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RESEARCH REVIEWS

The Navy's Viking Rocket

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DEPARTMENT OF THE NAVY
WASHINGTON, D. C.

COVER PHOTO: The Viking rocket shown on its way to the White Sands Proving Ground firing site is making its last move in a horizontal direction. Its next journey will be straight up--into the upper reaches of our earth's atmosphere, where its delicate instruments will gather the data sought by NRL physicists. The Viking program is summarized briefly and pictured extensively in "Rockets for Research" on pp. 14 to 20 of this issue. (Glenn L. Martin Co. photo.)

Approved by Bureau of the Budget, 13 April 1948.

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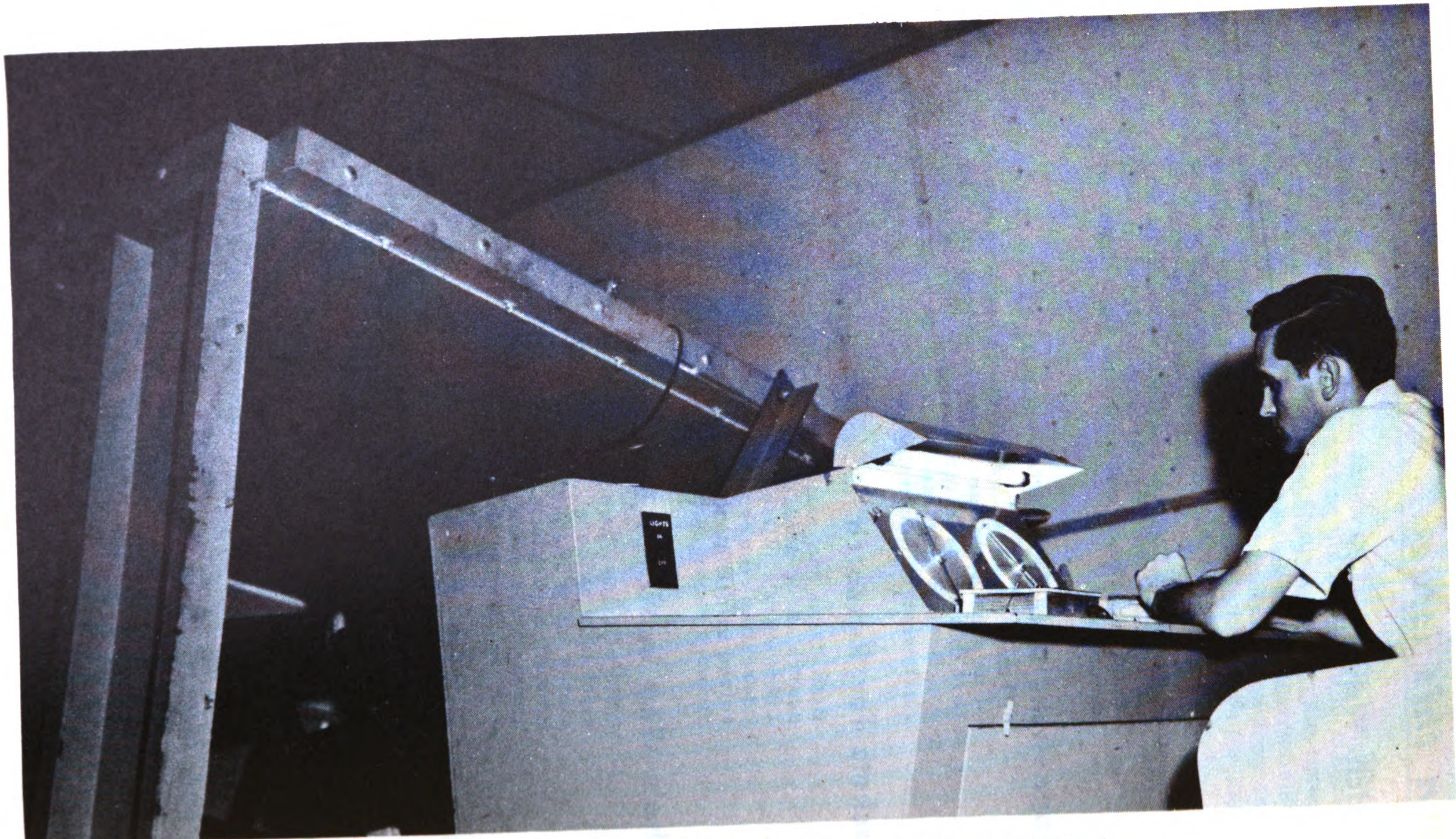

Pensacola tilting room used to test human perception of vertical.

Which Way Is Up?

by

Cecil W. Mann
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The vertical and horizontal lines and surfaces of the things we see are so obvious that the upright world and its horizontal correlates are usually taken for granted. We are accustomed to horizontal water surfaces and to the vertical pathways of falling bodies; we accept level ground and vertical walls; we normally assume an upright posture when we stand or walk. Nevertheless the perception of the vertical and horizontal is as much a problem as is the apparent size, color and distance of an object.

In his natural state, man is a daytime animal, normally adapted to perceiving three-dimensional space. His senses together show him an upright world and assist him in maintaining upright posture. When he moves in three-dimensional space, as in flight, however, his judgments of what he sees and his body position are complicated by the forces necessary to keep the plane in the air. Certain conditions may produce conflict between stimuli which, particularly under conditions of poor visibility, may result in faulty or hazardous flight. Experienced aviators report that their sense of balance and direction is disturbed by flying in overcast and by executing acrobatic maneuvers.

Among scientists interested in the problem, there has been dispute as to which of our senses plays the major part in allowing us to judge what is vertical and in maintaining an upright body position. Actually in maintaining equilibrium the important cues are both visual and proprioceptive. Phrased more carelessly, we might say that we keep our balance both by the things we see and those we "feel". Visual cues are supplied by the vertical and horizontal lines which are registered on our retinas and by the boundary of our visual field formed by the nose, cheeks, and ridges above the eye socket. A proprioceptive stimulus, on the other hand, is one which is produced within us by movements in our own tissue. These stimuli include effects produced in the mechanism in our inner ear and by tensions in our muscles, joints, internal organs and skin.

About 15 years ago one investigator (Koffka, 1935) put forward the theory that equilibrium is based upon visual cues. He claimed that the verticals and horizontals provided by nature and by man himself were the determining factors in enabling us to keep our sense of balance. If this were true it would mean that if our visual framework were tilted, then our perception of what was vertical would be correspondingly altered.

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In 1938, however, a somewhat different theory was proposed by Gibson and Mowrer. They proposed that visual cues, together with sensations produced by the pull of gravity, formed the basis of our judgments of what was upright. When there were contradictions in the evidence given to us by our different senses they felt that the pull of gravity was the more decisive factor. Later Gibson modified this theory. He proposed the idea that when what we see is consistent with the stimulus produced by the pull of gravity, then we are able to judge the true vertical correctly, even if the head is inclined. When visual and proprioceptive cues are discrepant, however, judgments of alignment will be uncertain.

We should remember in this connection that the evidence provided us by our various senses is consistent when the vertical lines projected on our retinas are parallel to the pull of gravity. This is true, of course, when the world is seen in the normal upright position; it is also true when our heads and bodies are tilted. This is because such a position does not actually change the direction of gravity; it merely means that its pull is across the body instead of lengthwise.

If, however, the surroundings we see are rotated so that the vertical lines produced on our retinas are not in alignment with the pull of gravity, then we have contradictory evidence from which to make our decision as to what is upright. Such discrepancies are also produced by keeping the visual image vertical but changing the effective direction of gravity by adding a centrifugal force. At Tulane and at Pensacola we have used such situations to test the way in which equilibrium is maintained.

The devices used in these studies were the Tulane tilting chair (Figure 1) and the Navy tilting room (frontispiece). The Tulane tilting chair is a sturdy wooden structure, electrically driven to produce lateral (sideways) tilt, control mechanisms to regulate the tilting, and selsyn recorders to indicate the magnitude of tilt. The chair is welded to the shaft of a reversible electrical motor geared to produce a maximum speed of 0.5 rpm. The master selsyn is geared directly to the shaft of the motor and permits recording of chair tilt to an accuracy of 0.4°. Parallel switches make possible the control of the chair either by the subject or by the experimenter, at the discretion of the latter. The chair is located in a lightproof room, and the experimenter's controls and recording devices are in an adjoining room.

The visual target is a narrow beam of light of controllable intensity. Its tilt can be controlled either by the experimenter or the subject, and read to an accuracy of 0.04°. The target device is attached to the floor of the chair and is adjustable to the eye-level of the subject. The Navy tilt chair at Pensacola is enclosed in a small room (a six-foot cube). This room is mounted so that it can be tilted sideways, independent of the tilt of the chair.

As we have explained, the sensory cues are considered consistent when the vertical lines seen on the target are parallel to the force of gravity. To test a subject's judgment of his body position without giving him any visual clues, he is tilted to the right and left in the darkened room up to angles of 90° and then required to return himself immediately by means of the controls to an upright position--that is, to a position parallel to the walls of the room. Many hundreds of trials showed a mean constant error of only 0.8°. This confirms our common experience of the obvious but often neglected fact that the normal individual, even without the aid of visual clues, aligns himself precisely with the direction of gravity's pull.

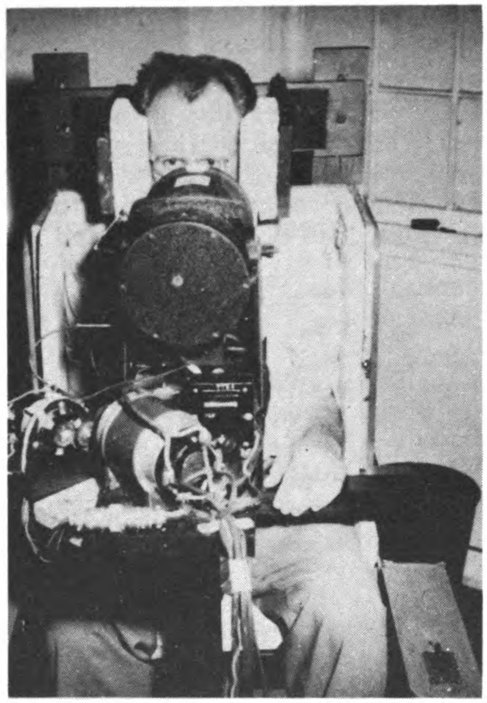

Figure 1 - Tulane tilting chair and visual target.

Casual observation during these experiments and later analysis of the data suggested that errors of judgment tended to be made in the direction of the tilt. To test this, a series of trials was made in which the subject was kept for 60 seconds in the position of tilt before being instructed to return himself to the upright. Errors in this series were compared with those made when there was no delay in the return to the upright. Under the delay condition, it was found that the constant error and a majority of judgments shifted towards the quadrant of inclination. It appears then, that when an individual is tilted sideways, he becomes adapted to the tilt. It is not clear, at present, what sense mechanisms are responsible for the adaptation.

Other experiments show that a subject can not only judge his body's position accurately without visual cues but can also judge precisely the position of other objects. Seated in an upright position in a dark room the subject was required to set the tilted visual target line to the true vertical, that is, parallel to the direction of the force of gravity. The mean constant error obtained from several hundred trials was only 0.3°. Moreover, judgment of the visual horizontal was of the same order of accuracy. These results indicate that the normal individual's judgments of vertical and horizontal lines are very precise.

In another series of trials the subject, while tilted at different angles up to 90°, was required to set the target line to what he believed to be the true gravitational vertical. When tilted at angles up to about 15°, normal subjects made errors of one or two degrees in setting the target line, and these errors were consistently in the direction of body tilt. However, at increased angles of tilt, the errors were all made in the quadrant opposite that of body tilt. The greater the tilt, the greater were the errors of judgment up to a maximum of 10° at 60° of body tilt; then the errors decreased to 8° as the body tilt was increased to 90°.

In 1861, Aubert found that a target line observed in a dark room appeared to rotate to the left when the head was inclined to the right. In 1916, Müller showed that for small angles of head tilt the target line rotated in the direction of inclination. The results obtained using the target line in the tilt chair confirm those of Aubert and Müller. Aubert also found that the rotation effect disappeared when the room was illuminated. It might be expected, then, that when observed from a position of lateral tilt a fully illuminated room would show less apparent tilt than would a target line in a darkened room. In order to test this, the subject was placed in a tilted chair position and required to bring the tilted room to the gravitational vertical. At 20° of body tilt the mean constant error made in adjusting the tilted room to the vertical was 3.5°, a value less than that obtained by using the target line in a dark room.

From these results it appears that when the cues are consistent the individual is able to make fairly accurate judgments of both visual and postural vertical. It should be noted, however, that body tilt does produce a slight increase in errors of judgment of the visual vertical, and that the errors are, in general, in the quadrant opposite to that of body tilt. Thus, it appears that when the evidence presented to our senses is not contradictory, we are able to make fairly accurate judgments of whether or not our bodies and the objects we see are vertical. Body tilt, however, makes us a little less accurate in judging whether what we see is upright.

We also performed experiments giving the subjects inconsistent stimuli. In some cases, what he saw as vertical lines were not in reality up-and-down according to the pull of gravity. One way to produce these effects is by tilting the surroundings.

In the first series of such trials the subject was placed in a room tilted at 20° and required to set himself upright while observing his surroundings. The maximum constant error of 2.0° shows that, though the individual is somewhat influenced by what he sees, the force of gravity nevertheless plays a dominant role in his judgment of his body's position.

Some of our experiments actually changed, in effect, the direction of the pull of gravity. This sounds like a difficult feat, but actually it may be done very simply by subjecting the individual to a centrifugal force like that experienced by a passenger on a merry-go-round. The Pensacola acceleration unit (Figures 2 and 3), which has been nicknamed "the Human Centrifuge", made this possible. The experimental car was rigidly fixed to a rotating beam of 20-ft radius, attached to a 22-ton flywheel and clutch-driven by a gasoline engine. The visual target (Figure 4) was a thin line of light which could be rotated by the subject. Recording devices were placed in the control room adjoining the acceleration chamber.

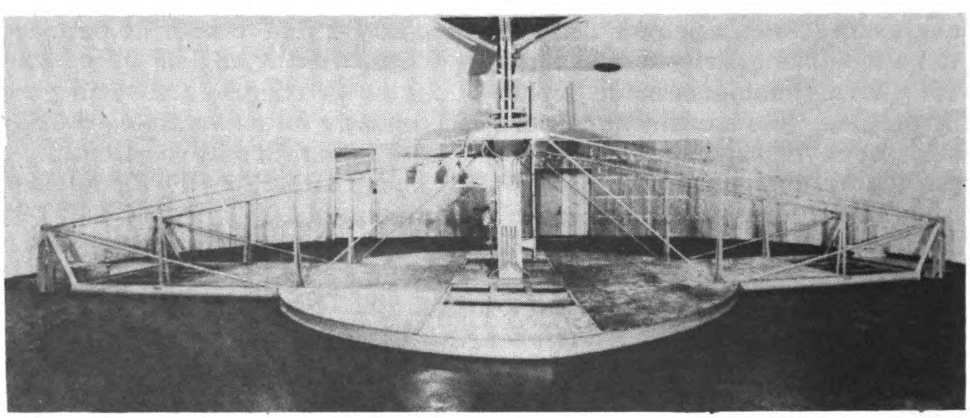

Figure 2 - Centrifuge chamber of Pensacola acceleration unit.

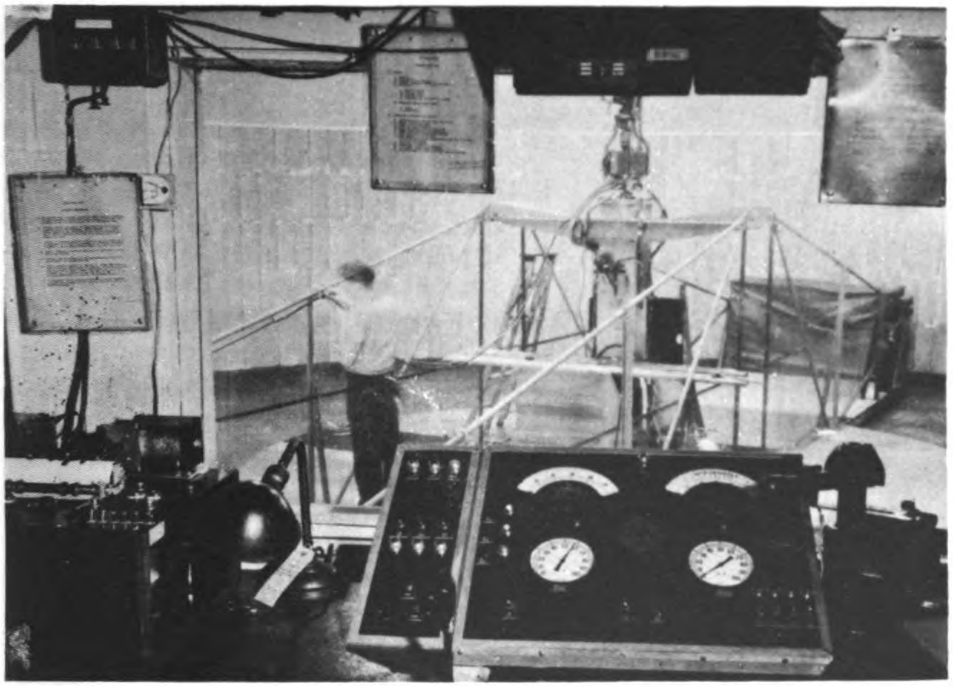

Figure 3 - Control unit of Pensacola acceleration unit.

The centrifuge was rotated at speeds of from 4 rpm to 11 rpm in a pre-arranged order in intervals of 1 rpm. The subject (Figure 5) was seated in total darkness, facing the direction of rotation, with his head firmly held in an upright position and his eyes closed. After the operator had accelerated the car to the desired speed and maintained it at that speed for 15 seconds, the subject opened his eyes and tried to adjust the target line to the vertical - that is, perpendicular to the floor of the building.

During counter-clockwise rotation of the centrifuge, the target appeared to rotate clockwise, the angle of this rotation being determined by the combined effects of centrifugal and gravitational forces. In order to set the target line in the true vertical the subject had to move it in a counter-clockwise direction to compensate for the clockwise effect of the combined forces, and at all velocities, the amount of movement corresponded with the calculated resultant of the centrifugal and gravitational forces. It should be remembered that the subject was in total darkness, except for the dimly illuminated target line, and had to depend for his judgment of verticality upon the effect of the combined forces upon his bodily sensations.

A slightly different arrangement was made in order to compare the effect of consistent and discrepant cues. A black rectangular panel, 21 by 29 inches with a one-half-inch white border was the visual background. In the center, a 14-inch metal disk was mounted, with a 1/4-inch white luminous line painted through its center. The disk was illuminated by a 24-watt bulb, and equipment was added to record the rotation of the disk by the subject.

In one series of trials the car was free to swing with the rotation of the beam. Discounting friction in the bearings the angle of swing

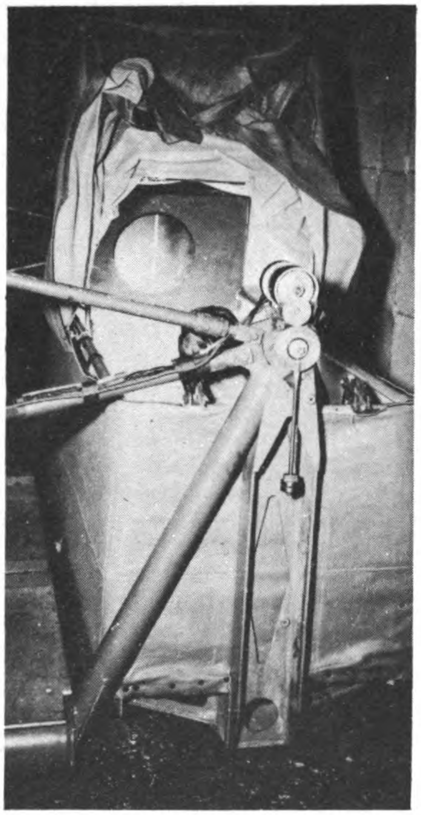

Figure 4 - Visual target in visual framework of acceleration car

equals the angle of the resultant force, hence the visual framework and the resultant force acting on the body are in alignment. Since the visual and the proprioceptive stimuli are consistent one would predict that the subject would align the target with the resultant force. This prediction is confirmed by the results. When the resultant angles were 23.6° and 44.5°, the mean judgments were 21.1° and 44.8° respectively.

In the second series of trials the car was locked so that it could not swing out with rotation of the beam. Thus, the visual framework was held parallel to the walls and the floor of the building, but the force on the body was in the direction of the resultant of the centrifugal and gravitational forces, a condition of truly discrepant cues.

For resultants of 23.6° and 44.5° the judgments were 7.0° and 16.4° respectively. It is clear, then, that discrepant sensory cues can reduce the individual's ability to make accurate judgments of the vertical.

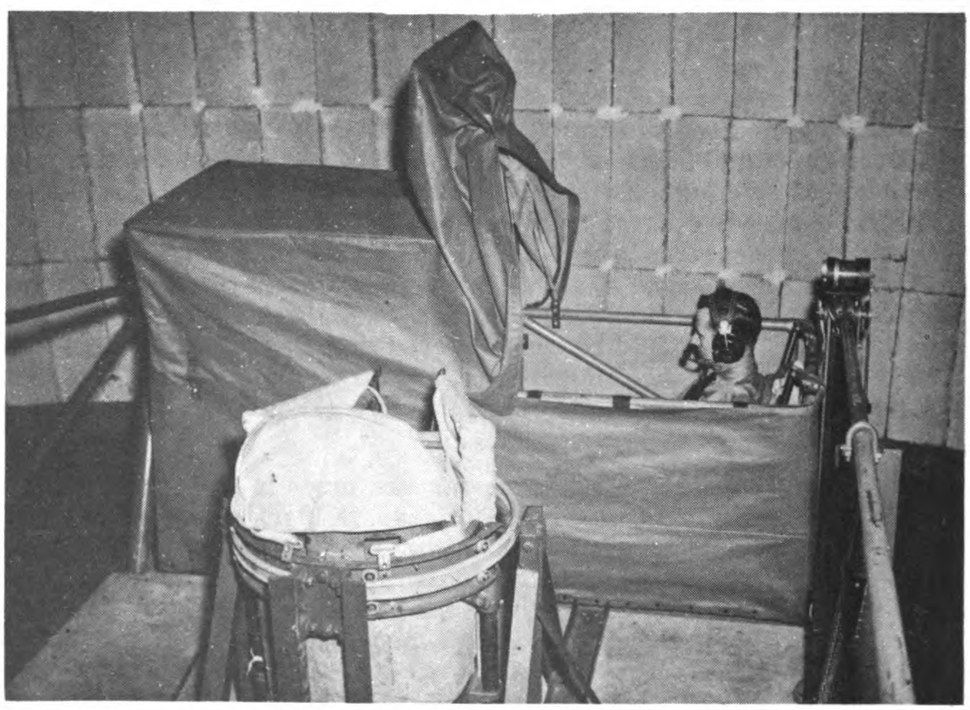

Figure 5 - Subject in car of acceleration unit

For future work it seems pointless to try to separate the influence of visual and proprioceptive cues on our judgment of the vertical. Instead it seems more profitable to see how these two types of perception interact and influence each other. Under practical conditions the individual makes his judgments of the lines of space and of his own body position as a result of stimulation from various receptors. It is our problem to set up conditions which will enable us to evaluate the contribution of each one in space orientation.

Appointed Leaders Less Authoritarian Than "Natural" Ones, Study Indicates

Leadership, the elusive quality that can make or break an organization, is under careful study by the Navy. The aim is to make more efficient use of personnel. To this end the Bio Sciences Group supports a program on leadership, carried out by the Human Relations and Morale Branch.

Some interesting findings in this field were divulged recently by Dr. Launor F. Carter, ONR investigator at the University of Rochester, who spoke at a meeting of the American Psychological Association. He has found that leaders who emerged from a group naturally are more authoritarian than those who are appointed to their posts.

Dr. Carter, who wrote on previous studies in the Research Reviews article, "Leadership in Small Groups", used 40 NROTC junior students for his experiments. These 40 were divided into five groups of eight members with equal leadership ability. Each group then participated in a reasoning task, a mechanical assembly task, and a discussion task. On the basis of leadership shown in these performances each group was broken into smaller groups of four and again subjected to testing.

The people referred to as leaders in the entire study were not only those appointed to the task but also those who emerged naturally as leaders. All were scored by observers, who found that the person officially appointed was sometimes in reality supplanted by another individual. The average leadership ratings of appointed leaders, however, were higher than those of other group members.

It was found that those leaders who were appointed thought that their duties consisted mainly of coordinating activities and keeping things moving instead of controlling or directing the actions of the group. The leaders who just emerged, as the group proceeded with its task, on the other hand, had to establish and hold their leading positions by forcefulness and aggressiveness in supporting their own proposals. These more authoritarian actions may have been adopted by the latter type of leaders because they did not feel as secure in their positions as the appointed ones.

The two types of leaders did, however, have some characteristics in common, i.e., the ways in which their behavior differed from that of the other members of the group. These differences, shown in all three types of tasks, indicated that leaders were concerned with analyzing situations and initiating the actions required.

Other scientists, who worked on the study of the behavior of leaders and other group members included William Haythorn, Beatrice Shriver and John Lanzetta. This contract is only part of a research program on leadership carried on by the Human Relations and Morale Branch.

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Magnetism and Catalysis

by
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If it were not for a certain class of substances known to the chemist as catalysts, the production of a host of indispensable items--fertilizers, explosives and high-octane gas, for example--would be slow and expensive.

A catalyst is a substance which changes the rate of a chemical reaction without itself being permanently altered. A good example of this is the old elementary chemistry experiment in which potassium chlorate is heated and oxygen is produced. Without the addition of a catalyst this reaction proceeds slowly, and strong heating over a long period of time would be required to decompose the potassium chlorate completely. But if a little manganese dioxide is added to the potassium chlorate, the reaction takes place with considerable vigor at much lower temperatures. At the end of the experiment the manganese dioxide may be recovered apparently unchanged and ready to be used over again.

For several years there has been a research program at Northwestern University which has as its principal aim a better understanding of the catalytic process. It is hoped that, in the long run, this will lead to more efficient and cheaper manufacture of many industrial products, but the immediate aim is to gather more knowledge about catalysts.

The principal method used in this study is magnetic susceptibility. Actually it is by no means obvious why there should be any relation between catalysis and magnetism. Everyone knows that a piece of iron is attracted to a magnet, and it is common knowledge that in some cases iron and substances containing iron (which are of course magnetic) are used as catalysts in making synthetic gasoline and other fuels from coal and water. This suggests a possible connection between magnetism and catalysis. Actually the connection is very close and much more than coincidental.

The science of magnetochemistry deals for the most part with effects which are quite small compared with the magnetic properties of iron. A common catalyst such as chromic oxide is attracted to a magnet, but the force of attraction is about one million times smaller than the attraction shown by a piece of iron of similar weight. Many substances such as water, quartz, oil, and wood are actually repelled by a magnet, although the force of repulsion is very small indeed. Materials which are repelled by a magnet are said to be diamagnetic;

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those which are weakly attracted are called paramagnetic; the very few which, like iron, are strongly attracted are called ferromagnetic. Many substances of interest as catalysts happen to be paramagnetic.

Of the several means available for measuring magnetic susceptibilities the one most appropriate for work on catalysts is known as the Faraday method. The sample under study, which may weigh a few hundredths of an ounce, is placed in a little glass bucket suspended at the lower end of a spring made of silica fiber. This spring is so sensitive that the weight of a signature on a piece of paper will extend it about an inch! Elongation of the spring is observed with a micrometer eyepiece arranged as in Figure 1. The bucket containing the sample is placed between the poles of a magnet which will produce a field of at least 10,000 and preferably 20,000 gauss. Both electromagnets and permanent magnets--the latter similar to those used in radar magnetrons--have been employed, but the electromagnets have some definite advantages. A feature of the magnetic field which is important is that it should vary in intensity along the axis of the silica spring.

If a sample is then placed in the bucket and the field is turned on, the sample and hence the lower end of the spring will be deflected. In an apparatus designed as shown diagrammatically in Figure 1 the motion of the sample will be downward if the sample is paramagnetic, upward if it is diamagnetic. Thus, it is possible to calculate the magnetic susceptibility of the sample. The glass bucket happens to be diamagnetic, but a correction may be made for this.

Magnetic measurements are often made at various temperatures. When high heat is desired the sample may be surrounded by a small furnace designed to fit between the poles of the magnet; conversely, low temperatures may be reached by the use of liquid air or other refrigerants in a specially designed vacuum bottle (Dewar flask).

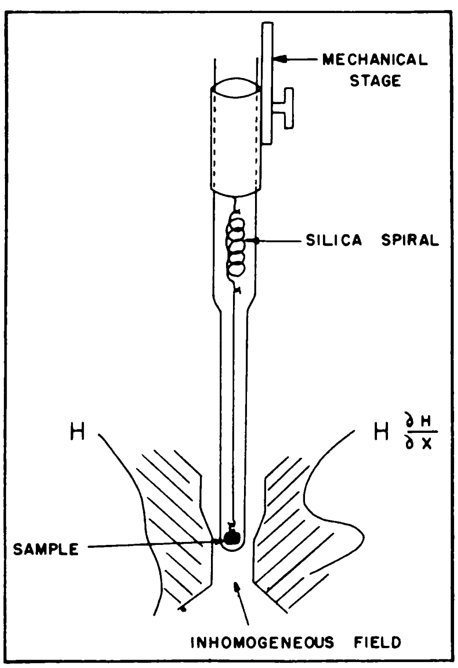


Figure 1. Faraday balance

Magnetic susceptibility measurements have a number of applications in chemistry and their use is steadily increasing. Here, however, our interest is confined to the study of catalysis.

Catalysis is often considered to have two branches, namely heterogeneous and homogeneous catalysis. The former covers those cases where the catalyst is physically distinguishable from the reacting substances and products. For instance, in the manufacture of ammonia (for fertilizers and explosives) the gases nitrogen and hydrogen are passed over the solid catalyst mixture which generally consists of iron oxide, aluminum oxide, and some potassium compounds. In some catalytic reactions, however, such as the union of amyl alcohol and acetic acid to form banana oil--the catalyst may

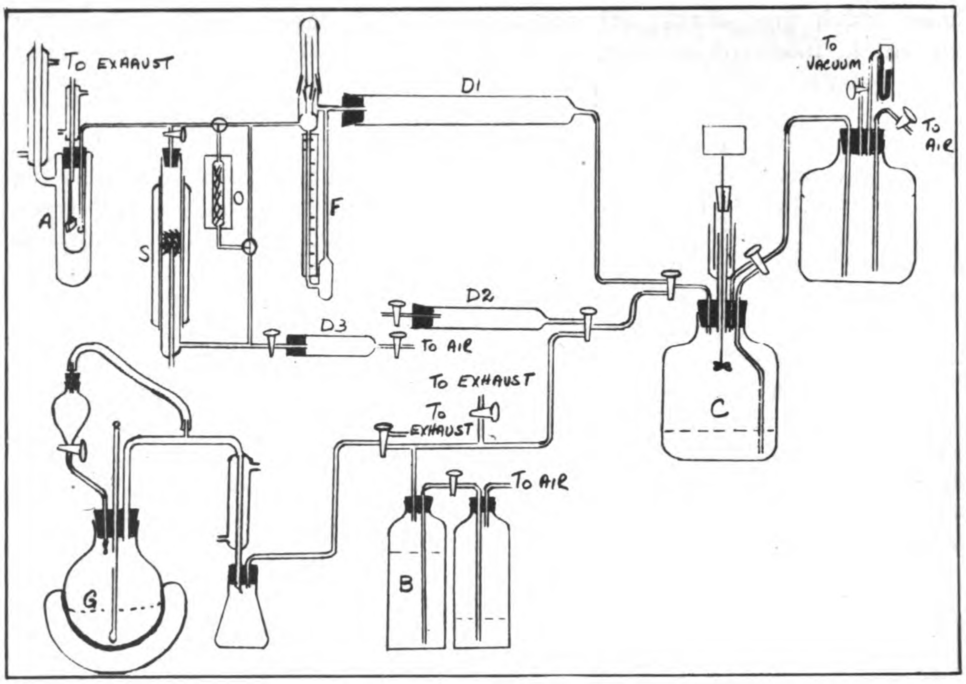


Figure 2. Apparatus for determining catalytic activity to CO oxidation

be simply a drop of hydrochloric acid which is added to and dissolves in the reacting liquids. Once the drop of hydrochloric acid has been added it becomes physically indistinguishable from the alcohol and acetic acid. This case is an example of homogeneous catalysis.

Our concern in the work described below is primarily with heterogeneous catalysis. Anyone who has been near a large oil refinery has doubtless seen, at least from the outside, an example of heterogeneous catalysis on a grand scale. The production of gasoline from petroleum is often achieved through a partial heterogeneous decomposition of the molecules in petroleum by a process known as catalytic cracking. A bank of so-called "cat-crackers"--huge vertical tanks--is usually the most conspicuous feature of a large refinery.

On a laboratory scale, especially for fundamental studies on catalysis, the reactions chosen for study are often of a less spectacular kind and practical applications are overlooked for the time being. Reactions are chosen, rather, for the ease and precision with which they may be measured and for the comparatively small number of variables which have to be controlled. Typical ones studied in connection with the magnetic properties of the catalysts include the production of toluene, the oxidation of ethanol, the decomposition of hydrogen peroxide, and the oxidation of carbon monoxide. The apparatus and procedure used for the last mentioned reaction will be described.

The object in this work is to compare the activity of several catalysts on which information has already been obtained from magnetic and other studies. To do this it is advisable to measure the catalytic activity at several different temperatures and with all other variables rigidly controlled. The reaction is

carbon monoxide + oxygen $\longrightarrow$ carbon dioxide

The apparatus used at Northwestern is shown in Figure 2. It consists of a carbon monoxide generator G, a graduated bottle B for measuring the carbon monoxide, a 50-liter carboy C for mixing and storing carbon monoxide-air mixtures, a drying tube Dl for removal of water and carbon dioxide from the gas before passage through the flowmeter F, and the furnace S containing the catalyst sample.

The activity of the catalyst (i.e. how good a catalyst is it?) is measured by finding the amount of carbon dioxide in the gas mixture after it has passed over and through the catalyst. The amount of carbon dioxide is found in the cell A. This cell consists of two platinum electrodes immersed in a suspension of barium carbonate in water--through which the gas mixture bubbles. The more carbon dioxide there is in the gas mixture the more the electrical resistance of the cell diminishes. Therefore the electrical resistance of the cell, as measured on a simple Wheatstone bridge, is a measure of the activity of the catalyst. If desired, the activity of the catalyst and its temperature may be recorded automatically and simultaneously on a recording potentiometer.

The general procedure is to fill the carboy C with a known mixture of carbon monoxide and air, which is then forced over the catalyst at a definite temperature and a definite rate. After a reading is obtained, the temperature is changed and another determination is made. Finally, the catalyst is removed and a different sample is put in the furnace. Considerable care has to be taken in preparing and handling the catalyst samples if reproducible, meaningful results are to be obtained.

Another typical experiment involves chromium oxide mixed with aluminum oxide, a catalyst which is widely used in the manufacture of toluene for making TNT. The catalyst has to be prepared in a special way, one of the successful recipes being to soak aluminum oxide (which possesses a very high surface area in proportion to its weight) in a solution containing chromium. The mixture is then filtered, dried, and heated to a higher temperature. The resulting catalyst is said to consist of chromium oxide supported on aluminum oxide. Many catalysts are made in such a way, and there has been considerable interest in knowing the relation of chromia to alumina and how the chromia is distributed on the surface of the alumina. The magnetic susceptibility gives some information on this point.

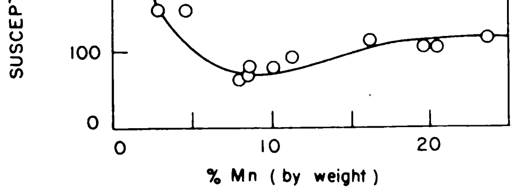


Figure 3. Magnetic susceptibility isotherm for supported manganese oxides

It is found that the less chromium there is in the catalyst the higher becomes its magnetic susceptibility. The interpretation of this fact is not easy, but the evidence seems to be clear that for all useful concentrations of chromium in the catalyst the chromium atoms are piled adjacent to each other the same way they are in a solid crystal of chromium oxide. On the other hand, measurements of the surface area of these catalysts indicate that the area is too large to be covered by uniform layers of chromium oxide spread over the alumina. This is simply because there is not enough chromia to go around. The conclusion has been reached, therefore, that these catalysts consist of little aggregates or islands of chromia which are the centers of catalytic activity and that these centers are widely separated from each other by bare, inactive, alumina.

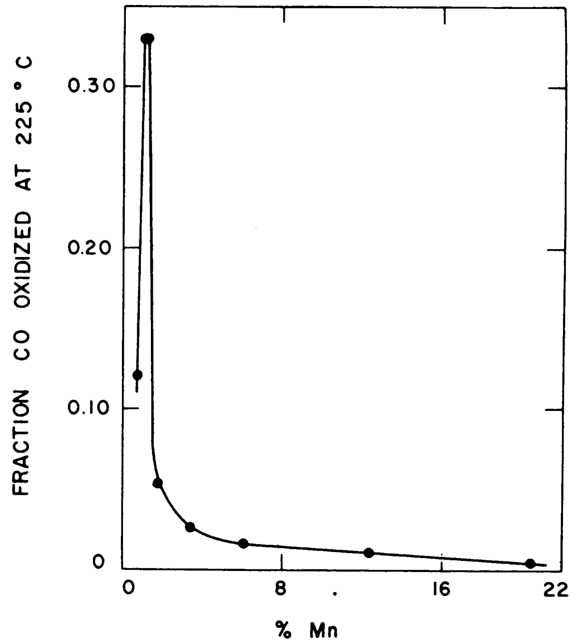


Figure 4. Catalytic activity of supported manganese oxides as a function of manganese concentration.

Similar results have been obtained with many other agents. One of the most interesting contains manganese. Normally when manganous nitrate is heated, it decomposes into pyrolusite, MnO_2, but if a high-surface-area alumina is soaked in manganous nitrate and then ignited, the nature of the product formed depends on how much manganese is present. If there is abundant manganese, the product is MnO_2 as before, but if there is only a few percent of manganese present, the product is Mn_2O_3. This effect, known as valence inductivity, seems to be caused by the manganese trying to imitate the crystal structure of the alumina support, the formula for which is Al_2O_3.

Magnetic-susceptibility investigations of supported manganese oxides not only show the effect of valence inductivity but, as in the case of supported chromia, they show the probable aggregation of the manganese into little islands. Studies on the catalytic activity of such mixtures by the carbon monoxide oxidation method described above show a great increase of activity parallel with the increasing magnetic susceptibility as the manganese concentration is lowered. This parallelism is so good that it would be possible to predict catalytic activity purely on the basis of a magnetic-susceptibility measurement.

At very low manganese concentrations the catalytic activity suddenly drops to near zero. This fact seems to show that there is a minimum size of the islands of manganese below which no activity is possible. This observation is consistent with current theories concerning the nature of catalytic activity. More important perhaps is the observation that raising the temperature of the catalyst raises its activity in exactly the same proportion regardless of how much manganese is present. This fact is regarded as showing that the nature of the catalytic process is exactly the same notwithstanding the change from MnO_2 to Mn_2O_3 and the steadily diminishing size of the manganese islands. For this particular system it has been proved that the catalytic activity depends on how many such centers of catalytic activity are available and not upon changing intrinsic activity of the islands.

We are still far from understanding completely the nature of catalytic activity. Better catalysts are still being made by trial and error rather than by a rational process. Nevertheless, the techniques briefly described above have added some new knowledge to this elusive field.

New Desks at ONR

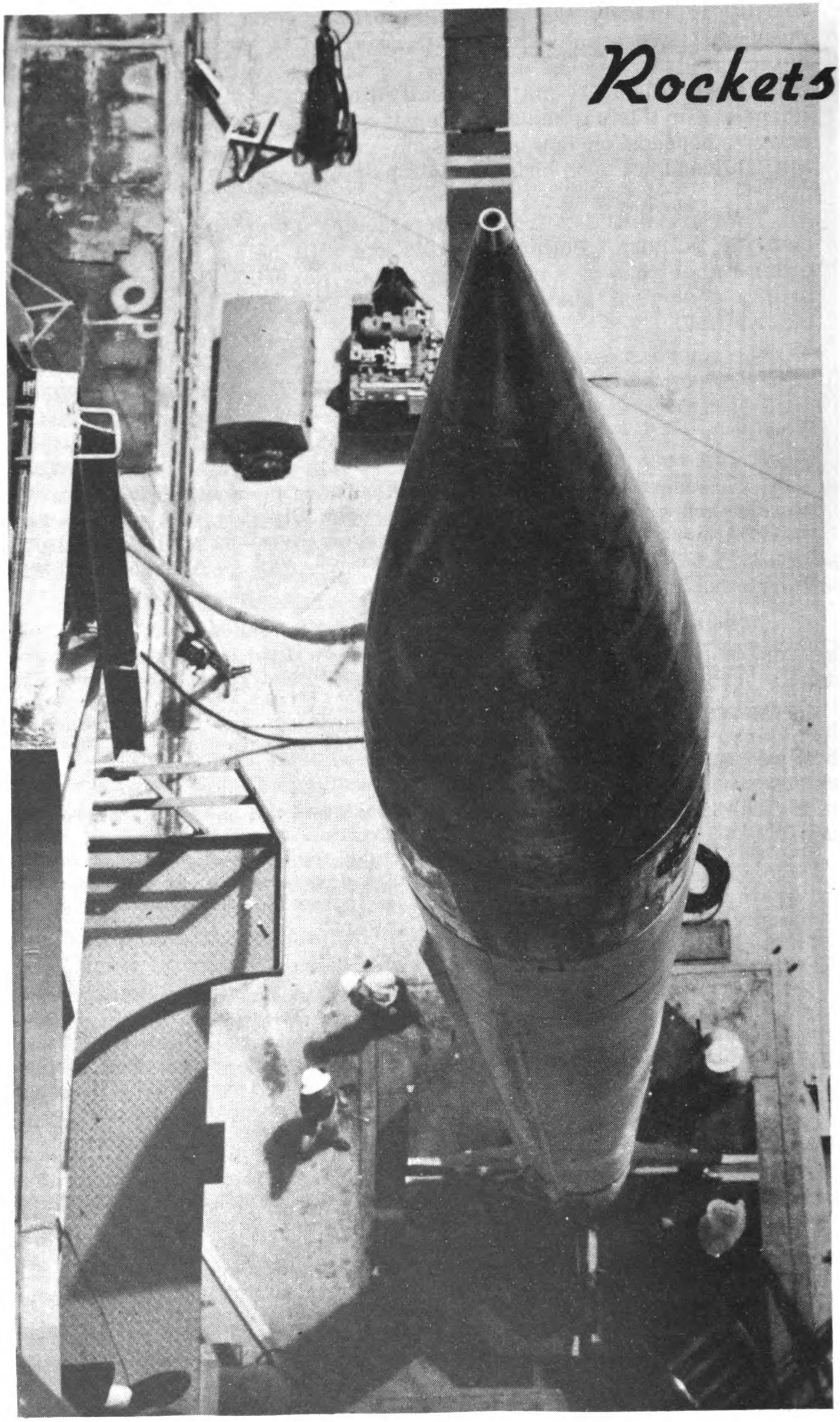
In recent weeks several new offices have been added to ONR's list of research units: The Material Sciences Division was created by a vertical bisection of the Physical Sciences Division, a Clinical Branch has been added to the Bio Sciences Division, and an Acoustics Branch to the Earth Sciences Division.

The separation of the former Physical Sciences Division into two units was made necessary by a great increase in the number of contracts. The branch designations remain unchanged; they are just regrouped. The Material Sciences Division, directed by Dr. Urner Liddel, now includes the Metallurgy, Organic Materials, Chemistry, and Power branches; Physics, Nuclear Physics, and Electronics remain under the Physical Sciences Division.

The Clinical Branch was created to meet the need for a horizontal control group within the Bio Sciences Division. It will take over management of division contracts on research as the various projects reach a stage where they are ready for applied development. It will also administer — at one desk — all contracts in the bio-science field for the Bureau of Medicine and Surgery. Captain J. A. C. Gray, USN, is the Branch Head.

Certain projects concerned with research on host response to infection which were formerly carried on by Microbiology Branch are being transferred to the Clinical Branch. Typical of these is a study on pulmonary anatomy and pathology which has added to the understanding of pulmonary diseases and which may aid in their treatment. Another is a study of vaccination with BCG as a means of combatting tuberculosis. The Physiology Branch is also transmitting some of its studies of circulation and respiration and of the physiological basis for treatment and rehabilitation. One such project deals with the function and morphology of blood vessels and has resulted in considerable progress in the treatment of frostbite.

The most recent addition to the Earth Sciences Division — the Acoustics Branch — is also the result of a regrouping to meet increased requirements. It has assumed sponsorship of contracts within the fields of fundamental physical acoustics, underwater sound, submarine detection, and mine warfare. The new branch is headed by Mr. Wilbert Annis.


Rockets

Research

The Viking Program is helping NRL researchers to probe the outer reaches of our earth's atmosphere.

Pictures in newspapers and magazines showing rockets soaring aloft into the blue somehow give the impression that the whole business of firing a five-ton rocket is a fairly routine procedure. Though facts are often given as to record heights reached, fuel consumed and other particulars, no real idea is conveyed of the magnitude of the work involved in the successful firing of a projectile carrying delicate research equipment.

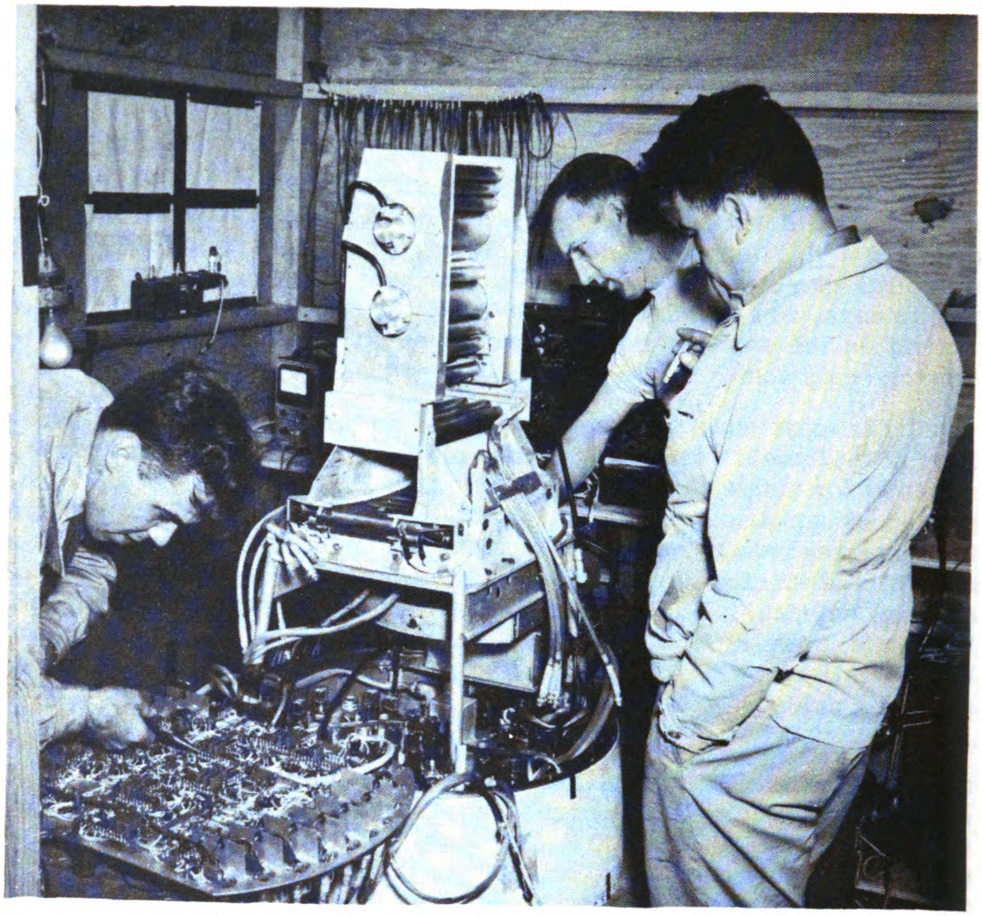
The most successful recent efforts in this field are the launchings of the Navy's Viking Rockets, one of which set a new altitude record recently for single-stage projectiles. The Viking was originally conceived by scientists at the Naval Research Laboratory as a vehicle for carrying research instruments into the upper atmosphere and as a means of advancing the rocket art in the United States in the interest of national defense. The Rocket Sonde Research Branch, headed by Dr. Homer E. Newell, Jr., directs the Viking program. The group under Dr. Newell is well qualified for the job, for its experience in rocket research dates back to the V-2 firings.

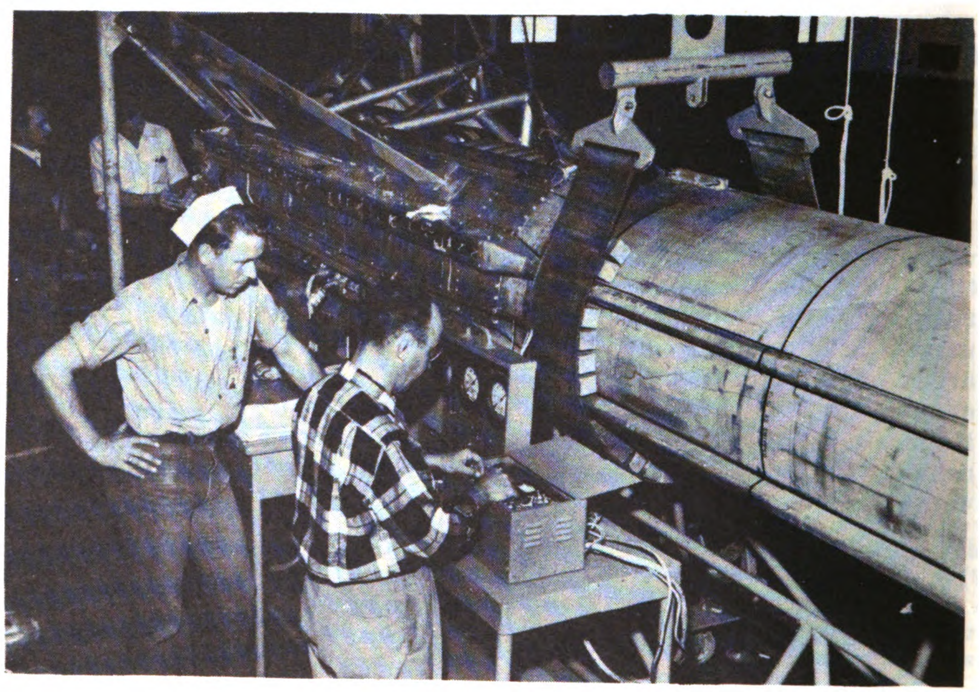
What does the Viking look like? In over-all appearance it is slimmer and more streamlined than its German predecessor, the V-2. A conical-tipped cylinder approximately 48 feet long and 32 inches wide, it weighs at take-off some 11,000 pounds. But only about one-third of this actually represents the structure of the rocket; 8,000 pounds of the total weight is accounted for by fuel--liquid oxygen and ethyl alcohol--necessary to propel the big rocket to altitudes of over 100 miles in nearly vertical flight. Propulsive force is obtained from a 20,000-pound (sea-level) thrust rocket engine.

Experimental equipment designed to gather data on cosmic radiation, the solar spectrum and air pressures in the upper atmosphere are installed in the rocket. Equally important is equipment which radios back to ground stations information on the rocket's progress. If necessary, a signal may be radioed to the rocket which will cut off the power to prevent the big projectile from traveling outside the firing range.

The pictures on these pages show some of the steps which are involved in the firing of a Viking--its preparation, the installation of scientific instruments, fueling testing, last-minute adjustments, take-off and recovery. But actually they cannot picture the endless patience, the months of labor and planning, the painstaking attention to detail which are required from the men who build, equip and fire the big rockets. The camera can only record some portions of the complex effort necessary if the Vikings are to be successful in obtaining the data which scientists need to add a little more to our constantly growing picture of the universe around us.

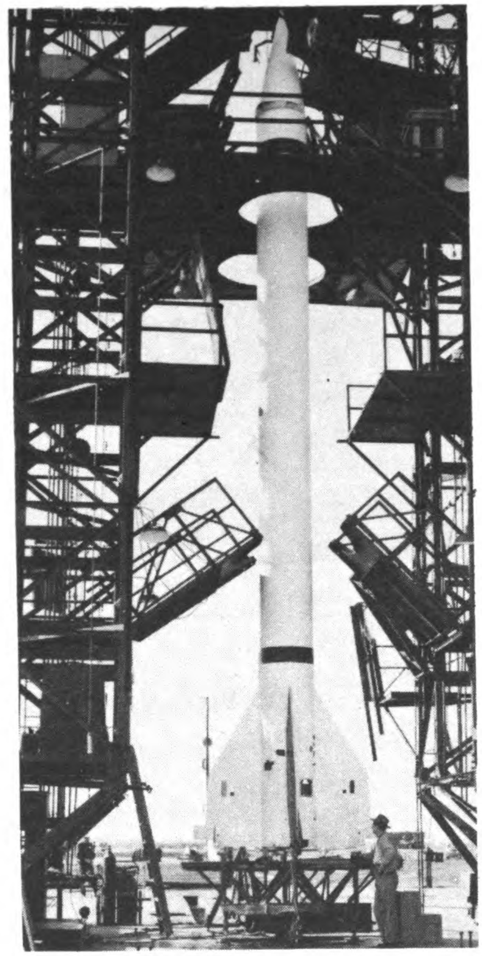
A bird's eye view of the last rocket fired (No. 7) taken from the gantry crane. The Glenn L. Martin Co., builders of the rocket, made this striking photo, and several of the others shown.

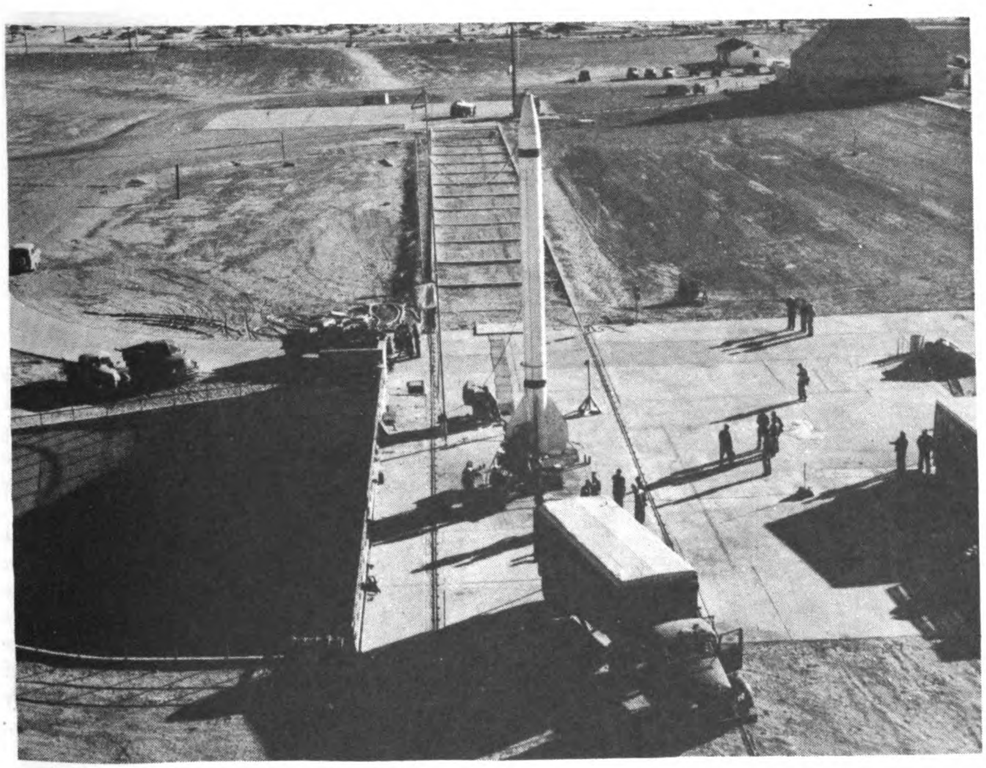


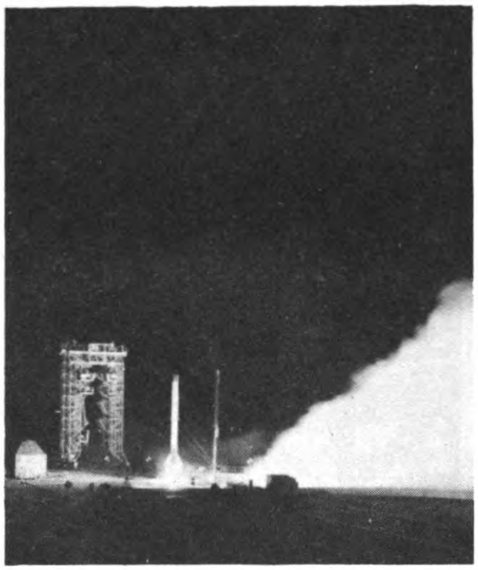


Before the Firing

While the body of the rocket has been under construction at the Glenn L. Martin Co. at Baltimore, Md., NRL scientists have been working for months on experimental equipment to be installed. In the picture opposite (above) Dr. G. J. Perlow and his colleagues work on a cosmic ray experiment. At the hanger at White Sands (opposite, below) further preparations for firing are made. Here power plant testing is underway. After these operations are complete, the projectile is transported to the firing site (see cover) and set up inside a structure called a gantry crane (at right) which allows workmen to have access to every portion of the Viking to make interference tests. Finally fueling begins as a truck carrying oxygen pulls up. (Not all these pictures show the same rocket. Seven have been fired.)





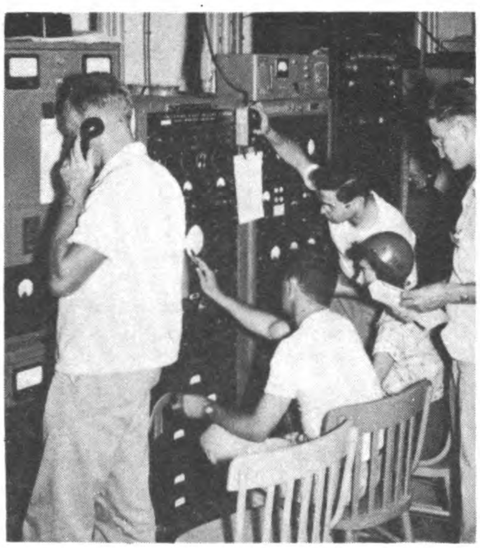


Final Testing

To measure the performance of th various systems a static firin (left) is staged--i.e., the completel assembled rocket is "fired", bu only after it has been bolted dow to prevent take-off. Usually som "bugs" are discovered at this stag and days or even weeks are require to remove them. Occasionally th rocket has had to be taken dow and transported back to the hanga for further adjustment.

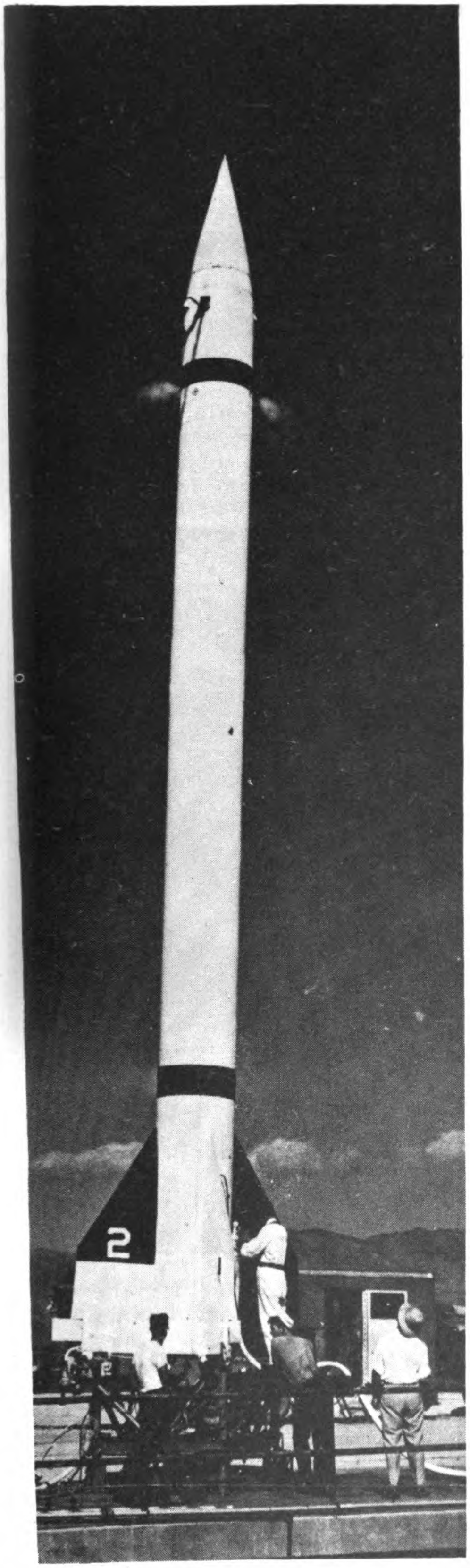
To Fire or Not to Fire

That is the question as these scientists discuss the records of the test firing. They can tell from these if the real firing is likely to be successful. This is a touchy decision, for a miscalculation might cause a failure and the loss of valuable equipment and time. But if all is well, the long months of work are approaching a successful conclusion.



The Launching

As scientists and technicians work with telemetering equipment in the blockhouse, from which the firing signal is given, the rocket stands ready to go. The firing panel, not shown, is also in the blockhouse. The big moment comes and the rocket takes off for the upper atmosphere. The pictures opposite show how it appeared to observers on the ground at intervals of a few seconds. The top picture is a shot of the "vapor trail" formed by condensed gases from the exhaust.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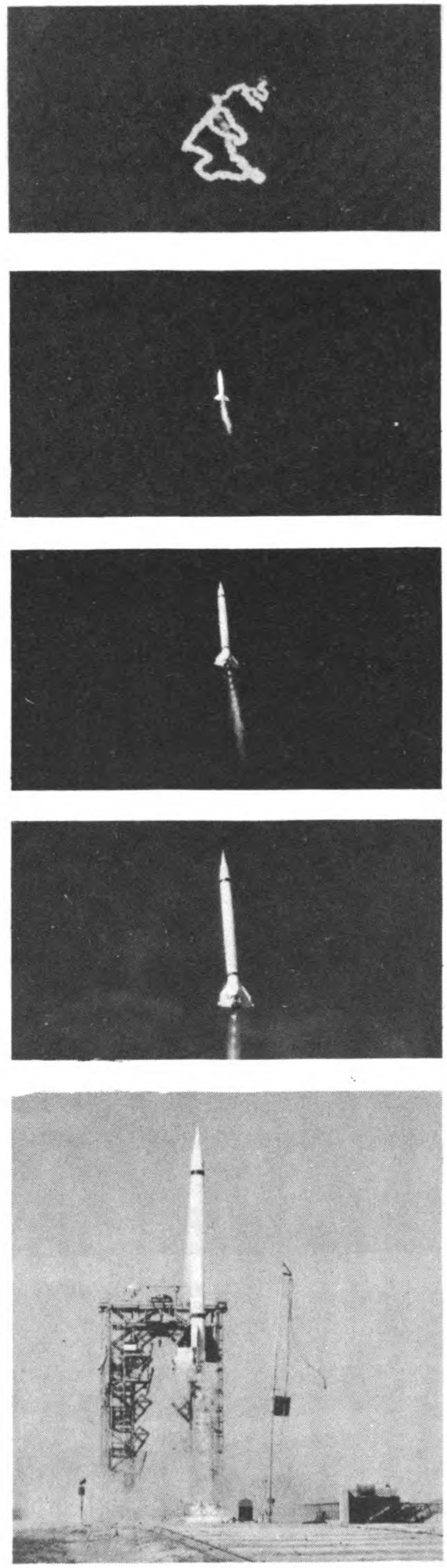
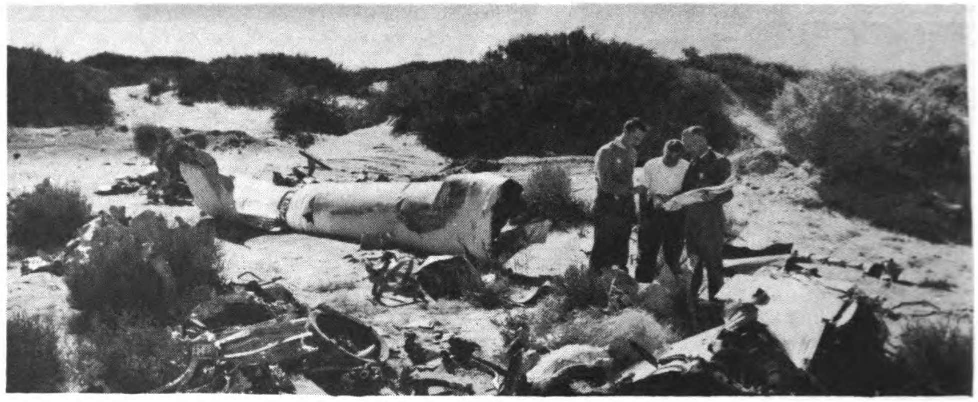
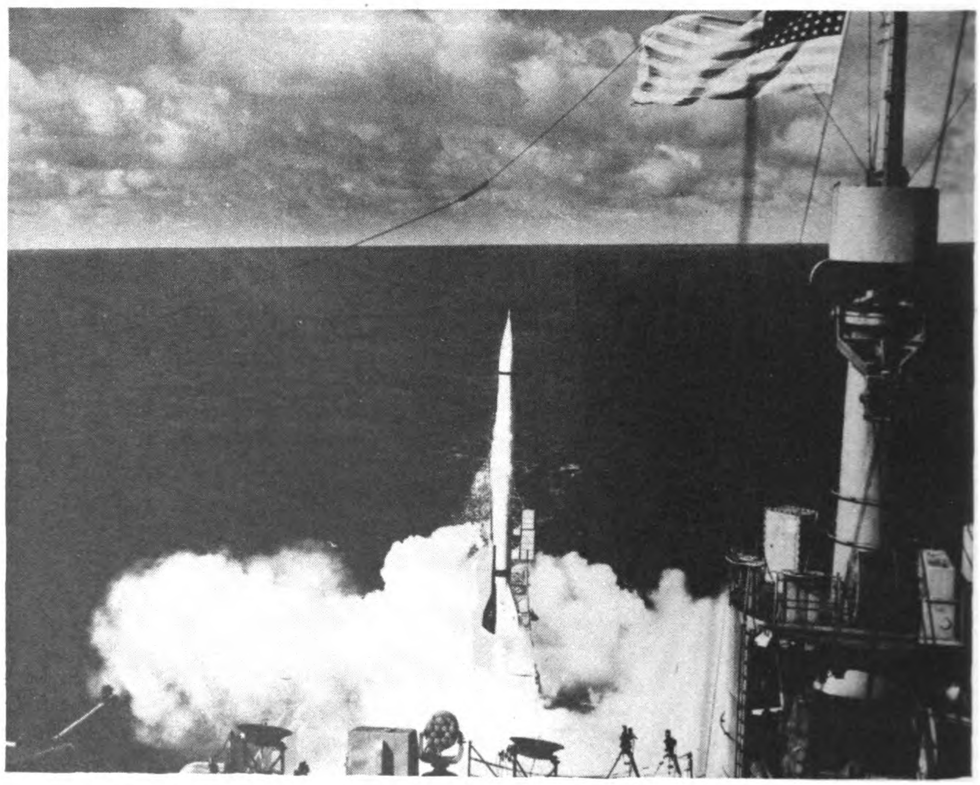
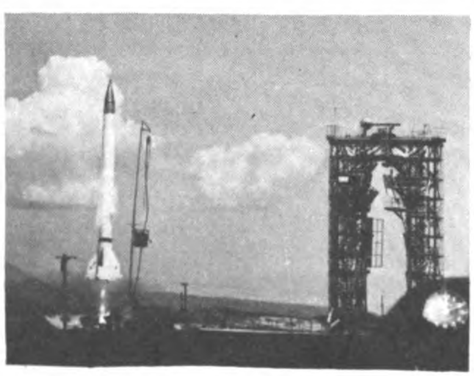




What goes up must come down, as the saying goes. This is part of what is left after aerodynamic forces and impact shock have torn the rocket apart. Much precious research data, however, will be found intact.





Two Record Breakers

Here are two Vikings which set records. Above, No, 4, fired last year from the USS NORTON SOUND, reached 105 miles, then a record for American single-stage rockets. The last one fired, No. 7 (at left) reached an altitude of 135 miles, a world record for single-stage rockets.

Who's Who in Naval Research

Last spring, when Chief of Naval Research RADM Bolster needed a replacement as Assistant Chief for Administration he reached into the retired list for CAPT Howard N. Coulter. It was by no means a blind choice; the two had been shipmates in that small but dedicated group of career officers who kept lighter-than-air alive in the Navy. They were together in the old "Los Angeles", together again aboard the "Akron", and together they swam away from the broken air frame of the sinking "Macon". Now—after a span of sixteen years--they are together again in the Navy's research program.

Captain Coulter will tell you in his unassuming way that he "can't claim to be a research man", but he has had considerable background in electronic engineering development. Graduation from the Naval Academy (1921), from the Annapolis "P.G." school (1927), and from Harvard (M.S., 1928) qualified him in radio communications. In this field he assisted in the development of early (experimental) high-frequency and super-frequency radio equipments for rigid airships, including the first RCA-Victor development of the "walkie-talkie" voice-communication field radio. He also teamed with Westinghouse-RCA engineers in pioneer development of facsimile radio.

While he was on duty aboard the "Macon"—then stationed in California—he became personally interested in the field of radio direction finders, ultimately obtaining a private patent jointly with a civilian scientist. Then, in February 1935, the giant dirigible crashed into the Pacific. Her loss, following so soon after the "Akron" tragedy, abruptly curtailed the lighter-than-air program.

From 1936 until we entered World War II, Coulter had typical "line" duty—first in the battlewagons, then as Training Officer at Lakehurst, and finally as Navigator in the cruiser "St. Louis". By this time however, he was a recognized authority on communications and just prior to Pearl Harbor he was transferred to Washington to serve with BuAer on the Joint Radio Board of the Joint Aircraft Committee. Not for long, for quite early in the war the depredations of the U-boat brought the almost forgotten gas bag into its own.

In 1942 the decision to establish blimp bases on the Pacific Coast gave Captain Coulter a chance to show what he could do, not only as a lighter-than-air specialist but as an organizer, administrator and leader. He set up and commanded NAS Santa Ana, California (blimps), and then commanded Fleet Airships Pacific until the end of the war. In both assignments he won SecNav commendation ribbons "...for exceptionally meritorious conduct...". This was not a routine handout of decorations; Captain Coulter had been responsible for improving the techniques of hunter-killer tactics, including that of landing aboard an aircraft carrier, that made the blimp so effective against submarines. He also made the bulky craft easier to handle by modifying the control system.

Captain Coulter remained on active duty for two years after the war—skippering navy transports and serving as First Naval Attaché in Manila. Then he retired, only to be called back to active duty in April 1951.

Asked if he minded being back in uniform again, Coulter replied "Indeed not! I was never gladder of anything in my life. It's too dull on the outside!"

After all, at a tanned and vigorous-looking 50, this many-sided officer is far too young to be on the shelf. Already possessing an enviable reputation as an expert in airship employment and in radio communications, he has plenty of time to develop his new specialty—research administration. The Captain's next move is to Northern California ("God's country", as he calls it) where, in November, he will assume command of ONR's San Francisco Branch.

New Light Thrown on Spread of Disease By University of California Scientists

By means of special equipment perfected at the Naval Biological Laboratory, scientists of the University of California have filled in some important gaps in our knowledge of how infectious diseases are spread. The equipment, described in the March 1949 issue of the Reviews, consists of an infection chamber with elaborate protective devices for laboratory personnel. A germ-laden cloud is sprayed past the noses of exposed animals, just as a human sneeze sprays such a cloud. Scientists know how many germs there are in the spray and the size of the droplets carrying them.

One of the important findings of the work was a verification of theories about the size of the particles in relation to the infectivity of germs. It was found that particles smaller than five millionths of an inch in diameter were most effective in getting germs into the respiratory tract and causing disease. Particles above this size were mostly repelled by the body.

The scientists also found out some interesting facts about the influenza virus. The germ is more infective when airborne than when it is carried in a liquid and survives best at 60 percent relative humidity—within the normal range of many cities. Extremely dry and extremely wet atmospheres were the most unfavorable for its survival.

What is ACTH?

by
Paul L. Munson
Harvard School of Dental Medicine

The "miracle" medicines, ACTH and cortisone, have made the headlines often in the past few months because of their dramatically beneficial effects on arthritis and other diseases. In spite of this there is still much that we do not know about these two substances.

ACTH is a hormone secreted by the pituitary - a small gland located at the base of the brain. It does nothing in its own right except to compel another gland, the adrenal, to increase its production of cortisone. The latter has quickly become famous for its effect on rheumatism (rheumatoid arthritis) and several other troublesome disorders. Cortisone, whether artificially supplied or made in the patient's own body under the influence of ACTH, does the same job.

Since it is not known which hormone will finally prove to be the one of choice, research is under way to produce both cortisone and ACTH more efficiently. Which can be made the more cheaply is an immediate practical problem, for both are now expensive. Many studies, however, are going to be carried out to learn how the body makes its own cortisone, and for these studies ACTH is essential. Furthermore, the leading role which ACTH plays in regulating normal body function impels us to investigate it thoroughly for its own sake.

Actually our problem in regard to ACTH is a dual one. First of all, we need to find out just what the substance actually is, for we know that the forms now used do not represent the hormone in its pure state. Secondly we have production problems. The only known source of ACTH at present is the pituitary gland, which manufactures and stores it. At present the ACTH used for research and treatment comes from the glands of hogs and other slaughterhouse animals. Because the organs from which the substance is made are small, the supply is limited and the cost is high. Research is therefore concentrated on determining what the hormone actually is--i.e., discovering the "pure" form in which it exists in the body--and in finding cheaper and more efficient methods of producing it.

Though the clinical use of ACTH is fairly recent, research along these lines has been proceeding for many years. As early as 1933 the brilliant Canadian biochemist J. B. Collip had prepared extracts from animal pituitaries which powerfully stimulated the adrenal glands. These were suitable for administration to animals and man; yet their

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Paul L. Munson began his research career in endocrinology while an undergraduate student at Antioch College. After receiving an M.A. from Wisconsin and a Ph.D. in biochemistry from Chicago in 1942, he was responsible for ACTH research and development for Armour & Co. until 1948. He then went to the Yale School of Medicine as Assistant Professor of Pharmacology and since 1950 has been Assistant Professor of Dental Science at the Harvard School of Dental Medicine.

possibilities were not at once exploited. Progress in research on cortisone and like compounds, however, eventually made the scientific community more receptive. Then, in 1942, a new era in medicine was launched by the almost simultaneous announcement of two young scientists that they had isolated from pituitary tissue what appeared to be pure ACTH.

There were some good reasons for thinking that this was true. The two men had used widely different procedures and different animals; yet they had obtained apparently pure proteins, identical in their chemical and biological properties. George Sayers at Yale had started with hog pituitaries, while Choh Hao Li at the University of California had used sheep pituitaries. In some ways, however, it seemed that if Li and Sayers were right--that is, if active materials which they had isolated were really the pure protein hormone--then prospects were not bright for making ACTH artificially or for determining its composition. This is because all proteins possess a very complicated chemical composition.

One encouraging possibility, however, did exist. Even though ACTH in pure form might be a protein, its powerful effects might be due to only a part of its constituents. In other words, only a portion of the ACTH molecule might be necessary for the powerful effects which it produces.

Evidence to support this view was promptly found. By 1943 Li had found that his "pure" ACTH was still effective even after it had been partially broken down by chemical reactions (involving weak acid or pepsin). And Richard Tislow at Harvard found a material which, though it acted like ACTH, was definitely not a protein. These findings did not mean that Li and Sayers were wrong when they said that the proteins which they had isolated were pure ACTH; they merely meant that the vital effects of ACTH could be obtained from a substance with a much simpler composition than that found in proteins.

Such a simple compound proved to be effective both in humans and animals and it is expected to be of the greatest value from the standpoint of synthesis and practical medical use. But its relation to the preparation of Li and Sayers was not immediately made clear; in fact the nature of pure ACTH is still in question.

Clearly much work was still necessary on this problem. In 1943 when the late Prof. Fred C. Koch and I began studying ACTH at the Armour Laboratories we needed a sufficient amount not only to study its effects on animals and humans but also to determine its chemical composition. Our efforts to produce enough of the purified substance from hog and sheep pituitaries produced some surprising and valuable results.

As is often the case, some of our difficulties led to interesting new discoveries. We had trouble in reproducing the results of Li and Sayers and, in the course of our work, set aside a by-product, designated La-1-A, which we did not expect to produce any of the effects of ACTH. Actually this supposedly impotent substance was destined for considerable fame. Tested by a new method of evaluating ACTH (developed by Marion A. Sayers) it turned out to have a potency which was unusually high by the standards current at that time. Subsequently its potency was tested repeatedly in rats, this time in direct comparison with the "pure" ACTH of Sayers and Li. Both in our own laboratory and in others (including Sayers') it was found to be more active than the supposedly "pure" hormone.

Actually La-1-A is itself far from pure. When tested by V. L. Koenig,[1] it was found to contain two distinct components. If one of these were pure ACTH and the other was an inactive protein, then the effective constituent must have been two or three times as powerful as the preparations of Li and Sayers. When the latter used the same test on his ACTH that Koenig had used on La-1-A the results were somewhat inconclusive, for this test can only show definitely in certain cases that a substance is impure; it does not give a sure proof of purity.

It was possible then, that Li's and Sayers' compound might actually be a mixture of active and inactive ingredients. Recent experimentation by Sayers seems to indicate that this is indeed the case. Certain chemical reactions enabled the detection of several distinct components, showing that the protein previously thought to be pure was in reality a mixture. This does not, of course, eliminate the possibility that several different forms of ACTH are present in the pituitary.

As to La-1-A, many questions still remain to be answered. Possibly it is chemically different from any of the ingredients of Li and Sayers' ACTH, but has the same biological effect to an even greater degree. At any rate, in spite of these uncertainties it has been put to many uses. It was the first ACTH preparation used effectively on human beings. Moreover, it became the standard for assessing the quality of large-scale production batches of ACTH and all human dosages of the substance were expressed in terms of mg of La-1-A. Finally the United Nations has made it the international standard for ACTH.

The superior potency of La-1-A compared to the proteins isolated by Li and Sayers was, of course, surprising. But equally surprising were the results of another comparison which was made with the substance. When we injected crude pituitary tissue into rats, we found that its potency was 10 to 30 percent of that of La-1-A; later work by Li and Sayers confirmed these results. This relatively high potency of crude pituitary tissue made it obvious that pure ACTH must be many times more potent than La-1-A.

In attempts at further purifications we obtained several products which were twice as potent as La-1-A, but these were still far from pure proteins. Before we could proceed further along these lines, our efforts at the Armour Laboratories were diverted to the development of a method for the production of ACTH in greater yield and on a large scale to meet the insistent demands for the hormone by other scientists. This presented a problem, for the original methods of Sayers and of Li were not aimed at commercial production of ACTH. The Sayers method yielded only about one percent of the ACTH that was contained in the starting material, while the Li method gave even less. From 1946 to 1948, Alfred G. Barry and I at Armour increased this yield about tenfold. More recently we (Frances L. Naylor and myself at Yale and Harvard) further improved our method to the point where nearly all of the ACTH in the pituitary gland can be obtained in useful form. From the standpoint of efficient production of ACTH this has, of course, been important; moreover we can be sure that the products obtained in high yield represent the total hormone content of the pituitary more fairly than the early preparations which excluded 99 percent of the hormone from study.

[1] He used the Tiselius electrophoresis apparatus, a device which separates mixtures of proteins whose molecules have different net charges.

Whether the newer materials, any more than the older ones, truly represent the native hormone--the form in which ACTH actually exists in the pituitary gland and the blood stream--is another question. Unfortunately the favored methods of extraction of ACTH from pituitary tissue involve reagents and conditions which often are injurious to proteins.

Reference has already been made to the early report by Li that the biological activity of his ACTH survived partial breakdown by acid or pepsin. Li's work was confirmed by a group of British workers associated with C. J. O. R. Morris, but it was not until early 1950 that further purification could be reported. Both Li and Morris had obtained low-molecular-weight ACTH-peptides eight times as potent as La-1-A, while Astwood, at Tufts, reported a potency of 30-fold for his product. Only a few months later both Astwood and the Armour research group (under Joseph Fisher) announced that they had prepared materials which were at least 100 times as potent as La-1-A. It is reported that these new preparations are clinically effective in doses as low as 1 mg (1/65 of a grain) per day. It is not claimed, however, that even these highly active materials represent the utmost in purification. The isolation of pure ACTH-peptide, like ACTH protein, has not yet been accomplished.

Are these newer materials actually the native hormone, or do they represent a specific portion of the true hormone which can be split off without loss of the biological activity? We believe the answer can best be found by the use of modern methods of protein isolation such as those developed by Edwin J. Cohn and associates at Harvard for the fractionation of blood plasma. These methods involve the addition of alcohol and metal salts at low temperatures. In this way the proteins of the plasma and perhaps also those of the pituitary can be separated and preserved in their native state for detailed study.

One of the obvious necessities for research in this field is the determination of the biological potency of any given preparation. To this end, use has been made of increase in adrenal size and preferably of depletion of one of the adrenal constituents, ascorbic acid (Sayers). We succeeded in devising a simplification of the ascorbic acid method that has been widely adopted. There is need for further improvement to save time and test animals, and with this incentive we are studying the possibility of utilizing depletion of cholesterol, another important adrenal constituent, as the basis for a new bioassay method.

In summary, it can be seen that much progress has been made in research on the chemistry of ACTH since 1942, when it had been prematurely decided that it had been isolated in pure protein form. We found impure protein preparations which were more potent than the supposed pure material, and now ACTH-peptides at least 100 times as active have been reported. The isolation of pure ACTH-peptide cannot be far distant. As an aid in attaining this goal we are attempting to develop more precise methods of bioassay. In the meantime, the more fundamental question of the true chemical nature of native ACTH is being investigated in our laboratory by modern methods of protein chemistry.

(It is a pleasure to thank Dr. Roy G. Hoskins
for his help in the preparation of this article.)

On the Naval Research Reserve

A Suggestion for the VNRR's Part in Today's Research and Development Program

by
LCDR Homer A. Turpin
Undersea Warfare Branch, ONR

Little did we realize, back in the early thirties the part the Naval Reserve organization was destined to play in the forties. We scarcely appreciated at that time the careful thought and planning behind the Naval Reserve program, which made each group, no matter how small or large, an organization with a definite goal. Toward the accomplishment of that goal all efforts were guided, with the result that at the crucial time the gain in training and experience paid off many fold.

In view of the present emergency we need not go into the purpose of the Reserve today; each member understands that. What is always important, however, is the progress in attaining that goal and those additional accomplishments which enrich it.

Let us look, therefore, into a possible goal which will not only be of interest to each Research Reservist, but which will also contribute directly to our national research and development program.

The sciences today embrace countless fields, which change constantly and rapidly. To keep abreast of all new developments and ideas and to determine which are of value to our National Defense is a momentous task requiring far more study and time than are presently available to those concerned.

It is a well known fact that many studies in research and development are duplications of effort, since solutions of the problems are already available; however, this information is tucked away in a university file, magazine article, or even in some scientist's brain, where its application to the military was never conceived. Overlooking such scientific knowledge results not only in a great loss to the military but also in a tremendous cost to the Nation in needless research and development.

Huge and noteworthy attempts are being made by the Library of Congress, Naval Intelligence, the Naval Research Laboratories, and countless other institutions, to screen carefully, catalogue, and file data on scientific documents to permit their ready reference. The magnitude of this task, even when attempted on a current day-to-day basis and from a limited number of sources, is tremendous. In terms of nationwide coverage one can readily visualize how immense would be the task of screening, evaluating, cataloguing, and filing efficiently the abundant and valuable items in basic and applied research.

The knowledge that the value of thousands of ideas, researches, developments, and designs, which are of definite value to the military, is nullified because they are hidden away in various documents presents a direct challenge to the Research Reserve. For the various components of the Research Reserve contain the talent capable of doing something about this situation.

The "doing something" would comprise the following:

a. Each Research Reserve unit would first determine by a careful survey the possible sources of Research and Development items in its specific locality. The sources could be the local library; research establishments, either independent or affiliated with local industry; universities; publications; and individuals.

b. After cataloguing each source and/or origin, the unit would then determine the field of science to which the source contributes. At this point the decision must be made as to which sources are of interest to the military. Such decisions will require careful consideration, for it is here that the Research Reserve's real contribution begins.

c. Once the source was established and its usefulness determined, a painstaking survey of all items available would be made. The subject matter, data, and information on each item should then be recorded in a manner similar to that used by The Library of Congress in its Technical Information Pilot (TIP).

d. Periodically, each unit would issue a summary of all items gathered to date, using a standard form under an appropriate title.

e. Such excerpts would then be forwarded to ONR-Washington where they could be combined and published.

Such a contribution could be made by the Naval Research Reserve and would be invaluable to the defense program. It would encompass every field of science; consequently every Research Reservist, no matter what his specialty, could participate. Not only would each individual share in effecting a worthwhile result, but also each individual would gain for himself invaluable information, study, and advancement in his field through the continued work required.

The foregoing suggestion is presented to Research Reservists with the firm conviction that its establishment will produce individual incentive and accomplishment; and, regardless of each member's scientific background, further broaden his knowledge in his own field and in those related to it.

Those who possess knowledge of scientific research are fully able and capable of undertaking such a task. Are you willing to perform such a duty?

New Promotion Selection Lists Announced

Here are the VNRR Officers on the selection list for promotion to Lieutenant Commander:

Allen, J. B. (9-5); Allen, P. H. (11-2); Alter, A. C. (11-2); Ames, F. H., Jr. (13-2); Anderson, C. I. (13-2); Anderson, J. B. (9-14); Anderson, O. E. E. (12-1); Arbogast, J. F. (4-5); Armstrong, C. V. (W-1); Boyd, J. L. (13-2); Bacchus, W. M. (8-7); Bacon, T. S. (1-3); Barber, C. H. (4-2); Bliven, C. W. (W-5); Bourland, L. T. (W-2); Braun, F. P. (4-6); Bright, R. V. (8-10); Clark, R. E. (4-4); Clegg, D. L. (3-1); Cooper, W. G. (W-2); Day, R. W. (3-2); Dial, W. B. (W-1); Doty, E. C. (4-3); Dowd, T. B. (1-1); Ennis, W. B., Jr. (5-3); Everson, J. W. (9-15); Flynt, M. S., Jr. (6-9); Foster, J. V. (12-3); Foster, R. B. (3-3); Fox, H. M. (8-8); French, L. E. (8-7); Froman, J. (12-1); Fryer, E. M. (11-2); Gammon, N. N. (6-4); Garimer, H. N. (W-5); Gerhold, N. R. (9-12); Goforth, F. N. (9-5); Goldberg, R. R. (4-1); Goulder, M. E. (1-1); Groschke, A. C. (9-16); Hallman, F. A. (11-3); Harlow, E. S. (5-5); Harvey, C. (8-3); Higbee, K. A. (11-5); Hilderbrand, J. L. (13-1); Hinze, R. B. (12-3); Howell, D. E. (8-8); Huntington, C. E. (3-5); Humphrey, J. B. (W-2); Isakson, F. B. (W-1); Isleib, H. W. (3-6); Jasper, G. E. (3-1); Jeter, M. A. (6-4); Johnson, C. Y. (W-2); Johnson, J. H. (13-5); Jones, J. P. (6-4); Kippenhan, C. J. (9-8); Klovstad, O. V. (5-4); Klotnick, G. (8-8, sub-unit); Kreske, R. (6-10); Lambert, J. R. (4-3); Larson, J. G. (W-2); Lepper, R., Jr. (1-2); Loring, W. C., Jr., (1-1); Maday, A. T. (3-2); Marston, G. A. (1-3); Mayfield, R. M. (9-23); McAnally, J. S. (6-10); McChesney, L. D. (6-2); McGuire, V. (6-4); McLean, L. V. (8-2); Militz, R. O. (3-4); Miller, W. V. (4-7); Moore, T. P. (9-8); Moore, W. F. (3-7); Null, L. E. (6-4); Norton, P. F. (4-4); Nowacki, L. J. (4-7); Olson, R. A. (W-5); Palmer, E. F. (3-7); Peterson, H. L. (W-1); Price, D. O. (6-6); Rasmussen, O. M. (9-20); Ries, H. C. (1-1); Root, D. M. (5-2); Schiller, R. E. (8-3); Sanderson, J. D. (12-5); Sandt, R. E. (3-8); Shafer, R. L. (11-1); Shaw, R. H. (9-5); Smith, C. N. (5-2); Smith, D. L. (W-1); Smith, N. L. (W-2); Springfield, W. T. (6-4); Staehling, E. C. (9-15); Stevenson, K. O. (4-3); Stevens, D. M. (9-12); Stimpson, J. W. (1-2); Stobaugh, R. L. (6-5); Stone, E. C. (13-3); Stoughton, R. K. (1-1); Stringfield, T. F. W. (13-4); Sundvor, T. E. (9-6); Tilden, R. J. (1-2); Tithen, S. S. (9-17); Verhoeven, L. A. (13-1); Walker, L. H. (12-1); Widdoes, L. C. (6-3); Wolf, R. J. J. (4-8); Yust, H. R. (11-2).

Officers selected for promotion to Lieutenant include:

Allard, R. W. (12-6); Duff, J. T. (5-3); Dworschack, R. G. (9-2); Eden, W. G. (6-2); Eigelsbach, H. T. (5-3); Kenaga, E. E. (9-15); Lehman, J. (9-12); Maass, A. R. (4-2); Mensh, I. N. (9-8); Metcalf, T. G. (9-20); Mills, R. C. (9-20); Reece, A. MacD. (4-4); Roessler, R. B. (11-1); Roessler, W. G. (5-3); Schachman, H. K. (12-2); Shechmeister, I. L. (9-8); Thomas, W. D., Jr. (9-12); Wagner, R. M. (13-2); West, M. C. (12-6); Wiswell, O. B. (8-4); Yocom, C. F. (13-3); York, R. (12-4).

Navy Reserve to Include Key Civilians and Reservists of Other Services

Under the present mobilization set-up many key civilian posts in the Navy Department would be vacated when personnel who now fill them were recalled to active duty in one of the Armed Services. To prevent this, the Chief of Naval Personnel has announced that certain reserve officers of other Armed Services and some civilians will be recommended for appointments in the Naval Reserve.

Three types of employees will be considered for such appointments:

(a) Key civilian employees of the Navy who, as reserve officers of other services, are likely to be lost to the Navy by reason of orders into active service.

(b) Reserve personnel of other services who possess special qualifications and experience needed by the Navy.

(c) Civilian employees who hold positions in which military personnel will be employed after mobilization. This would include MSTS personnel and certain persons who are trained and experienced in the operation of controlled minefields.

The important thing for Naval Commanders to establish in making requests for appointments under this program is that a position exists for which an officer instead of a civilian will be needed in the event of mobilization. The system should not be used in an attempt to retain civilians in jobs that will still be non-military after mobilization. Such key civilian posts will be protected by deferment.

Only individuals occupying key positions at GS-9 or higher will be considered for the appointments and no one will be assigned to a higher grade than the one he holds in another service. The usual requirements of a baccalaureate degree from an accredited college plus five years of experience useful to the Navy apply to this program. The alternative, of course, is high school graduation plus 10 years of experience in a field directly related to the specialty for which the individual is being recommended. While it is not desired to exclude candidates over the age of 40, favorable consideration of these applicants is unlikely unless their qualifications are exceptional.

Nuclear Reactors Theme of Oak Ridge Seminar

Nuclear reactors—the big machines that knock atoms apart—will be the subject of the Third Annual Nuclear Science Seminar for Research Reservists, scheduled for November 28 to December 12. As usual, ONR is sponsoring the meetings.

RADM Chester M. Bolster will greet some 55 delegates from Eastern and Mid-Western Research Reserve units on the opening day of the seminar. The curriculum, still in the planning stage, will include discussions by leading authorities in various fields of nuclear reactor utilization. Armed with new information, research reservists will be better able to continue their assistance to the defense efforts of the Nation.

Other speakers and further plans for the seminar will be announced in the next issue of Research Reviews.

Here is the nuclear reactor that VNRR members will have an opportunity to study at the Oak Ridge seminar next month. The pile stands in an open room which gives workers easy access to its loading faces. Substances to be irradiated are pushed in with a long rod through a carrier.

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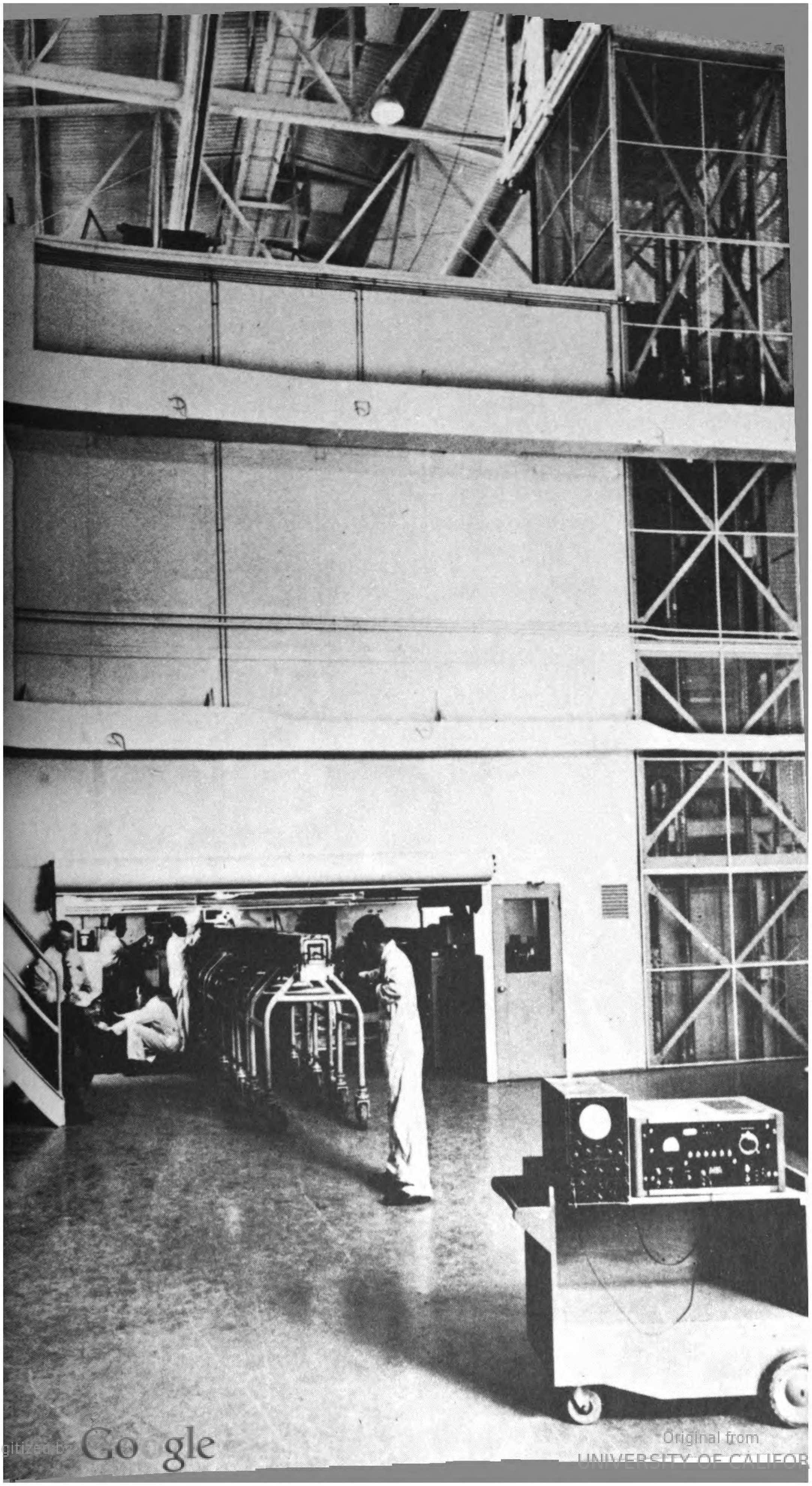

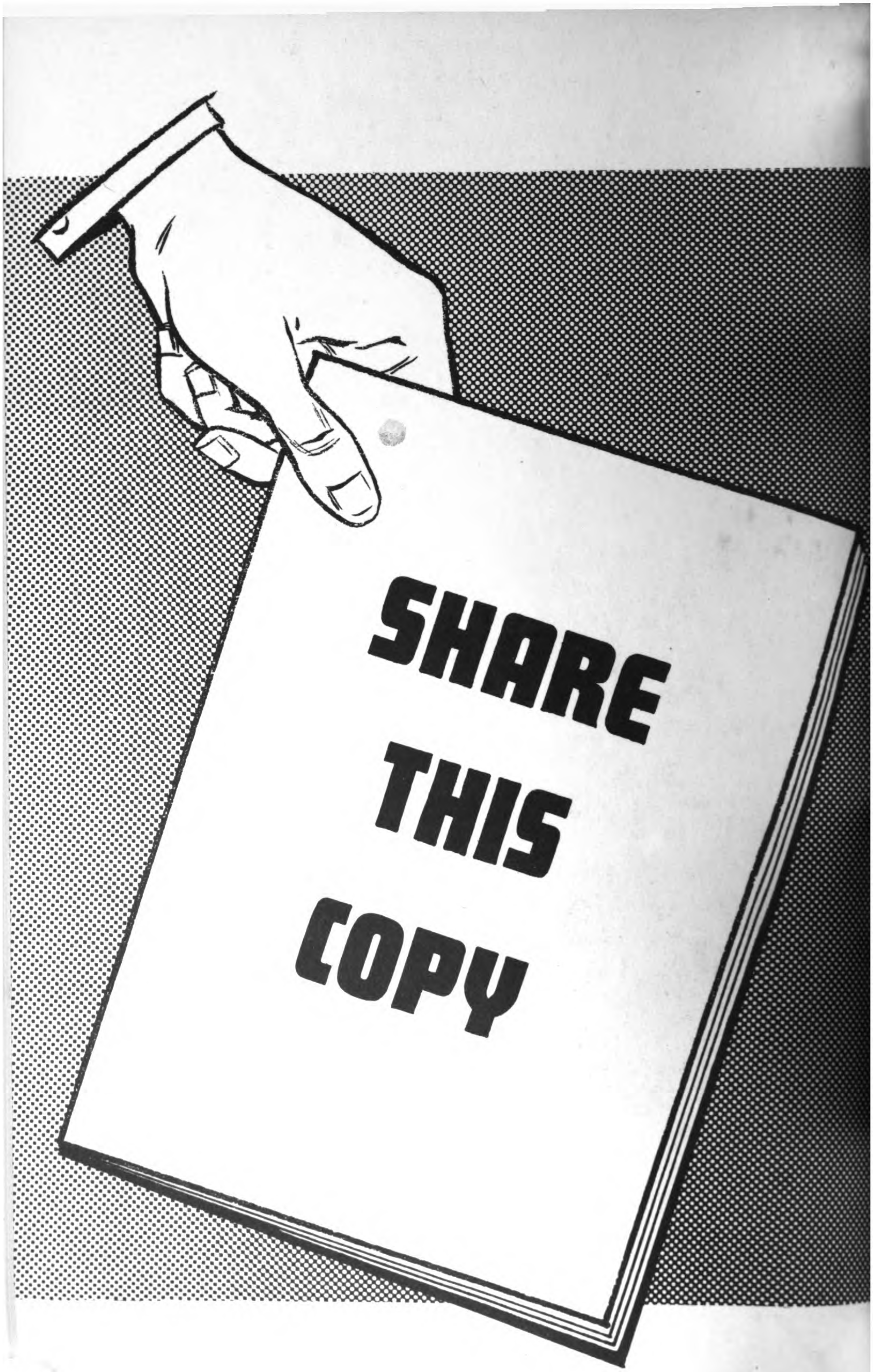
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