OFFICE OF NAVAL RESEARCH OCTOBER 1952

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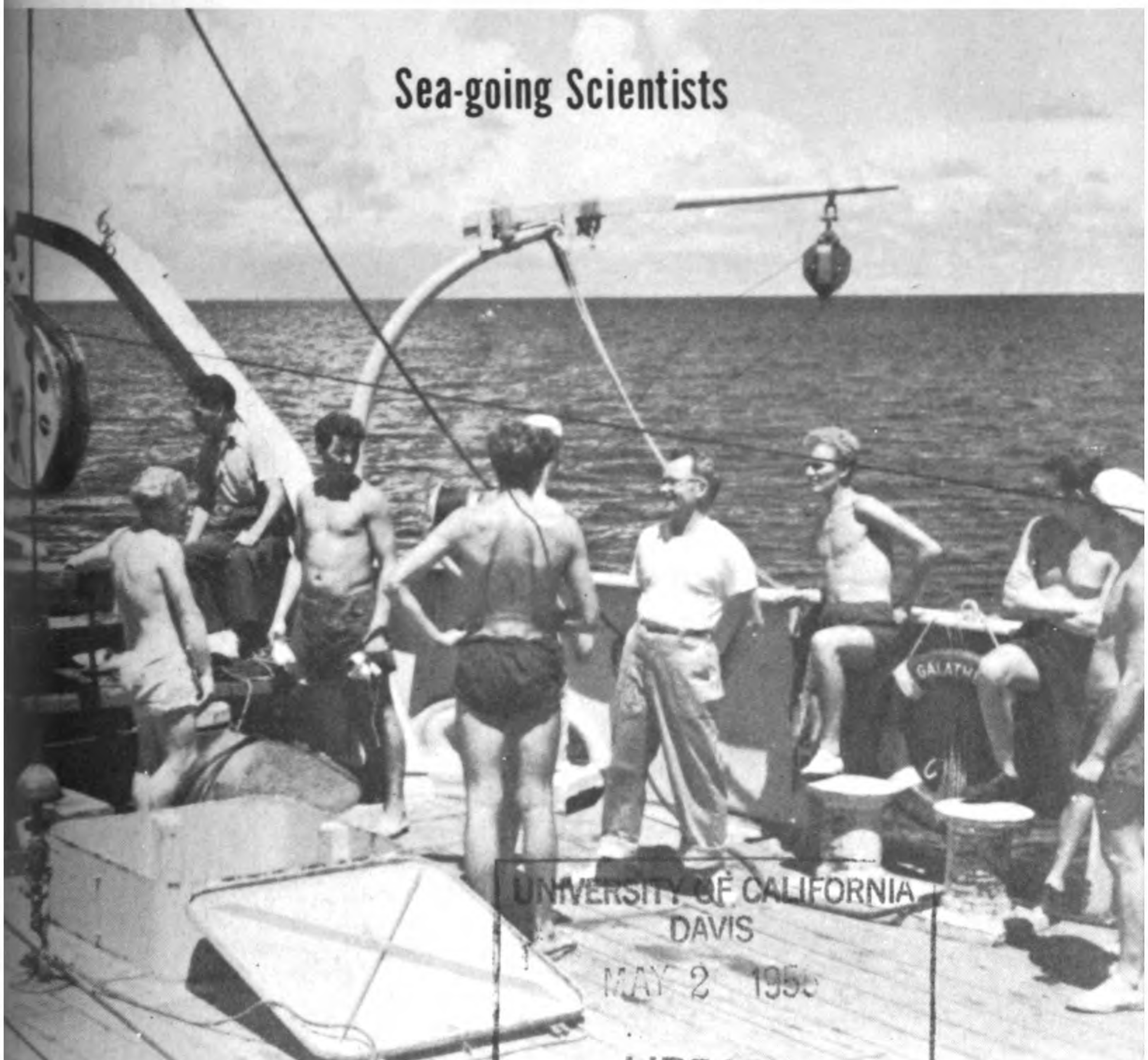
RESEARCH REVIEWS



NAVEXOS P-510

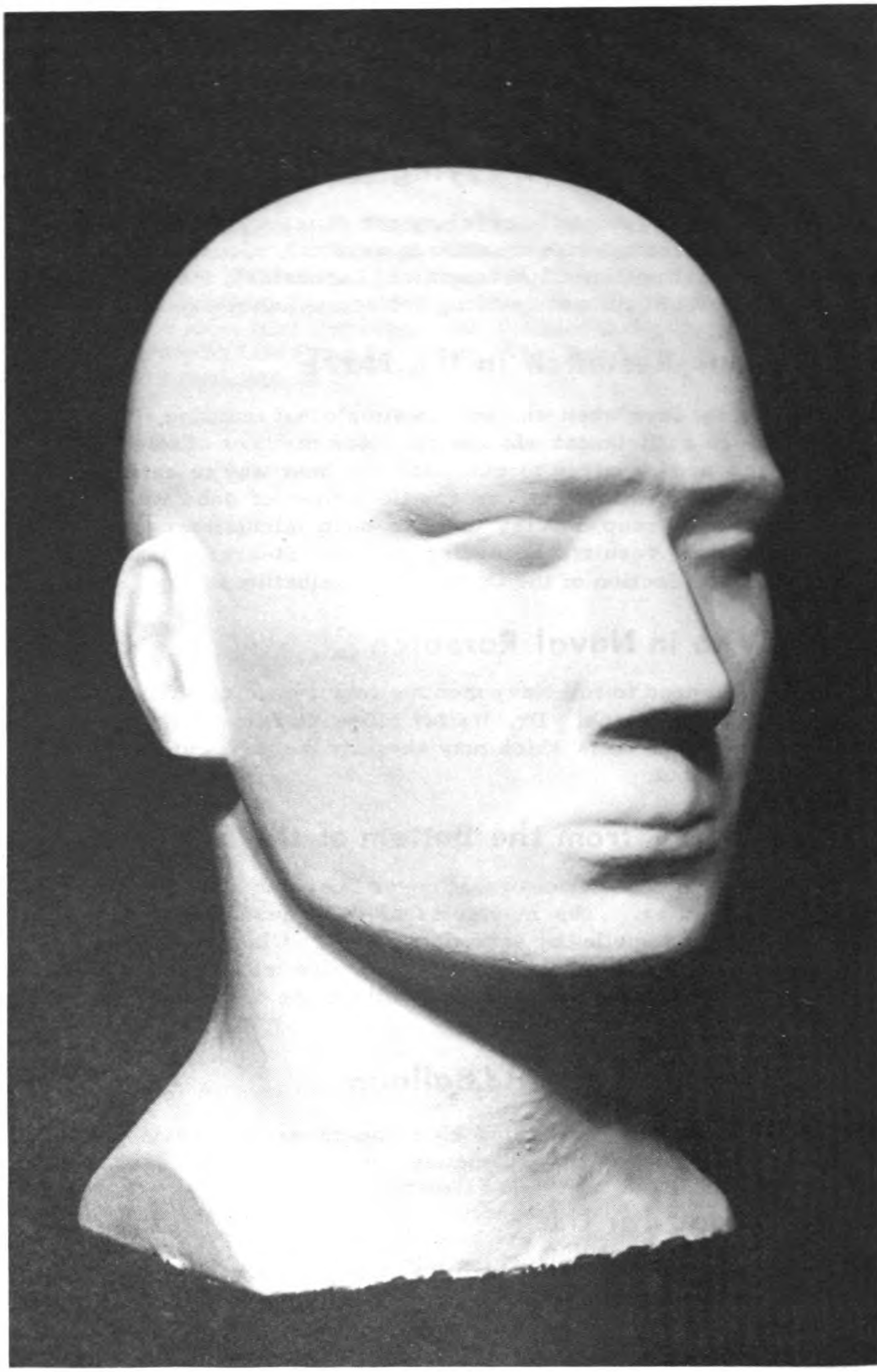
DEPARTMENT OF THE NAVY
WASHINGTON, D. C.

COVER PHOTO: Waiting expectantly as a "catch" is pulled up on the end of a tapered cable is a very unusual group of deep-sea fishermen: The crew and scientists of the Danish ship Galathea. Their objective was science, not sport. For more about what they caught and "the ones that got away" see "Dredging Life From the Bottom of the Sea," by Dr. Claude E. ZoBell, pp. 14-20.

Research Reviews endeavers to report briefly highlights of technical progress in research by Navy laboratories and contractors and the development of important naval research facilities. Articles which meet these broad criteria and possess a good degree of readability are welcomed. Manuscripts and changes of address should be sent to Code 250, Office of Naval Research, Washington, D. C.

Approved by Bureau of the Budget, 14 February 1952

In this Issue--



As big as life but not quite as natural is this plastic head, constructed by researchers at the Cornell Aeronautical Laboratory to test the effects of various forces on the human skull and brain. The dummy is made of methyl methacrylate and covered with a polyvinyl foam "skin." Inside, brains are simulated by a high-viscosity silicone oil.

Headgear for Safer Flying

A staff-written article on work conducted by the Development Division and Materials Department of the Cornell Aeronautical Laboratory.

Disaster is at hand if a man at the controls of a plane is knocked into semiconsciousness and no one is available to take over. Since this is a common situation in military craft under enemy fire, it has become essential to equip flyers with helmets that will afford them maximum protection against head injury. The Office of Naval Research and the Navy's Bureau of Aeronautics came to grips with this problem by contracting with the Cornell Aeronautical Laboratory to make a thorough study of the best helmets so far devised and to supplement these studies with others aimed at designing a head covering superior to any now in use.

There were a lot of factors to consider before any real evaluation could be made of the effectiveness of certain helmets or of the characteristics that should be built into new headgear. Unfortunately, designing an effective helmet is not nearly so simple as it sounds. Obviously it must be sturdy enough to prevent its bending under heavy blows and striking the skull through the cushioning material inside. In fact, the helmet should not even deflect readily enough to dent the padding appreciably before that material has had time to absorb and spread the shock of the impact, instead of concentrating it on one vulnerable spot. It might be simple enough to construct a helmet to meet such specifications were it not for the fact that the pilot of a modern plane must have unimpeded vision and free head movement to do his complex job well. Therefore, his headgear, though it must be sturdy, must also be comparatively light and compact. Obviously these requirements present some difficulties.

To design an effective helmet there were four things researchers needed to know:

(1) What parts of the head were particularly vulnerable and needed protection.
(2) How strong the helmet shell should be.
(3) What kind of padding (suspension) it should contain.
(4) How much force applied to a particular portion of the helmet would be cushioned by various suspension systems.

One way to get data on what constitutes an "ideal" helmet was to take a few of the common types used in football, industry and the Armed Services and find out in what ways they were satisfactory and in what ways they were deficient. Seven[1] were selected—including one football helmet and six anti-buffet and crash helmets furnished by the Bureau of Aeronautics (Figure 1). Adequate testing of these presented some

[1] Though eight helmets are shown in Figure 1, no. 6 was used only for impact tests; therefore only seven helmets were actually tested completely.

problems. Just testing the helmets alone would give some valuable data on their durability under impact, but it would not tell the investigators how well they could protect the human beings who were to wear them. And after all, it would be of little use to have the helmet remain in fine shape while the skull of the pilot wearing it was shattered. This was a definite possibility with certain types of headgear.

Naturally the researchers could not use human guinea pigs for these life-and-death experiments. So they tried an effective substitute — constructing a head form that would simulate the real thing (see frontispiece). This presented a complex problem. Skin, muscle, bone and brain all had to be imitated by synthetic materials that would offer approximately the same susceptibility to damage as the human head.

Actually physiologists felt it would not be feasible to attempt to duplicate exactly the head and brain. A reasonable facsimile was all they were aiming at. Measurements were made of head dimensions to find out how the various parts such as the cranial vault, the face, and the neck should be bonded together. Then a plastic head form was made of two shells of methyl methacrylate, which, it was felt, would meet the specifications. Unfortunately no really satisfactory method could be found to measure the consistency and stiffness of human brains, so an educated guess had to be made as to the material best suited to simulate them. The gelatinous brain fluid first used proved to be too temperature-sensitive, and a high-viscosity silicone oil was substituted which proved more satisfactory. No attempt was made to duplicate the brain's entire anatomy, but certain vital vulnerable portions were constructed. Then a rather satisfactory imitation of skin to cover the plastic headform was obtained by the use of a polyvinyl foam, after tests had been made to determine the thickness, compressibility, flaccidity and resistance of human tissue. A final touch of realism was added; since hair affords considerable protection from blows to the head, researchers felt that the headform should not be a "baldy." They were a bit puzzled, however, by the fact that aircraft pilots, like other men, vary in the amount of hair they have and some even aggravate the situation by getting crew-cuts. The scientists solved the problem rather simply by the use of various toupees.

Duplicating combat conditions was also a problem, but long experience of the Cornell Aeronautical Laboratory with aviation problems had resulted in plenty of engineering skill that came in handy to the helmet investigators. A platform and track were built to accommodate a 12-pound catapult car to which a ram was attached (Figures 2 and 3). The evaluation procedure simulated crash impacts by catapulting the ram against the sample helmet, which was mounted on a plastic headform. The headform was attached to a plastic neck which afforded it support approximately equal to that given a human head by the neck muscles. Though it was recognized that fatalities resulting from blows to the head are often caused by neck injuries, researchers on this project decided to keep the problem simple by confining their attention to the skull. This was about all the special equipment the experimenters needed. In conjunction with it, they used a battery of instruments—a barium titanate accelerometer, a pressure pick-up, four SR-4 bonded strain gages, and a drum chronograph—to measure and record the various physical properties in which they were interested.

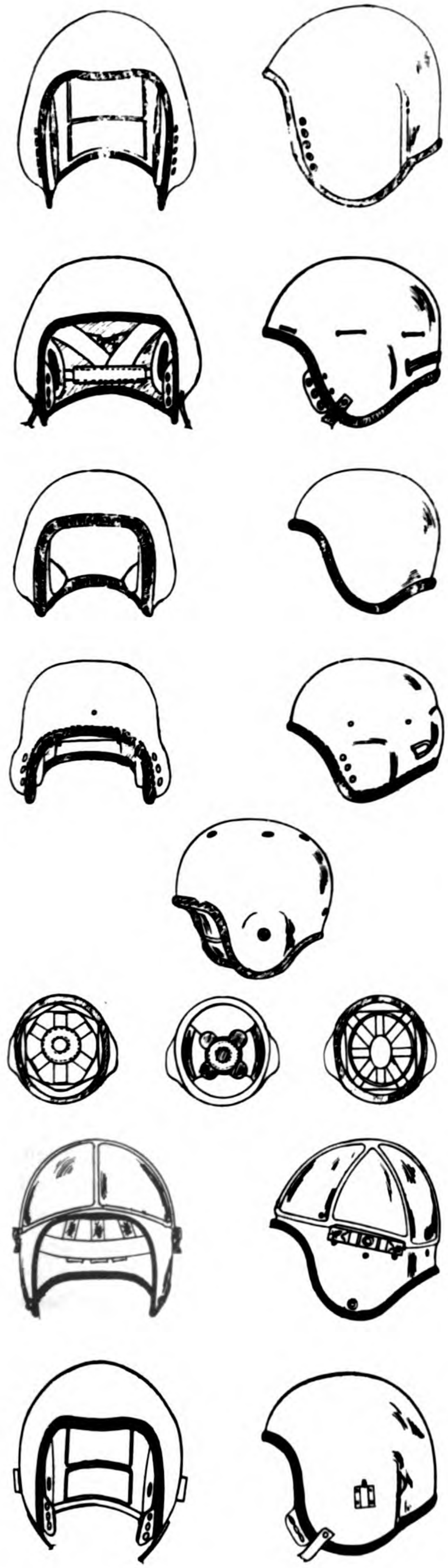


Figure 1. The test helmets.

No. 1. U.S. Navy Type H-1. Plastic-impregnated molded fiberglas flock with 8-cu-ft-density latex rubber foam pads. Trim: extruded rubber edging cemented to shell; weight: 35.5 oz.

No. 2. USAF Type P-1A. Plastic-impregnated molded cotton fabric with cotton webbing, four-strap eight-point hammock, and foam rubber padding. Trim: extruded rubber edging cemented to shell; weight: 32 oz.

No. 3. Plastic-impregnated cloth laminate with cellulose acetate foam padding. Trim: foam rubber edging covered with soft leather; weight: 33 oz.

No. 4. Plastic-impregnated cloth with double-hammock, six-strap suspension and foam rubber padding. Trim: foam rubber edging covered with leather; weight: 33.5 oz.

No. 5. One-piece molded football helmet, with various types of suspensions and paddings. Helmet at left has floating hammock with double suspension band; center helmet is free-hanging, head-fitting, with soft leather hammock; helmet at right has web hammock and double suspension band.

Nos. 6 & 7. Plastic-impregnated molded fiberglas flock, with nylon web straps attached to leather-covered sweatband and foam rubber padding. Trim: extruded rubber edging cemented to shell; weight: 25 oz.

No. 8. Modification of H-1, with a chin strap, more space in crown and three external projections. Padding and shell are similar to those in the H-1 but the helmet does not extend as far down the neck. Weight: 37 oz.

With their equipment in shape they were ready to start testing helmets. The first thing on the agenda was to find out how much of the head should be covered to give the pilot maximum protection and yet permit him to do his work effectively. Fortunately a sizable amount of research had already been done on the tolerance of the human skull and brain to various types of forces— impact, acceleration, rotation, hydrostatic pressure, etc. Studies had even been made on the kinds of injuries that produce the stages of unconsciousness common in boxers, which are expressed by the terms "out cold," "knocked out" and "out on his feet." The most vulnerable parts of the skull (the temporal regions and the brow) were well charted, as were the sensitive parts of the brain. Consequently there was little difficulty in deciding what parts of the head required protection. The real problem was to find out how much helmet was needed to do it effectively. Photography was found to be the best tool for this phase of the investigation. Pictures were taken against a grid background, first of seven bare-headed men, then of the same men wearing the various types of helmets used in the experiments (Figure 4). Area measurements were first taken of the total projected area of the unhelmeted head. Then corresponding measurements were made of the area of the head protected by the different helmets. These area measurements were then used to compute helmet coverage and the helmet utility ratios (i.e., the form-fitting property of the helmet). The studies revealed that Helmet No. 5 provided the best coverage from the front, Helmet No. 1 from the side and No. 4 from the rear. Nos. 1, 2 and 3 were the most form-fitting, although No. 1 was too narrow through the crown and later had to be modified to correct this flaw.

Next attention was turned to helmet shell stiffness. Tests were made on dry skulls, on simulated plastic headforms and on the seven test helmets by means of a hydraulic press used in conjunction with a strain gage (Figure 5). These tests revealed some rather alarming things. Though Helmets Nos. 1, 2, 7 and 8 have good stiffness up to loads of 75 lbs, all the headgear deflected too much at loads greater than this—a rather serious situation, since it is easy to visualize combat situations in which skulls and headgear would be subject to greater strains.

Aside from stiffness, there were other things researchers wanted to know about the helmets. Did they, for example, have weak spots where a piece of shrapnel might easily penetrate to embed itself in the skull beneath? Studies revealed that the helmets were uniformly strong, although they could all be penetrated by a blunt-pointed anvil at impact energies of 48 ft lb. In this connection, headgear which contained rivets for fastening in the sweatband proved most dangerous.

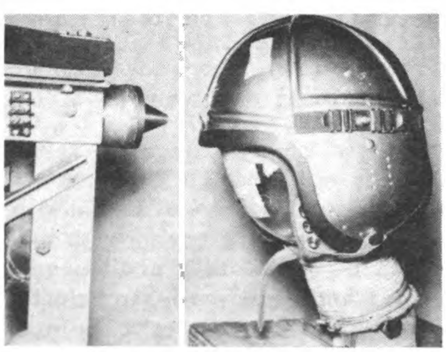


Figure 2. Close-up of head and helmet in test position.

The most comprehensive of all the tests were those which measured the performance of the helmet under impact. Blows of various intensities were delivered with both blunt-nosed and sharp-edged rams on the front and side of each helmet and measurements taken of velocity, acceleration,

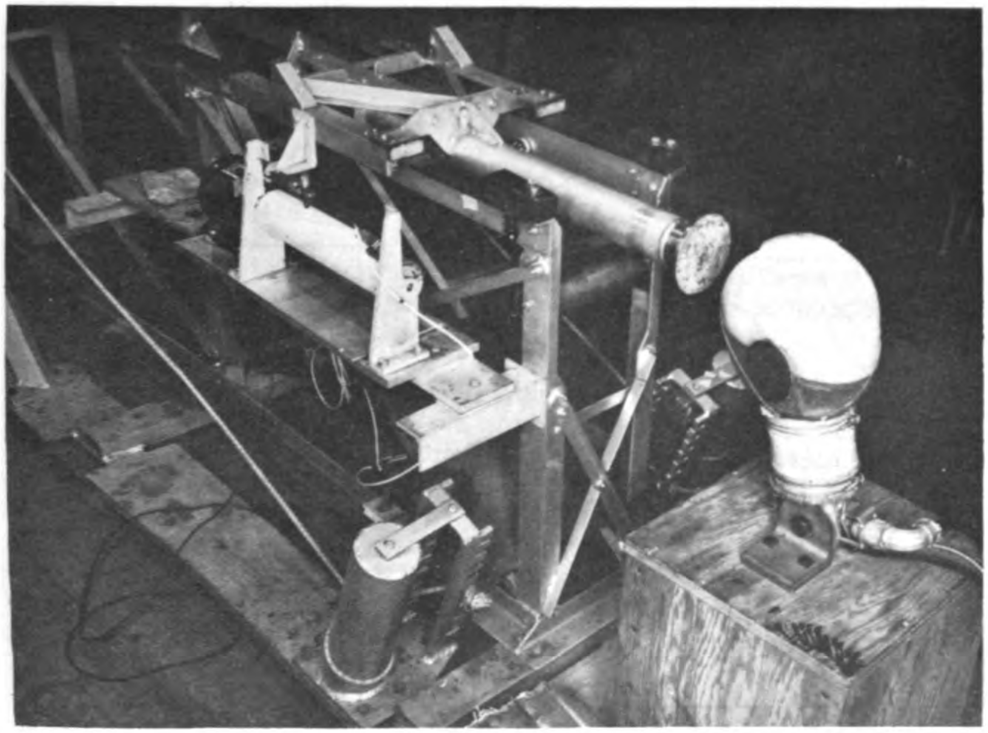


Figure 3. Head form in position for impact blow.

and relative strain. More elaborate tests were run on one helmet of the anti-buffet type to include measurements of the relative displacement of the head and helmet. One helmet (No. 7) gave low acceleration readings under impact but unfortunately the pressure readings in the brain fluid were very high. No. 2 seemed to provide better protection to the brain, though it gave higher acceleration readings.

The padding of the helmets commanded special attention in the tests. Actually there were two distinct things researchers wanted to know about the "innards" of the various headgear. They wanted to find out which materials provided the best cushioning effects and how the padding should be placed in order to afford maximum protection. When several types of padding were compressed with a hydraulic ram some

Figure 4. Comparison photographs of helmet No. 7, which were taken to show the amount of protection the headgear afforded.

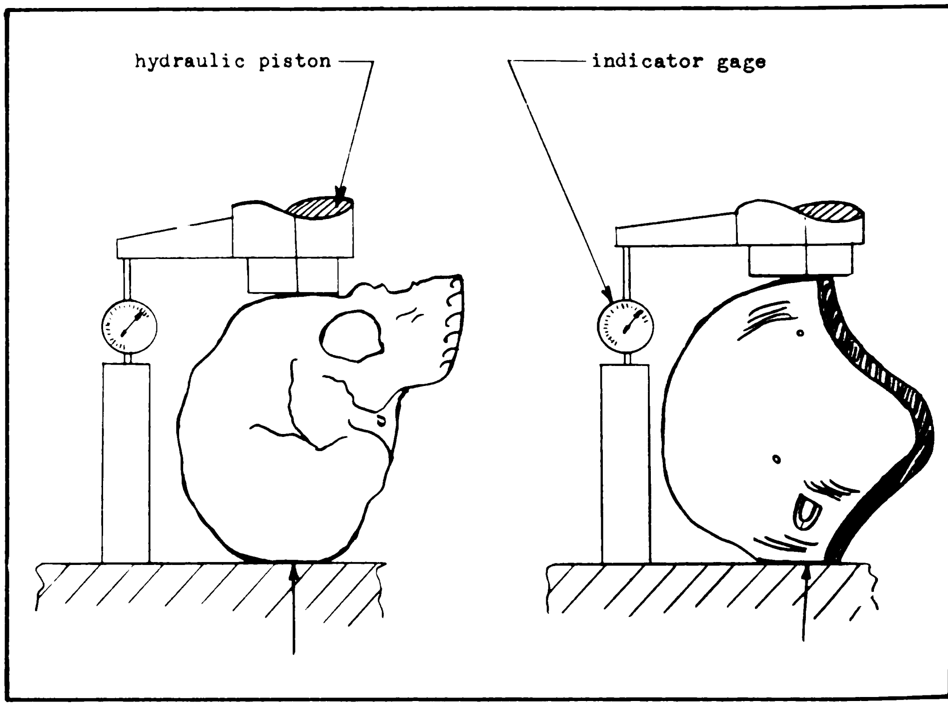


Figure 5. Method of measuring stiffness of skull and helmet.

suprising results were obtained. Foam rubber and felt, long favorite cushioning materials in a variety of applications, were found to be inferior to a trademarked plastic material called Ensolite.

The way padding was placed in a helmet was found to have a very definite effect on its efficiency. When the cushioning material was in direct contact with the head, high peak pressures resulted at the point of impact. When the padding was supported by a web suspension system, however, performance of the helmet was much better; the pressure was distributed to various parts of the skull instead of being concentrated on one spot. Unfortunately one disadvantage was attached to such a system — it caused the helmet to slip considerably under the impact. This does not seem to be a serious difficulty, however, since a chin strap could be used to anchor the helmet more firmly on the head or a suitable combination of the two padding systems could be devised. In either case, the padding should be smoothly attached to the shell, for in one helmet hard spots under ridges where the webbing was attached caused harmful load concentrations on the skull.

As the result of ONR's contract with Cornell, a comprehensive idea of the problems involved in constructing a suitable helmet was obtained. The investigators of medical phases of the problem had the benefit of consultation, when needed, with the Cornell Medical College and with the University of Buffalo Medical School. The recommendations of the investigating groups as a whole were:

(1) For proper support of the head within the hard shell of the helmet, the favorable features of the web or strap suspension

system should be combined with suitable contact padding to allow loads to be transmitted from the helmet shell to the head with a minimum of load concentration and slippage.

(2) The stiffness of the helmet shell should be increased (in a manner not to increase the weight) in order to allow the load to be transmitted to the suspension system without having the shell deflect inward to contact the head.

(3) Helmet designs should not sacrifice form fitness to allow for head size adjustment. Adequate space must be maintained between helmet shell and head.

(4) Additional protective features should be considered for the back of the neck when the head and helmet are tipped forward. The exposed neck is vulnerable to spinal damage with the helmet in this position.

(5) Helmet design should eliminate hard fittings and projections from the helmet shell for attachment of padding or webbing. The presence of these fittings causes load concentrations which, since they cannot be properly distributed thru the suspension system, result in skull damage.

Further work will be necessary to develop additional techniques of evaluation for improved helmet designs. Such techniques are expected to be more far-reaching in their scope than those used at present because of their utilization of improved instrumentation and head form developments.

NRL Has New Nuclear Physics Facilities

New facilities for research in nuclear physics, now being completed, represent the first major laboratory expansion at the Naval Research Laboratory of ONR since the end of the war. The two new buildings will provide approximately 40,000 square feet of laboratory and office space.

Scientists have already begun to move into one of the buildings, a two-story square structure of steel-reinforced concrete. This building will contain a 5-million-electron-volt Van de Graaff generator, in addition to machine shop facilities. One of the structure's interesting features is the windowless and completely air-conditioned room provided for the generator.

The second and larger of the two buildings will contain a 2-million-electron-volt Van de Graaff generator and also a 20-million-volt betatron. The generator, which is of the vertical type, will be housed in a four-story tower portion of the L-shaped structure. The betatron will be housed in one of two heavily shielded rooms with concrete walls seven feet thick and a four-and-a-half-foot ceiling. As a protection against the tremendous radiation emitted by this accelerator, its beam is directed away from the Laboratory; the nearest dwelling in the direction of the beam is seven miles away.

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Operations Research in the Navy

by

C. M. Stearns
Operations Evaluation Group

"We have come to the point where the needs of the Department of Defense bid fair to require the full time of two out of every three scientists and engineers who are engaged in research and development in this country . . . It is a matter of the gravest national import that that vast mustering of precious talent be devoted to the tasks that most need to be done and not pre-empted from other lines of endeavor for use on projects that are unnecessary or that could just as well be postponed." The speaker was Dr. W. D. Cornell, Director of the Planning Division of the Research and Development Board; the occasion was the tenth anniversary of the Navy's Operations Evaluation Group — a little-known team that has, since 1942 and under varying titles, been performing a vital function for the Navy.

Dr. Cornell had a point. To give it weight, it might be added that the Research and Development Board's descriptive listing of ONR's current projects alone is four inches thick and contains 1530 single-spaced pages. There are some 2500 research tasks tersely described, and on each of these individual tasks an average of three reports have been published during the past year. (For the Navy as a whole — including the work sponsored by the Bureaus and the research done in the Naval laboratories — there are 16 volumes that require four feet of shelf space.)

Who is going to sift; who is going to select; who is going to help the Bureau Chiefs and the Chief of Naval Operations to decide, ultimately, what is going into the ships, into the planes, or into the books of tactics? We begin to see why the Navy has its Operational Development Force (OPDEVFOR) and Operations Evaluation Group (OEG).

OPDEVFOR deals with the evaluation of weapons and weapon systems in the hardware prototype stage to determine the utility of those weapons — much as consumer research operates on household appliances. OEG, on its side, deals in theory and statistics; it uses reason and mathematical processes to reduce guesswork to logical probabilities.

A characteristic of recent large-scale wars has been their complexity. The number of alternatives which must be considered in any one decision, and the number of decisions made, at least in part, on technical grounds increased greatly in the 20th century. Recent wars have also been characterized by a great increase in mechanization.

C. M. Stearns (A. B., Harvard University) has been Head of the Publications Section of OEG for the past 18 months. Previously he did similar work at the California Institute of Technology. During the war he served as Publications Officer of the Naval Ordnance Laboratory.

Because the conflicts have lasted for several years, many changes in equipment and technique have been introduced while they were going on, and these changes have given great temporary advantages to the side introducing them. It has been important to anticipate these changes, to appreciate the new possibilities that they introduce, to detect them by close measurements of changes in the outcome of particular operations, and to devise quickly the proper equipment and tactical countermeasures.

Finally, perhaps one of the most simply expressed characteristics of recent wars has been their great wealth of incident. There have been many and repeated engagements, even though the number of large-scale engagements (clashes of whole Fleets or Armies) has remained small. When these engagements have consisted of many unit operations with sufficient elements of similarity, an understanding of them obviously can and should be obtained by established statistical methods. This is the source of much of the strength of the operations research method, and the origin of many of its successes. When an operation occurs once or twice only, the full range of possible outcomes, and how they would be affected by choices of alternatives, is never fully revealed. The opinion of the persons participating is the only available guide. It is well known, however, that even among operations having an underlying similarity, there are wide fluctuations in the possible outcomes, and that opinion based on the outcome of a single engagement may yield very misleading information as to what the most probable outcome in other similar operations should be. The statistical aspect of operations research removes these questions from the realm of opinion, and puts the answers on a solid analytical basis.

This does not mean, of course, that O. R. can predict the outcome of any single given engagement. All of these systems aim to have the player who uses them win the largest possible number of times. In many cases, however, their use will lead to the loss of a particular hand which could have been won in some other unpredictable way.

It may be worthwhile to refer here to certain arbitrarily selected examples of operations research.

The British Bay of Biscay offensive was a result of the demonstration by the Operations Research Section of Coastal Command (RAF) that a rather small amount of around-the-clock flying in a small area would expose to surface attack every German submarine leaving port. Numerous attacks resulted from surprisingly little flying, and many submarines were sunk or damaged.

Another operation, the South Atlantic air blockade, was little publicized but was nevertheless very important logistically. With a total of four long-range sorties a day of B-24 and PBM aircraft, the entire South Atlantic from South America to Africa was blockaded against disguised ships bringing tin and rubber from Japan and Malaya to ports under Germal control. In January 1944 our forces, with these four sorties a day, found all five ships that attempted to make the run. Before the establishment of the blockade the Germans had been getting more tin and rubber than we had, since many of the blockade runners had been successful. The five that were caught carried enough tin and rubber to keep the German war machine going for 18 months.

And then, in the Pacific, there was the submariner's 64-dollar question: Was it better to use radar to detect Jap planes, or was it better to leave the radar off because it seemed to be attracting Jap planes as a bare light-bulb attracts mosquitoes? The operations-research answer: "Leave your radar on; you are 'seeing' more planes because you can see farther, not because there are more planes there." (This turned out to be 100 percent correct; we later learned that the Japs weren't using any airborne equipment that could detect our radars).

Today, the purpose of the Operations Evaluation Group is "to provide the Navy with advice, based on quantitative study of whatever data may be available, on equipment, tactics, or strategy, to aid in making the executive decisions that guide the Navy's development and operation."

An example of the kind of problem currently under study by the Operations Evaluation Group is that of scheduling the activities of seaports heavily taxed by the demands of war. The mathematical technique that has been used on this problem brings to light two interesting points. First, it showed that you can run a big system closer to its capacity than you can a smaller one without danger of tie-ups— i. e., a 10-berth seaport may break down under a 6-ship-per-month load, while a 100-berth port may hold up under a 90-ship load. Second the research showed that you can predict, from the size of the seaport, and the load on it, when it will break down. Thus steps can be taken to keep things moving.

The technique used in this case has recently been applied to problems that arise in running naval battle-communications networks heavily loaded by the demands of airplane-to-ship, ship-to-ship, and intraship commands; in controlling antiaircraft batteries on ships under heavy enemy attack; in designing methods of providing air support to the ground troops in Korea; and in other diverse situations.

Another example of current operations research, drawn from Korean experience, concerns antiaircraft fire (the enemy's) and airplane fire (our own). Suppose that a pilot goes out on a mission; he gets an antiaircraft shell in one wing, regains control, and goes on; he finds a MIG-15, engages in a dogfight at an altitude of six miles and a speed of Mach .95, and (barring accidents) flies back to his base. He obviously knows little about what is likely to happen on his <u>next</u> mission, or what to do about it.

When an operations analyst considers a thousand such flights, however, and learns which antiaircraft hits do the most damage, he can help aircraft designers to build less vulnerable planes. And if the analyst learns (from film exposed in cameras mounted with the guns) at what speeds, altitudes, and angles, and with what guns fired for how long at what ranges, pilots shoot down the most MIG's, he can tell a pilot quite a lot that he would otherwise probably never live to find out.

This kind of data-analysis and logical reasoning is influencing high-level decisions regarding mine warfare vs mine countermeasures, it is helping to plan the tactical doctrine for hunter-killer teams, and it is offering solutions for many submarine and antisubmarine warfare problems (such as the potential usefulness of, and tactics best suited to, helicopters and blimps). Operations research takes up where intuition leaves off; it offers the best possible solution to problems that have become too complex for ordinary horse-sense.

In the Navy, operations research began in April 1942. That was four months after Pearl Harbor; and the big question was, "Who is going to win the Battle of the Atlantic?" A small element of the Atlantic Fleet was set up under Captain (now Admiral) W. D. Baker as an ASW (antisubmarine warfare) unit. The latter was soon reinforced by a group of scientists organized in Boston by the National Defense Research Council.

About a year later the famous Tenth Fleet was created, and given the responsibility for the war against the U-Boats in the Atlantic. The NDRC antisubmarine group was taken in as an integral part of the new Fleet and was given the name ASWORG.

As the ASW picture became less critical in 1944, the group expanded its interests into the fields of pro-submarine warfare, air warfare, and air defense (of particular concern was the defense against Kamikaze attacks). A separate group functioned in the field of mine warfare. Before the war was over, however, the operating Navy saw a need for a naval unit which could evaluate, at sea, the ideas and gadgetry spaded up by ORG and other scientific groups. Thus was organized the Anti-Submarine Development Detachment, Atlantic Fleet (ASDEVLANT).

Shortly after the end of the war, ASDEVLANT became the present OPDEVFOR (Operational Development Force); and ORG became the Operations Evaluation Group. OEG is now set up to handle research on any phase of the Navy's diversified operations.

The Massachusetts Institute of Technology is responsible for OEG, under contract with ONR. M. I. T. provides, at present, about 50 civilian scientists who stand ready to give advice to the staff of the Chief of Naval Operations or to the various field commands, such as those in Hawaii, Tokyo, and the Mediterranean. Divided into task sub-groups, these men are working full time for the Navy on one operational problem or another. The group is directed by Dr. Jacinto Steinhardt.

RADM M. E. Curts, Assistant Chief of Naval Operations for Readiness, has this to say about operations research: "Operations Research helps the Navy to do the best it can with what it has now, and to get the best to meet future needs. It did the first of these in the late war. It is doing the second today."

Combined Armed Services Symposium

The Air Force was the host at a Symposium held at Wright Field on 10 and 11 September. Representatives from the various services were on hand to discuss shock and vibration problems as related to "Air Drop in Flight and Impact Upon Landing." Leading the Navy group at the Symposium was Dr. I. Vigness of the Naval Research Laboratory.

Who's Who in Naval Research

Dr. Orr Reynolds

The welcome mat is out at ONR these days for Dr. Orr Reynolds, cheerful, energetic Head of the Biological Sciences Division, who is returning to his home office after a six-months leave of absence—a "busman's holiday," as he terms it.

Actually Dr. Reynolds was "borrowed" by the American Physiological Association to organize a rather unusual project. Under the sponsorship of the National Science Foundation, the Association is trying to find out just what is happening to the field of physiology in this age of increasing scientific specialization. As Dr. Reynolds points out, the field at one time was thought of as embracing all plant and animal biology; now it has narrowed down until it is commonly thought of as being the study of the biological functions of man; recently there has been some speculation as to whether it will eventually narrow down until it is extinct! Among the things which APA is interested in finding out is how good communication is between the various specialists who are classed as physiologists, whether scientific progress is being impeded by lack of such communication, and how enlightened the public is about studies in this field.

Being a physiologist himself, as well as a scientific administrator of wide experience, Dr. Reynolds had both the interest and experience for this job. His degree in physiology was acquired at the University of Maryland, where he worked both on his own dissertation and on problems of aviation physiology for the National Institutes of Health. A call to the Navy interrupted, and he did not actually receive his doctorate until the War was over.

During his Navy service Dr. Reynolds continued research along the same lines that he had been pursuing at the National Institutes of Health. At the Naval Air Station, Pensacola, he served as instructor in oxygen and safety equipment in the School of Aviation Medicine. More of the same followed at Quantico, Va., where he was Officer in Charge of the USMCAS Altitude Training Unit. His most interesting duty, perhaps, was at Patuxent, Md., where he was project director of the Physiology Testing Section— which involved putting human "guinea pigs" in low-pressure chambers and noting their reactions, which were almost universally unpleasant— toothache, ear discomfort, and the "bends" whicn usually afflict deep-sea divers. Dr. Reynolds himself spent some

2,000 hours in low-pressure chambers with the result that he is now extremely susceptible to bends. The studies showed that just providing high-altitude flyers with oxygen is not, as some people contended, sufficient; they must be provided with pressurized surroundings if they are to remain efficient and comfortable (and, incidentally, alive). Jet flying, of course, would have been impossible without such provisions for pilot safety.

In 1945 Dr. Reynolds entered the Aviation Branch, Research Division, of the Navy's Bureau of Medicine and Surgery where he administered research projects in aviation psychology in Navy labs. From here it was a logical step, when he returned to civilian life in 1946, to take the job of Head of ONR's Physiology Branch. In 1949 he was made Director of the Biological Sciences Division.

Part of Dr. Reynolds' success as a research administrator is to be found in his unusual concept of his job. He believes that his main task is to expedite the work of his associates, rather than to direct it. This is because he feels that creative ideas for the bio-sciences program should be evolved on the working level, instead of being handed down from above. From Dr. Reynolds' point of view this leads to the evolution of a sounder, more realistic program, better suited both to the changing needs of the Navy and to the shifting developments in the world of science.

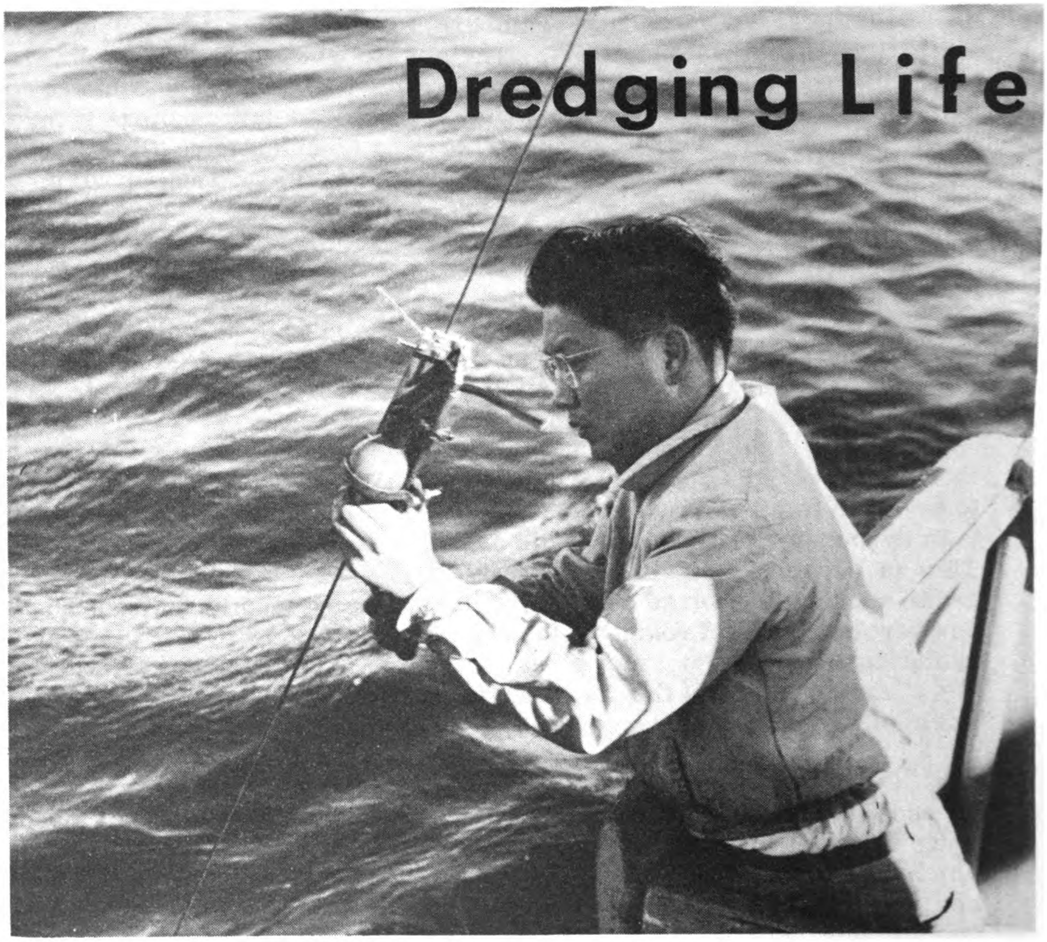
Out of the office, Dr. Reynolds' interests are anything but ordinary. He used to be a devotee of the medieval sport of falconry, but has given it up in favor of the more relaxing spare-time occupation of fishing, which he avers is the only thing he can do without hurrying. He has won considerable renown as a guitarist; in fact in his younger days his musical interests led him to form a professional band, the "Temponians" which earned him enough money by playing at dances to pay for "two cars and a honeymoon." He and Mrs. Reynolds live in Bethesda, with their six-year-old daughter.

The Changing Scene with ONR Scientists

Dr. Henry A. Imus has returned to his duties as Head of the Physiological Psychology Branch, Office of Naval Research, Washington, D. C. after completing a year's service as Scientific Liaison Officer in the field of Psychology, London Branch of ONR. While in England, Dr. Imus was elected a fellow in the Royal Society of Medicine, and a member of the Ergonomics Research and the British Psychological Societies.

The new head of the Biochemistry Branch is Mr. Leo A. Shinn, who has replaced Dr. Louis Levin. Before taking over his new assignment, Mr. Shinn was in charge of the organic chemistry program of ONR's Chemistry Branch. His background, before he came to ONR in 1947, includes service with the Division of Nutrition and Physiology, Bureau of Dairy and Industry, Department of Agriculture.

Dredging Life f



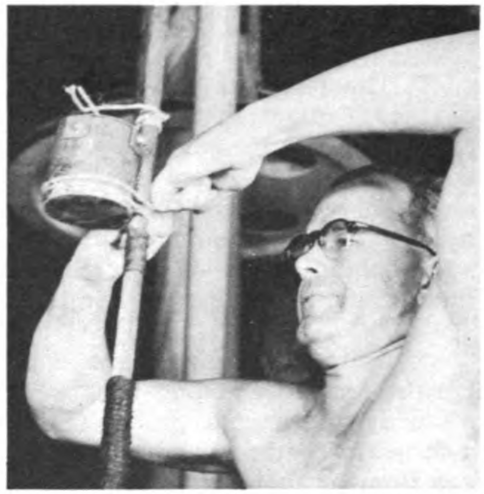
Fishing in the deepest parts of the sea calls for very special equipment. Some — like the bathysphere shown far right (opposite) — was already available. Other devices, however, had to be invented — for example, the bacteriological water sampler which Richard Y. Morita (above) is shown removing from the hydrographic wire. This device was developed by the author to be sterilized and sent to any depth to collect samples of uncontaminated water. Several can be operated in tandem by means of messengers — i.e., weights that slide down the wire to activate the opening mechanism at the desired depth. Other instruments used are shown on p. 16.

The exped

om the Bottom of the Sea

by

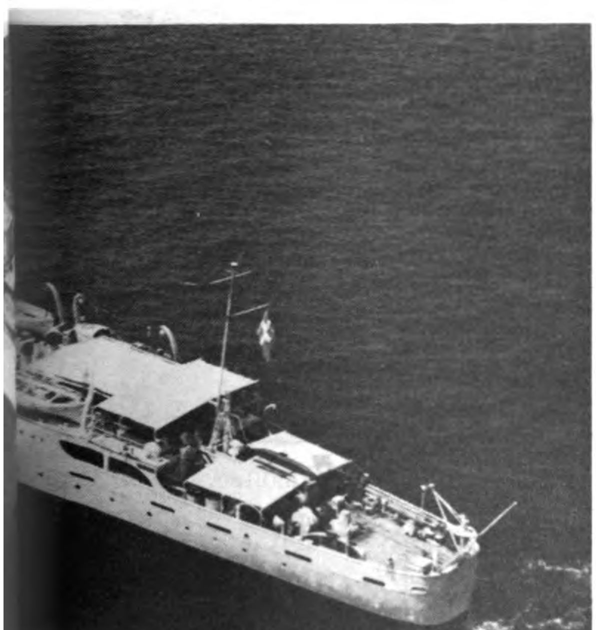
Claude E. ZoBell
Scripps Institution of Oceanography



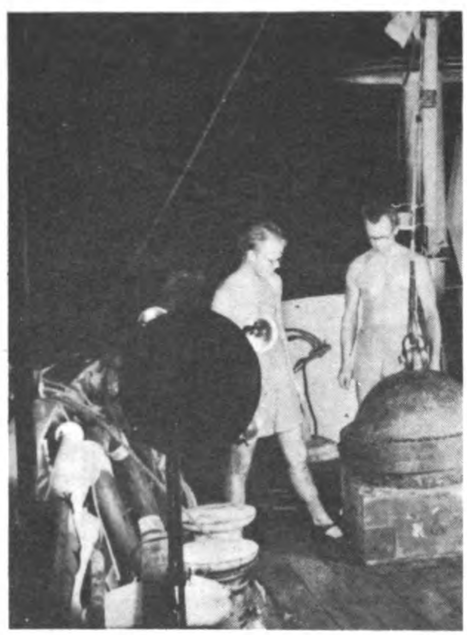
Dr. ZoBell lashes a piece of high-pressure apparatus to the cable before it is lowered.

Until recently the dark crevices of the ocean's lowest depths were assumed to be without living organisms of any kind, the possibility of such life supposedly being precluded by high hydrostatic pressure, low temperature, lack of food, and other adverse conditions. Few observations, however, had been made at depths exceeding about a mile and a fourth, although roughly half of the vast sea floor is under 2-1/2 miles or more of water. It was therefore an event of unusual scientific interest when the Galathea Deep Sea Expedition recently demonstrated for the first time that organisms occur in the lowest depths of the sea.

The Galathea is a 1630-ton Danish frigate converted for exploring the deep sea. During its 60,000-mile cruise around the world



ip, R. D. N. Galathea



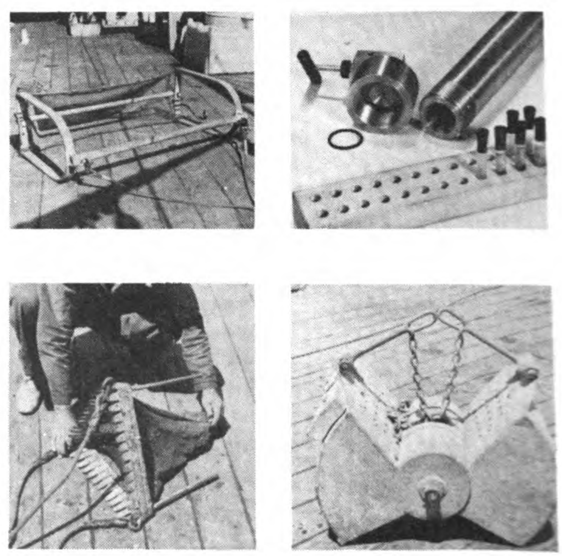
Bathysphere aboard Galathea.

in 1950-52, this 258-foot ship was manned by some 90 officers and men of the Royal Danish Navy, with about 15 scientists as supercargo. On separate phases of the expedition the Office of Naval Research was represented by Dr. Rolf L. Bolin, an ichthyologist from Stanford University, and Mr. Richard Y. Morita and Dr. Claude E. ZoBell, both microbiologists from the Scripps Institution of Oceanography.

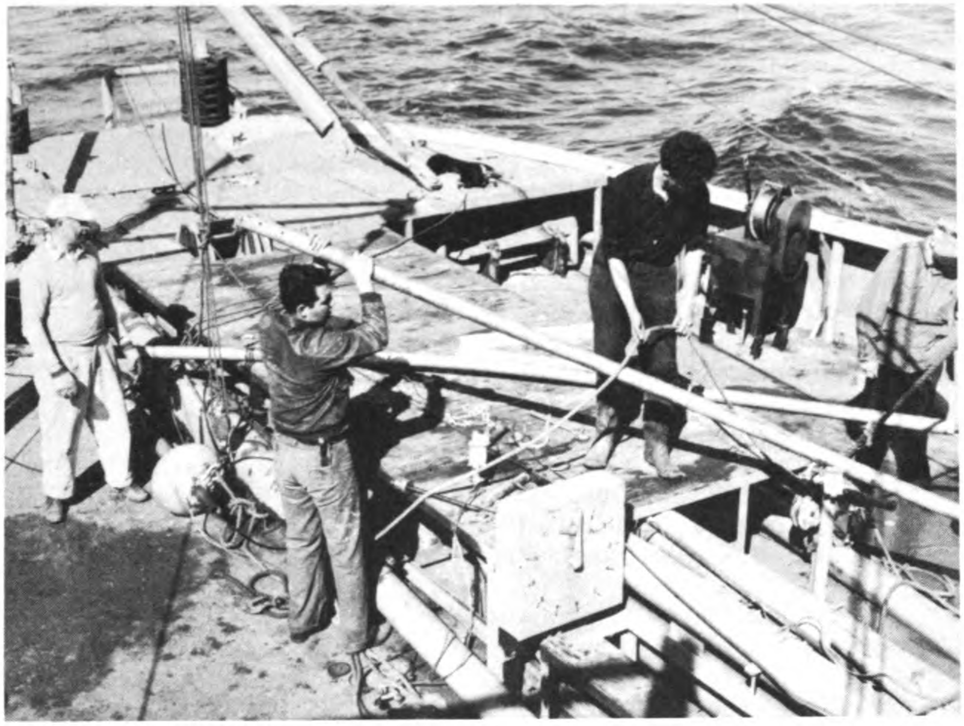
The ship was equipped with the best navigational aids, sounding devices, hydrographic apparatus, and gear for collecting oceanographic data. The step-tapered dredging cable was almost 8 miles long, its diameter ranging from nearly half an inch for the first 2 1/4 miles to about an inch for the final 5/8 of a mile. With a breaking strength of nearly 40 tons, this unique braided-wire cable, which weighed 8.7 tons when submerged in water, could have safely lifted a load of 10 tons from the deepest known depression in the sea.

Bottom samples were collected with an assortment of sledge trawls, grabs, and mud-corers. A sledge trawl consists essentially of a sturdy, rectangular, metal frame to which a baglike net or metal mesh web is attached to retain the catch. Since the trawl is towed along the sea floor at about one knot, it can be expected to catch only stationary or slowly moving creatures. For different kinds of bottoms the Galathea employed trawls having beams with a width of mouth opening of 3, 6, 10, and 20 feet respectively.

The grab consists of a pair of heavy, metal, hinged jaws held open during descent. Upon contacting the bottom a trigger-like mechanism



These instruments enabled scientists to fish up strange creatures from the bottom of the sea. At left is a three-foot beam dredge; above are the six-foot sledge trawl for catching marine organisms, and the pressure vessel in which they have to be stored; below are a bottom trawl and the Peterson grab.



Two sections of bottom corer being rigged on the Horizon (a Scripps Institution Ship). The top section of the corer rests on the deck near the feet of the author, left.

releases the jaws, permitting them to bite off as much as a cubic yard of soft bottom material.

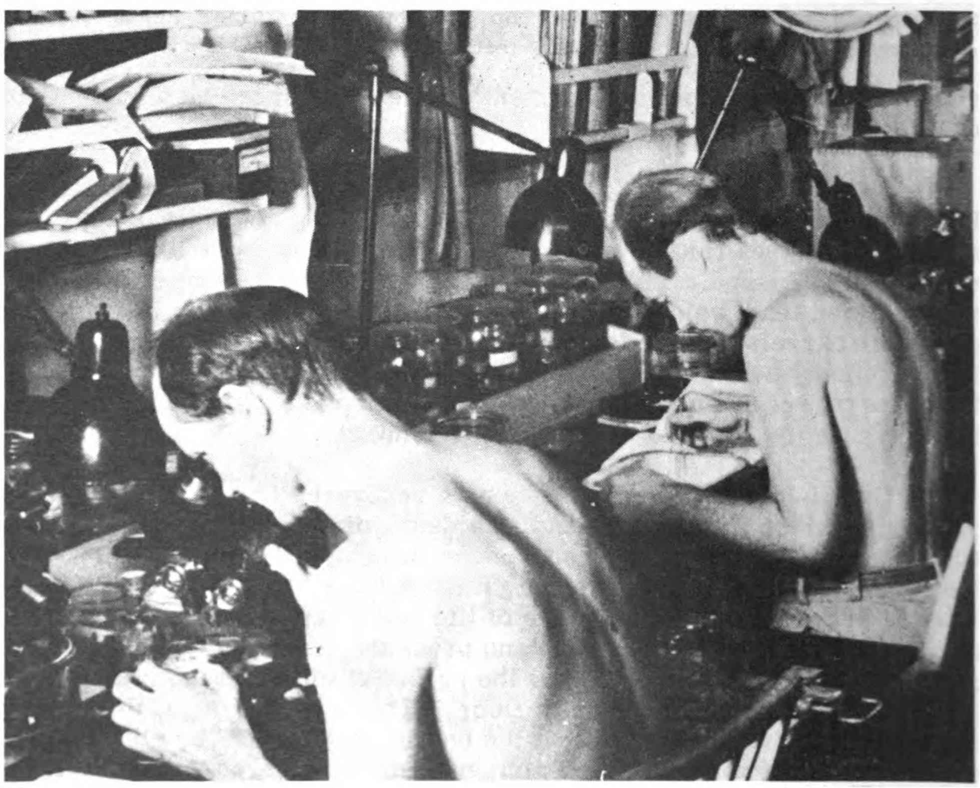
A bottom-corer is a long piece of steel pipe with a sharpened nose. Held in a vertical position with the nose pointing down, it is lowered rapidly to the sea floor, where its own weight may drive it a meter or more into the mud. Ingenious devices have been developed by which streamlined lead weights, multiple explosive charges, or hydrostatic pressure barrels provide for greater penetration. The mud core is held in the pipe by automatic one-way valves or core catchers. Ordinarily the core barrel is lined with a thin transparent plastic sleeve or cylinder to facilitate the removal of the mud core intact.

On 15 July 1951 a mud core was recovered from the Philippine Trench east of Mindanao Island at a depth of six and one-half miles. Examination with a phase-contrast microscope showed it contained large numbers of active microorganisms. An hour or two after recovery of the sample all evidence of life had disappeared from the portion kept at normal temperature and pressure, presumably because the organisms were unable to survive the sudden change in climate attending their transfer from the deep sea floor. This was not surprising, considering that the temperature at the bottom is near 3°C and the hydrostatic pressure is about 1,040 atmospheres, compared with a surface water and air temperature of 30°C and a pressure of one atmosphere.

It was not impossible, however, to keep some of the denizens of the deep alive. Shortly after being brought to the surface, portions of the sample from the sea floor were transferred aseptically to refrigerated stainless-steel vessels in which the specimens were subjected to the pressure of the ocean bottom. Under these conditions the microorganisms not only remained alive but specimens planted in appropriate nutrient media reproduced and exhibited evidence of biochemical activities. By the use of a method familiar to microbiologists (the minimum dilution method) we demonstrated that the deep sea sediment from the mud-water interface contained from thousands to millions of living bacteria per gram. Probably many more failed to reproduce in the nutrient medium or perished in transit from the sea floor to the refrigerated pressure vessels.

These observations on the occurrence of living bacteria were duplicated on other samples from the Philippine Trench. Barophilic bacteria, whose well-being requires high pressure, were also found in abundance in bottom deposits collected from the Soenda Deep off the southwest coast of Java, the Weber Deep in the Banda Sea, the Solomon Deep near the Solomon Islands, and from the Kermadec-Tonga Trough north of New Zealand, at depths ranging from four and one-half to six miles.

Barophilic bacteria from the deep sea differ in many respects from organisms found in soil, sewage, or shallow marine bottoms. Learning how their protoplasm, enzymes, and physiology differ from surface-dwelling organisms, which are ordinarily damaged by high



Some of the Danish scientists aboard worked twelve hours a day examining deep-sea specimens.

Dr. ZoBell, back in his dry-land lab, investigates the behavior of enzymes at different hydrostatic pressures.

pressure, may contribute to our understanding of the fundamental processes of life. In any case knowledge of the barophilic organisms is essential to an understanding of life at great sea depths.

Besides bacteria, representatives of 25 different families of animals from depths exceeding four and one-half miles were identified by the Danish zoologists on the Galathea Expedition. The bottom fauna from depths exceeding six miles included many animals belonging to the same biological classifications as anemones, water polyps, clams, sand fleas and lobsters (i.e., 27 varieties of actinians, more than a hundred holothurians, five kinds of bivalves, three amphipods, five worms, and two crustaceans). Although the animals were dead and distorted when they reached the surface, their normal habitat unquestionably is the deep sea floor where pressures of the order of 1,000 atmospheres prevail.

One may wonder about the source of food for animals living far below the zone of green vegetation. Discovery of fragments of cellulose and lignin from surface-dwelling organisms shows that a small quantity of organic matter from the higher regions reaches the deep sea floor. This meagre supply may be supplemented by bacteria, which are known to serve as a source of food for many marine creatures. This idea gains credence from the fact that most of the animals found on the deep sea floor were types adapted to feed on small particles. The gut of some, in fact, was gorged with microorganisms.

The next question which naturally arises is: How do deep sea bacteria obtain their food and energy? They get it primarily from dissolved and colloidal organic matter which is continually supplied by the movement of water masses in most ocean basins. Bacteria also assimilate organic wastes, including animal excreta, converting an average of from 30 to 40 per cent of its carbon content into nutritious cell substance. Autotrophic bacteria that fix carbon dioxide while oxidizing ammonia, nitrite, elementary hydrogen, or other inorganic substances as a source of energy may also contribute to the food cycles in the deep sea.

Although the Galathea Expedition and related research has established the existence of life at great oceanic depths, the "biggest fish" probably got away. Any large agile animals that might live on the deep sea floor could escape our rather cumbersome collecting devices which had to be manipulated through miles of water from a ship on a storm-tossed sea. Even the barophilic bacteria that were captured alive probably represent the hardiest varieties rather than those typical of the abyss, for the others probably expired in transit. Only by perfected procedures and extensive effort will we learn more about the mysteries of life in the last great unexplored frontier that encompasses approximately one-third of the earth's surface.

* * *

Claude E. ZoBell (B.S. and M.S., Utah State Agricultural College, Ph.D., University of California) is a Professor of Marine Microbiology at Scripps. His publications include a textbook ("Marine Microbiology") and more than 150 technical articles on bacteria in the sea. His research program has been supported in part by grants from the Rockefeller Foundation, the American Petroleum Institute, and the Office of Naval Research.

How to Get Rid of Radioactive Waste

It is always encouraging when fundamental research—which is sometimes difficult for the Navy to justify financially—comes up with immediately usable information. The California Academy of Sciences, while engaged in an oceanographic survey supported by ONR, discovered that not far off the coast of California the ocean bottom has wide areas of thick, gooey, mud. Inasmuch as the depth there is around 3000 feet, that doesn't seem to be very important intelligence—except as basic knowledge. On the contrary, it has solved a very practical problem: What to do with the considerable quantities of radioactive waste accumulated from various developmental projects. The waste can be loaded into steel drums, carried to the muddy-bottom areas, and there dropped overboard. The drums will sink into the mud long before they disintegrate, and the mud will absorb the dangerous radiation. This will avoid contaminating huge volumes of sea water (and the finny inhabitants thereof), which would happen if the drums disintegrated on a hard-sand or rocky bottom.

World's Largest Plastic Balloon

Giant skyhook partially inflated.

In the early hours of dawn on September 3, 1952, at New Brighton, Minn., preparations for the launching of the "Giant Skyhook" had been completed. This giant balloon made of polyethylene plastic 0.001 inch thick was to be the scientist's answer to "getting up high enough" and "staying there long enough" to study the primary cosmic rays of very high energy. While the balloon was being inflated, shifting winds caused excessive handling of the fragile material and holes appeared approximately 30 feet from the apex of the balloon. It was decided to launch the balloon in order to observe the feasibility of the experimental launching technique, but the valuable scientific instruments were detached prior to take-off.

The Skyhook balloon—178 feet in diameter and 3,000,000 cubic feet in volume—was made by General Mills, Inc., for the Office of Naval Research. It was designed to float at an altitude of 120,000 feet, staying there for at least 10 hours of its 24-hour flight, carrying a 250-pound gondola of scientific instrumentation for the Naval Research Laboratory, and special photographic plates for NRL and private institutions. The balloon provided the logical answer to the type of studies desired by ONR. The cosmic-ray particles in question can be detected by instruments very infrequently, perhaps only once in 12 hours, and are free from secondary radiation only above 110,000 feet. Hence, the balloon is the only vehicle capable of the required altitude and duration.

Although the perforations in the giant balloon prevented the ascent of the instruments, the launching itself was successful and provided needed experience in handling a plastic balloon approximately four times as large as any previous Skyhook.

Better Binocular Use

A staff-written article on work by
Dr. Walter Miles, Yale University

The use of binoculars has long been standard military practice. The Navy, in particular, relies heavily on the efficiency of its personnel in employing them on watch. To increase this efficiency or to find out more about an observer's reactions as he uses binoculars, the Office of Naval Research sponsored a study which was conducted by well-qualified specialists at Yale University.

The two more common means of using binoculars became the starting point for obtaining the basic information sought. One of the methods was called "discontinuous" and for convenience was designated by the letter "N" as data were accumulated. The other method, "continuous", was given the letter "B" as a symbol. The "discontinuous" method is the one ordinarily used by an observer as he brings the glasses to his eyes after locating an object he wishes to examine more carefully. The continuous use of binoculars is standard Navy practice when a methodical search is being made; men on watch scan the surface of the sea for long periods without removing the binoculars from their eyes.

To carry out the tests, the Yale supervisors of the project selected two groups of young men in good health. One group, experienced in using binoculars, was brought in from the U. S. Submarine Base in New London, Conn., through the cooperation of Capt. T. L. Willmon, Officer-in-Charge, Medical Research Laboratory. These men, who were from submarine crews, had all been on lookout duty. The second group, designated as "untrained", was selected locally in New Haven to parallel as closely as possible the ages and educational ranges of the Navy subjects.

The operating locale of the tests was the roof of a building on the Yale University campus. Fanning out from this location were five field stations, easily distinguished from each other, and from the general background (Figure 1). The distances of the field stations from the observation point ranged from 589 to 3,860 yards. As the target for the binoculars, each station had a white square, easily visible to the naked eye, that stood full-face to the observers. The testing procedure was keyed to two positions of black symbols exhibited in the center of the squares: A pair of black horizontal bars and a pair of black vertical bars. A condition of the test was for each observer to start from a pre-fixation position. That is, the gage was first fastened to the top of a tall stone tower near the middle of the range before being shifted to the target; the five targets fanned out on either side of the pre-fixation position to make the maximum lateral angle 36 degrees. Thus the observers would not be required to scan an area wider than that directly in front of them.

The purpose of the tests that were made at Yale was to compare the N and B methods in terms of the following: (1) how accurately the

Figure 1A (above). The five target stations, photographed on a hazy day. Pre-fixation point on tallest building, the Harkness Tower, is indicated by a cross with a dot above it. A large elm tree was removed from a position which obscured Station 3; unfortunately the Taft Hotel, which looms too close to Station 5 could not be similarly transplanted.

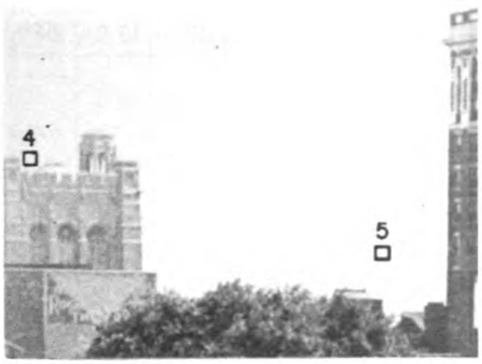


Figure 1B (left). Stations 4 and 5 in greater detail.

subjects identified symbols (either vertical or horizontal bars) displayed at the five field stations; and (2) the time it took in each case to get a response. It was the simplest of identifications, as the observer said merely "up" or "down" to tell the test supervisor what he thought he saw; he was not confronted with complex identifications and it was not expected that he would get 100 percent accuracy on all sizes of symbols shown to him.

While the primary test was always a simple identification, the material presented varied in difficulty in two directions. One was concerned with the influence of changes in size; another was concerned with the results that might be obtained if the degree of contrast of the dark symbols on the white target was varied. Arbitrarily, six different variations in size, and six different variations in contrast were chosen to bring out more information on the use of binoculars. A typical target is shown in Figure 2.

The subjects were brought individually to the roof-top observation point, where the nature of the task was explained and they were shown the type of target that would be presented. The five target stations and the pre-fixation position were pointed out. Preliminary adjustments of the 7X50 binoculars were made, and each subject was instructed on using the two methods, "N" and "B," in carrying out the tests. Several

Table I--Time Required For Recognition at the Five Stations

	Time on target			Time locating target			Total time of trial			% of total time "on target"		
Stations	N	B	N-B	N	B	N-B	N	B	N-B	N	B	N-B
23 trained subjects												
1	2.44	2.41	.03	2.53	2.49	.04	4.97	4.90	.07	49.1	49.1	0
2	2.50	2.23	.27	2.83	2.28	.55	5.33	4.51	.82	46.8	43.7	3.1
3	2.46	2.00	.46	2.93	2.70	.23	5.39	4.71	.68	45.6	42.5	3.1
4	2.60	2.53	.07	2.33	2.26	.07	4.93	4.80	.13	52.7	52.6	.1
5	2.52	2.50	.02	2.56	2.80	.24	5.09	5.31	.22	49.6	47.0	2.6
Average for all responses	2.50	2.33	.17	2.64	2.51	.13	5.14	4.85	.29			
Average for correct responses	2.48	2.32	.16	2.48	2.39	.09	4.96	4.71	.25			
Average for wrong responses	2.54	2.38	.16	3.16	2.90	.26	5.69	5.30	.39			
23 untrained subjects												
1	2.68	2.60	.08	2.94	2.92	.02	5.62	5.53	.09	47.7	47.0	.7
2	2.68	2.20	.48	3.16	2.79	.37	5.84	4.99	.85	45.8	44.2	1.6
3	2.78	2.09	.69	3.41	3.22	.19	6.19	5.31	.88	45.0	39.4	5.6
4	2.80	2.77	.03	2.97	3.01	.04	5.77	5.78	.01	48.5	48.0	.5
5	2.79	2.59	.20	3.28	3.23	.05	6.07	5.83	.24	46.0	44.4	1.6
Average for all responses	2.75	2.45	.30	3.15	3.04	.11	5.90	5.49	.41			
Average for right responses	2.75	2.47	.28	2.90	2.81	.09	5.65	5.28	.37			
Average for wrong responses	2.78	2.47	.31	3.70	3.59	.11	6.48	6.04	.44			

minutes of practice were allowed before the observers were started on the formal tests. A timer was used to record quickness of response, and after each subject was tested his results were checked against the target tender's schedule for that same target. The subjects making the tests were all urged not to guess, but to strive to be accurate. In the case of a quick identification, they were not complimented. During the course of the test, the observer was not informed of his accuracy; in fact the examiner did not know how many errors had been made until completion of the day's testing.

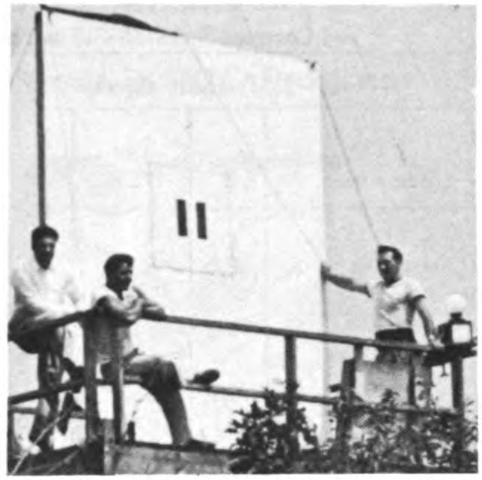


Figure 2. Close-up of a target used to test methods of using binoculars.

Twelve targets, six in the size series and six in the contrast series, were used at each station. Each subject was given 115 trials in identifying the symbols. Each group of 23 made a total of 2645 trials — 5290 in all. There were a few cases when mishaps nullified a trial, and several responses were indeterminate and, consequently, were counted as half errors.

In a run of 1,319 tests by the Navy group on the "B" method of using binoculars 65.7 percent of the responses were correct. In the case of the "N" method, 67.0 percent of the answers were correct. The 1,299 tests of the "untrained" group resulted in 61.4 percent accurate responses when the "B" method was used and 61.7 percent when the "N" method was used.

It took both the Navy men and the "untrained" people longer, however, to give responses when the size of the target was varied than when the degree of contrast was changed; moreover, accuracy by the "B" method was 7 to 13 percent better in the contrast series and accuracy by the "N" method was 6 to 9 percent better. Comparison of the two methods of using binoculars in terms of the response times is shown in Table I.

The two methods of using binoculars may be further compared in terms of group target-thresholds achieved in the test. Results from all five stations are shown in Table II. An extra-large target designated as "A" proved to be well above the average threshold of detection for both the Navy men and the "untrained" group. There was no significant difference in the percentage of accuracy which resulted from method "B" or method "N" in using binoculars. This indicates that the more readily visible the target objects are, the less it matters what method of using binoculars is employed.

A second target in the size series, designated "B" brought out a latent advantage held by the trained Navy men in using the "N" method; their accuracy was 81.6 compared to 71.9 for the untrained group. With

Table II - Percentage of Correct Responses on Targets in Size Series (A - F) and Contrast Series (6 - 1) on Five Observation Stations Combined

		23 Trained Subjects				23 Untrained Subjects			
Size series		B	Top B 2/3	N	Top N 2/3	B	Top B 2/3	N	Top N 2/3
(Largest)	A	92.6	97.4	91.8	95.2	82.2	95.5	83.0	94.2
	B	75.5	81.3	81.6	88.6	76.7	86.6	71.9	79.5
	C	78.6	82.9	67.0	80.8	60.5	69.7	68.4	78.2
	D	48.8	52.6	63.9	70.6	45.1	52.3	52.1	55.4
	E	40.7	34.4	44.7	43.8	46.1	50.0	47.6	48.8
(Smallest)	F	41.5	39.1	39.7	41.8	46.9	47.4	37.3	39.8
Contrast series									
(Greatest Contrast)	6	81.0	89.5	73.9	82.1	75.8	82.7	71.4	82.0
(Targets 6 to 1 inclusive,	5	79.7	87.2	76.4	91.0	76.2	83.7	67.6	77.0
all B size)	4	78.6	82.7	78.8	89.0	61.9	71.2	72.4	78.7
	3	75.0	77.6	68.4	81.8	64.8	74.7	69.9	73.3
	2	61.7	73.4	63.1	66.3	54.4	59.1	58.0	62.5
(Least Contrast)	1	57.2	55.2	58.6	58.3	51.9	56.7	56.7	58.1

target "C", the accuracy of both groups was reduced as detection became more difficult; the Navy men now were slightly less proficient in using the "N" method than the untrained group (67.0 to 68.4) but were far superior (78.6 accuracy compared to 60.5) in use of the "B" method.

The data collected support the conclusion that the continuous and discontinuous methods of using binoculars do not bring the same results either in speed or in accuracy. When the observers used binoculars only after having located the target with the naked eye, the over-all elapsed time was greater, but the identification accuracy was better. Choice between the two methods in a practical situation would seem to rest on the relative importance of speed versus threshold detection.

In the free and easy atmosphere of "no danger" under which the tests were run, 12 of the 23 Navy men expressed a preference for the "N" method, 9 preferred the "B" method, and two had no preference. Among the "untrained" subjects 7 voted for "N", 13 for "B", and three had no preference. It seems that the men who have had less practice in the use of binoculars tend to prefer keeping them at their eyes rather than making the numerous ocular adjustments required by the "N" method.

On the Naval Research Reserve

VNRRU Members Participate in ROC Program

The VNRRU members who participated in the ROC program this year are (first row, left to right): LCDR Orlando C. Kreider, Unit 9-5, Ames, Iowa; LCDR John A. Snoody, Unit 12-1, San Francisco, Calif.; LCDR N. M. McClung, Unit 9-20, Lawrence, Kansas; LT James E. Land, Unit 6-2, Auburn, Ala; (second row, left to right): CDR John O. Chellevold, Unit 9-19, Iowa City, Iowa; LCDR James L. Hildebrand, Unit 13-1, Seattle, Wash.; LCDR Lee D. McChesney, Unit 6-2, Auburn, Ala.; LT P. C. Magnusson, Unit 13-5, Corvallis, Ore.

Eight Research Reserve officers have been able to contribute their specialist knowledge to an unusual Navy training program, conducted during the past summer in a school at the U. S. Naval Station, Long Beach, Calif. They served as instructors in the Reserve Officer Candidate Program, a phase of the Navy's preparedness policy of having trained commissioned officers available immediately when a national emergency arises. The school, which customarily has two six-week sessions, gives college undergraduates who are enlisted members of an organized naval reserve unit, intensive courses in the fields of naval orientation, navigation, naval weapons, and military drill. Upon completion of their ROC course (which takes two summers) and receipt of their degrees, the candidates are given reserve commissions as ensigns.

The school is staffed by 200 administrators and instructors, most of whom, like the VNRR members pictured, are reserve officers recalled to active duty. The roster of the school reads like a "Who's Who" in education, since the instructors include superintendents of schools, deans, and academic coordinators.

RADM W.K. Phillips Praises
VNRRU 6-6's Seminar Efforts

High praise for VNRRU 6-6's part in the recent successful psychological warfare seminar has been voiced by RADM W. K. Phillips, Assistant Chief of Naval Operations, in a letter to LCDR R. F. Schenkkan, Commanding Officer of the unit. The Admiral's letter read, in part:

"I would like to take this opportunity to express my appreciation for the excellent work that you and your Unit have done in making possible the First Naval Reserve Psychological Warfare Seminar.

"Today as never before there is an urgent need to keep abreast of the latest scientific developments in weapons and defenses, both physical and psychological. The importance of attack and defense against attack upon the mind must certainly be given proper emphasis.

"The efforts of VNRRU 6-6 are a definite contribution to the Naval Reserve Training Program and reflect the enthusiasm and 'know-how' that has made the Naval Reserve Program the success that it is today. The continued success of this program will be contingent upon the interest and resourcefulness of the Reserve officer. I am sure that the Navy can continue to depend on its Reservists whenever the situation requires their services."

Date for Changes in Reserve Act

The following letter will be of interest to Research Reservists:

From: Chief of Naval Personnel
To: Commandants, ALL Naval Districts
Commandant, Potomac River Naval Command
Chief of Naval Air Reserve Training

Subj: Armed Forces Reserve Act of 1952 (Public Law 476, 82nd Congress), action required under

1. Subject law was signed by the President on 9 July 1952. It will have the effect of changing some of the organizational concepts and terms presently being employed in the Naval Reserve. This letter is to advise that the effective date for most of the provisions of this law is 1 January 1953. The necessary changes are presently being studied and timely notice will be forwarded outlining any required action. Efforts are presently being made to rewrite Part H of BuPers Manual incorporating all of the changes under this act and have it issued shortly after 1 January 1953.

/s/ T. BURROWES

Assistant Chief for Naval Reserve

Unique West Coast Seminar Held

Reservists who attended West Coast Seminar.

Getting a comprehensive, first-hand impression of the Navy's sprawling West Coast research and military activities in two weeks sounds like a tall order— yet, thanks to skillful organization and planning, that is just what 80 research reservists managed to do last month. The officers took part in a unique "caravan" seminar, held under the auspices of ONR and the Twelfth Naval District. "Research and the Navy" was the theme of the seminar activities, which included the customary program of lectures by top Naval authorities, supplemented by a new feature— flying visits to numerous naval installations and research activities in the San Francisco area.

During the first portion of the schedule RADM J. L. Hall, Jr., Commander Western Sea Frontier, spoke to the reservists on the potential value of the Research Reserve, after an introduction by RADM B. J. Rodgers, Commandant Twelfth Naval District. Other high points of the seminar included talks by CAPT C. G. Grimes, Deputy and Assistant Chief of Naval Research, who discussed the ONR set-up, and CAPT Albert B. Cook, Director Military Personnel Division, ONR. Other speakers who had topics of special interest to the reservists included: RADM C. L. C. Atkeson, Jr., Commander Destroyer Flotilla One and Representative of Commander-in-Chief Pacific Fleet, who discussed "Pacific Operations" and RADM E. C. Ewen, Commander, Fleet Air Alameda, Representative of Commander Aircraft Pacific Fleet, whose topic was "Naval Air in the Korean War."

The "caravan" aspect of the seminar, which made it unique in VNRR annals, consisted of flying trips to such naval and research activities as Ames Laboratory at Moffet Field, the Stanford Research Institute, the Naval Biological Laboratory at the Oakland Naval Supply Center, and the U. S. Naval Radiological Defense Laboratory.

VNRRU 12-1, commanded by CDR Ralph A. Jack, shared the credit for the success of the Seminar with personnel of the Twelfth Naval District.

Nuclear Science Seminar Scheduled

Nuclear reactors will be the theme of the Fourth Annual Nuclear Science Seminar, scheduled to start November 30 at Oak Ridge, Tenn.

Quarters have been obtained to house over 50 trainees. Applications will be accepted up to November 1.

Scientific Security in the United States

The following excerpt is taken from an article, "Military Security in An Atomic Age", by CAPT Leonard B. Loeb, USNR (Ret.), published recently in BuOrd's Naval Reserve Information Bulletin. It should be of interest to research reservists.

"For the protection of security items on a national basis, there exist two general philosophies on the maintenance of security. First is the absolute totalitarian maintenance of security, involving the exclusion of other nationals and restricted intercourse of one's own nationals with other people's. This might be termed the "iron curtain" policy. It was practiced in increasing measure by the German Nazi regime... It is in some measures utilized by all countries at war. This scheme is exceedingly effective for relative short-term periods. Over the years it dooms its users to ultimate failure, especially in the technological domains. Advance is possible only on the free exchange of ideas. Long confinement leads to intellectual inbreeding and lack of growth. It breeds chauvinism, over-confidence, and self-delusion. It is, furthermore, completely repugnant to free peoples.

"The other philosophy is that of a planned and reasonable set of security measures within a free state. The effectiveness of this approach is influenced by several factors. It is much more difficult to develop. It is never entirely secure. It depends on constant analysis of information, classification, and declassification. It depends on patriotic cooperation of individuals and the press. It depends on constant vigilance— not only to apprehend the unreliable but also to condition free peoples to security-mindedness. It is particularly subject to compromise by careless, inadvertent, and apparently irrelevant disclosure to intelligent and capable enemy agents. These persons, having a clearly defined objective, can piece together information easily obtained from many individuals in a community where movement and speech are unrestricted. On the other hand, it permits healthy growth by stimulating the exchange of ideas so vital to development. It prevents the development. It prevents the development of public delusion by practiced governmental deceit so dangerous to national welfare and to a prolonged sound popular morale. It is in keeping with democratic ideals and principles, even though in war there must be restrictions. It is also probable that the damage done by what leakages occur is relatively slight, and probably much less than that due to the ultimate complete inefficiency of the "iron curtain" or to the damage done by over classification and overlong maintenance in a classification."

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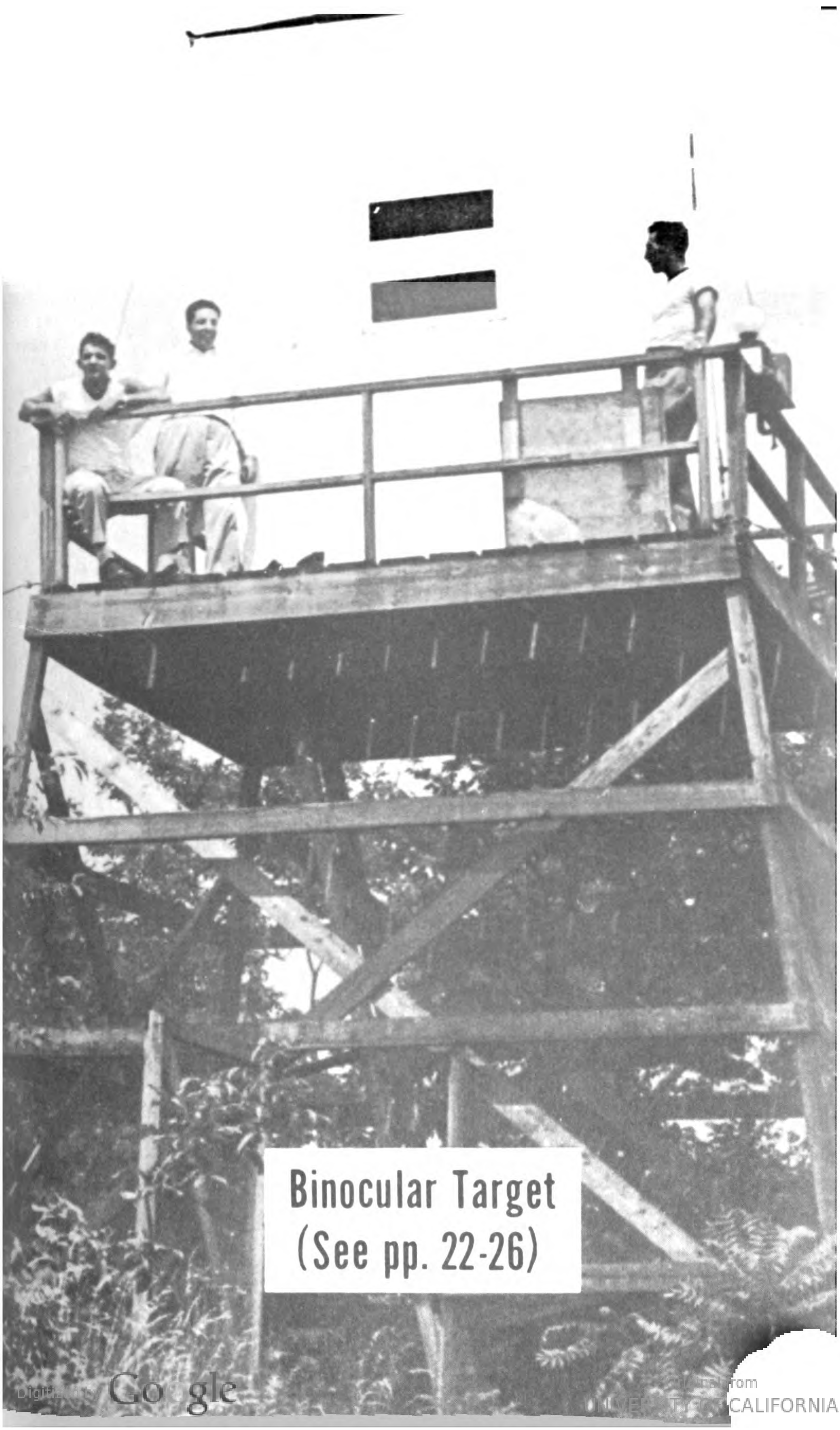
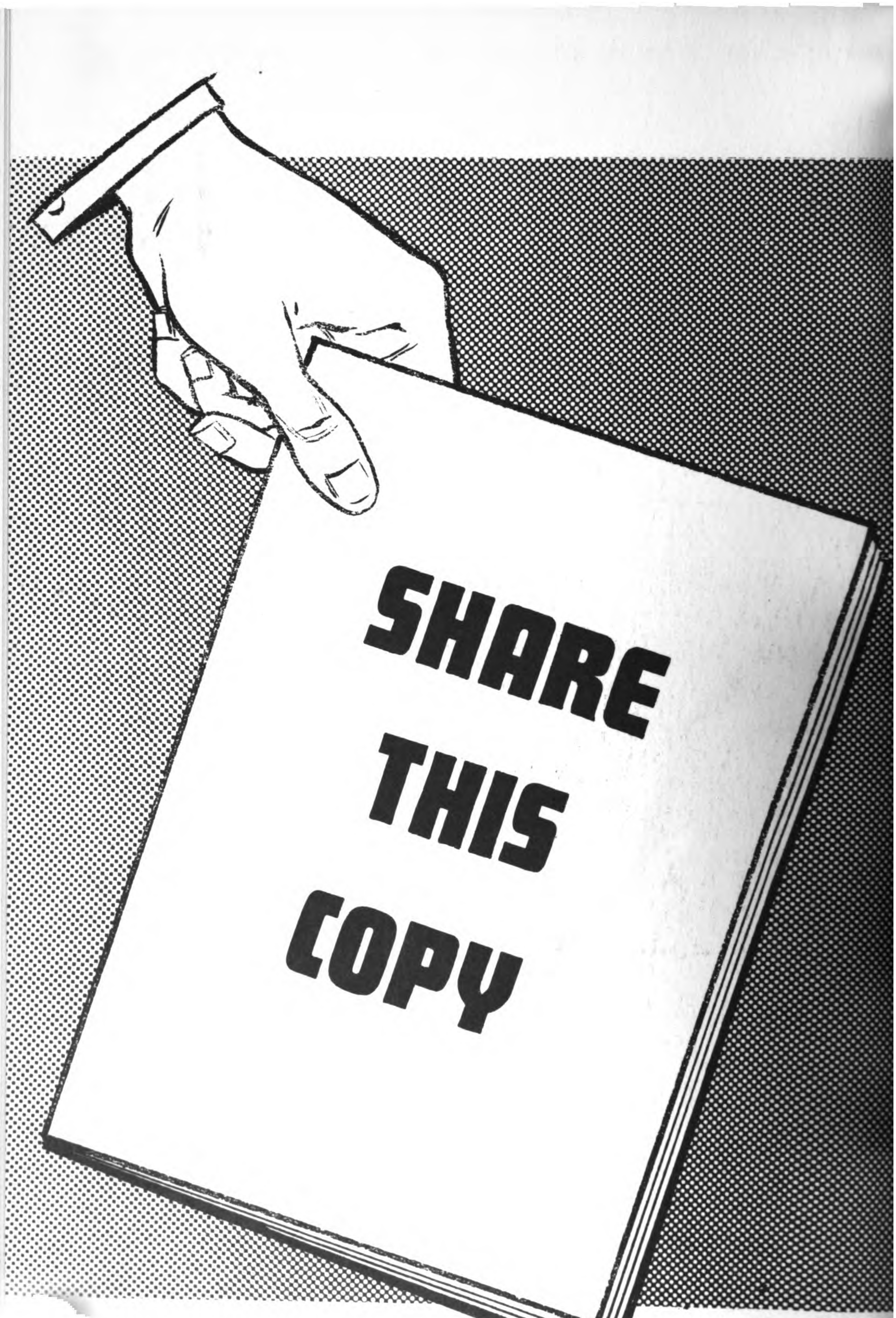


Binocular Target
(See pp. 22-26)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