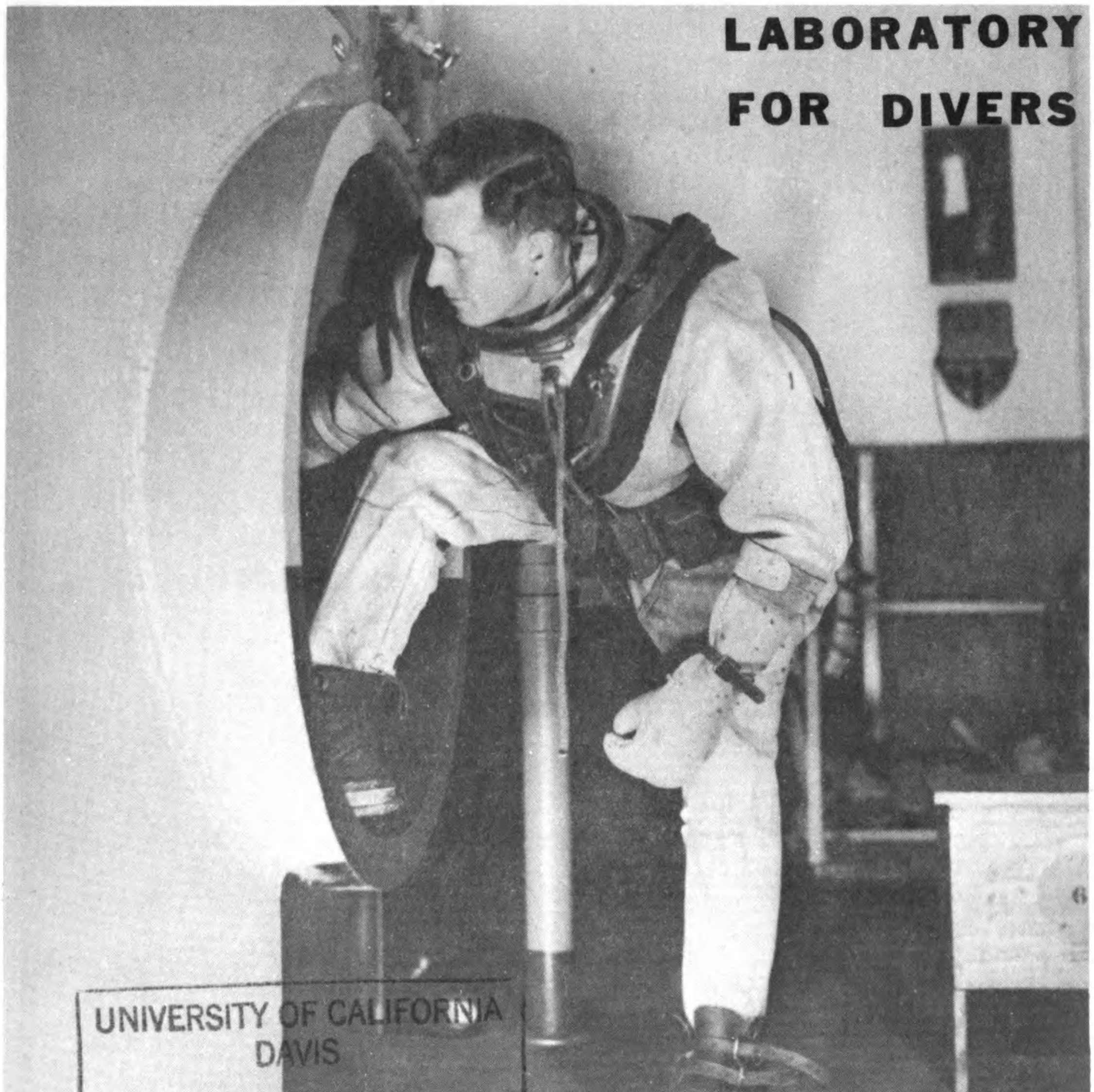
OFFICE OF NAVAL RESEARCH SEPTEMBER 1955

RESEARCH REVIEWS



NAVEXOS P-510

DEPARTMENT OF THE NAVY
WASHINGTON, D. C.

COVER PHOTO: A diver at the Navy's research facility in Washington, D. C. is about to enter the hatch of an igloo which is directly above a vertical wet tank, cylindrical in shape and holding water to a depth of seven feet. Here at the Experimental Diving Unit, depths of several hundred feet can be simulated, and thus aid in the research on diving problems of the Navy.

Research Reviews endeavors 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 740, Office of Naval Research, Washington, D. C.

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Approved by Bureau of the Budget, 28 February 1955

In This Issue

Fully-dressed diver equipped with helium-oxygen outfit.

Navy Diving Research

The Experimental Diving Unit, one of the most unusual research facilities in America, is housed in a large, airy, modern building in the southeast corner at the U. S. Naval Gun Factory, in Washington, D.C. One end of the building also houses the U. S. Naval School, Deep Sea Divers, but the two activities operate independently. Where the school works primarily with the embryo diver, EDU is manned by seasoned veterans who are qualified to evaluate and give opinions on diving equipment and methods.

People have been diving with helmets and surface-connected air hoses for well over a century, and the U. S. Navy has been investigating deep-sea diving problems since 1912. By 1925 the experiments had grown to such an extent that the Experimental Diving Unit was set up as a permanent activity under the sponsorship of the Bureau of Construction and Repair (now the Bureau of Ships). There are still many questions, both physiological and equipment-wise, whose answers remain hazy. Hence the research organization is manned by naval line officers, medical officers and enlisted divers. The line officers have diving and engineering backgrounds, while the medical officers are experts in the highly specialized field of submarine medicine. The enlisted divers (see frontispiece) are selected personnel with several years of experience in the various phases of diving.

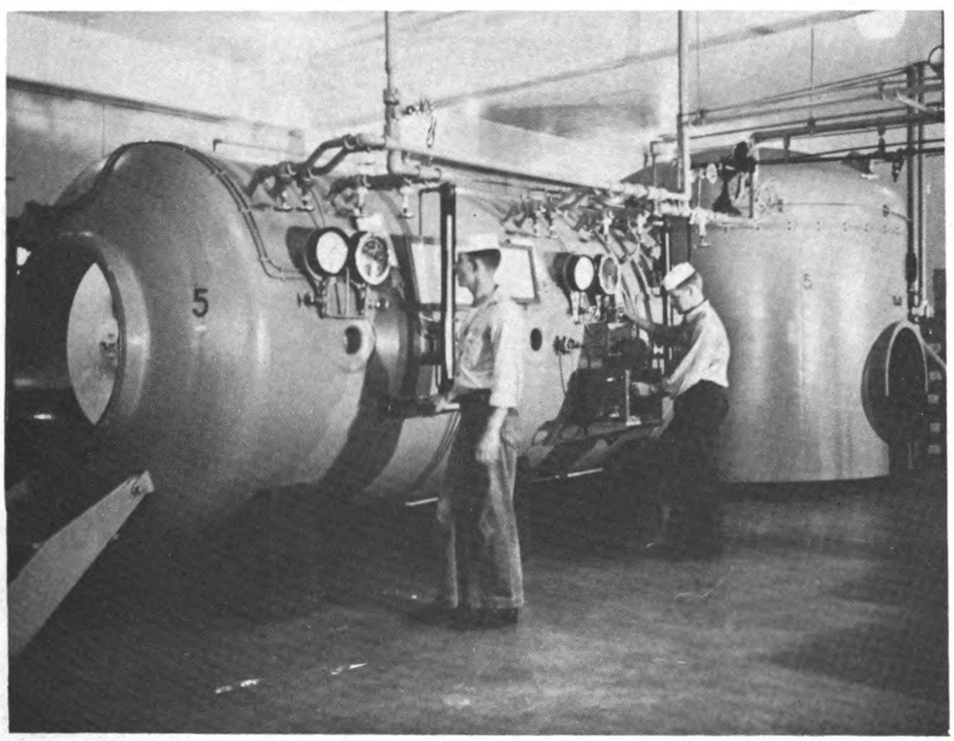

Figure 1 - Recompression chamber. The design permits close observation valuable to physiological research

One of the principal items of laboratory apparatus in diving research is the pressure tank and recompression chamber unit (Figure 1). This consists essentially of three sections: The wet tank, with the dry tank (or igloo) above it, and the recompression chamber. All sections of this unit are capable of withstanding internal pressures up to 350 lb. per sq. in. (785 feet of sea water). Each section has its own pressure controls and it is possible to "lock" divers from the wet tank, through the igloo and into the recompression chamber without dangerously reducing their pressure (depth) at any time. In operation, the vertical cylindrical wet tank is filled with water to a depth of about 7 feet. The divers enter by way of the igloo (see cover photo) and the wet tank hatch. The wet tank is then sealed shut, or (depending on the type of dive) the wet tank and igloo are operated as a single unit or lock. In either case, air is admitted to the space above the water to build up a pressure equal to the depth desired. Thus depths up to several hundred feet can be simulated with the divers actually under only a few feet of water. The divers can be kept under close observation at all times, from above or through glass ports in the wet tank. More important, expensive physiological data and mechanical information may be collected through the use of continuous carbon dioxide and oxygen analyzers, strain gage pressure transducers, and numerous other instruments. Some of these instruments are standard laboratory equipment, while others have been designed and built at EDU for their own specific purpose (Figure 2).

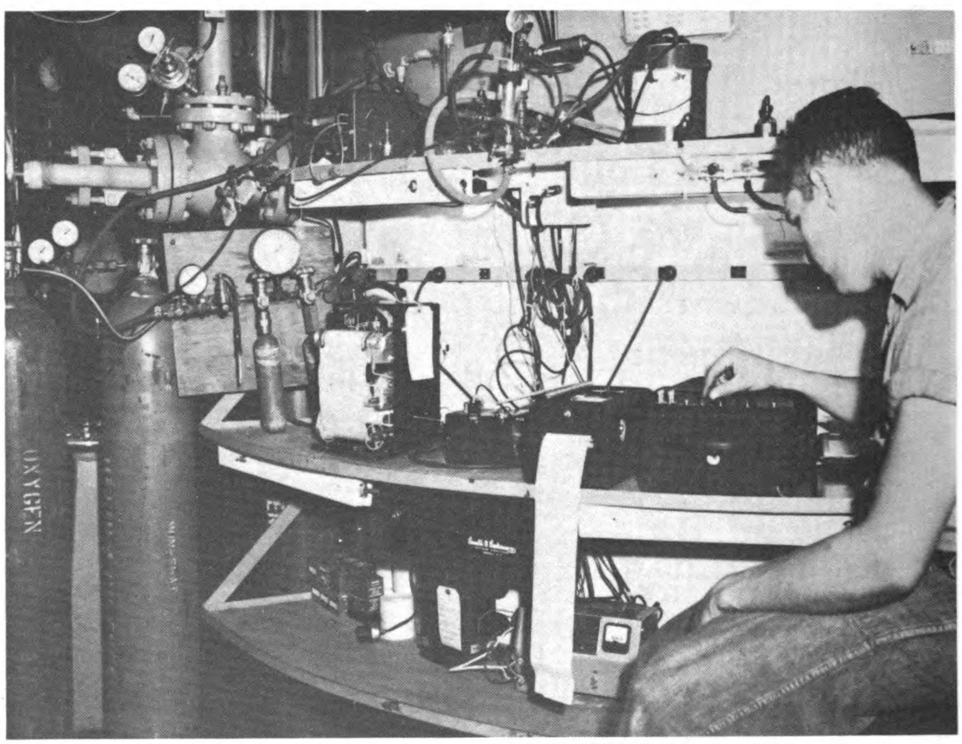

Figure 2 - Specialized laboratory equipment in use at EDU

If at any point during a dive in these pressure tanks, a diver shows signs of abnormality, a medical officer can be "locked in" through the recompression chamber and in a matter of seconds can be with the diver. The divers can be moved to the relative comfort of the recompression chamber with no change in their pressure environment. Once in the chamber, medical aid (if required) can be administered (Figure 3), and the diver can relax and chat with his mates while the pressure is being reduced. In some cases, where it is necessary for divers to spend many hours under pressure, food and the all-important cup of coffee can be locked in.

EDU maintains a small but well equipped laboratory containing many types of gas analyzing equipment and other instruments which assist in diving physiology studies. There is also a carpenter's shop, metalsmith's shop and a machine shop, all of which are well equipped with hand tools plus some items of power equipment. These facilities, together with the administrative office and medical office make up the U. S. Navy Experimental Diving unit.

Within the past decade, a host of new and perplexing problems have been introduced by the development of scuba (self-contained underwater breathing apparatus). There are several types of scuba, including the open-circuit demand type using compressed air, the closed-circuit or recirculating type using oxygen, and the semi-closed-circuit mixed-gas type. Each type has its own peculiarities and problems with some problems applying to all types in general. Many sports divers using

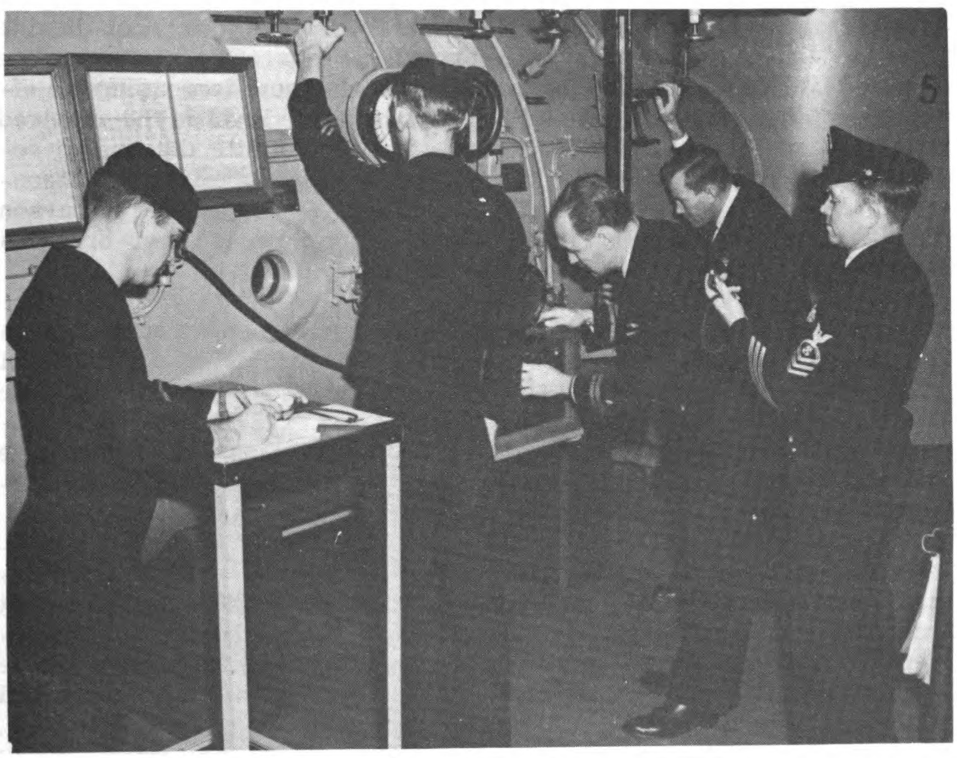

Figure 3 - Doctors and tenders "standing by" a recompression chamber ready to render assistance to a diver if he needs attention

scuba are scarcely aware that they are invading a realm where the risks are many. Some of the dangers connected with scuba diving are: drowning, air embolism, carbon dioxide blackout, oxygen poisoning, anoxia, bends or decompression sickness, and nitrogen narcosis. The layman knows little of these with the exception of drowning, and many fatalities have been attributed to drowning when they were probably brought on by other causes.

Drowning, of course, can occur in scuba diving if a diver accidentally floods his mask or mouthpiece and does not know how to clear it. However, adequate training can minimize the hazard of drowning.

The greatest danger in scuba diving is probably air embolism, caused by failure to exhale while ascending from a depth. Air locked in the lungs expands rapidly as the external pressure falls, first distending and then rupturing the lungs, driving air through the heart into the main arteries. The bubbles block circulation of the blood, particularly in the brain, usually causing death in short order. The most common cause of this accident is an interruption of the breathing supply, necessitating a rapid ascent to the surface. If the diver becomes panic stricken and holds his breath during the ascent, he will almost invariably develop air embolism. Both air embolism and drowning can occur with all types of scuba.

Carbon dioxide blackout and the lesser effects of excessive carbon dioxide are accidents characteristic of closed-circuit scuba with carbon dioxide-absorbent canisters. Carbon dioxide build-up occurs in the breathing system when the canister fails to remove all carbon dioxide from the exhaled gas, for any of several reasons. The rising carbon dioxide level tends to stimulate respiration, further decreasing the efficiency of the canister. When the carbon dioxide level in the inspired breathing mixture reaches 3 percent effective, definite discomfort results. If the carbon dioxide rises above 10 percent effective, unconsciousness will result in a short time. There is little danger of carbon dioxide poisoning in open-circuit scuba as long as the diver breathes normally.

Oxygen poisoning is also more common to closed-circuit scuba in diving. Pure oxygen is toxic under pressure, and high percentages of oxygen in breathing mixtures can also be toxic. Definite limits of time and depth for oxygen breathing are under study at EDU. Certain individuals seem to have more tolerance than others, and even the same individuals may vary in tolerance from day to day. Oxygen toxicity frequently produces serious convulsions and unconsciousness.

Anoxia is caused by a deficiency of oxygen in the breathing mixture, and again is more common to closed-circuit scuba. It can result from inadequate purging of the apparatus, malfunctioning of the equipment or use of improper mixture for supply. Anoxia gives very little warning and can produce unconsciousness if oxygen percentages fall below 12 percent effective.

Bends or decompression sickness is a danger well known to deep-sea divers. It is the result of minute bubbles of nitrogen (or other inert gas) forming in the blood or in various tissues when decompression is too rapid. Decompression problems have become more complex with the advent of mixed-gas diving. When compressed air was breathed exclusively, decompression could be calculated on the basis of depth, time and work rate. Now a fourth factor must be considered: the partial pressure of the inert gas in the breathing mixture. Thus far, decompression sickness has not been a great problem among scuba divers because the available gas supply normally limits the depth and time to the safe diving, or "no decompression" range. However, with the present trend toward larger capacity air bottles, and the proficiency with which some divers can shift to a fresh breathing apparatus while under water, this problem of "bends" is becoming increasingly important.

Nitrogen narcosis, or the "Rapture of the Depths" is encountered only at excessive depths. It is a condition similar to alcohol intoxication and can be very dangerous particularly for scuba-equipped divers swimming around with no contact with people on the surface. The depth at which nitrogen narcosis occurs varies somewhat with individuals. The range is generally from something over 100 feet to a little over 200 feet when breathing compressed air. Experienced deep-sea divers seem to develop more tolerance to this condition.

Three lineofficers, three medical officers and 14 enlisted divers at EDU are at present carrying more than 20 active projects. Several of these pertain to the physiological aspects of diving. Others include equipment development and evaluation, extending the limits of helium-oxygen diving, and one project concerning underwater television equipment. Some of the physiological studies are necessarily long and laborious. Evaluation projects are usually faster moving and more interesting. In general, the personnel at EDU are pleased with their assignment, engrossed in their work, and proud of their accomplishments.

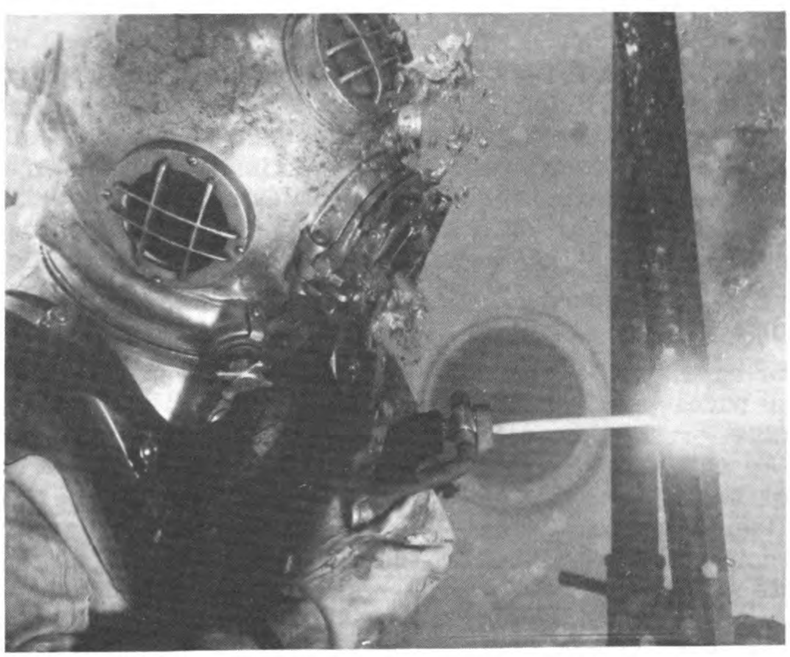

Figure 4 - Diver using oxy-electric torch

Navy Administration of Research and Development

CAPT L. D. Coates
Deputy and Assistant Chief of Naval Research
Office of Naval Research

In 1946, the Office of Naval Research stood almost alone in the support of scientific research. The wartime Office of Scientific Research and Development had closed up shop. The atmosphere for the past year had been one of demobilization. Scientists wished to leave government work and get back to teaching and personal research interests. The Navy wanted to maintain a nucleus for military research and it supported basic research, which at that time was getting support from practically no other source. The over-all concern was to lay the foundation for long-range needs.

At that time ONR was the only organization in the Federal government that was well equipped to deal with science. ONR assumed the responsibility for supporting research in nearly every area that had implications for the Navy. It was specifically charged by law with fostering and encouraging scientific research, and also with the coordination of naval research programs throughout the Navy. This function of coordinating research consisted primarily of devising ways and means for ensuring that people working on related problems had access to information produced by each other. ONR acted as a forum where scientists working on common problems could meet, get to know one another and trust one another's work, and exchange ideas. This applied not only to research scientists, but to research administrators and representatives of the Chief of Naval Operations.

The administration of Navy research and development has changed gradually since World War II, in order to stay abreast of changing times and changing needs. During the nine years since ONR was established, the scientific community went from a wartime to a peacetime basis. Leadership in world science passed from western Europe to the United States. The Department of Defense was created and went through several modifications. A National Science Foundation was established and the Army and Air Force set up offices to conduct scientific research programs.

During the early post-war years, the research programs of the technical bureaus were relatively small, and there was little in the way of formal effort to coordinate them into an over-all Navy research program. As ONR's operations evolved, it moved into studies of technical areas or broad warfare fields where the work appeared to require pulling together, although many segments of the research program remained under the cognizance of the bureaus. ONR coordinated these segments with its own program, in an effort to prevent any unwarranted duplication of effort, and also fill gaps in the program. The over-all coloration of the programs stemmed then, as now, from operational requirements prepared by the Chief of Naval Operations. As far as topside management and direction was concerned, the center of gravity rested in the Chief of Naval Operations, rather than the Secretary's office.

In 1947 we entered a period of major changes. The National Security Act which established the Department of Defense also established the Research and Development Board. The Board was to coordinate the research and development programs of the three services. It had broad powers to advocate new programs. All of the actual work was to be conducted by the services, however, and the Board had no power to initiate new programs. It functioned through committees of civilians and military men in each of the major technical fields. There were committees on electronics, guided missiles, aeronautics, ordnance and other technical fields.

The Research and Development Board was abolished in the fall of 1953, when the Department of Defense was reorganized and a number of assistant secretaryships created. The Board's statutory authority was vested in the Secretary of Defense, and an Assistant Secretary of Defense for Research and Development was established. The committees, panels and working groups of the RDB were replaced by a new type of organization. A Research and Development Policy Council was established, to concern itself with broad policy direction of the national research and development effort. Coordinating committees were set up to provide the Policy Council with advice in their particular areas. Advisory Panels were formed, to provide sources from which the Assistant Secretary, the Committees and the services themselves could obtain technical information.

During the RDB era, there were few formal changes in the Navy's system for administering R and D programs. There was a trend toward a more integrated over-all Navy research program, largely through the type of informal coordination carried on by ONR. It became increasingly apparent that programs must be in terms of developing weapons systems, rather than weapons. It became apparent that as our programs took us deeper into science there was more and more a common scientific foundation for different kinds of development.

A growing realization of the value of examining an entire warfare area from a research and development standpoint led to the technique known as the large-scale study project. The study project has made great contributions to the coordination of Navy-wide research programs, since it causes all aspects of a problem, including current research prospects, to be examined, and a great deal of information is pulled together.

During the last year the Navy has begun another era of marked changes in its administrative setup for research and development. These changes stem principally from recommendations made after a study of the organization of the Navy Department by a committee headed by the Under Secretary, Mr. Gates. These changes are all in the direction of a more formal integration and coordination of research and development.

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From our standpoint, the most important and far-reaching recommendation was that the Chief of Naval Research should be given responsibility for coordinating the developmental phases of research and development. The Secretary of the Navy implemented this recommendation on June 24, 1954. For the first time, a central point was established for coordinating the many development programs being carried on by the technical bureaus. This action has had considerable implications for ONR, and a little later we shall summarize what we are doing to carry out this new responsibility. First, however, let us look at the other changes that came about at approximately the same time.

At the time the Gates committee made its study, the Assistant Secretary of the Navy for Air was responsible for three major areas: personnel, air, and research and development. The committee felt that these functions were of such importance and scope that they should be divided between two assistant secretaries. As a result, a new Assistant Secretary for Personnel and Reserve matters was established. The Assistant Secretary of the Navy (Air) is now responsible only for research and development and for naval aviation policy matters. He is not responsible for procurement aspects of naval air. Since a large proportion of aeronautical matters are closely bound up with research and development, we now have an assistant secretary who can devote most of his time to the research and development field. I think that this also is in keeping with the trend toward recognition of research and development as an important functional area, which to some extent must be guided and administered as an entity, rather than as an appendage to the several different weapons areas.

The Gates Committee also felt that over-all Naval administration would benefit by some formal means for coordination between high civilian and military executives. It recommended the establishment of six internal advisory committees made up of key executives. One of these is the Navy Research and Development Committee, which has been established. It is chaired by the Assistant Secretary of the Navy (Air). Its members are the Deputy Chief of Naval Operations (Fleet Operations and Readiness), the Deputy Chief of Naval Operations (Air), the Assistant Chief of Staff (G-4) of the Marine Corps, the Chief of Naval Research and the Assistant Chief for Research and Development from each material bureau. One important effect of this committee has been to give the bureaus a voice in the formulation of over-all Navy research and development policy.

A fourth change which occurred during this period emanated from the Congress. The Congressional committee which reviewed our budget requests each year expressed growing concern over the way in which the Navy research and development budgets were presented. The Bureau of Aeronautics would go before the Committee with its request for money to purchase aircraft, to conduct its departmental operations, and for the rest of its activities. One of these activities would be research and development in connection with aircraft. The Bureau of Ships would appear with requests for funds and authority to build new ships, convert existing ships, run the shipyards, and conduct research and development in connection with ships and equipment. The other bureaus and the Marine Corps would do the same, in their fields. The Office of

Naval Research would appear, requesting funds for still another research program. Altogether, research and development funds were requested under nine separate appropriations. The committee members felt this arrangement did not give them a clear over-all picture of the Navy budget requests for research and development. So, during the hearing in the spring of 1954, they directed the Secretary of the Navy to combine these requests in one appropriation and present them in a single budget.

All funds for the Navy's research and development programs are now combined in a single appropriation titled "Research and Development, Navy". Under this procedure, the Chief of Naval Research combines the budget requests of the bureaus, the Marine Corps and ONR into this single appropriation. ONR is responsible for the administration of this appropriation and for maintaining the necessary control records.

These are the four most important recent changes in the administration of Navy research and development:

The first established a central place for coordination of all Navy development programs.

The second will permit the Assistant Secretary (Air) to spend much more time on his research and development duties.

The third established the Navy Research and Development Committee.

The fourth combines the naval R and D programs into a single budgetary package.

These major adjustments indicate the direction in which research and development administration has been evolving. It is an evolution toward integration of separate, diverse but related segments, and toward a more clearcut fixing of responsibility at the top. Naval research and development is being viewed and directed as an entity.

Coordination through the means of a central focal point does not have to imply control, however. The bureaus will continue to be responsible for preparing and carrying out their portions of the program, in support of their weapons areas. ONR will continue to conduct the supporting research necessary to provide new knowledge to nourish these programs.

As ONR views its new responsibility for coordination of development, the general objective of coordination is not to control or to master-mind, but to work together with the different offices and bureaus, and their laboratories and contractors. ONR coordination of research in the past has emphasized improvement of the flow of information among persons actually performing research. Occasionally it would endeavor to sharpen a program and to accelerate the flow of results into the applied and development areas. This was done in some cases by an over-all study of a technical field, to see exactly what the current state of the art was, and perhaps point out potential lines for military application.

In ONR's new role, this kind of coordination will be continued, but we must add to it, as we work out methods for coordination of development programs. We are proceeding very slowly, as a matter of choice. We know of no clear-cut pattern which can be superimposed on Navy R and D programs to make everything work perfectly. Probably there is no single best method for what we are trying to do.

One effective means is the large-scale study project. We have used this approach to military problems before, and it has produced some real strides forward in the solution of major problems. The large scale study project is an inherently good method of achieving coordination in a given technical field or warfare area, and we intend to make continued use of it in carrying out these new responsibilities.

In ONR we are establishing the administrative structure to do the planning and work out procedures. The Research Group within ONR has responsibilities for coordination of all naval research, and a position of Deputy Science Director for Research Coordination has been established. It will be the focal point for policy direction of research coordination activities. Research coordinators have been designated for the various technical fields.

In moving toward this more formal coordination of research, we are making use of the case study method. Since it will not be possible to start new coordination efforts right away in all the technical areas, a first step has been to select a number of technical areas for study and action, such as metallurgy, corrosion, human engineering, underwater sound, physics, and so on.

Coordination of development will be handled by a new group in ONR, which reports directly to the Chief of Naval Research. The staff for this new group is being added gradually. As Admiral Furth told the Congressional appropriations committee, "The area has been divided into manageable segments and we are now engaged in obtaining the man best qualified for each segment. We hope to find these individuals in industry, in universities or in the Armed Forces research and development organizations, and obtain their services by outright employment, by sabbatical leave or by borrowing their services temporarily for short periods." The end product of this group's operations will be recommendations to the Navy Research and Development Committee, where the bureaus, ONR and the Chief of Naval Operations can participate in policy decisions.

In moving into this new area of coordination, ONR's emphasis throughout has been upon achieving coordination through voluntary means. We have no intention of wielding a club, for we know this would hurt the entire program. We want to set up procedures that will make it easier for the bureaus, ONR, the Chief of Naval Operations and the various committees to see what is going on, and so help their planning activities.

Naval research and development is in an interesting new phase. We are working out administrative machinery which is intended to make it easier to provide wise guidance for the entire Navy program. It is intended to produce a tighter program, since there will be more knowledge of work being done by everyone in a given field, and in overlapping fields. We want to achieve these objectives with a minimum of new administrative machinery. We believe they can be achieved without sacrificing the many advantages inherent in the Navy's decentralized bureau system, with each bureau responsible for all phases of a given weapon, from applied research on through development, production, installation and maintenance.

Research administration in the Navy is following a general trend dictated in a large part by the growth and national importance of research and development itself. In its early days, ONR stood pretty much alone where research was concerned. Since that time, the level of Federal support for research has increased rapidly. The National Science Foundation and the Atomic Energy Commission have been created. The Army and the Air Force conduct basic research and extensive development programs, which must be coordinated with ours. Our own programs have grown. Because we are no longer alone in the field, our programs must be pinpointed to make sure that dollars spent for our work could not earn a greater return in some other program.

Thus, the growth in sheer size of the National research and development effort, and the Navy's share of that effort, produce the need for better coordination that comes with the growth of any endeavor. In addition, the growth of scientific knowledge, the speedup of its application to technology, with the resultant growing complexity of modern warfare has brought an imperative demand that research and development be a well-thought-out, coordinated effort.

The administration of research and development in the Navy Department may well grow more difficult as these growth factors continue to operate. Certainly, better methods for obtaining a well-integrated program will have to be evolved, and they must be simple, workable, and above all, flexible methods. We are feeling our way in a field that is new in its immensity of scope and size and we must be alert and inventive yet cautious in application.

New Development Coordinator Named at ONR

Dr. Royal Weller, Chief Scientist from the Naval Air Missile Test Center, Pt. Mugu, Calif. has been loaned to the Office of Naval Research for a tour of six months to serve as Development Coordinator. He relieved Dr. O. T. Marzke who is returning to his former post as an Associate Director of Research, Naval Research Laboratory.

Prior to his experience at the Naval Air Missile Test Center, Dr. Weller was Principal Physicist and Engineer at the Naval Ordnance Laboratory and has served on the National Advisory Committee for Aeronautics. A well-known expert in Photoelasticity and Ordnance Development, Dr. Weller is a Fellow of the Physical Society, and a member of several other scientific organizations.

High-Altitude Portrait of Storm Clouds

Otto E. Berg

Rocket Sonde Branch
Atmosphere and Astrophysics Division
Naval Research Laboratory

For almost a decade NRL has been actively engaged in the field of high-altitude photography from rockets. In the main, the aim of the program has been to obtain photographs of the earth from a rocket so that the rocket's aspect (orientation in space) during its flight could be determined.

On October 5, 1954, a two-stage Navy Aerobee carrying 170 pounds of experimental instrumentation, including two 16-millimeter movie cameras, rose to an altitude of 100 miles over the deserts of New Mexico. Both cameras were designed and built at the Laboratory and mounted to take pictures perpendicular to the axis of the rocket. One camera contained black and white film and used an extremely wide-angle lens (90 degrees); it took six pictures a second with an exposure of 1/1500 second at f 4.5. The other camera contained color film and used a semi-telephoto lens; this camera took six pictures a second with an exposure of 1/500 second at f 3.5; a Wratten 2B filter was employed to eliminate the blue haze commonly found in color photographs taken from high altitudes.

To obtain aspect information, it is desirable that the pictures taken by rocket-borne cameras show recognizable features on the surface of the earth. Such features will, of course, be most evident when there is a minimum of cloud cover. For this reason, and because optical tracking from the ground is also desired, rockets are seldom fired when the cloud coverage exceeds 10 percent. At the time of this rocket flight there was a generous scattering of clouds over the area surrounding the launching site. However, owing to a large opening in the cloud cover directly above the launching site, it was decided to fire as scheduled (Figure 1).

The entire flight was a success—the propulsion system operated smoothly; telemetering was continuous and complete; the trajectory had been calculated properly; the nose section was severed and lowered relatively gently by parachute to the earth; the cameras were recovered in good condition (Figure 2); and the camera film, when developed, exhibited excellent definition and exposure.

In addition to aspect information, the cameras had recorded in their flight the unforecasted presence of a hurricane over southern Texas and Mexico. This atmospheric monster with its spiral tentacles, embraced an area of more than 1000 miles in diameter.

The flight pattern of the rocket near its summit altitude made it possible to assemble a mosaic from the individual frames of the movie film. This pattern was such that as the rocket approached its summit, it was slowly rolling on its axis and gradually tipping over toward the

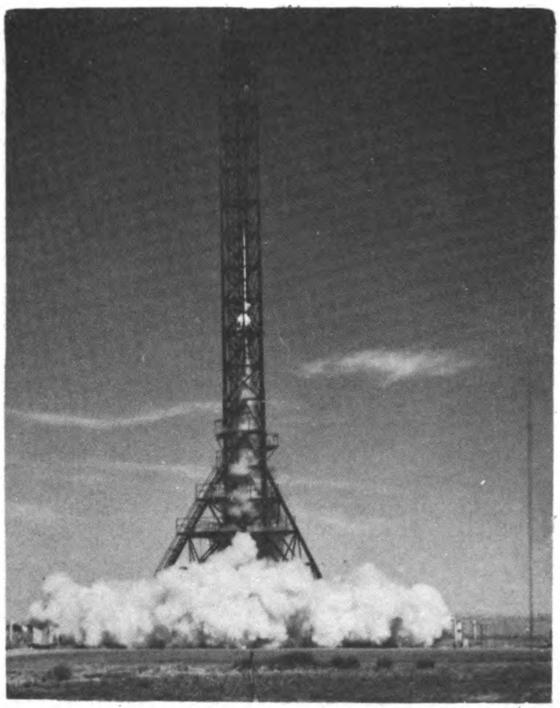

Figure 1 - Aerobee making its exit from the launching tower at White Sands Proving Ground

southeast. As a result, on each roll the camera was swathing through successive strips of the earth, each swath overlapping and appearing northwest of the previous one. Figure 3 is the resulting mosaic composed of about 90 enlargements from the movie film. The tropical storm seen in the picture invaded the Southern United States from the Gulf of Mexico and assaulted parts of Texas and New Mexico with no warning from the weather stations.

These pictures mark the first time that such a storm has been photographed from an altitude sufficient to show the detailed structure of a storm over a large area. Photographic mapping of such cloud formations is usually accomplished by the use of airplanes. This system is not completely effective in hurricane studies, chiefly because of the plane's limited altitude which is only slightly above hurricane cloud formations. This necessitates the taking of many pictures to map the cyclonic pattern by "looking down into" the storm.

The U. S. Weather Bureau has long recognized the need for more effective aerial mapping of cloud formations—particularly in the regions and during the seasons of hurricanes. Meteorologists pointed out that the NRL pictures could give them information about the hurricane in advance of evidence from their regular weather stations. The reason for this was exceedingly interesting and became apparent from a careful study of the NRL photographs and the weather station reports for the days preceding and following the rocket firing date. In this case, the initial stage of the

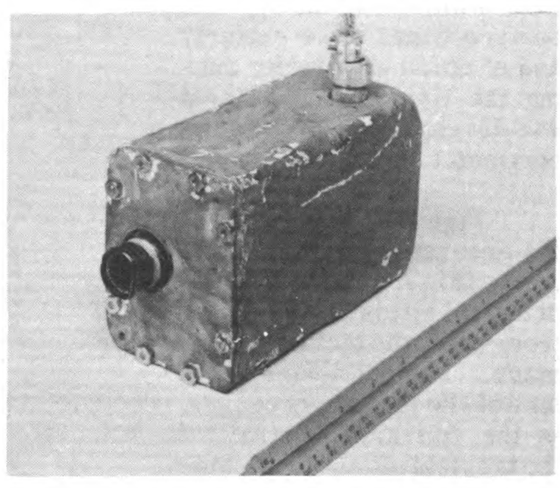

Figure 2 - 16 mm movie camera recovered after making a photographic record on two-stage Aerobee flight—the camera is contained in glass laminate armor

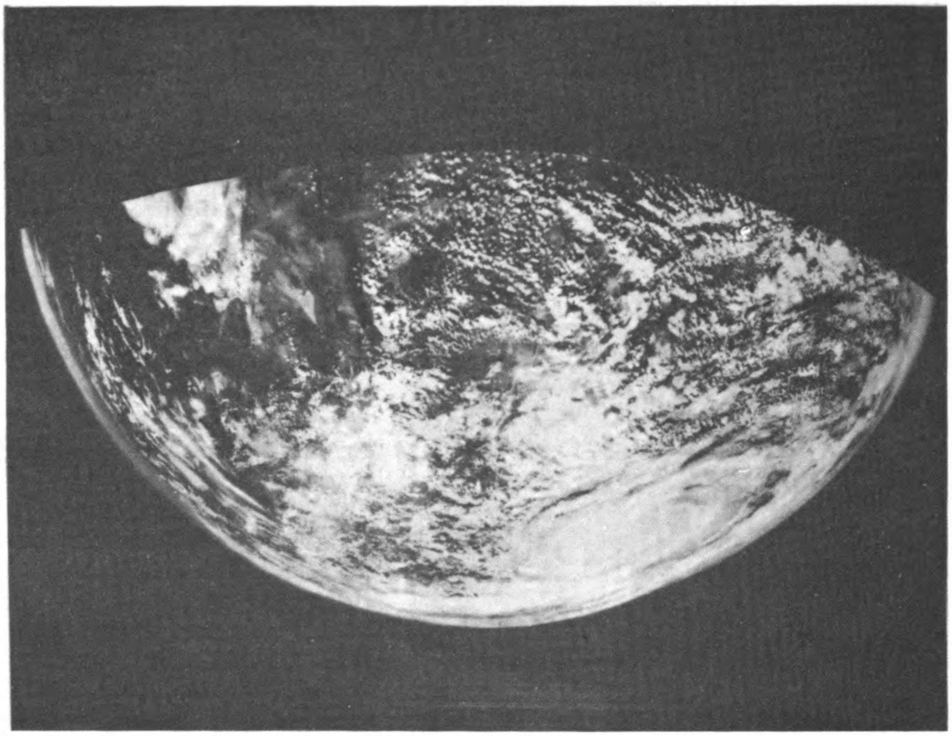

Figure 3 - Mosaic of area photographed 100 miles above the earth, featuring a tropical storm and associated clouds. Note the position of the minor vortex in the upper left corner; the eye of the hurricane is shown in the bottom right portion (light area) of the picture

storm was almost entirely a high-altitude disturbance with little or no related surface winds. Actually, the surface winds were easterly and of nominal velocity during the time that the storm was developing to major proportions overhead.

Figure 4 is a sketch of the area covered by the composite (Figure 3) showing the principal cities and the point from which the pictures were made. The outstanding feature of the mosaic, of course, is the full-area portrait of the tropical storm. The composite exhibits an area of one and a quarter million square miles and a horizon length of 2500 miles. This is the largest area of the earth ever

Figure 4 - The area contained in the mosaic is shown within the dotted lines

contained in a single picture from effectively one point. It is also the first time that the earth has been successfully photographed in natural color from rocket altitudes.

It is conceivable that the type of meteorological data represented by these pictures will become routine in the not too distant future. The Weather Bureau has made a formal proposal for rocket reconnaissance of the occurence of high-altitude atmospheric disturbances during hurricane seasons. The information obtained would be correlated with ground observations from the regular weather stations. In the more distant future, these techniques of rocket reconnaissance will be applied to investigations of other meteorological phenomena.

10th Annual Instrument-Automation Conference and Exhibit

From September 12 to 16 the Navy's newest scientific instrument developments were displayed at the 10th Annual Instrument-Automation Exhibit of the Instrument Society of America held at the Shrine Exposition Hall in Los Angeles, Calif., in connection with the Society's annual conference.

The Navy activities which participated in a showing of their latest in scientific instrumentation were:

Navy Electronics Laboratory, San Diego

Naval Research Laboratory, Washington, D. C.

Naval Ordnance Laboratory, Corona, Calif.

Naval Ordnance Laboratory, White Oak, Silver Spring, Md.

Naval Boiler Turbine Laboratory, Philadelphia, Pa.

Bureau of Ordnance

Special Devices Center, Port Washington, L. I., N. Y.

Underwater Sound Reference Laboratory, Orlando, Fla.

Naval Ordnance Test Station, Inyokern, Calif.

Those scientific instruments and automation procedures which are new or developed in the past year were on display.

The Navy was represented in the first International Instrument exhibit of the Society held in Philadelphia, Pa. last year. New devices shown by the ten activities reflected the manner in which the Navy is meeting problems of scientific instrumentation and automation.

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Lay-Up of Composite

As the preceding article indicates, scientists at NRL have been actively engaged in the photography of the earth from rockets. For purposes of mapping and meteorological studies it is desirable that the high-altitude pictures encompass as large an area of the earth as possible. One way of accomplishing this is by the use of a wide-angle lens on the camera. With this method, however, considerable distortion is introduced in the resulting photograph, and although the degree of distortion is known, the picture is inconvenient for mapping and for meteorological studies.

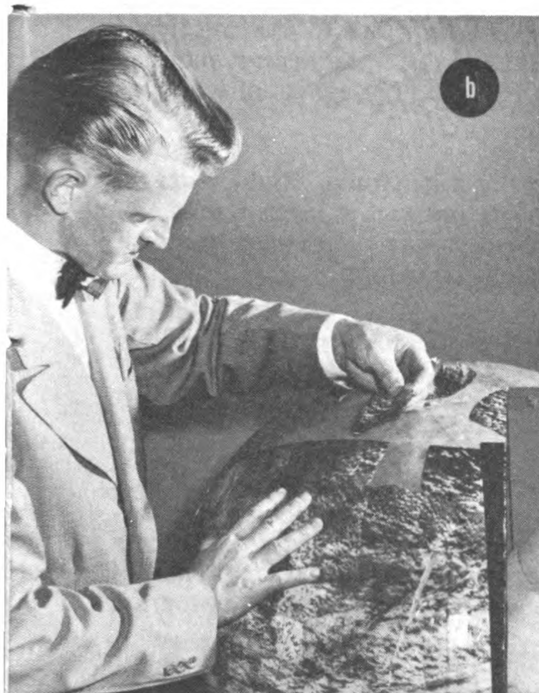
Another method for obtaining large-area, high-altitude photographs is by the assembly of a number of photographs from a camera having a longer focal length lens into a composite or mosaic. A criterion which reduces the frequency of such composites is that all pictures comprising

—more on page 18

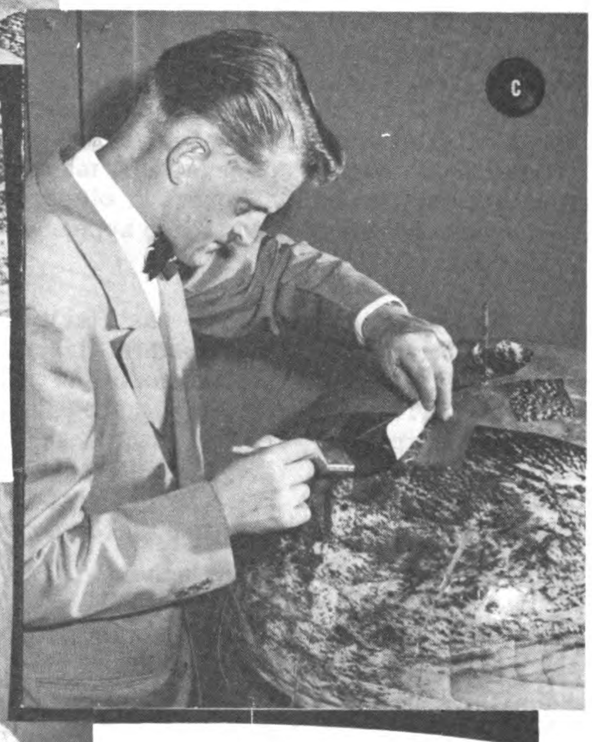
Cutting small segments of map from photographic print of aerial film exposed during rocket flight. Only the center section of each print is used; this eliminates portions near the edge distorted by the lens during exposure

Measureme
position anc

e Photographic Map



In matching small segments, clouds and surface features are used in aligning each picture with adjacent ones



Picture segments are carefully pasted on sphere to complete the mosaic which represents 1,250,000 sq. mi. of the earth's surface

its are made radially from the rocket
from the horizon to the geographic point

the mosaic must be taken from the same altitude, or nearly so. This criterion was met in the NRL Aerobee flight of October 5, 1954 during which almost 500 pictures were recorded of the earth within 5 miles of the peak altitude of 100 miles. Approximately 90 of these pictures were selected and assembled into the mosaic shown. Due to the relatively long focal length lens used (35 mm) and because only the center sections of each picture were used, the distortion due to the optical conditions was reduced to a minimum.

Inasmuch as circumstances in this flight (altitude, flight pattern, etc.) allowed the composure of a mosaic from such a large number of prints, and consequently such a large area, it was necessary to mount the pictures in a fashion which we believe to be unique.

It is obvious that the focal surface of the camera in a spinning, tumbling rocket is a sphere. Imagine a camera at a fixed point in space with the film plane always perpendicular to the axis of the lens (the direction toward which the camera is aimed). Then as the camera continually takes pictures while it rotates and spins (in a rolling, tumbling rocket) the film plane is also rotated about that point. The result is a spherical film made up of many segments or individual pictures. Consequently, a mosaic comprised of many pictures or segments of this sphere must also be a sphere. In other words, a true enlargement of this spherical negative must also appear spherical, or severe distortion will occur.

The question then is — what factors dictate the radius of the sphere? Strange as it may seem at first, the dimensions of this sphere are independent of the dimensions of the subject—in this case the spherical earth. The radius of the sphere is determined only by the angular coverage of the lens and the size of the enlargement of the individual camera frames. In this particular case the angular coverage and enlargement were 12° and 3 inches respectively. The circumference of the sphere is then $\frac{360}{12} \times 3$ or 90 inches, or more correctly the radius of the sphere is about 14.33 inches.

Illustrations a, b, and c show the procedures followed in assembling the composite. Illustration d shows how geographical features were located, and similarly how the position of the tropical storm was established.

NRL Scientist Gets Navy's Meritorious Civilian Award

At a luncheon recently, Martin Katzin, Consultant at the Naval Research Laboratory in the Electronics Division, was presented with the Meritorious Civilian Service Award. Dr. R. M. Page, Associate Director of Research for Electronics, made the presentation, and cited the work of Mr. Katzin in the fields of radio and radar propagation during his years of service at NRL. The Meritorious Service Award is the second highest honorary award the Navy may bestow on civilian employees for outstanding contributions to the Navy. Mr. Katzin is the sixth person at NRL to be honored by this award since 1950.

Detection Kit for Showing Contamination in Aviation Gasoline

J. A. Krynitsky and W. D. Garrett
Fuels Branch, Chemistry Division
Naval Research Laboratory

Jet aircraft operating from carriers in many cases use a special blended fuel called Jet Mix. It is customary to prepare this Mix aboard carriers from two standard fuels—115/145 avgas and a heavy liquid fuel called JP-5. From this situation an operational hazard has arisen as it has been shown that the presence of as little as 0.5% of JP-5 in 115/145 avgas can impair the efficiency of the avgas as a fuel for reciprocating engines in aircraft assigned to the carrier. Since the possibility of contamination of avgas always exists when two fuels are in such close proximity and are handled together, BuAer sought a simple test for this contamination.

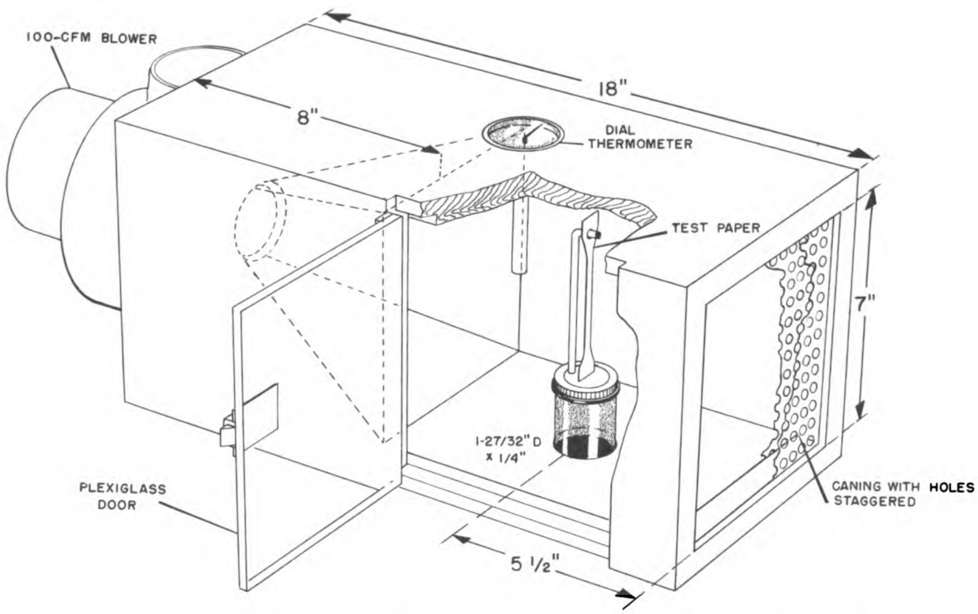


Figure 1 - Apparatus for testing contamination in aviation gasoline

The job of developing the test was given to the Naval Research Laboratory by a request of BuAer. A literature survey disclosed several previous studies into this problem but none offered an acceptable method. Another novel and more promising approach was decided upon. In essence this procedure involved the suspension of the lower portion of

*Material for this article has been taken from an official report prepared by J. A. Krynitsky and W. D. Garrett, April 1955 a strip of filter paper in the gasoline, and passing of an air stream over the exposed paper surface. The gasoline rises up the paper by capillary action and is evaporated. Under these conditions, the height to which the paper is wetted in a given time (creep height) is governed largely by the quantity and volatility of the heavier components in the gasoline. By introducing a suitable oil-soluble dye, the creep height of the gasoline sample can be easily indicated.

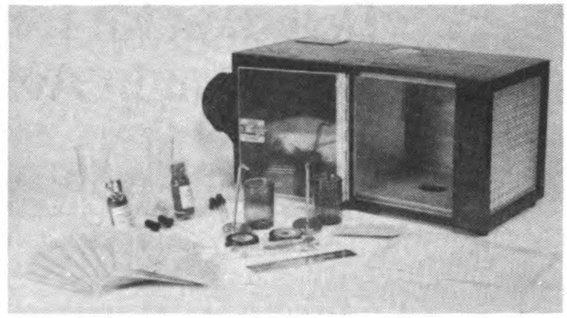


Figure 2 - Items of equipment to be assembled in kit

In developing the test, scientists at NRL defined the effects of fifteen different variables and conditions, and methods were devised by which these were either eliminated or compensated. This was followed by the design of a suitable piece of apparatus (Figure 1) which was built and tested at the Laboratory. The miscellaneous items of equipment packaged with the final kit (Figure 2) include calibrated paper, test assemblies, 60-ml graduates, indicator dye solution, eye droppers, celluloid centimeter rules, thermometer wicks, psychrometric slide rule, wrench, and sets of instructions.

The kit is 8-1/2 by 8-1/2 by 23 inches and weighs about 16 pounds. There is a 100-cfm exhaust blower located at one end of the test box (Figure 3) to provide proper air velocity during the process of a test. The aluminum funnel in the after portion of the box and the staggered caning at the inlet are incorporated to smooth out the air pattern. A circular recess in the bottom of the box serves to position the test paper assembly. The test can be viewed at all times through the plexiglas door. Each package of calibrated test papers (Figure 4) has two tables printed on it to enable the operator to calculate readily the extent of contamination from the measured creep height.

The response of the developed method is somewhat semilogarithmic in nature so that its determinations are more precise at the lower levels (e.g., 0.5%) of contamination. The operating time required to assay a suspected sample of gasoline is one hour. Laboratory evaluation of the workability of the finished product proved that the kit can be used satisfactorily by untrained personnel with only the printed instructions as a guide.

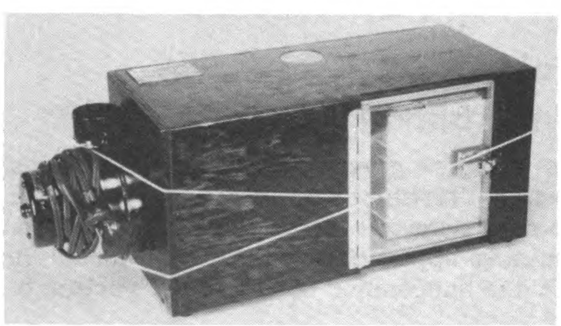


Figure 3 - Test box and assembled equipment

At the request of BuShips, NRL produced and standardized a number of

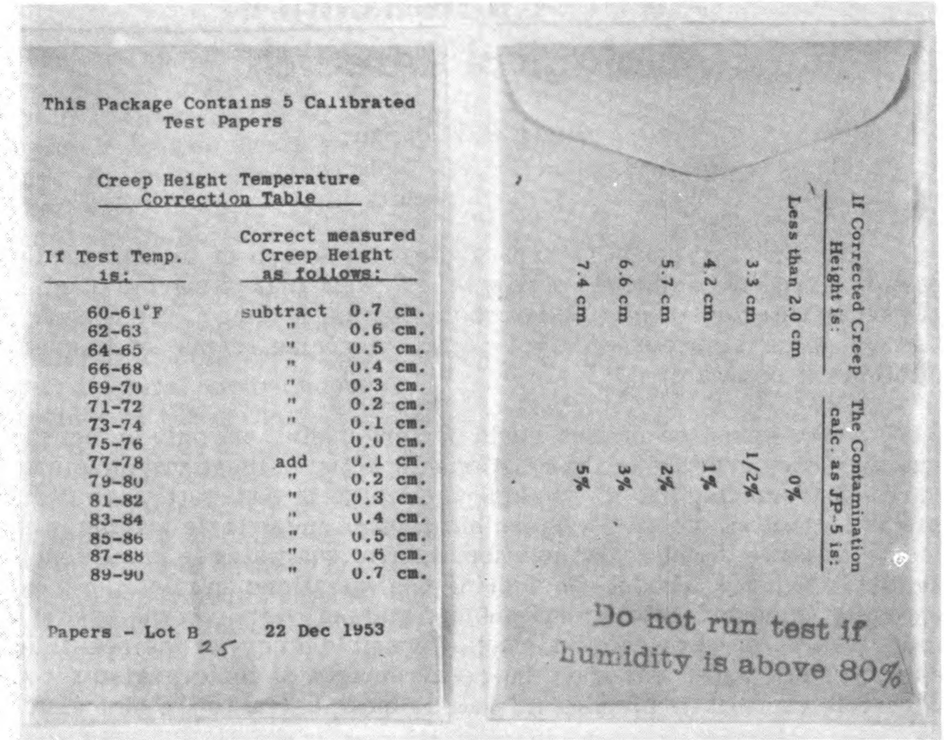


Figure 4 - Packaged test papers; printed tables on each piece of paper facilitate calculation of contamination

such units for distribution throughout various carriers of the fleet. Reports received thus far, indicate satisfaction and acceptance by the operating forces.

Miniature Weather Station of the Navy Weighs Six Pounds

The Navy is giving a series of sea tests to a new miniature weather station that stands only 23 inches high and weighs six pounds. It was designed to provide supplementary weather information when conditions are such that it is impractical or dangerous to use standard permanent weather instruments.

The miniature weather recording set is so small that it can be held in one hand. Intended for shipboard use, it can automatically record essential data in total darkness or under severe weather conditions. It takes only a few minutes for the sensing elements of the set to position dials which measure surface atmospheric pressure, temperature, relative humidity, wind speed and direction. A lever locks all readings in place for subsequent recording in a sheltered area.

The equipment was developed for the Bureau of Aeronautics by the Friez Instrument Division of the Bendix Aviation Corp.

Use of Marine Fungi in Biological Research

Helen S. Vishniac
Lecturer in Microbiology
Yale University

The first problem in investigating any group of organisms that occupy a special habitat is, why do they? What makes marine fungi, or any other category of marine microorganisms, marine? The answer is usually given, at present, only in very imprecise terms—of tolerated dilutions of sea water.

A more precise answer would be very useful, not only in increasing our understanding of the relationship between these organisms and their environment, but for making up synthetic sea water. Synthetic sea water allows the mid-western biologist to investigate marine problems; it allows the biologist to whom natural sea water is more readily available to work without considering the variations in minor, but biologically important, components of natural sea water. In the past synthetic sea water has meant as exact as possible a copy of the real thing. Synthetic sea water based on the requirements of the organisms concerned is essentially simpler as well as more useful to the biologist.

Synthetic sea water is used by biologists primarily for growing microorganisms in pure culture—that is, in the absence of any other living thing. Pure culture studies are in turn necessary for the following sorts of investigations:

Description of marine organisms — The description and naming of marine fungi, which is fundamental to research, has been made very difficult by the perishability of many forms as collected in nature. Pure cultures are not so perishable and may be maintained as reference standards.

Their control — Filamentous marine fungi have been shown to be one cause of deterioration in wood and cordage submerged under aerobic conditions. More delicate parasitic forms attach economically important plants and animals. For example, Labyrinthula (one of the fungi known as slime molds) caused the near disappearance of eel grass along the coasts of the Atlantic and with it the edible mussels, scallops, and the feeding grounds of many game birds.

Their physiology — In any such relatively unknown group as the marine fungi one hopes and expects to find organisms uniquely suited to investigations of general biochemical interest.

For these reasons, our laboratory has first tried to determine which of the major components of sea water are required by marine fungi, and whether sea water really does contain the best concentrations of these inorganic ions. Some marine fungi (in fact, most of the more familiar filamentous forms resembling bread mold, Penicillium, etc.) are known to grow in fresh water as well as in the ocean, or even in salt solutions much more concentrated than sea water. The so-called lower fungi are more exacting: they will grow only in sea water. These are the obvious choice for investigating the fine points of the fit between the growth requirements of marine fungi and the very constant chemical environment provided by the oceans. We have done most of our work with three species of Labyrinthula isolated by S. W. Watson, both because they are marine and because one species presents a very interesting biochemical problem.

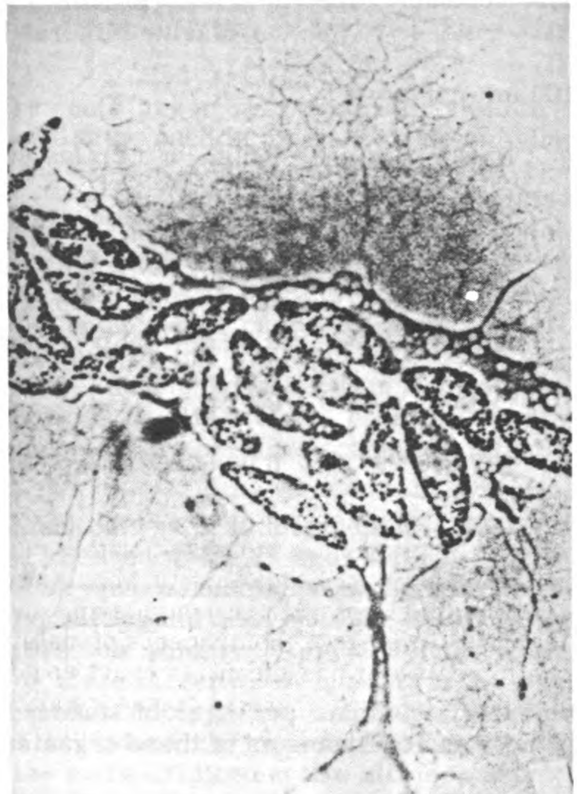


Figure 1 - Labyrinthula cells in phase contrast. Photomicrograph used by courtesy of S. W. Watson

Labyrinthula, the cause of the wasting disease of eel grass, is shown in Figure 1. It is a pink to colorless, single-celled microorganism which is very unlike the usual notion of a fungus and is not closely related to other fungi. The spider-web background in the illustration is made of proteinaceous material secreted by the spindle-shaped cells, along which they glide.

The synthetic sea water which we developed for Labyrinthula is shown in Table I. Media made with this inorganic base also support as good or better growth of other marine fungi (including the clam parasite Sirolpidium) as media made with natural sea water. Many of the ingredients of our synthetic sea water would be included in any culture medium—phosphate, ammonium, and traces of metallic ions are generally required by microorganisms from any source. The important points to note are the following:

Sodium chloride at 2.5 percent (an average of the best concentrations for the three species studied) provides 428 mg-atoms of sodium per liter. Standard sea water contains 470 mg-atoms of sodium per liter.

The final medium, consisting of mineral base, energy source, and vitamins, when brought to the proper degree of alkalinity for growth, contains 14.4 mg-atoms of potassium per liter. Of this, the two more exacting species require at least 11.0 mg-atoms per liter compared to

TABLE I
Marine Mineral Base

100 ml. contains:

NaCl	2.5 g.	Zn (as sulfate)	2.0 mg.
KCl	0.1 g.	Mn " "	2.0 mg.
$MgSO_4.7H_2O$	0.5 g.	Fe**	0.2 mg.
KH_2PO_4	0.01 g.	Co (as sulfate)	0.02 mg.
$CaCO_3$	0.02 g.	Cu " "	0.002 mg.
EDTA*	0.05 g.	B (as boric acid)	0.02 mg.
$(NH_4)_2CO_3$	0.02 g.	Mo (as sodium molybdate)	0.02 mg.

*EDTA is ethylenediamine tetraacetic acid; Versene, free acid.
**As stock solution containing $FeSO_4.7H_2O$, 24.9 mg./ml. (Fe, 5.0 mg./ml.); EDTA, 30 mg./ml.; and $(NH_4)_2CO_3$, 20 mg./ml.

the 9.96 mg-atoms per liter of standard sea water. The sodium and potassium requirements of these organisms do not interact.

The more exacting species will not grow if either the calcium or magnesium content of the medium is lowered. These species would probably grow better if more calcium and magnesium could be provided; technical difficulties have so far prevented determination of the best concentrations of these ions. The less exacting species, while growing best in the concentrations used, will grow sufficiently at lower concentrations so that we could show that calcium and magnesium ions are partly interchangeable. The medium contains 2.0 mg-atoms of calcium per liter (cf. 10.24 in standard sea water) and 20.3 mg-atoms of magnesium per liter (cf. 53.57 in standard sea water).

Our conclusion is that the more exacting Labyrinthulas not only require sodium, potassium, calcium, and magnesium ions, but require them in concentrations of the same order of magnitude as in standard natural sea water. They do not require the strontium and boron which complete the list of major cations in sea water. (Boron is included in the medium only as a trace element, which can be omitted without affecting growth.)

This information has been used in isolating and growing other marine fungi. It has also provided the means of investigating the biochemical problem of the Labyrinthulas. One species, L. vitellina var. pacifica, requires for growth very small amounts of cholesterol (2.0 μg. per ml.), in addition to synthetic sea water, monosodium glutamate as energy source, and the vitamin thiamine. This requirement is of interest first, because it is a genuine growth factor requirement, which represents the inability of these cells to manufacture metabolite which may be essential to all plant and animal cells. Secondly, it is one of only five microorganisms which can be used to study cholesterol as a growth factor and it has certain unique advantages over the other four for such study.

Not all cholesterol requirements are growth factor—or vitamin—requirements. Cholesterol may also be used in media as a detoxifying agent for unsaturated fatty acids. In this role, however, it can be replaced by other, chemically unrelated, substances. The cholesterol requirement of Labyrinthula is very specific. The only compounds which can replace it are chemically related steroids which must have the long side chain of the cholesterol molecule (shown diagrammatically in Figure 2). Very few changes can be made in this molecule without inactivating it; a shift in the configuration of the C-3 hydroxyl, some (but not all) shifts in the position of the double bond between C-5 and C-6 are as fatal as shortening the side chain. Most of the products of very mild oxidation, such as cholestenone, are still as active, or slightly more so, as cholesterol.

Which of the active steroids is the natural metabolite? This is a question to which specificity studies suggest no answer, since at no point do the specificities of the five known steroid-requiring microorganisms coincide. One of the advantages of Labyrinthula, however, is the existence in culture of two species which will grow without added steroids. We have grown one of these in sufficient quantity to be able to say that at least 95 percent (and possibly all) of its steroid content is cholesterol. If cholesterol is indeed the missing metabolite in L. vitellina var. pacifica, then the more oxidized active steroids should be converted into cholesterol by this species. We are now trying to ascertain, with the aid of radioactive cholestenone, whether this indeed occurs. If it does, it will provide supporting evidence for the idea that cholesterol, now known mainly as a raw material for the manufacture of the steroid hormones and bile acids which accumulate inconveniently in arteriosclerosis, is a vital cellular ingredient in man, as well as in Labyrinthula, at the other end of the evolutionary scale.

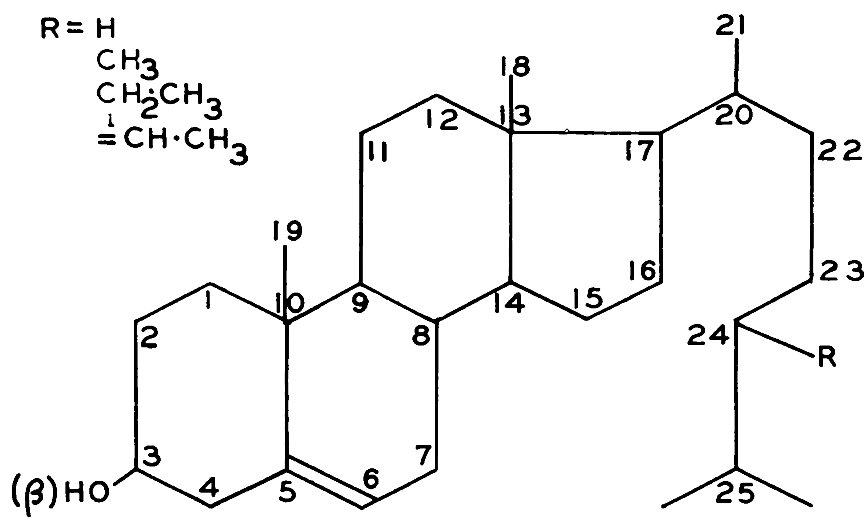


Figure 2 - R = H, the cholesterol molecule; R = CH_3, campesterol and dihydrobrassicasterol; R = CH_2CH_3, clionasterol and β-sitosterol; R= $=CHCH_3$, fucosterol. All of these closely related sterols which have been tested are active for Labyrinthula.

The Moon Position Program of I.G.Y.

Wm. Markowitz
Director, Time Service Division
U. S. Naval Observatory

During the forthcoming International Geophysical Year, 1957-58, an intensive program on a world-wide basis is to be carried out for the determination of the position of the moon by photography. This program has for its aims the solution of several special problems in the fields of astronomy, geophysics, and geodesy. These include the determination of uniform time, changes in the speed of rotation of the earth, corrections to the elements of the moon's orbit, and the size and shape of the earth.

The idea of using the moon for the determination of time and for geodetic purposes is not new. It was proposed over 400 years ago that the moon be used to determine time.

The rapid development of the maritime industry after the discovery of America made one navigational problem critical, namely, finding the longitude at sea. It was proposed as early as 1514 that the moon be used to solve this problem. The motion of the moon amongst the stars provides in effect a clock, the moon being the hand and the stars being the hour marks. If a table of the moon's position were available to the navigator he could determine the time at some fixed meridian by determining the position of the moon. The difference between this time and the local time, which may be readily determined, furnishes the desired longitude.

The method did not come into use, however, until about 1760, when tables giving the position of the moon and the positions of the stars with the requisite accuracy became available. Observing the position of the moon at sea was known as "casting a lunar." At just about the same time the marine chronometer was invented. This enabled the longitude to be determined with much higher accuracy and with much less difficulty than by the lunar method. Nevertheless the lunar method continued in use on a limited scale until the early 1900's.

Although the use of lunar observations for determining time at sea died out, the use of the moon in precise time-keeping has more recently taken on a new importance. Accurate positions of the moon, obtained by astronomers from transit observations and occultations,* had shown an apparent wandering of the moon from its predicted place. When analyses of the orbital motion of the earth, Venus, and Mercury about the sun showed corresponding discrepancies, it became clear that it was the rotation of the earth that was not uniform. The moon or the planets may be used to furnish uniform time, but because of its rapid motion the moon is most suitable, and has been used by astronomers when uniform time was needed. The uniform time so determined is called Ephemeris Time.

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*Shutting off of the light of one celestial body by the intervention of another.

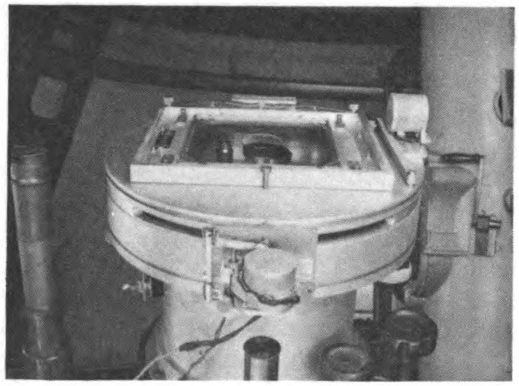

Figure 1 - View of moon camera

Time as determined at the U. S. Naval Observatory is the standard of time as well as frequency for the United States. In recent years there has been an increasing demand for more and more precise determination of both. Consequently, there has been an urgent need for a rapid method of determining the position of the Moon with great accuracy.

This problem was solved by the construction of the dual-rate moon-position camera (Figure 1), which simultaneously tracks the moon at the lunar rate and the surrounding stars at the sidereal rate. Since the moon is held fixed relative to the stars a sharp photograph is obtained, and measurement of the plate furnishes the position of the moon relative to the stars with an accuracy higher than that obtained by other methods. The dual-rate camera makes it possible for the first time to determine the position of the moon accurately whenever it can be clearly seen at night.

At the center of the field of the camera there is placed a dark, plane-parallel glass filter through which the image of the moon passes. During the exposure the filter is tilted, thereby moving the image of the moon (Figure 2). The axis of tilt and the rate of tilt are selected for each observation so as to keep the moon fixed relative to the stars (Figure 3). The epoch of observation is the instant when the dark filter is parallel to a light yellow filter which is in front of the star field.

Measurements are made of the coordinates of about 10 stars and about 30 points on the bright limb (outer edge) of the moon. Three points are in theory sufficient to determine the position of the center of the

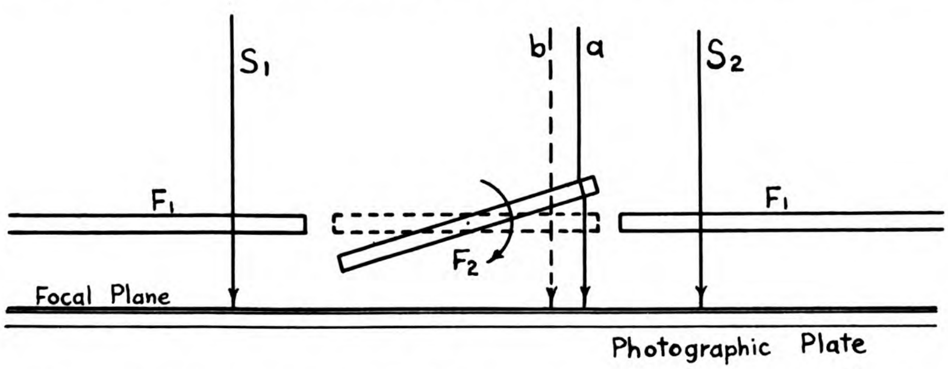

Figure 2 - A ray of the moon's image, at "a", is deviated as it passes through the tilted filter, F2. When the filters are parallel there is no deviation, as at b. A continuous tilting of the filter during the exposure removes the motion of the moon relative to the stars, at S1 and S2

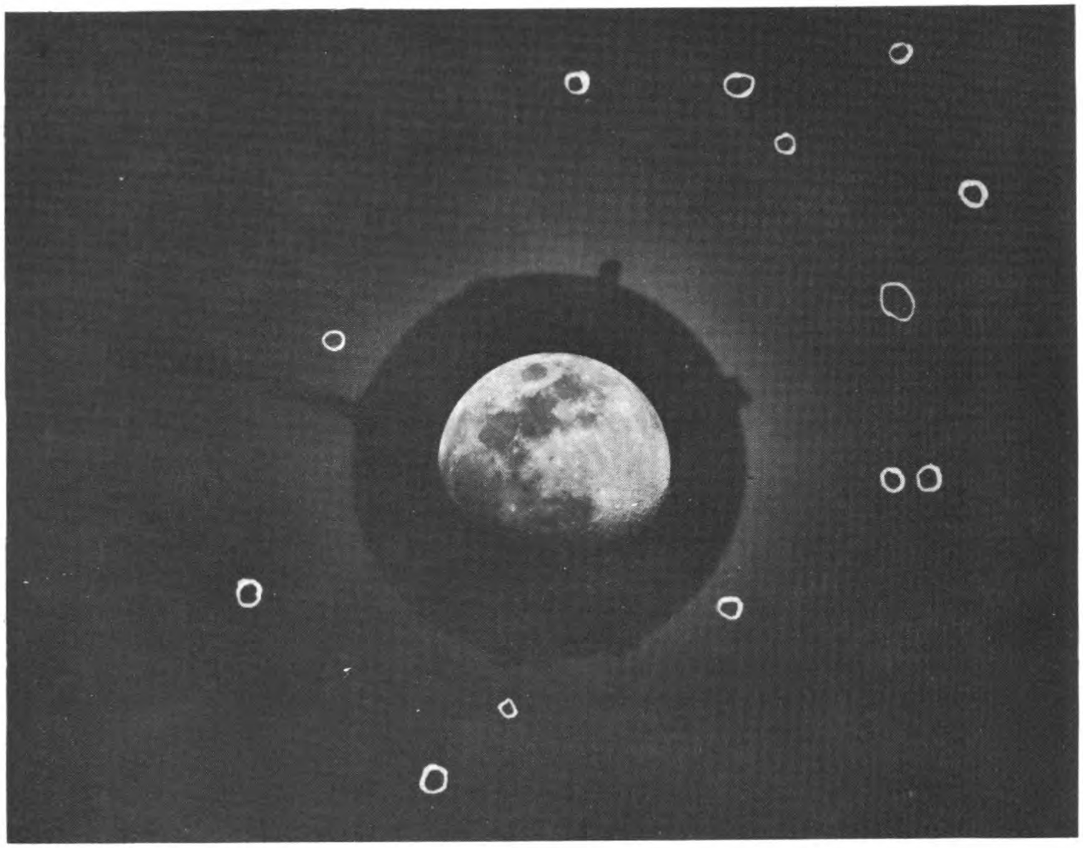

Figure 3 - View of the moon and the Pleiades.
The stars are within the marked circles

moon but more are measured so as to reduce the error due to limb irregularities. Corrections for the latter will be applied when a current Naval Observatory program for their determination is finished.

The camera was attached to the 12-inch refractor of the U. S. Naval Observatory in June 1952. It has been in continuous use since then for the determination of Ephemeris Time.

The time ordinarily determined is mean solar time, of which Universal Time, or G.M.T., is one form, and it is based on the rotation of the earth. Owing to variations in the speed of rotation of the earth Universal Time is not uniform. The Naval Observatory now determines both Ephemeris Time and Universal Time. The difference between the two is ΔT = E.T. - U.T. The value of ΔT is found to be, now, about 30 seconds. It may be noted that it is the non-uniform Universal Time which is to be used in determining longitude with a sextant.

The moon is useful in geodesy because of its nearness; its apparent position against the background of stars is sensibly affected by the position of a station with respect to the center of the earth. Hence, it becomes possible to obtain information about the geometric position of the station. Geographical positions are ordinarily based on astronomical observations which are referred to the direction of gravity at the station. Local gravity anomalies affect the positions so obtained, and do not give the proper relation to the center of the earth.

The observations of the position of the moon are not affected by gravity, and may be used to furnish an independent determination of the size and shape of the earth. During the last 20 years several highly accurate techniques for using eclipses and occultations for geodetic purposes have been developed. The observational opportunities for using these techniques, however, are limited. To utilize the moon fully it is necessary to make a general solution for a large number of unknowns, and thousands of observations are required to separate these unknowns satisfactorily. A world-wide program is needed, and the dual-rate camera lends itself to such a program.

In order that this program could be placed under way rapidly the Office of Naval Research offered to pay for the construction of 20 cameras and 4 measuring engines. These items are now being constructed under the direction of the Naval Observatory, and will be placed in trial operation in 1956. The cameras will be attached to telescopes of the cooperating observatories. These observatories are located in North America, South America, Hawaii, New Zealand, Australia, Japan, India, Africa, and Europe.

The Naval Observatory will operate stations at Washington, D. C., and San Diego, California, while the U. S. Coast and Geodetic Survey will operate the station at Hawaii.

The I.G.Y. program proper will run from June 1957 to December 1958. During the course of the program preliminary values of Ephemeris Time will be obtained. A comparison with mean solar time will reveal changes in acceleration and in the rate of rotation of the earth, which may then be correlated with geophysical date obtained from other programs of the I.G.Y. A general solution will be made by the Naval Observatory after the observing has been concluded, and should be completed about 1960.

International Study on Atomic Energy Dangers

As prelude to the big conference in Geneva on "Atoms-for-Peace," atomic scientists from 14 countries met in London from August 3 through August 5. They were concerned with the dangers that arise from the use of atomic energy, and measures that may be taken to avert or minimize these dangers.

At the conference which was attended by 130 scientists, some discussion developed on the dangers arising from nuclear-powered airships. It was pointed out that the engines cannot be shut off like those powered with gasoline or jet fuels. Thus in the case of a crash or other accident, the nuclear power plants would represent a great hazard very difficult to control if the engine were shattered or ruptured. Therefore some stringent government regulations might be needed to enforce special "packaging" of radioactive materials intended for the use of aircraft engines.

In a similar vein, adequate precautions were urged on the entry of nuclear-powered ships into world ports. It was suggested that port authorities might insist that there be absolutely no risk of contamination to their facilities or harbor due to the visit of the ship in port.

Membership of Naval Research Advisory Committee

Since 1946, the Office of Naval Research has had the benefit of the guidance and suggestions of a committee made up of outstanding scientists in the country. The membership of this Advisory Committee has changed from time to time, and there has also been some rotation among the officers.

At a recent meeting, Dr. J. A. Stratton, Provost, Massachusetts Institute of Technology, was elected Chairman of the Naval Research Advisory Committee to succeed Dr. John A. Hutcheson, Vice President and Director of the Westinghouse Electric Corp. Another change in the officers found Dr. Mervin J. Kelly elected Vice Chairman to succeed Dr. Stratton. Dr. Kelly is President of the Bell Telephone Laboratories.

Reappointed to membership of the Committee was Dr. A. B. Kinzel, Vice President of Research for the Union Carbide and Carbon Co. He will serve three years as will Dr. Frederick Seitz, a new member, who is Director of Physics, Physics Dept., University of Illinois.

The Office of Naval Research has not only received valuable collective guidance from the Committee, but on occasion has benefitted from individual contributions. Only a few years ago Dr. A. B. Kinzel, Dr. J. E. W. Sterling, and Dr. J. A. Hutcheson spent three days at the Navy Electronics Laboratory assisting the Bureau of Ships in a comprehensive survey of the Laboratory's operations and program.

In addition to the more specialized and individual contributions, the Committee at its formal meetings receives reports on the Navy's research effort and considers the policy questions uppermost in the minds of those administering the research programs. Examples of these are the supervision and coordination of research and development by the Office of the Secretary of Defense; Marine Corps research; contract policy; research and development on critical materials; and utilization of scientific resources on a long-range basis.

Following the various presentations at the meetings of the Committee, the members have been in the habit of attending a conference with representatives of the Secretary of the Navy and of the Chief of Naval Operations. These "briefings," as they are called, provide an opportunity for a review of the day's discussion, and for the presentation of recommendations.

Dr. Lund Heads ONR Engineering Psychology Branch

Duties as head of the Engineering Psychology Branch at the Office of Naval Research have been assumed by Dr. Max W. Lund. He replaces Dr. Franklin V. Taylor who is now on part-time leave in England.

Dr. Lund was formerly Head of the Human Engineering Branch at Navy Electronics Laboratory in San Diego, Calif. Prior to that he was an Associate Professor of Psychology at the University of Utah. Previously in San Diego, he was Dean of the School of Letters, Arts, and Sciences, San Diego State College.

On the Naval Research Reserve

Eighth Annual Research Reserve Seminar

Approximately fifty members of Naval Research Companies, along with six representatives from the Army Research and Development Reserve Program, attended the Eighth Annual Research Reserve Seminar at Washington, D.C. during the period 11-22 July 1955 (see photo inside back cover).

CAPT Theodore Blanchard, USNR, Special Assistant to the Chief of Naval Research (Research Reserve) was seminar chairman. The seminar program was opened with an address by the Honorable Donald A. Quarles, Assistant Secretary of Defense (Research and Development). Mr. Quarles, who discussed "Research and Development in the Armed Forces", was followed by VADM R. P. Briscoe, USN, DCNO (Fleet Operations and Readiness). VADM Briscoe's remarks emphasized the importance of research in support of fleet operations.

During the first week of the seminar two days were devoted to a review of the Office of Naval Research - its mission, organization, operation, and some of its major programs. This phase of the schedule was introduced by the Honorable James H. Smith Jr., Assistant Secretary of the Navy for Air and by RADM F. R. Furth, USN, Chief of Naval Research. Secretary Smith discussed some of the Navy's research and development problems at the present time and emphasized the importance of the reserve component keeping abreast of these problems and assisting in their solution. RADM Furth's subject was "The Research Reserve - ONR's Standby Force".

CAPT L. D. Coates, USN, Deputy and Assistant Chief of Naval Research, discussed the "Administration of Research and Development in the Navy", and Dr. T. J. Killian, Deputy and Chief Scientist talked on "ONR's Role in Research and Development". These speakers were followed by CAPT S. M. Tucker, USN, Director, Naval Research Laboratory, and CAPT C. H. S. Murphy, USN, Commanding Officer and Director, Special Devices Center, who presented the mission, organization, and work of their respective ONR field activities. CAPT C. B. Hart, USN, Assistant Chief for Research discussed the "ONR Contract Program". His talk was followed by an open house afternoon, during which time the research reservists visited the research divisions and branches representing their particular interests.

A second ONR Day was devoted to presentations by the research divisions. This program was introduced and conducted by Dr. R. M. Robertson, Science Director, ONR. The Mathematical Sciences, Earth Sciences, Material Sciences, Physical Sciences, and Naval Sciences Divisions were all represented by groups of speakers who reviewed outstanding programs and projects.

Members from Research Reserve seminar ride up on beach
in plastic boat at Fort Belvoir

The representatives of the Biological and Psychological Sciences Divisions made their contributions to the seminar program in conjunction with presentations by personnel from the Bureau of Medicine and Surgery and from the Naval Medical Research Institute. Their presentations were made at NMRI as a part of a full day's field trip to that activity. The seminar program for this day was introduced by CAPT W. E. Kellum, MC, USN, Commanding Officer, NMRI, CAPT Clifford Phoebus, MC, USN, Special Assistant for BioSciences, ONR, and CAPT O. D. Yarbrough, USN, Director of Research Division, BuMed.

On Monday of the second week the Honorable Albert Pratt, Assistant Sec Nav for Personnel and Reserve Forces, spoke to the group on "Esprit de Corps in the Armed Forces". Later in the program, the group heard from RADM W. K. Romoser, ACNO (Naval Reserve), who spoke on current Naval Reserve planning, CAPT E. K. Van Swearingen, Assistant Chief of Naval Personnel for Education and Training, who discussed some aspects of the Navy's training program, and from CAPT Frank G. Selby, Director of the Public Information Division of the Office of Information.

One of the outstanding features of the program was a joint presentation by CAPT W. B. Moore, USN, Executive Assistant, Atomic Energy Division, CNO, and by CDR G. B. Cattermole, USN, Executive Officer, Development Division, Armed Forces Special Weapons Project. These officers made a most effective presentation of the Navy's interest in atomic energy and in special weapons.

Among the promenent civilian speakers who addressed the seminar were Dr. A. K. Brewer of the Office of the Chief of Naval Operations, Dr. Harvey Hall, Director of Operations Research Division, ONR, and Mr. Ray Mayhew of the National Science Foundation.

Field trips to research and development laboratories in the Washington area were spaced at appropriate intervals during the two-week period. The group visited the Applied Physics Laboratory at

Silver Spring, Md., the David Taylor Model Basin, at Carderock, Md., and the Army Engineer Research and Development Laboratories at Fort Belvoir, Va. (see figure).

Social occasions for the period featured a banquet on the opening night and a crab feast and picnic in conjunction with the field trip to Annapolis, Md. This entertainment was arranged by Naval Reserve Research Company W-7, Annapolis, Md.

Seminar in Aviation Medicine

The Chief of Naval Personnel has authorized a seminar in Aviation Medicine for members of the Naval Research Reserve. The seminar will be one of the regular ONR-sponsored seminars for the present Fiscal Year and will be conducted during the period 13-26 May 1956. BuPers Instruction 1500.B will be amended to include this seminar in the over-all offering, bringing Research Reserve Seminars for Fiscal Year 1956 to a total of nine. Quotas for the seminar, reporting instructions, and other pertinent information will be disseminated at an early date.

The seminar will be conducted by the U. S. Naval School of Aviation Medicine, Pensacola, Fla., in collaboration with the Naval Air Training Command and the Office of Naval Research.

The purpose of the seminar is to provide members of the Research Reserve with information concerning scientific problems related to human factors in Naval Aviation. The subject matter will be of interest to physicists, chemists, mathematicians, biologists, physiologists, psychologists, and to other scientists in fields allied or basic to medical research.

The seminar will be open to members of the Research Reserve, regardless of designator.

A sample of the program to be offered has been prepared, and the seminar promises to be an excellent active duty for training opportunity for research reservists with appropriate qualifications.

Preliminary arrangements have been worked out by representatives of ONR, the U. S. Naval School of Aviation Medicine, and the Naval Air Training Command. Prior to its approval by the Chief of Naval Personnel, the seminar received the endorsement of the Chief of Naval Air Training and the Chief, Bureau of Medicine and Surgery.

The proposal for the Aviation Medicine Seminar was made by LCDR Henry A. Imus, Commanding Officer of Naval Reserve Research Company W-5, who represented the Research Reserve in the conference at Pensacola. Thanks are due to LCDR Imus for his efforts in providing the Research Reserve with a valuable addition to its seminar training program.

Seminar at Idaho Falls

The Second Annual Nuclear Sciences Seminar at Idaho Falls, Idaho, was conducted during the period 25 July - 5 August 1955. Approximately fifty members of the Research Reserve had the opportunity to hear from many of the foremost scientists in the nuclear field as well as from prominent military authorities. The seminar, which as sponsored by the Office of Naval Research, the Atomic Energy Commission, and the Operating Contractors at the Naval Reactor Testing Station, was established and conducted by Naval Reserve Research Company 13-6, Idaho Falls, Idaho.

Dr. R. L. Doan, Manager, Atomic Energy Division, Phillips Petroleum Company, set the atmosphere of the seminar (appropriately enough on Pioneer Day, a local holiday) by reviewing the work in the atomic field and defining the present day frontiers of the science.

The speakers who addressed the group were for the most part from the Idaho Operations Office, Atomic Energy Commission, or from the staff of contractors operating various projects at the National Testing Station.

Outstanding features of the seminar program were the field trips. On Thursday, 28 July, the group visited the Naval Ordnance Plant, Pocatello, Idaho. On Saturday, 30 July, a tour of the AEC's Submarine Thermal Reactor was made. On Wednesday, 3 August, there was a tour of the Materials Testing Reactor, the highest neutron flux reactor in operation and the research tool making possible the knowledge necessary to build the atomic plants of the future. The group also visited the Chemical Processing Plant, where spent reactor fuel elements are dissolved and the unburned fuel recovered for reuse. An interesting feature of this trip was the remote analytical laboratory where samples having hundreds of roentgens per hour radioactivities are measured and analyzed behind thick walls and lead glass windows to provide the information necessary to operate the plant.

On Wednesday of the first week, RADM F. R. Furth, USN, Chief of Naval Research spoke to the group on "ONR's Approach ot Naval Research". CAPT Theodore Blanchard, USNR, Special Assistant for Research Reserve, also visited the seminar and discussed developments in the reserve program with the group.

Mr. R. L. Stoker, of the Rocky Mountain Nuclear Power Studies Group, summed up the seminar on the last day when he made his address on "The Future of Industrial Reactors".

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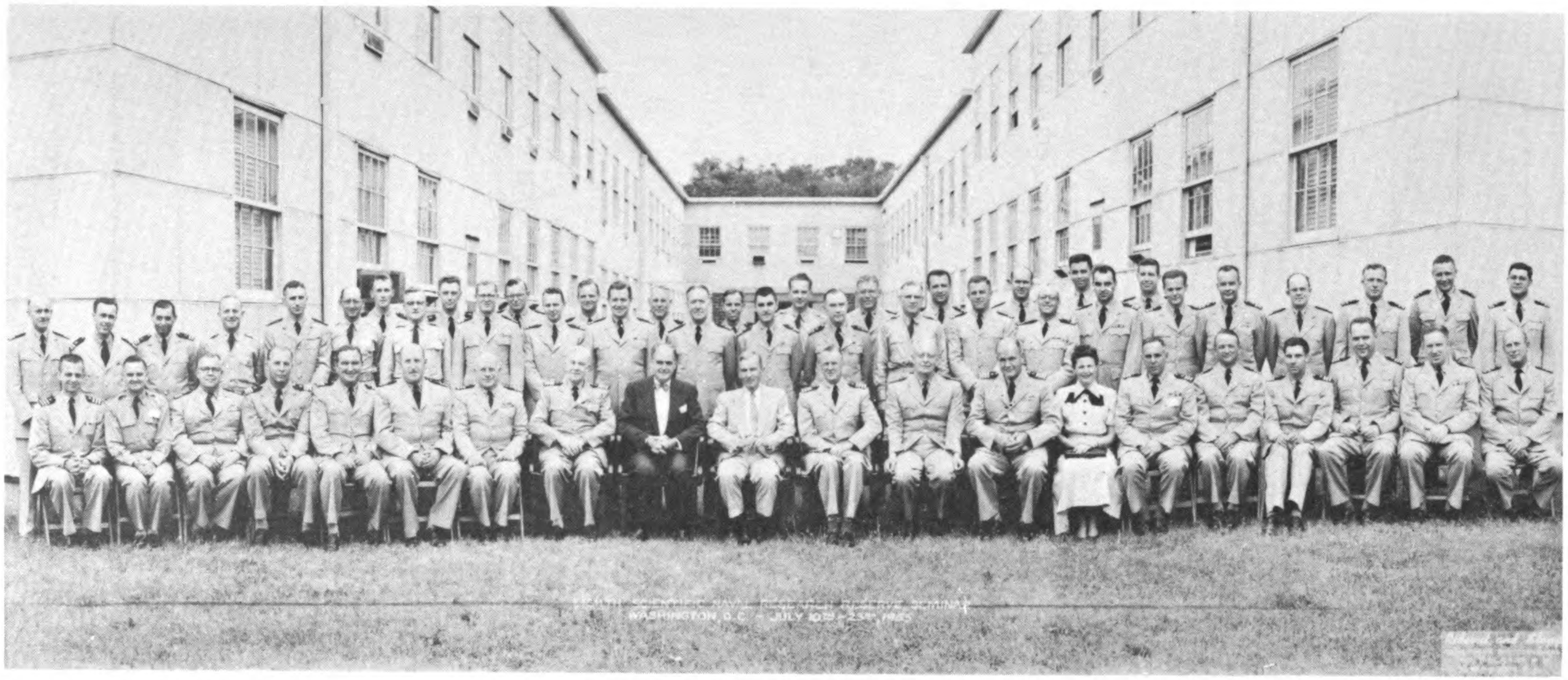
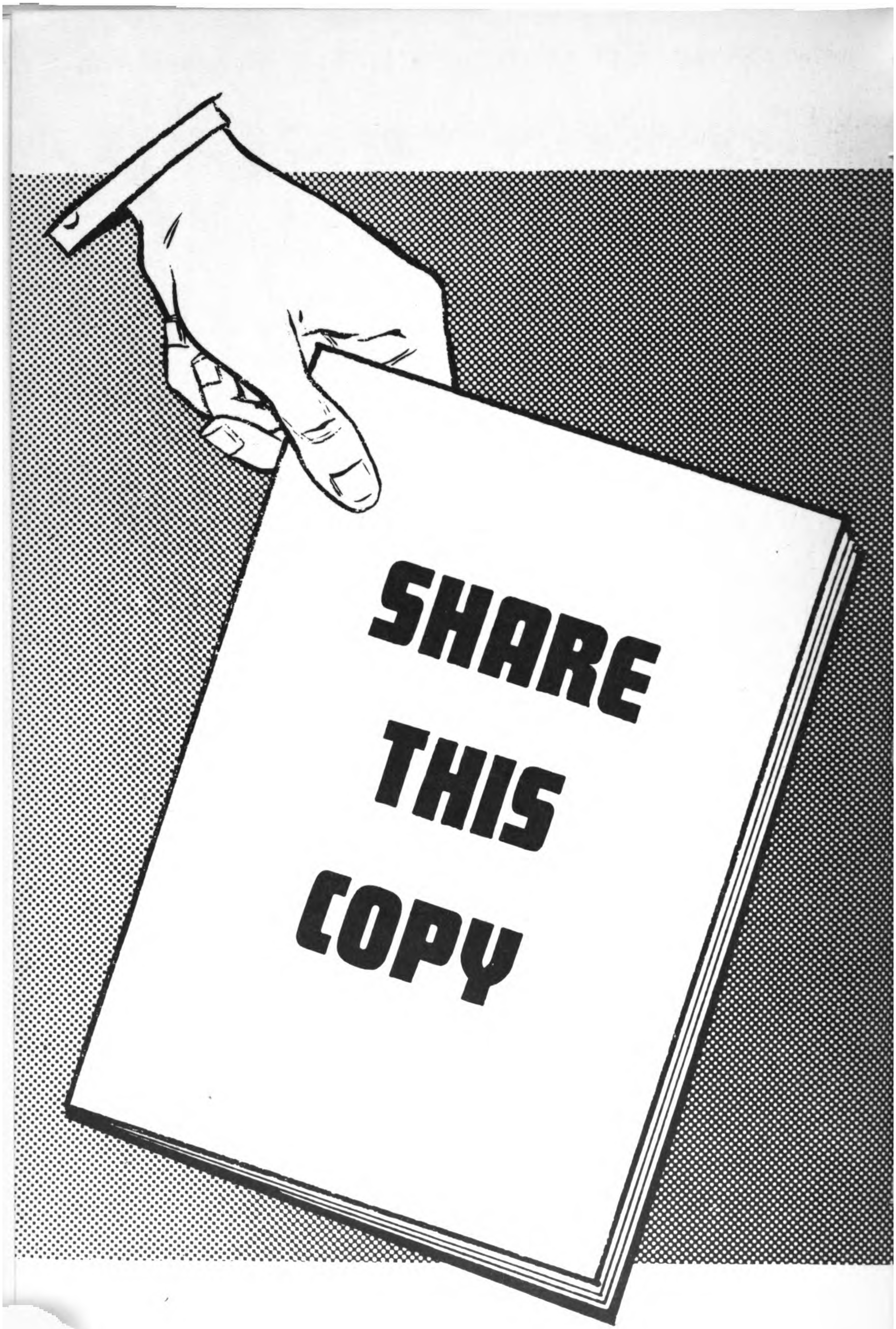


Reserve officers attending Eighth Annual Seminar during a visit to the Army Engineer Research and Development Laboratories at Fort Belvoir, Va. (See page 31).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