office, Chicago, gave a presentation on "Basic Research," and CDR Hughes, Reserve Assistant of the ONR Branch Office, Chicago, made the closing remarks.

Reservist Appointed Dean

CDR Albrecht

CDR William P. Albrecht, USNR, a member of Naval Reserve Research Company 9-20, Lawrence, Kansas, has been appointed Dean of the Graduate School of the University of Kansas.

CDR Albrecht holds a B. S. degree from Carnegie Institute of Technology, an M. A. degree from the University of Pittsburgh, and a Ph. D. degree from the University of Chicago. He also studied at the University of Oxford as a Ford Faculty Fellow.

During his career CDR Albrecht taught at Carnegie Institute and the Universities of Pittsburgh, Chicago and New Mexico, and since 1957 has been Professor of English and Chairman of the Department of English at the University of Kansas.

Promotions to Lieutenant Commander

Seventy-nine Research Reserve Lieutenants were among the 2,887 officers of the Naval Reserve selected for promotion to the grade of Lieutenant Commander. The Board which made these selections convened on March 5, 1963, and its report was signed by the President on April 19. Congratulations to all.

Ammerman, D. J.	5-12
Augustine, P. R.	5-10
Bair, E. E.	9-2
Barlow, H. B., Jr.	1-2
Barnhart, B. J.	8-5
Blum, E. D. (C. O.)	9-10
Bosshardt, R. M.	4-8
Boston, F. R.	9-3
Bradshaw, R. D.	11-5
Brainerd, R. C.	3-14
Breland, E. W., Jr.	8-4
Brewster, H. M.	3-8
Briggs, D. E.	9-3
Bruce, W.	8-9
Campbell, D. R.	12-3
Childs, W. B.	5-8
Clavel, A. L.	4-11
Cobb, K. K.	6-15
Crossley, H. E., Jr.	1-1
Dahlinger, H. O.	6-18
Deam, E. L.	9-2
Devaney, J. J., Jr.	1-1
DeVolpi, A.	9-23
Ekern, W. F.	12-3
Griffin, D. E.	8-8
Guditz, E. A.	1-1
Harmelink, V.	9-24
Harper, H. M., Jr.	4-4
Hay, W. C., Jr.	3-12
Humphrey, A. S.	9-25
Kassabian, J. J.	1-1
Kieffer, T. J.	9-5
Kilgore, D. C.	6-5
Kindig, D. A. (C. O.)	11-5
Krass, H. C.	9-23
Kremp, B. F.	6-8
Lane, W. P.	5-8
Langenheim, R. L., Jr.	9-2
LaRoche, J. J.	5-1
Larson, H. J.	12-2
Lauriente, M.	5-4
Lembke, W. D.	9-11
Leo, P. P.	12-3
Lier, D. W.	8-9
Lyttle, J. D.	12-3
Marihart, D. J.	13-4
Marshall, F. R.	8-5
Martin, J. P.	9-10
Nowlin, J. F., Jr.	8-4
Nutty, J. E.	9-5
Parker, J. W. (C. O.)	3-12
Ransom, J. C. W.	13-4
Rauen, T. J.	5-9
Rausch, W. P.	3-5
Raynes, H. D.	5-4
Rhodes, A. J.	8-1
Sampson, J. L.	1-1
Scarlett, C. H.	3-9
Schweinsberger, R. A.	12-3
Scott, A. L.	3-14
Scott, F. E.	6-8
Sergeant, R. L.	3-12
Sherman, H. W.	9-3
Simester, L. A. (C. O.)	9-24
Simonds, R. E.	13-6
Smith, A. G.	6-6
Smith, R. W.	8-5
Stamm, G. L.	5-9
Stefano, F., Jr.	3-8
Stout, R. G.	6-8
Swanson, N. P.	9-22
Thompson, J. C.	5-11
Tresansky, J. O.	5-10
Tschudy, J. J.	12-7
Urick, E. A.	5-1
Wegner, G. H.	8-8
West, W. R.	4-3
Wilcox, R. H.	5-9
Wilson, T. A., Jr.	6-6

A REMINDER ON PROMOTION REQUIREMENTS

- Officers selected for promotion must qualify within one year from the date on which the President approved the report of the Selection Board in order to receive pay and allowances, if applicable, from that date.

- The physical examination may be taken as soon as the official letter of notification of selection has been received.

A FEW STATISTICS

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

DATE OF RANK		DESIGNATOR		YEAR OF BIRTH		STATUS	
		1105	53				
Earliest	1-1-45	1106	1	Earliest	1912	Ready	76
Latest	3-1-58	1315	2	Latest	1933	Standby	3
Median	11-1-56	1355	4	Median	1928		
		1405	14				
		1455	3				
		1515	1				
		1665	1				

Weekend Seminar Held at Houston

Naval Research Reservists crammed a three-day space seminar into a busy weekend on March 15-17, 1963, at the National Aeronautics and Space Administration Manned Space Center in Houston, Texas. Naval Reserve Research Company 8-4, Houston, with LCDR M. G. Gugenheim, USNR, Commanding, arranged and sponsored the seminar. The aerospace engineers from NASA who addressed the seminar revealed to the reservists details about the Mercury, Gemini, and Apollo space programs. Also, reservists learned of Manned Spacecraft Center operations, communications with earth from space, and the use of astronaut trainers and crew equipment (see photo at right).

The seminar convened on Friday evening at the Naval Reserve Training Center with a welcome by CDR J. S. Foard, USNR, Commanding Officer of the Center. Also greeting the group were CDR I. S. Heath, USNR, Director, Specialist Program Branch, Eighth Naval District, and CDR O. D. Hughes, USNR, Research Reserve Assistant, Office of Naval Research Branch Office in Chicago.

In attendance were 85 reservists—35 members of Houston's NRRC 8-4, 12 members of Houston's Army Research and Development Company, and other reservists from New Orleans, Dallas, College Station, Austin, and Freeport.

NASA engineers and the subjects of their talks were: Mr. John H. Boynton (Project Mercury), Mr. Arthur J. Thiberville (simulation and crew operation), Mr. Homer W. Dotts (Project Gemini), Mr. Joseph T. Doke (Project Apollo), Mr. Paul Kiehl (crew equipment), Mr. Elwyn H. Yeater (manned spacecraft center operations), and Mr. James Prim (crew training simulator).

The seminar concluded on Sunday with a tour of the NASA facilities at Ellington Air Force Base.

So successful was the weekend training that a resolution was made to conduct a similar seminar next year.

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Promotions to Captain - Staff Corps

The March issue of Naval Research Reviews listed the line officers of the Research Reserve who were selected for promotion to the grades of Captain and Commander. On March 14, 1963, the President approved the report of the Selection Board for staff corps officers, and the Chief of Naval Personnel released the names of the officers selected. Congratulations are extended to the following Research Reserve officers who were on the list:

FOR CAPTAIN, MEDICAL SERVICE CORPS

W. R. Boss	5-10	D. E. Howell	8-13
H. N. Gardner	5-10	R. W. Jones	8-13

Also selected for Captain in the Medical Service Corps was Henry A. Imus, who is known to many Research Reservists for his past activity in organizing the Aviation Medicine Seminars at Pensacola, Florida.

FOR CAPTAIN, MEDICAL CORPS

R. A. Love 3-9

Officers inspect gear at the NASA Manned Space Center in Houston, Texas, during a weekend seminar arranged by NRRC 8-4. From left to right are LT R. J. Ward, USNR, and LT J. F. Nowlin, USNR, members of NRRC 8-4; and Mr. Paul Kiehl and LCDR M. G. Gugenheim; USNR, Commanding Officer of NRRC 8-4. See article, page 28.

IN THIS ISSUE

AVAL RESEARCH REVIEWS publishes highlights of research conducted by Navy laboratories and contractors and describes important Naval experimental facilities. Manuscripts submitted for publication, correspondence concerning prospective articles, and changes of address, should be directed to Code 740, Office of Naval Research, Washington 25, D. C. The magazine is listed for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Subscription price: $1.50 per year in the U. S. and Canada; $2.00 per year, foreign; $0.15 per individual copy. The issuance of this periodical approved in accordance with Dept. of the Navy publications and printing regulations.

EDITORS: A. T. Drury and Richard D. Olson

NAVEXOS P-510

Dr. Harold Gandy conducts a laser experiment at the Naval Research Laboratory. NRL's laser program is not only yielding new and improved laser materials, but is also bringing about a better understanding of the factors that control spontaneous emission and other optical properties. See page 18 for discussions of other recent NRL investigations.