OFFICE OF NAVAL RESEARCH JUNE 1954

RESEARCH REVIEWS

Probing the Depths

NAVEXOS P-510

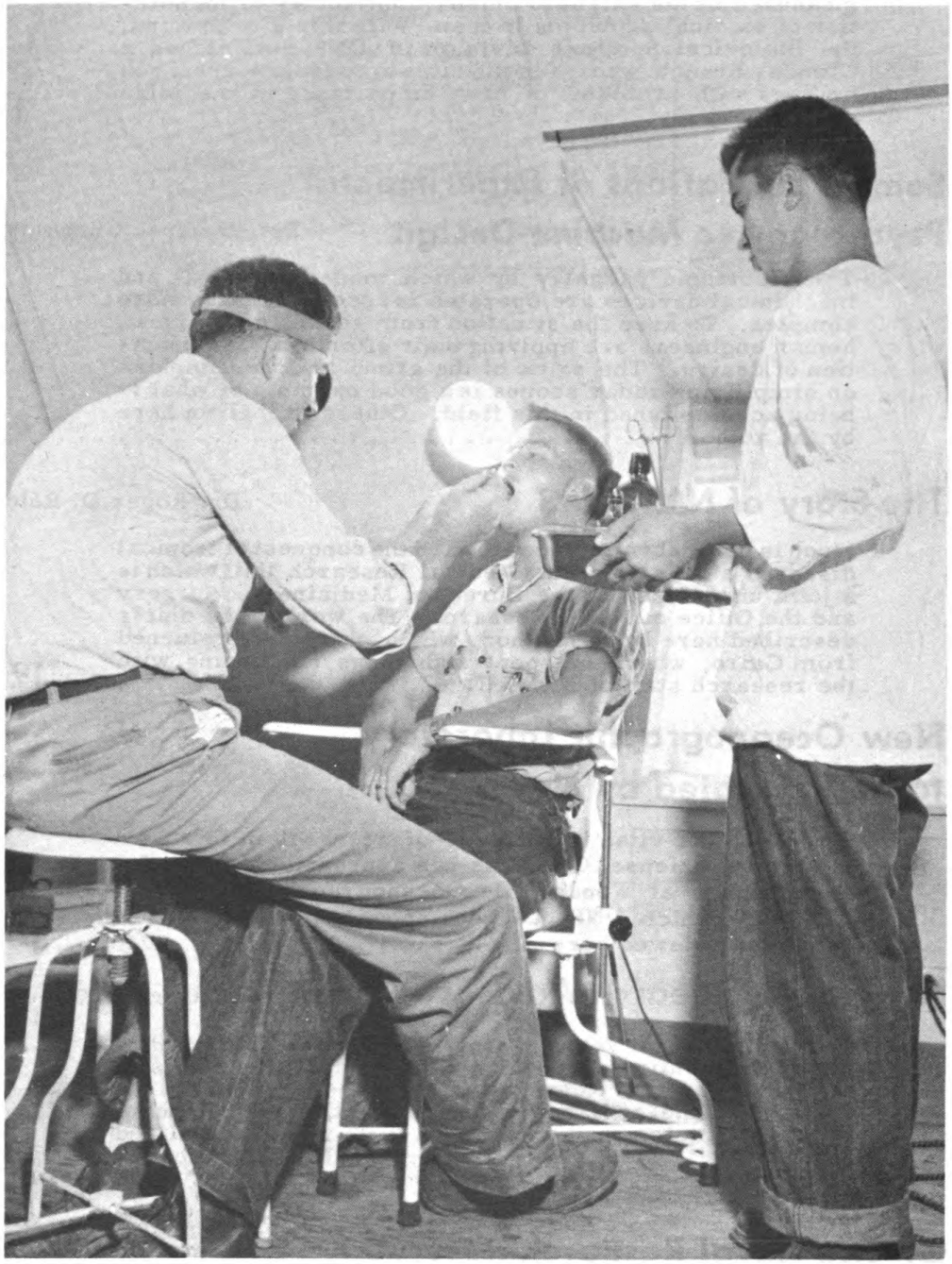
DEPARTMENT OF THE NAVY
WASHINGTON, D. C.

COVER PHOTO: The new laboratory at the Woods Hole Oceanographic Institution. Here, research of vital importance to national security is being conducted under contract to the Office of Naval Research; Woods Hole is world famous for its researches in the field of oceanography; the work being done here is described on page 19.

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.

Approved by Bureau of the Budget, 14 February 1952

In This Issue



One of the outlets for medical research . . . . the Naval Hospital

The Clinical Aspects of Biologic Research

by

Joseph F. Saunders

Assistant to the Head of the Clinical Branch, ONR

One of the problems confronting any agency sponsoring a research program in the biological sciences is that of applying these results to medical problems in man. In an attempt to overcome this, the Office of Naval Research established a Clinical Branch in its Biological Sciences Division in order to correlate the results of certain phases of biologic research with problems of naval importance in medicine and surgery. The functions of the Clinical Branch were designed to conduct a program in the more applied aspects of those biologic problems of medical importance to the military, including neuropsychiatric disorders. In addition, the responsibility of supervising an extramural program sponsored by the Bureau of Medicine and Surgery was vested in this Branch. Another important function is that of maintaining liaison with the Research Division, Bureau of Medicine and Surgery and its numerous laboratories, and civilian institutions in the program of the Biological Sciences Division of the Office of Naval Research.

The actual research program of the Clinical Branch includes three major categories of military significance. These are (1) blood, circulation, and fluid balance; (2) neuropsychiatric stresses and deviations; and (3) prevention and management of pathologic states. The first of these programs includes such studies as: (1) development and testing of synthetic or naturally occurring substitutes for use as blood volume restorers, (2) factors which stimulate production of hemoglobin and red blood cells, (3) physiology and pathology of cold injury of the extremities, (4) proliferation of lymphocytes in epidermal injury, (5) erythrocyte-antibody reactions and erythrocyte destruction, and (6) preservation and sterilization of blood plasma.

The need for a general purpose blood volume restorer is essential in the treatment of shock resulting from trauma, burns, and other injury, particularly in situations when the supply of whole blood becomes inadequate. Simultaneously, the need of improved processes for sterilization and preservation of plasma and whole blood has become apparent due to medical complications resulting from infected plasma. Methods for the preservation of blood serum and the mechanism of red blood cell antigenicity are of considerable importance in clinical practice, while information relative to the causative factors in the antigen-antibody complex could possibly affect an alteration of present-day infusion.

To date there is only one task under the second program. It is concerned with the effects of stress on colloidal systems in man, with special reference to acceleration, anoxia, and decompression stresses. As the stress state imposes additional burdens on the colloidal system,

information concerning the underlying mechanisms is needed, particularly under combat, where the problem of stress becomes manifold.

The third program—prevention and management of pathologic states—covers such tasks as (1) studies of pulmonary anatomy, pathology, and techniques for the treatment of anomalies and injury; (2) studies of infectious hepatitis; (3) replacement of opaque corneas with plastic materials; (4) function and morphology of blood vessels; (5) studies concerning combat head injury, particularly follow-up studies; (6) control of postoperative and other posttraumatic pain; (7) amino acid metabolism in surgery; and (8) study of bone and tissue repair.

This program, therefore, covers a broad and varied field. The knowledge of definitive etiology, treatment, and prevention of many diseases is far from complete, and in these respects, further fundamental and applied research is extremely important. In the study of pulmonary anatomy and pathology, through functional and experimental correlation of techniques already developed, a better understanding of cardiopulmonary diseases and their management may be obtained. Pathologic alterations involving the cornea may be remedied by replacing this delicate and vital tissue with a suitable and durable synthetic material, which can be successfully grafted to the tissues of the eye. Further clarification of the inherent anatomy and morphology of blood vessels will benefit the clinician and the surgeon in the medical and/or surgical treatment of damaged or diseased blood vessels. Plastic repair of major blood vessels may greatly improve the circulatory tree by preventing what may have resulted in marked ischemia and eventual loss of limbs or life. Improvement in therapy of the pre- and postoperative patient is vitally important, particularly in the recovery period which can be shortened by a diet fortified with certain nutritional essentials. Isolation of a potential healing factor in wounds such as burns, deep lacerations, multiple fractures, and other cases of serious tissue injury could probably result in the development of a topical substance, capable of ameliorating present-day treatment of, and accelerating recovery in, such serious medical emergencies.

During the two years in which the Clinical Branch has been functioning, several significant accomplishments have evolved from its research program. Fundamental investigation of pulmonary anatomy and physiology for the development of improved techniques for use in thoracic surgery has shown that the pulmonary veins of an entire lung of an experimental animal can be tied off without producing hemorrhage and necrosis, provided the animals are protected with antibiotics. After this ligature, a remarkably extensive "collateral" circulation develops. This operation suggests a simple procedure with possible applications in the partial correction of disturbed blood flow due to congenital defects of the great vessels.

As a result of the development of an ultraviolet color-translating microscope,[1] cell structures under normal and abnormal conditions

[1]Support for this project came from an ONR Contract and grants-in-aid from the American Cancer Society and the Atomic Energy Commission.

can be studied with increased accuracy. This instrument will probably be highly valuable in studying the complex nature of proteins, peptides, polysaccharides, and other biologic tools essential to health and well-being, and in studying diseased tissues without altering the morphology by the use of differential stains. Specimens, which are completely colorless when viewed by ordinary light, give results comparable to a selectively stained sample with this instrument. More accurate analyses of chemical composition appear possible, particularly the nucleic acid distribution of cells undergoing mitotic activity. The speed and ease of making and processing photographs with this instrument make possible the examination of a large number of fields or specimens in a short time. This photographic image allows for a permanent record of the observations for later evaluations and comparisons with other specimens.

In the investigation of function and morphology of blood vessels, it was demonstrated that the most favorable results in the treatment of frostbite are obtained through the use of a tetramethylammonium compound to effect prolonged vasodilation following rapid thawing of the frozen part. The problem of treatment of frostbite is a controversial one and this study represents one of several aimed at clarifying the most satisfactory methods of treatment.

An apparatus has been developed which controls much of postsurgical and other posttraumatic pain. It consists of a series of plastic tubes, inserted near the site of surgical intervention, through which an anesthetic agent such as procaine is administered. The application of this process has proved successful in controlling pain in various types of thoracic, abdominal, inguinal, and rectal surgery. This method is safe and free of inconvenience to the patient—the anesthetic agent can be administered at more frequent intervals, without repeated injections.

Work with glycerol pectate shows the potentialities of an effective blood volume restorer which is relatively cheap to manufacture, is nonantigenic, durable when subjected to prolonged storage and exposure to varying temperatures, and capable of being stockpiled in a minimum of space such as on a ship, submarine, or aircraft. Although this product is still in an early stage of experimentation, results of trials in restoring blood volume of animals in various stages of shock suggest that it is a potentially active blood volume restorer.

In another task concerned with the physiologic properties of blood volume restorers, the effects of such variables as simple replacement, overloading, and route of administration upon the plasma volume and the native plasma protein content of blood were studied. It was found that the magnitude of the plasma volume change was largely dependent upon the volume of fluid injected and the method of treatment, rather than on the protein concentration.

Accomplishments such as these and further solutions to the multitude of problems confronting the clinician and surgeon will continue to contribute to the better understanding of etiology, symptomatology, and therapy of disease. The development of improved techniques for the treatment and/or prevention of diseases to which both military and civilian populations are prey will continue to be forthcoming as a result of this combined effort of clinical and biological research.

Some Applications of Experimental Psychology to Machine Design

by

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For over seventy years, experimental psychologists have been working in academic laboratories, studying human capacities to see, hear, perceive, work and think. Only recently, however, have the facts and methods, which they have garnered, been put to use. A relatively new application of their findings in modern technology—both industrial and military—is human engineering, the engineering of machines for human use and the engineering of human tasks for operating machines. Although most of the research in this area has been supported by the Navy and Air Force and has been designed to solve military problems, its results have a wide range of usefulness. The basic principles involved in designing machines of war are very similar to those encountered in the design of industrial, agricultural and household equipment.

The science of engineering psychology dates back to the famous time and motion studies of Frederick Taylor, in 1881. Despite this early start, there were relatively few scientific studies in human engineering before 1940. The big impetus came in World War II. The war needed, and produced, many complex machines; however, the machines did not always do what was expected of them, mainly because of the limitations of the humans who operated them. The war also brought together psychologists, physiologists, physicists, design engineers and time and motion specialists to help find solutions to production problems. This partnership of laboratory scientists with practical engineering talent was a happy one, resulting in a fertile exchange of ideas and viewpoints. Today, there are many such groups busy with research on man-machine problems; their aim is to make the job fit the man—any man. This can be accomplished by designing machines and human tasks so as to make the most efficient use of the operator's talents and limitations.

One of the very earliest discoveries of experimental psychology was that people differ and that they differ in all sorts of ways—in height, weight, intelligence, reaction time, memory, visual acuity, learning ability, personality, and in 1001 other ways. So important was this discovery, that a whole new branch of psychology has been built up around it. This is the field of individual differences, the study of which provides the foundation underlying the development of psychological tests and personnel selection procedures. At first glance, this might not seem to be a discovery at all. That people differ is obvious. However, the importance of this difference is often overlooked.

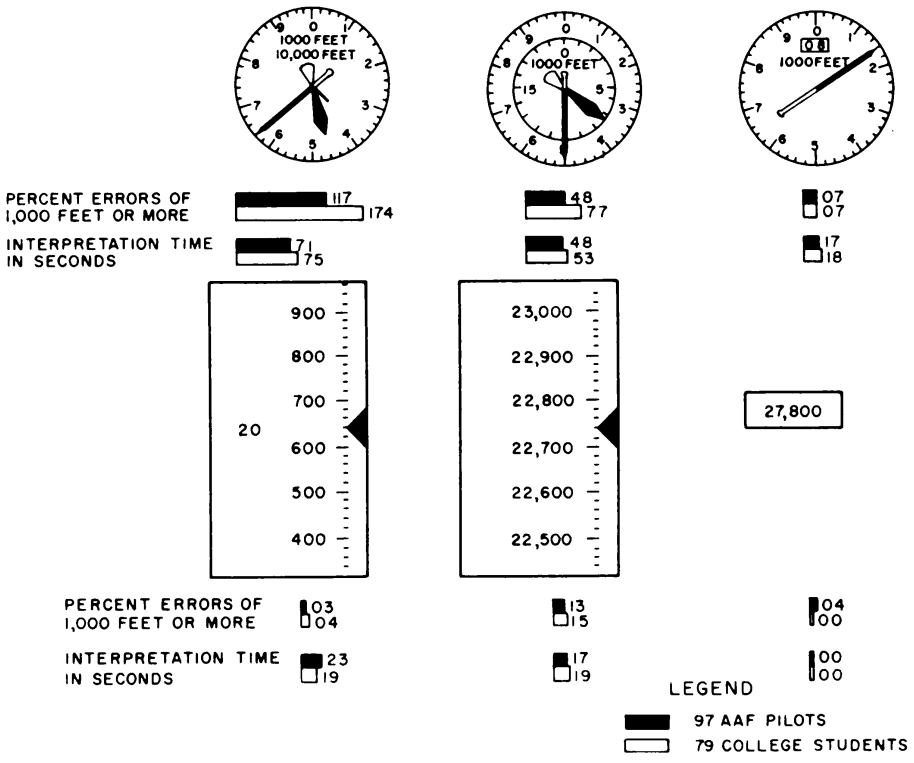
During the war, manufacturers were required to build full-scale mockups of complicated pieces of machinery before going into production. And what was the standard of human acceptability? If the

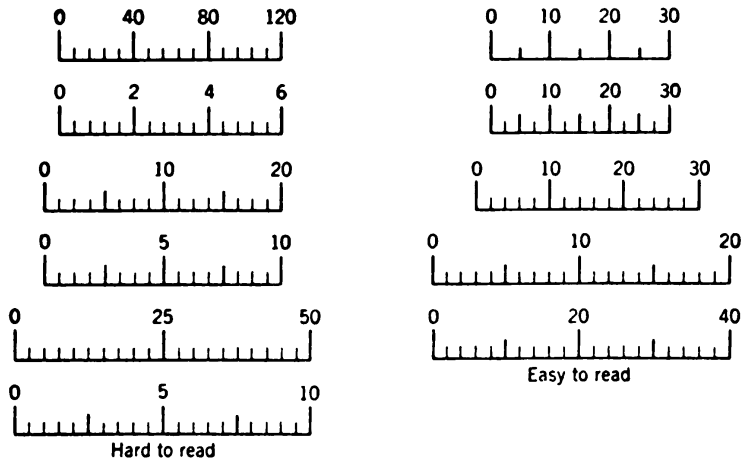
engineers and consultants on the mockup board could reach the controls and read the instruments—if they could climb in and out of the seats, the mockup was generally considered satisfactory. But herein lay the difficulty; the design engineer may often be the worst person in the world to judge the human acceptability of a piece of equipment, precisely because he is not an average person. He is above average in intelligence, being a college graduate, and is familiar with numbers. The scale or dial he may find so easy to read may be quite unintelligible to some of the people who have to use it, and a good piece of equipment is one that can be operated easily and efficiently by all the people who have to use it.

A second contribution of experimental psychology to machine design is that experimental psychologists like to substitute experiments for experience and facts for opinions. When there is a decision to be made about alternative solutions to a particular problem, the experimental psychologist says, "Let's try it." He brings to his trials and tests a long familiarity with the dangers of casual observation and the pitfalls to be avoided in conducting human experiments, coupled with a knowledge of the scientific method, the rigor of laboratory experimentation, and the power of modern techniques of statistical inference.

Because visual means of communication from machines to man are so important to the design of man-machine systems, engineering psychologists have spent a great deal of time and effort thinking about these problems and working on them. Let's look at a few typical studies.

Until very recently, engineers had very little scientific information to use in designing the most readable kind of dial. They usually





made their dials meet other requirements—engineering convenience, for one thing. Round dials, for example, are probably very popular because, as one engineer puts it, "You can wrap ten inches of scale around a three-inch dial." Customer preferences have also had a lot to do with the kinds of dials we see around us. Automobile speedometers are designed primarily to "look nice."

Recently, however, there has been some research on the shapes of dials, and we shall look at one of these studies as an illustration of the kind of thing that can be done about it. In this study, five different types of dials were compared; vertical, horizontal, semicircular, open-window, and round. The percentage of incorrect readings made by 60 subjects in reading these dials was then charted. Since there was a total of 1020 readings for each dial, the differences between dials are highly significant from a statistical point of view. The open-window dial gave the fewest errors; there were only five out of the whole batch of 1020 trials. The round dial was next best with 11%, and the horizontal and vertical dials were poorest.

Multirevolution dials such as conventional aircraft altimeters are among the most difficult to read, probably because people must combine the readings of two or more separate pointers. They are used, nevertheless, because one revolution of a pointer on a circular dial does not give enough scale length to provide the needed accuracy. For instance, the altitude range in which conventional aircraft operate (roughly 0 to 40,000 feet) cannot possibly be covered accurately in one revolution of a pointer on a dial of ordinary size. The clock is another such instrument, as are also the aircraft tachometer and airspeed indicator. The drawing at the bottom of the preceding page shows the conventional three-pointer altimeter and the five dial designs which gave the best results in experimental studies.

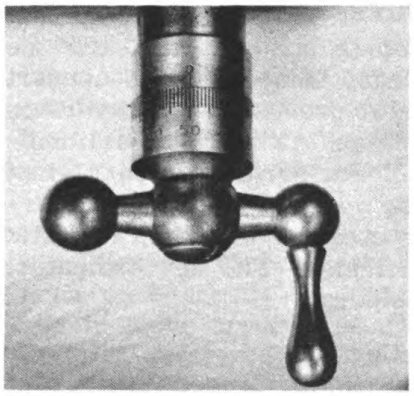
Although the shapes of dials are an important consideration in dial design, there is another human problem in dial reading which is even more important—namely, the way in which the scale is graduated and numbered. On the basis of the results of studies of this problem, engineering psychologists have been able to formulate some general principles about good and bad numbering systems. Perhaps the results

of these studies can best be summarized by the examples of good and bad scales shown at the top of the preceding page. In general, the relative difficulty of these scales is about the same if we multiply or divide the scale numbers by 10. This means that the top scale on the right would be easy to read whether the numbers went 0, 1, 2, 3, or 100, 200, 300. The same is true for the other scales.

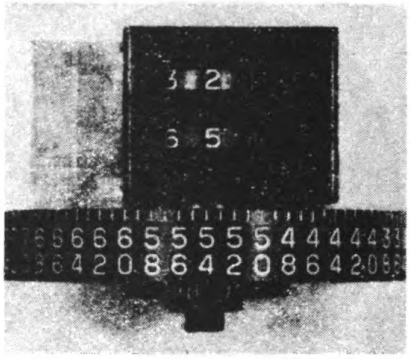
Some of the worst dials from the standpoint of human engineering principles are multirevolution dials you can probably find in your own cellar. These dials are used on the kilowatt-hour meters installed by many gas and electric companies. During the War when there was a shortage of meter readers, electric companies in several large cities asked householders to read their own meters. The results were so bad that after a short trial period, the electric companies gave up in despair. They finally compromised by having cards printed showing the faces of the dials, the householder being instructed merely to draw in the positions of the pointers. One could scarcely want for a more dramatic illustration of the difficulties that poor dial designs can produce.

Sometimes we need to ask ourselves whether we need a dial at all, or whether some other kind of quantitative indicator would be better for the purpose. The results of one study aimed at answering this question have led to several important developments. Pictured below, is a schematic diagram of a radar scope (PPI). The dark line extending upward toward the upper left-hand corner is a cursor line which can be rotated about the face of the tube by the radar operator. When the cursor line intersects the target, the radar operator reads the bearing of the target from the scale around the scope face; in the drawing it reads 315°.

In one large experiment performed on this kind of a radar indicator, at the Special Devices Center under contract to ONR, a direct-reading counter was substituted for the scale around the PPI and the two were compared. The results of a large series of trials showed that when radar operators had to read the bearings of targets from circular scales like those shown above, 10% of their readings were in error by 1 degree or more. Further, they required on the average, 3.3 seconds to swing the cursor around to a target and read the scale around the PPI. When, however, they performed exactly the same operations with the direct-reading counter, only 2% of their target bearings were in error, and on the average it took them only 1.7 seconds to read the bearing. Thus, the substitution of a direct-reading counter for the circular scale resulted in a 50% saving in time and a decrease in the number of errors



to one-fifth of the original number. This is one of many instances of the way in which research has paid off, for direct-reading bearing counters are now being utilized in the Navy's latest radar equipment.



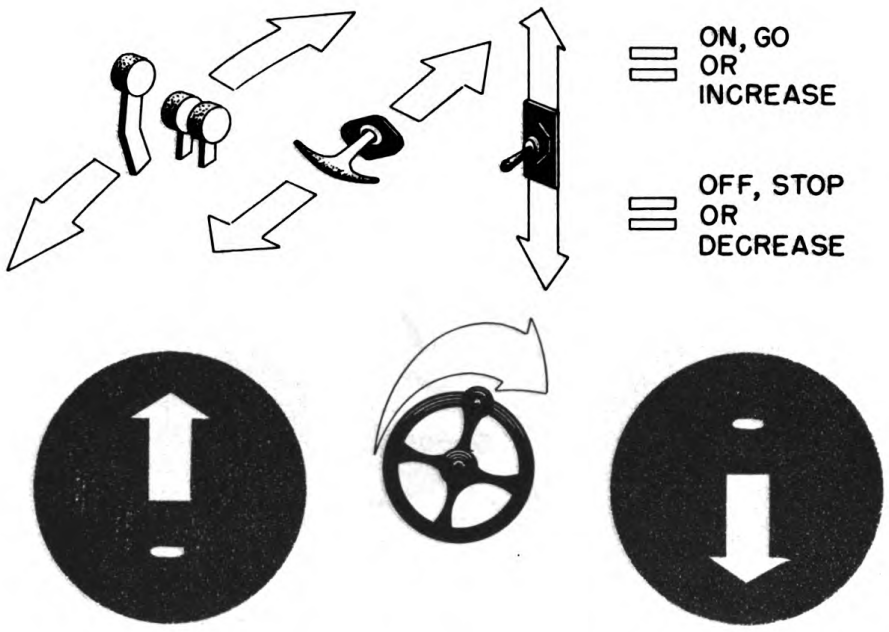
Another related application of the direct-reading principle has been in the design of indicators for machine tools. The indicator shown in the lower left-hand corner of the preceding page is one of a type commonly used on lathes and other machine tools. It consists of a circular steel disc, subdivided by lines engraved in the metal. The smallest division of the scale corresponds to 0.001" of linear travel of the tool, and a complete revolution of the dial corresponds to 0.125" of linear travel.

Types of Scale Markings Used on Varmeter by 48 Operating Companies
(From a Survey by the AIEE Instruments
and Measurements Committee, 1950)

Type of Scale Marking	Companies Using Each Type	
	Number	Percent
In-0-Out	28	41.8
Out-0-In	7	10.4
Lead-0-Lag	6	9.0
Lag-0-Lead	4	6.0
To-0-From	2	3.0
From-0-To	3	4.5
Minus-0-Plus	3	4.5
Plus-0-Minus	1	1.5
Buck-0-Boost	1	1.5
Boost-0-Buck	1	1.5
Received-0-Delivered	2	3.0
Under excited-0-Over excited	1	1.5
Value-0-Value	5	7.5
To specific point-0-To specific point	3	4.5
Total	67	100.2

If the operator has to make movements larger than 0.125" he must first read off initial and final settings, then count and convert complete revolutions of the dial. The mental processes of conversion involve addition, subtraction, and multiplication. Although the arithmetic is simple, it takes time and leaves room for errors. In an attempt to eliminate this arithmetic and simplify the operator's task, an experimental dial-counter indicator was constructed and tested in realistic industrial tasks against a conventional indicator. The new indicator, shown above, reduced time and errors considerably.

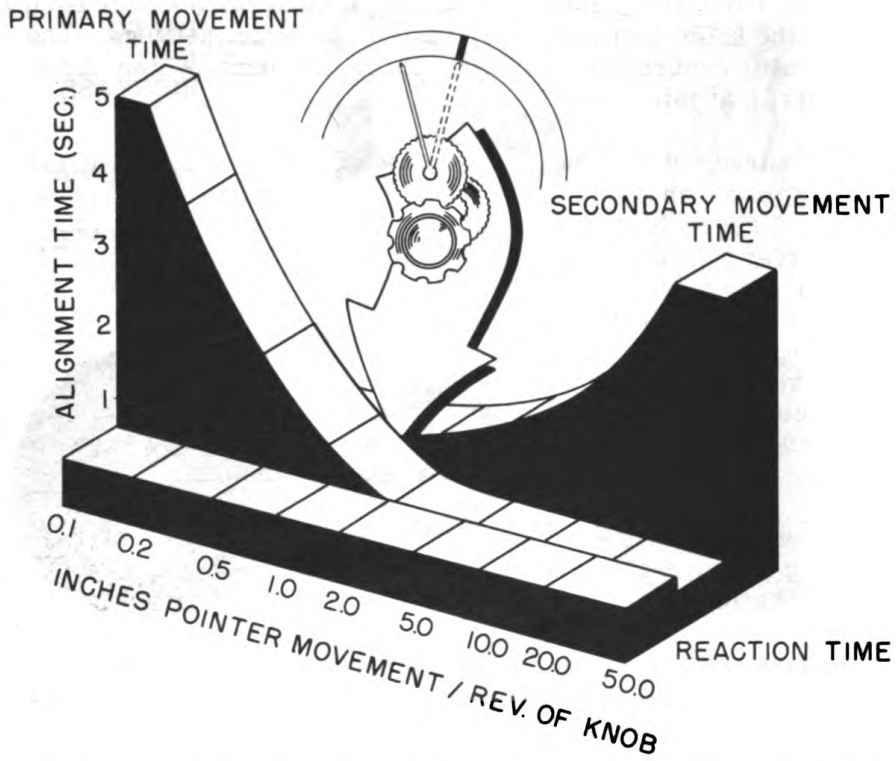
Where many different models of similar equipment are involved, a major source of confusion and errors can be traced to lack of



standardization of controls and indicators. A striking example of this is contained in a report published by the Instruments and Measurements Committee of the AIEE just a few years ago. The committee sent out a questionnaire to 106 operating companies to find out how they mark their varmeters. (A varmeter is used in electrical power stations to measure reactive voltamperes consumed or supplied by some piece of electrical equipment.) The questionnaires were in the form of a diagram, with spaces provided for the indication of the scale marking and the direction of the deflection under certain assumed conditions. The replies received from 48 companies are shown in the table on the preceding page. Note that 9 different kinds of markings, or—if you count different directions—14 different kinds of indicators, are used by these 48 companies. Incidentally, the fact that the total comes to 67 means that many companies used more than one type of marking on different varmeters within their own organizations.

Earlier we spoke about some of the movement and control problems that have come to the attention of engineering psychologists. Let us now take a brief look at some typical studies on these problems. One of the persistent problems encountered in nonstandardization of movement of controls, is controls which do not follow "natural" directions of movement. Fortunately, experimental solutions for these problems are often easy to come by. Typically, a control is left in a neutral position and the experimental subject is told, "Make the machine go faster by operating this lever," or "Turn the machine on by flipping that switch." All the experimenter has to do is watch what the subject does first.

Some preferred directions of movement that have come out of tests on hundreds of people are illustrated above. Toggle switches should move upward for ON, GO, or INCREASE and downwards for OFF, STOP, and DECREASE. Levers and controls which move inward and outward should also follow consistent directions of movement. In



the case of handwheel controls, clockwise movements of the handwheel should move displays downward if the display is to the right of the handwheel and upwards if it is to the left. Counterclockwise movements should produce the reverse. Although these might appear to be extremely simple principles and obvious to any industrial designer, it is surprising how often they are overlooked.

Not all movement or control problems are as easily settled as are those regarding the direction of movement. Oftentimes there is no commonsense principle, or simple set of observations, to which the designer can turn for the solution of a control design problem. In such a case the only recourse is that of experiment. The results of a typical experiment on control movement are shown above. Here the problem was concerned with the optimum gear ratio for the movement of an indicator. The results of this experiment showed that the task could be dissected into three distinct components. The first is simple reaction time, the time it takes for a person to get going. Note that it is relatively constant for all gear ratios. The second is primary movement time, the time it takes to move the needle to about the correct vicinity. If a pointer is geared to move only a small amount for each revolution of a knob, primary movement time is long; on the other hand, it is short if the pointer movement is large for each revolution of the knob.

The third factor is what we might call secondary movement time, the time required for fine corrective movements once the pointer is at about the right vicinity. Secondary movement times are very nearly the inverse of primary movement times. When a single revolution of the control produces a large amount of pointer movement, it is very difficult to get precise settings because the pointer moves too fast. If,

on the other hand, the pointer moves only a small amount for each revolution of the knob, then it is very easy to get exact settings. The best over-all ratio occurs at that point where the sum of the three time components is at minimum.

This survey of human engineering has hardly scratched the surface of the research areas that have been explored by engineering psychologists. There have been many auditory studies which have contributed greatly to the improvement of voice-communication channels. In addition, a number of investigations have been made on the working environment—the conditions of temperature, humidity, noise, vibration, and lighting which affect the efficiency of the human machine. Recent studies have attacked the problem of integrating information from several sources into a most effective display. Developments in this field have been so rapid that there is now a textbook of applied experimental psychology and several handbooks of human engineering data.

Also worth mentioning briefly are some broader problems which engineering psychologists are now attempting to answer. Most of the illustrations we have talked about apply to the components of man-machine systems. Actually engineering psychology has much to contribute to the design of entire man-machine systems. Recently, for example, there has been a great deal of publicity about electronic "brains" —automatic machinery and computers of all sorts. But the people who design and develop such machinery are often the first to admit that these automatic machines do not in any real sense "think" or make decisions. They are rather like superrapid nervous systems with no brains. They must be told what to do at every vital point by the men who do the "programming."

This opens up for investigation a whole series of man-machine problems. In what sense is man superior to contemporary machines, and vice cersa? What should man's role be in complex man-machine systems and in the automatic factory of the future? Should he be simply a monitor? If so, how can machine displays be simplified for easy monitoring? Should man be used as an integrator of sensing mechanisms? Should he be in a position to exercise executive decisions? These and many more questions like them must be answered before we can design the most efficient man-machine combinations. In their search for answers to questions like these it is possible that engineering psychologists will open up new and fruitful avenues of technology.

ERRATUM

On page 1 of the May Issue, the work of V. Bjerknes was erroneously accredited to his son, J. Bjerknes. The latter is a member of the faculty the the University of California, and has also done work in the field of weather prediction but to his father must go the credit for originating our modern concepts of weather forecasting.

The Story

Tropical diseases create serious medical problems for our Armed Forces. Military personnel, stationed in areas where such diseases occur, often become infected. How such diseases are transmitted is often not known, nor are adequate means of diagnosis and treatment available. Exotic diseases which is another and better name for tropical diseases - are common in Egypt and opportunities to study them in their natural environment are unparalleled anywhere else. It is not surprising, then, that the Navy promptly accepted the opportunity to intensify its researches in such diseases when facilities, formerly occupied by the American Typhus Commission in Cairo, became available to the Navy in 1945. In keeping with its traditional interest in tropical medicine, the Bureau of Medicine and Surgery promptly established Naval Medical Research Unit No. 3 (NAMRU-3)* on Jan. 15, 1946. Existing facilities were expanded with surplus equipment from laboratories in the Pacific, that were being decommissioned at that time, and a special agreement with the Egyptian Government assured continuous occupancy of a 2-1/2 acre tract adjacent to the Abbyssia Fever Hospital.

Our scientists were enthusiastically welcomed by the government officials of Egypt and this venture has, since its inception, been a cooperative undertaking of mutual benefit to both parties concerned. The Navy and other Defense departments profit by having increased knowledge on the control of diseases to which our personnel may be exposed. We, on the other hand, can assist in the solving of Egypt's health problems and add to the world's knowledge of these diseases.

Capt. Alton R. Higgins, MC, USN, is the Director of NAMRU-3, and Dr. H. Leonard Jones is Assistant Director. The professional staff is not large as such "institutes" go. It is significant to note, however, that Egyptians outnumber Americans at every level of operation. This arrangement has worked amazingly well and this close professional association has a highly favorable influence on attitudes of the Egyptians towards Americans. This spirit of teamwork was cited by the Honorable Jefferson Caffery, United States Ambassador to Egypt, in an address he gave before the Unit in which he stated, "I should like to speak of another achievement, dear to the heart of a diplomat; that is, the achievement by men of different nations of complete trust and confidence in each other and in the nobility of their common purpose."

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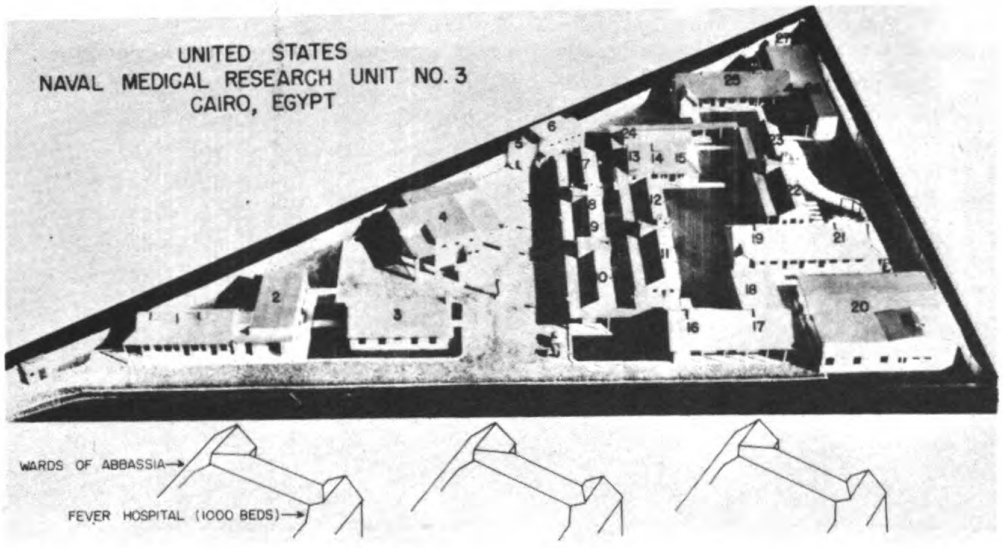
*NAMRU-3 is one of four such units sponsored by the Bureau. NAMRU-1 is located at the University of California at Berkeley and has as its particular function the study of airborne diseases. NAMRU-2 operated in the Pacific during World War II in the study of tropical and semitropical diseases. At the end of the war it was disestablished, and consideration is being given to re-establishing it. NAMRU-4 is located at Great Lakes Naval Training Center and studies upper respiratory diseases, particularly in reference to transmission, prevention and relation to such diseases as rheumatic fever and scarlet fever.

E NAMRU-3

by
Dr. Roger D. Reid
Head, Microbiology Branch
Office of Naval Research

The research program includes two broad projects; one is on the preventive medical aspects of diseases in Africa and the Middle East. The other is concerned with the clinical aspects of diseases endemic in these areas. The large number of reports emanating from the researches of NAMRU-3 indicate the degree and scope of interest of its scientists. The laboratory is organized into nine departments as shown on p. 18. Cooperation between the departments has been developed and encouraged under the wise leadership of the past and present directors so that each contributed in its own special way to solving problems and the whole operates as a single unit. For example, the Medical Zoology department collects rodents and other zoological specimens which are identified and classified; at the same time, it furnishes material for examination by the Bacteriology and Virology Departments in their search for agents of disease; this in turn adds to knowledge of the epideminology of disease.

The Clinical Department studies diseases in man and has access to selected cases admitted to the hospitals in Cairo, especially the 1000-bed Abbyssia Fever Hospital adjoining NAMRU-3. Cases of particular interest to the research program are transferred to the wards of NAMRU-3. The Pathology, Bacteriology, Virology, Biochemistry, parasitology, and Physiology departments provide extensive laboratory examinations to assist the clinicians in their work on hospitalized or on



1 Administration Offices
2. Heads Of Department Offices
3. Medical Library
4. Maintenance Shops
5. Serological "Cold Room"
6. Power House
7. Virus & Rickettsia Laboratory
8. Virus & Rickettsia Laboratory
9. Pathology & Clinical Lab
10. Biochemistry
11. Clinical Ward
12. Clinical Ward
13. Pharmacy
14. Protozoology
15. Medical Zoology
16. Photography & Med illustration
17. X-Ray, BMR, ECG Laboratory
18. Clinical Chemistry
19. Recreation & Staff Lunch Room
20. Medical Stores
21. Conference Room
22. Helminthology
23. Bacteriology
24. Media & Sterilization
25. Entomology
26. Animal House
27. Incinerator

Technicians in Biochemistry Laboratory testing chemicals for their ability to kill snails.

ambulatory patients in the villages. The Entomology Department collects, identifies and classifies insects for examination by other scientists to determine which of them may act as reservoirs and transmitters of disease organisms.

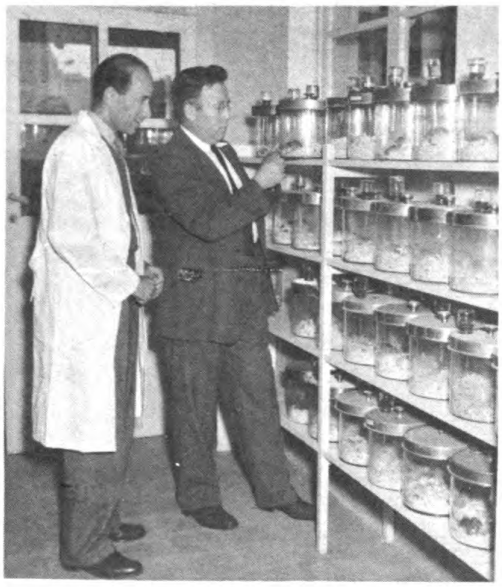
Such examples of collaboration between these scientists could be expanded considerably. Sufficient evidence that the unit is working profitably can be found in the long list of publications issued by it during the past three years.

In describing the facilities of NAMRU-3, the Library deserves special mention. It contains more than 6000 bound volumes of reference books and periodicals and subscribes to 110 scientific journals. Egyptian scientists and physicians make frequent visits to the library to use the material so valuable to them and not available elsewhere in Egypt.

Another example of cooperation between Egyptians and Americans is the weekly seminar on some subject of medical or public health importance.

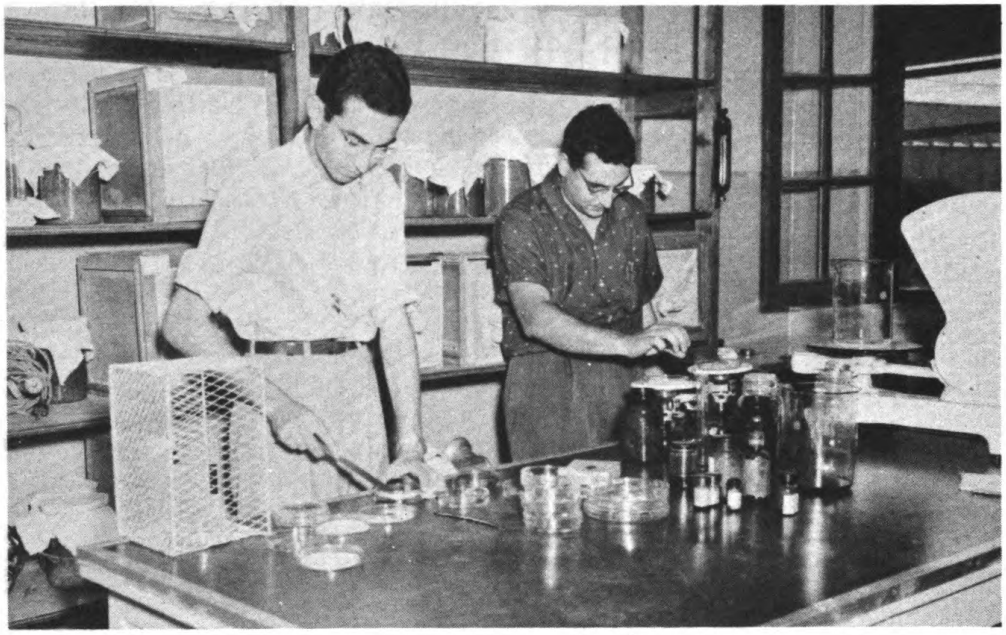
The Head Nurse at NAMRU-3 Dispensary is drawing a specimen of blood from a patient suspected of being infected with West Nile virus.

Egyptian scientists frequently present reports and participate actively in the discussions. At one of these seminars Dr. Mahmud Himly, Director of the Bilharzia and Ankylostoma Treatment Section of the Egyptian Ministry of Health, discussed the problem of snail control. He pointed out that much progress has been made in informing the Egyptian population that certain snails are responsible for transmitting the germ that causes bilharziasis, better known to Americans as schistosomiasis. In spite of this, it still stands first in the list of public health problems in Egypt. He praised NAMRU-3 for its assistance in advancing knowledge in respect to bilharziasis. There is no doubt that the greater understanding that comes from cooperative study at the international level will make it possible to prevent the disease in American personnel should it ever become encessary to send large numbers of us into areas where it is endemic. It would be possible to eliminate schistosomiasis in spite of the natives' reluctance to observe elementary sanitary practices if the snails which are obligatory intermediate hosts between man and man could be destroyed. Such snails infest the irrigation canals which also serve as a place to bathe and to carry away the sewage from the villages.



Dr. Hoogstraal and assistant examine specimens in the rodent colony.

Egyptian technicians collecting ticks from desert animals and soil.



Technicians in Entomology laboratory prepare cultures for growth of insects.

Biochemists at NAMRU-3 are searching for a compound that will destroy the snails and still be harmless to man.

The subject of another conference was "Ticks and their relation to disease." This report was made by Dr. Harry Hoogstraal, an American civilian who is Head of the Medical Zoology department. Dr. Hoogstraal is assisted in field collections by Abdel Aziz Salah, who is loaned to NAMRU-3 by the Egyptian Ministry of Health. Several species of ticks not previously known in Egypt—have been described by these workers. One of these has been named "Salahi" in honor of Abdel Aziz. At the seminars and in reports, it is continually emphasized that ticks and other insects may carry bacteria, other microbes and viruses and transmit them to man.

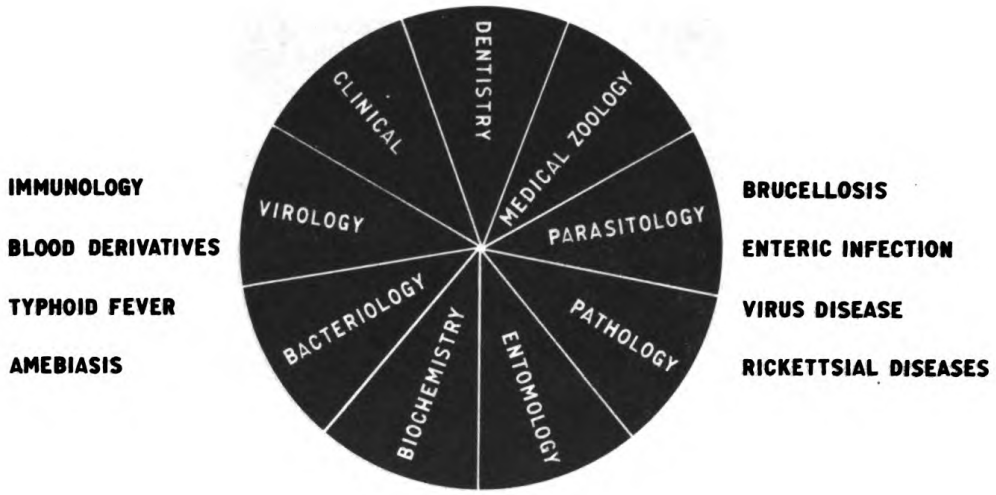
Very little is known about the native animals or insects that may harbor viruses and even less is known about their mode of spread or the incidence of any specific viral disease. The Virology department is headed by Dr. Richard Taylor, who has been assigned to the Unit by the Rockefeller Institute for Medical Research for two years. Beginning July 1, 1954, Dr. Taylor's services at NAMRU-3 will be made possible by means of funds allocated by the Bureau of Medicine and Surgery for a contract between the Office of Naval Research and the University of Chicago. In spite of many difficulties inherent in this work, remarkable progress has been made.

One of the most serious problems investigators of infectious disease in Egypt must face is the fact that children especially are subject to so many different febrile diseases. They are so common that the parents do not consider them serious and they are not brought to the attention of the medical profession. Even if adequate facilities existed

in the rural areas, which they do not, the native physicians would not have a chance to investigate these illnesses adequately. Dr. Taylor's group has examined the blood from many febrile children and has tested hundreds of blood specimens from many apparently healthy children. There is strong evidence that many of the viral diseases encountered in this country also occur frequently in Egypt. It has been shown that a large number of children under five years of age have antibodies (substances found in blood after exposure to certain germs) against poliomyelitis virus, Q fever, typhus fever, and a newly discovered virus first found in Egypt and known as West Nile virus. It is worthy of mention and certainly to the credit of the Egyptian public health authorities that smallpox vaccination is compulsory by law and the disease is, therefore, never seen in the native population.

Many of the viruses may be found in wild or domestic animals and fowl. Usually they do not cause apparent illness in such hosts but the germs are there and may be transmitted from such reservoirs to humans by insects that bite first the infected animal, then the man. Such transmission of disease are especially important in Egypt and other countries where man and domestic animals share the same quarters. The virologists at NAMRU-3 are looking into the extent that animals may harbor viruses. They do this by testing blood specimens for the occurrence of antibodies in the serum. Such antibodies are specific for the virus harbored and may be detected long after the virus has left the animal. In this respect antibodies are like fingerprints left behind after the culprit has gone. Data accumulated show that a surprising number of viruses, capable of causing human disease, may be spread by animals with the occasional help of certain insects. Examination of thousands of insects has shown that many of them can take a virus from an animal

Patients come to Ministry of Health Dispensary at Sindbis where history taken by local physicians who are cooperating with NAMRU-3.



reservoir and carry it around the house or desert for a long time and then pass it along to a human being.

Among the diseases that have caused the Navy a great deal of trouble in the past, and apprehension for the future, is bacillary dysentery. In cooperation with the Egyptian Ministry of Health, NAMRU-3 is conducting research on dysentery in the village of Sindbis, located a few miles from Cairo. Since natives of the villages do not visit the city or other villages to any great extent, such a study can be controlled much better than in the United States where people are always on the move. Egyptians have great confidence in their physicians, nurses, and technicians. A current study on 300 village children between the ages of six months and three years is designed to determine if bacillary dysentery can be prevented by vaccination or by prophylactic use of sulfonamides or the "miracle drugs." One of the first studies undertaken at Sindbis was an attempt to evaluate vaccines for use in preventing typhoid fever. Few opportunities for such an investigation can be found anywhere else.

The magnitude of the fly problem in Egypt is almost inconceivable to an American. Entomologists have found that DDT is not the answer to the control of flies in Egypt because they develop resistance to the drug rather quickly. Some excellent work on the mechanism of the development of resistance has been done at NAMRU-3 by specialists assigned there by the U. S. Department of Agriculture.

The Dental Department has found that the fauna of Egypt provides excellent material for fundamental studies that may have far reaching implications. Research is being conducted on dentition and the functioning of salivary glands in desert rodents. The bacteriostatic and bacteriolytic activity of saliva and its antibody content are being investigated in patients suffering from endemic disease.

It would be quite difficult to appraise the great importance of NAMRU-3 to the future of science, preventive medicine, and the introduction of a healthier way of life to the people of Egypt. It is certain, however, that here is a proving ground to test the premise that scientists can be very effective diplomats and contribute greatly to the cause of international understanding and world peace. NAMRU-3 is making the most of this opportunity.

New Oceanographic Laboratory to be Dedicated by Navy

The Office of Naval Research will dedicate a new oceanographic laboratory at Woods Hole, Massachusetts on June 21, 1954. The laboratory building, erected at a cost of $792,000 including land, will be operated by Woods Hole Oceanographic Institution under contract with ONR for the purpose of studying problems of undersea warfare.

At the June 21 dedication ceremonies Rear Admiral J. R. Perry, Chief of the Bureau of Yards and Docks, will present the building to Rear Admiral Frederick R. Furth, Chief of Naval Research. Principal speakers will be the Assistant Secretary of the Navy for Air, James H. Smith, Jr., and Dr. Detlev W. Bronk, president, National Academy of Sciences. Admiral Furth will preside.

Others expected to attend include members of the Naval Research Advisory Committee, representatives of the Navy Department, Department of Defense, national scientific organizations and universities, and national, state and local leaders.

Congress appropriated funds for construction of the Laboratory in June 1952. Erection of the modern, three-story, concrete-frame, brick-faced building began early in 1953. Located on a one-acre tract adjacent to WHOI, the laboratory building contains 26,000 square feet of floor space.

Oceanographic research began at Woods Hole shortly after the Civil War with the establishment of the first permanent sea coast laboratory. As the area was particularly adapted to this type of research, the Marine Biological Laboratory and the U. S. Fish and Wildlife Service were located there before the turn of the century. Woods Hole Oceanographic Institution was established in 1930.

Early in World War II, the Navy turned to the oceanographic laboratories for help in countering the menace of enemy submarines. Their scientists, working on problems ranging from underwater sound to the effect of explosions, helped develop new techniques for undersea warfare.

The Navy is continuing a strong program of oceanographic research to preserve gains made during World War II, and to meet new challenges of undersea warfare. This program requires additional facilities which are being provided with completion of the Laboratory of Oceanography.

Oceanographic knowledge finds its greatest military application in the field of undersea warfare. Knowledge of undersea conditions is indispensable to successful operation of submarines. In order to operate with confidence and safety, the submarine commander must possess

accurate knowledge of bottom topography and of physical conditions of the sea water itself, such as temperature and salinity gradients. Submarine evasive techniques are aided by knowledge of how to hunt for "thermoclimes," areas of marked temperature change, which tend to deflect the searching sonar beams of the enemy. Knowledge of bottom conditions is important. A sandy bottom, for example, tends to reflect sonar beams and therefore provides a poor hiding place for a submarine, while a muddy bottom tends to absorb sound waves in the water. The development of all types of sonar gear for underwater communication depends upon an understanding of the behavior of sound in water, which is a major objective of naval oceanographic research.

Mine warfare is another area of undersea military operations in which oceanographic knowledge is vital. Knowledge of contours and composition of harbor floors and beaches, tides and current actions is required in order to detect enemy mines and lay mines of our own.

Successful amphibious operations depend upon sound understanding of beach and surf conditions and the ability to predict probable sea states at a given time and location.

The Navy's many engineering activities rest upon a foundation of oceanographic knowledge. A ship which is to operate successfully in the sea must be designed to take the best advantage of the limitations imposed by oceanographic conditions. In constructing its shore facilities-docks and other harbor installations—bottom contours, beach erosion, tide and wave action, and possible long-term rise in sea level must be considered. By-products of the Navy program often are of direct benefit to fishing and shipping industries, and to other aspects of the national economy. Following the dedication ceremonies there will be a three-day scientific convocation, planned under the auspices of the National Academy of Sciences—National Research Council. Leading national and international scientists will participate.

EXPERIMENTAL PORTABLE TV SYSTEM DEVELOPED

The only instructional television system developed specifically for training purposes by the U. S. Navy was unveiled last month at the Armed Forces Communications Conference at the Hotel Shoreman, Wash. D. C. Developed by ONR at the Special Devices Center, Port Washington, Long Island, New York, the ITV system is the result of five years of research in educational television. The simplified equipment was especially designed for use by ordinary classroom and laboratory instructors. The new equipment does away with costly studio equipment and personnel which previously made educational TV too expensive.

The prototype model ITVS on display has one orthicon camera with provision for including two more cameras. The camera, with its complete receiving and transmitting equipment and sound system has been cleverly housed in a small, desklike console easily moved from one classroom to another. From this console the TV program can be transmitted by cable to as many as 100 different TV receivers, located in as many different areas.

The Naval Research Advisory Committee

by

Gordon K. Bell

Executive Secretary, Naval Research Advisory Committee

The preamble to Public Law 588, 79th Congress, 2nd Session, stated that the purpose of this Act was to establish an Office of Naval Research and a Naval Research Advisory Committee. Section 4 amplified on the intent of the latter and authorized the Secretary of the Navy to appoint up to fifteen people from "...those persons in civilian life who are preeminent in the fields of science, research, and development...to consult with and advise the Chief of Naval Operations and the Chief of the Office of Naval Research." The Secretary was also given authority to define the term of membership and specify meeting dates.

At its first meeting on 14 October 1946, the Assistant Secretary of the Navy, the Honorable W. John Kenney, served as the temporary chairman and, together with Fleet Admiral Chester W. Nimitz, Admiral D. C. Ramsey, Vice Chief of Naval Operations, and Vice Admiral H. G. Bowen, Chief of Naval Research, outlined the broad direction of the Navy's research effort, and particularly, the purpose and functions of the newly created Office of Naval Research. In discussing future operations of the group, the Assistant Secretary expressed the feeling that the Committee would probably be most effective if it operated on as informal a basis as possible.

The Committee, at its second meeting, further discussed its mode of operation and concurred with Mr. Kenney's view. The members also agreed to meet about three to four times a year to review the program of the Office of Naval Research, and, in the interval between meetings, to assist the Navy and the Chief of Naval Research, either as individuals or as subcommittees. Dr. Warren Weaver of the Rockefeller Foundation was chosen to be the first Chairman, and Rear Admiral de Florez, USN (Ret.), Vice Chairman.

Since these early organizational meetings, the Committee, although functioning in different ways, has retained the prerogative of directing its own operations, receiving only nominal staff assistance from the Office of Naval Research. The original intention of providing ad hoc assistance to the Navy has also continued. At various times individual members have made important contributions through their availability for personal consultation. As one of its recent group activities, a subcommittee consisting of 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. A reading of the agenda items of the Committee reflects, as few other documents do, the problems which have been confronting the Navy since 1946. For example, one finds such items as: the advisability and practicability of hiring German scientists for work in this country; the Navy and the National Science Foundation; the possible transfer of funds from AEC to the ONR nuclear physics program; the supervision and coordination of research and development by the Office of the Secretary of Defense; Marine Corps research; Project HARTWELL; the wartime organization of science and the maintenance of basic research; contract policy; research and development on critical materials; utilization of scientific resources on a long-range basis and other classified problems.

Following the various presentations at meetings, and after an executive session, the Committee has been in the habit of meeting with the Secretary of the Navy, the Chief of Naval Operations, and representatives from their offices. These "briefings," as they are called, provide an opportunity for a review of the day's discussion and the presentation of recommendations. The Committee also often asks that documents and studies be prepared and submitted to the Secretary.

The value of this Committee, as in any advisory group, rests primarily upon the high personal qualities and variety of experience that its members bring to their task. In this regard, the Secretary of the Navy has found in making his appointments that the outstanding leaders in educational, government, and industrial research activities have been most cooperative in volunteering their services to the Navy. This is evidenced by a review of a list of the former members of the Committee, which includes: Dr. Lowell T. Coggeshall, Dr. Karl T. Compton, Dr. Hugh L. Dryden, Dr. Leonard Carmichael, Dr. Lee A. DuBridge, Dr. William V. Houston, Dr. William S. McCann, Dr. Clark B. Millikan, Dr. William A. Noyes, Jr., Dr. J. Robert Oppenheimer, Mr. Lewis L. Strauss, Dr. Detlev W. Bronk, Mr. Richard J. Dearborn, Dr. Warren Weaver, Dr. Phillip M. Morse, and Dr. Arthur H. Compton.

The present Committee consists of Dr. A. V. Astin, Director, National Bureau of Standards; Dr. Luis de Florez, President, de Florez Engineering Company; Dr. R. E. Dyer, Director of Research, Emory University Hospital; Dr. J. C. Hunsaker, Dept. of Aeronautical Engineering, M.I.T. and Chairman of the National Advisory Committee on Aeronautics; RADM P. F. Lee, USN (Ret.), Gibbs and Cox Co.; Dr. I. I. Rabi, Dept. of Physics, Columbia University; Dr. W. R. Sears, Director, Graduate School of Aeronautical Engineering, Cornell University; Dr. E. H. Smith, Director, Woods Hole Oceanographic Institute; Dr. H. N. Stephens, Vice President, Central Research Dept., Minnesota Mining and Mfg. Co.; Dr. J. E. W. Sterling, President, Stanford University; and Dr. G. D. Stoddard, recent President of the University of Illinois. The Committee is also most fortunate in having Dr. A. B. Kinzel, President, Union Carbide and Carbon Research Laboratories as Chairman, and Dr. J. A. Hutcheson, Vice President, Westinghouse Electric Corporation Research Laboratories as Vice Chairman.

As has many times been stated by the Secretary, the Chief of Naval Operations, the Chief of Naval Research, and their officials, the

Naval Research Advisory Committee has through the years provided the Department of the Navy with invaluable advice and service. This has resulted primarily from the capabilities of its members and their continuing interest and desire to assist the Navy.

A value of a corollary nature, sometimes overlooked in reviewing the Committee's usefulness to the Navy, and particularly to the Office of Naval Research, is that of having a receptive yet critical sounding board upon which to review thoughts, programs, and plans. Also, as in so many cases, there is a two-way exchange of benefit in which the members also take with them useful understanding and appreciation of defense problems and efforts in naval research. Therefore, one can see how six years' experience as a member may well be of importance to the present Chairman of the AEC, and how benefits stem from the meeting, as individuals, of such people as Dr. Rabi, Chairman of the AEC General Advisory Committee; Dr. Astin, Director of the Bureau of Standards; and Dr. Hunsaker, Chairman of the NACA. And, significant as this intra-Government cooperation may be, it is of more importance that a program with national impact and responsibility is receiving that preeminent civilian advice and counsel originally intended by Congress.

New Altitude Record Set by Super Skyhook Balloon

Project SKYHOOK, ONR's plastic balloon program of high altitude research, marked the approach of a new era on 18 May when a Super SKYHOOK--the largest plastic balloon ever built--was successfully launched in Minneapolis by contractor personnel of General Mills and established an unofficial new altitude record of 117,000 feet. Cosmic ray equipment was carried aloft for the University of Minnesota, an ONR-AEC contractor, and results will be published after a careful analysis of the data.

Statistics released to describe the giant aerostat indicate its enormous size. Deflated length was 282 feet, almost as long as a football field; at ceiling altitude, with helium fully expanded, its volume was 3,200,000 cubic feet; about as large as the famous EXPLORER II, its fully expanded diameter was 200 feet; and the area of 1.2 mil polyethylene film was approximately 3 acres. The Giant was constructed of 72 segments (called gores by balloonists) with almost four miles of heat seals to form a gas-tight barrier.

The most important aspect of the Super SKYHOOK, however, is the challenging new opportunity its successors will provide for fundamental investigations at altitudes above 99.5% of the earth's atmosphere. Cosmic ray physicists will now be able to perform experiments heretofore impossible to investigate low energy primary particles which are absorbed by the atmosphere at altitudes above 100,000 feet. Although rockets carry instrumentation to much greater altitudes, the flights are of such short duration that many important experiments can only be carried out by the constant-level plastic balloons developed in the SKYHOOK program.

Collier's Magazine for 11 June 1954 carries an interesting article on balloons entitled " A Report on Our 'Flying Saucer' Balloons."

On The Naval Research Reserve

Secretary Quarles Addresses NRL Unit

On May 7, the Honorable Assistant Secretary of Defense, Donald A. Quarles, visited the Naval Research Laboratory, Washington, D.C., to address NRRC W-2 at its regular bi-monthly meeting. The Secretary spoke on the research program of the Defense Department and how this program is meeting security needs, as measured by the progress of other nations in the fields of aeronautics and electronics. He stressed the importance of maintaining our technological superiority by means of a continuing program of basic as well as applied research.

Prior to his address, the Secretary was escorted on a tour of the laboratory by the Director, Dr. E. O. Hulbert and his staff. One point of interest was the LCM which was tied up at the laboratory recently for over a month while sound equipment was installed for research purposes. In the above picture, Secretary Quarles is shown leaving the ship with RADM T. B. Hill, Commandant, PRNC. Among other items inspected at the laboratory were the NRL large Van de Graaf installation, a model of the proposed reactor and the areas in which it will be installed, and the proposed new-type display system developed at NRL.

NRRC W-2 is one of the largest units in the Research Reserve Program, comprising over 70 members, most of whom are scientists employed at NRL. Distinguished scientists from all over the country have appeared as guest speakers at its meetings where ideas are exchanged on current problems in government research. LCDR Andrew D. Bogard is Commanding Officer.

NRRC 4-8 Produces TV Show in Cleveland

Congratualtions are in order for NRRC 4-8, Cleveland, Ohio, and its Commanding Officer, CDR Viktor Schreckengost, for their excellent half-hour TV program on 28 March 1954 over Station WNBK/NBC, Cleveland. This company is a member of the Cleveland Technical Societies Council, the sponsor of a weekly series of educational television programs stressing the scientific activities and accomplishments of its 41 member societies. Advantage was taken of this excellent opportunity to inform the public on the work of the Office of Naval Research and the activities of the Research Reserve Program in the Cleveland area. Background props, including ship and plane models, as well as interesting training devices, were supplied by ONR and SDC. The theme of the program, entitled "Rabbits to Rockets," was based on the fact that the Navy is interested in all phases of scientific research.

Low temperature research and the importance of "liquid air" as a research tool were demonstrated by means of a tea kettle of liquid nitrogen boiling on a cake of ice. A visual description of various electronic devices including an electrical thermometer for measuring very low temperatures was followed by a film entitled "The Navy and Science." The program closed with a personal message stressing the mission of ONR from RADM F. R. Furth, Chief of Naval Research, which was read by CDR Schreckengost. Reserve personnel appearing on this show are pictured above left to right; LTJG Richard R. Bartelme, Executive Officer 4-8, Mr. Henry Derwis, Student Representative of Lincoln High School, Charles S. Baughman, SA, member of 4-8, CDR Schreckengost and LT James A. Brandt, Program Officer, 4-8. The Cleveland Public Relations Naval Reserve Company also assisted in the production.

Training Duty Seminars for Fiscal 1955

BuPers has approved the following seminars for 1955; all are limited to 50 officers with the exception of the Washington Seminar, which is open to 100. Applications should be submitted at least 2 months in advance.

9 Aug - NRL, Wash., D. C.
9 Aug - Idaho Falls, Idaho
23 Aug - ONR, Wash., D. C.
30 Aug - West Coast, San Francisco
29 Nov - Nuclear Science, Oak Ridge, Tenn.
18 Apr - Special Devices, Port Wash., L. I.
13 Jun - Metallurgical Research, Columbus, Ohio

ONR Projects Exhibited at Bolling AFB on Armed Forces Day

Pictured here are some of the officers of NRRC W-1 and W-2, who acted as hosts to visitors on Armed Forces Day; l. to rt., front row, CDR Wilcox, CDR Horseman, LT Chiantella—second row, LT Abraham and LT Whiting. Much of the spectator interest was focussed on exhibits of projects being sponsored by the Office of Naval Research. Among these were displays of rocket launching to obtain meteorological data, hydrofoils, and research in the fields of dentistry and marine biology. Over 400,000 persons attended the exhibit.

SDC Seminar Highly Successful

The Special Devices Center at Port Washington, L. I., held its fourth annual seminar from 18 Apr to 1 May. Among the points of interest visited by the reservists attending were the Merchant Marine Academy at Kingspoint, Grumann Aircraft Corporation and the N. Y. Naval Shipyard. Pictured opposite are the officers who attended the seminar and distinguished guests: l. to rt., CDR Edmondson, Director NRR Program; CDR W. C. Hall, Jr., Executive Officer, SDC; CAPT Harry Sosnoski, Director SDC; RADM F. R. Furth, CNR; RADM R. H. Hillenkoetter, Commandant, 3rd Naval District; and RADM L. DeFlorez, USNR(Ret).

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SDC Seminar Group