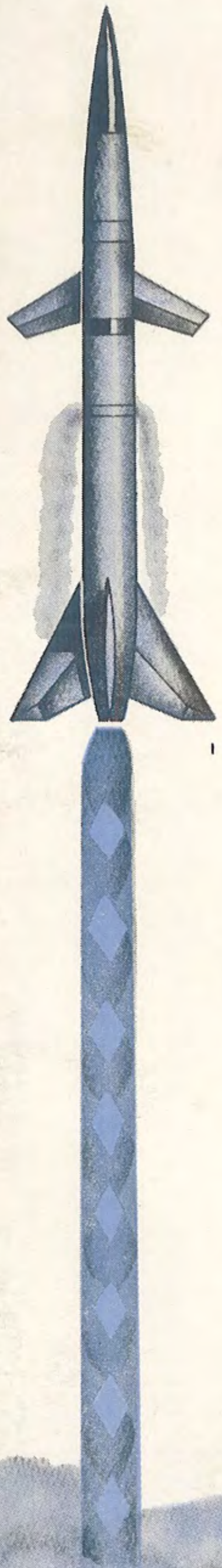
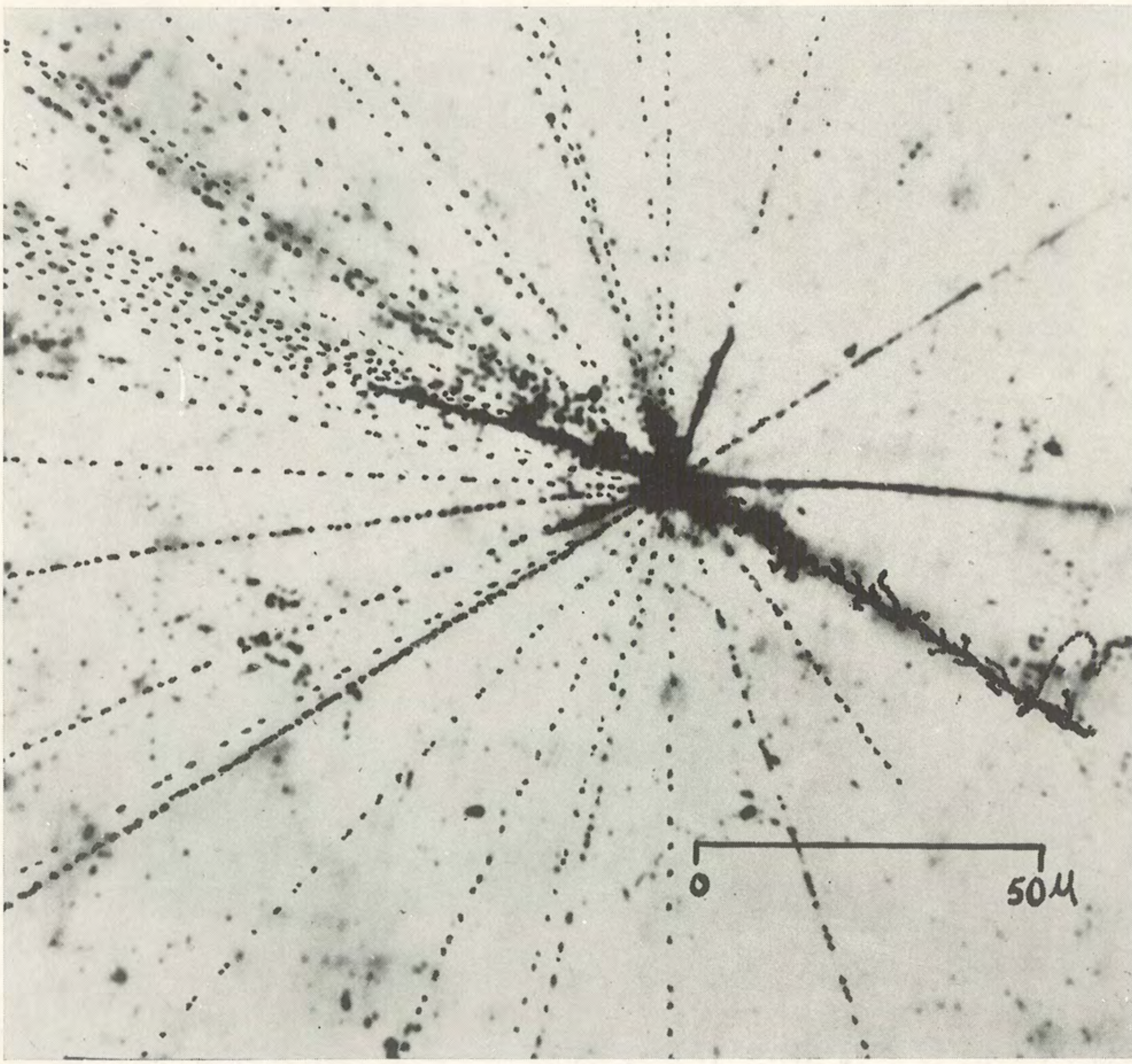
Vol. II, No. 4
WINTER
1954-55



"Missile Away!"

THE NEW MEXICO - WEST TEXAS SECTION
OF THE AMERICAN ROCKET SOCIETY



COSMIC RAY
BURST — (Yagoda)

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"MISSILE AWAY!"

Vol. II, No. 4
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CONTENTS

Editorial: "where do we go from here?"

We have passed a milestone, The New Mexico-West Texas Section is now five years old.

Those five years have seen a great deal of change, both for rocketry and the Rocket Society. The Korean War gave real impetus to research and development in American rocketry; we realized in those years that American freedom wasn't something to be taken for granted. We realized that if we wanted freedom, we would have to be ready to fight for it, at any time, at any place, and with utter ferocity.

We ended the era of the V-2 rocket in September, 1952. In its place came others—CORPORAL, to mention but one. The era of the true guided missile began, heralded by the NIKE.

Where were you five years ago? Did you have any conception of the work you would be doing today? Can you look back with the perspective of those years and see real progress?

The American Rocket Society has grown as well, and the New Mexico-West Texas Section has surged ahead from those few, pioneer charter members to become an organization over two hundred members strong . . . an organization recognized as the most active in the country. If the El Paso meeting did no more than that, it pointed out the fact. We have a nationally-recognized magazine which has won plaudits as being a first-class professional publishing and editing job. We now hold a monthly meeting with a social hour and refreshments following. We have been, we feel, very successful and instrumental in pushing reforms within the ARS: revision of by-laws, recognition of the active sections as being the heart and soul of the Society, representation of sections through national officers elected from said sections, to name but a few.

We are ready to admit we have laid it on rather heavily with the chain-and-mace and the bastinado on occasions. But we felt that it was called for insofar as earlier and less brutal methods failed to gain any recognition. We may be called rebels and rabble-rousers at times and cause the national officers a bit of discomfort, but we are after one thing and one thing only: a bigger, better, more active ARS, a society which will offer real benefits and real pride to its members, a society with which you should be associated if you are engaged in the broad field of rocketry and guided missiles.

This we want, for rocketry is expanding and the ARS must expand and grow with it. We have our roots in those wonderful early days when rockets were but toys, and we have managed to stay with it as those toys have grown into gigantic streamlined beauties which transcend time and distance and climb to beyond the envelope of the world.

Let no one be so audacious as to imply we intend to stop and rest here. Rocketry will not stop once it has perfected anti-aircraft missiles and long-range rockets; it will not stop once it has taken a man across the continent in an hour; it will not stop at a manned satellite, nor at the Moon, nor at the planets. It may get sidetracked along the way; it may pause to develop high-temperature, high-speed chemistry; it may dawdle in shaft drilling operations while combustion theory is given rigor thorough ram-jet research; but it won't stop. A rocket engineer need not fret about that. The rocket is too basically useful as a device. And the things which grow from rocketry — the electronic techniques, the instrumentation developments, the guidance and radar advances — will grow and reach out into our everyday lives much as aviation has done.

This Section intends to grow along with it. We intend to increase our membership, improve the quality of our programs, and raise our publication to even higher standards. When the time arrives that a seemingly-impossible goal has been reached — and we have reached plenty of them in the last five years — it is time to strike for an even higher goal. We would like to see all sections have a man on the National Board of Directors. We would like to see "Jet Propulsion" improved even more. We would like to dispel forever the feeling that the ARS is a propulsion society.

But these goals cannot be reached without the support of the members. By support, we do not mean a mere nodding of acquiescence or a pat on the back. We mean support as a bridge is held above a river. It is true that the majority of the structure of a bridge serves merely as a quiet foundation, but a bridge is not made up entirely of foundation and pilings. There is always something there which carries the live loads. Thus an organization must have members with spirit, drive, and enthusiasm if it is to stay alive.

(Next page, please . . .)

Editorial: "where do we go from here?" continued

One of the main points brought up at the annual business meeting in New York in December was keeping the members we now have. To do so, the Society feels now that the individual member must be offered more.

This is a two-edged sword. The ARS can offer benefits without number, but they must be supplemented and complimented by the member himself. It has been said over and over again, and we repeat it again: you get out of an organization what you put into it.

Therefore, we suggest the following new goals for the New Mexico-West Texas Section:

(1) Improvement of programs. The monthly meeting is a must. The National Headquarters now stands ready to assist us in obtaining speakers and films; there is no reason why we cannot make use of these aids.

(2) A more consistent membership policy, to include supplementing our roster with more student and associate members. The new by-laws provide for student memberships for enlisted members of the armed forces; there is tremendous potential here. And the new requirements for associate membership now allow **anyone** who is **interested** to join the ARS. We have over 200 members in the Section; less than 5% of these are associate members.

(3) Continued improvement in our publication. Let's consolidate our "Missile Away!" and continue to develop it as a fine semi-technical pictorial magazine; we are just beginning to discover what we can do with the publication. Announcements and executive letters should reach the membership more regularly. And we should have an attractive membership brochure.

(4) As the major American technical society devoted to rocketry, we find ourselves more and more in the position of being spokesmen for the field. Publicity is not what we need now; we need **public relations.** We suggest the addition of a special subcommittee to the Publications Committee to that effect. And the National Board of Directors should consider setting up a standing committee for public relations on a national scale. In conjunction with this, we should follow the lead of the Southern Ohio Section in setting up an Education Committee to send speakers, films, and displays around to regional high schools, colleges, civic groups, and fairs to bring to students and the public the essence of what we are doing and what it all means.

(5) With the Co-operative Student Plan right in our own yard, we are missing one of the biggest bets in the world if we do not encourage the formation of student groups. The ASME, the ASCE, and AIEE, and others have student groups in colleges around the nation. Is there any reason why the ARS shouldn't? These student groups can be patterned after the groups of those other organizations. We are in favor of this because those self-same students will be the rocket men who will follow in our footsteps.

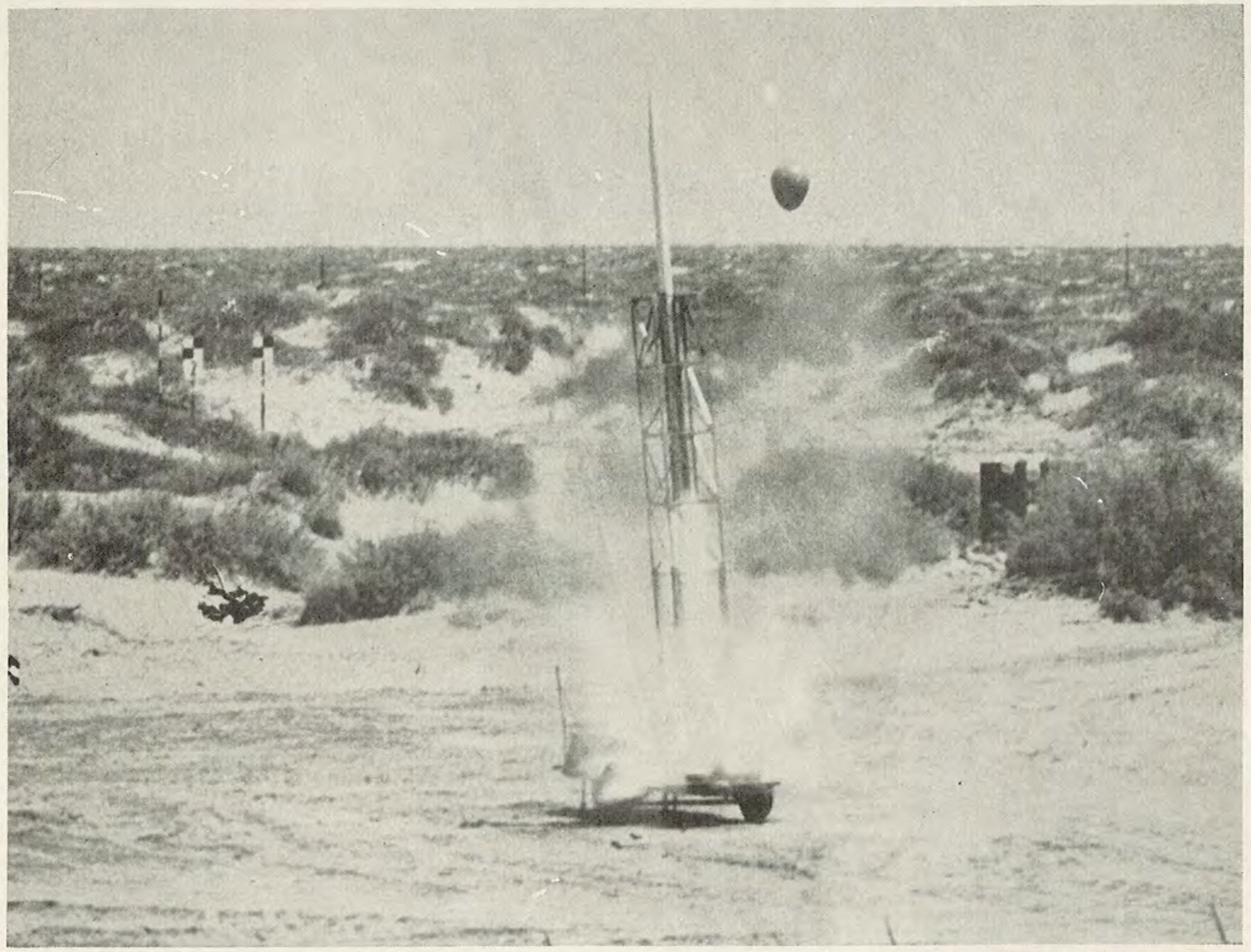
There are many other things we would suggest, but it all adds up to this: We have accomplished our immediate goals; we now need new goals and new policies if we are to keep up with the times. The new keynote in the ARS is co-operation within the Society and between Sections and National Headquarters, and the Sections have been given new power and responsibilities. It is now up to us to respond.

After all, we asked for it, didn't we?

—G. H. S.

We point with pride to the fact that "Missile Away!" is the only semi-technical magazine in America devoted entirely to rocketry and its allied sciences. Why not point with pride to the fact that you are a subscriber?

1957: The Rocket Program of the International Geophysical Year



DEACON MISSILE TAKEOFF (At Churchill, DEACONS will be launched from balloons. See article . . .)

BY
E. W. DIEHL
LCDR, USNR

The International Geophysical Year is a major event in scientific circles. But in 1957, they're going to have some interesting problems at Fort Churchill, Canada. Who knows, it might provide valuable information on how to live on Mars, too!

Fort Churchill, Manitoba, Canada may replace the White Sands Proving Grounds as the center for high altitude rocket research during the International Geophysical Year in 1957 and 1958.

The International Geophysical Year is a period of approximately twelve months chosen for the study of physical phenomena on and surrounding the earth's surface. The time is agreed upon for this study by geophysicists from interested countries over the entire world. It is chosen for convenience in the study of and is frequently coincident with periods of unusual solar activity. The periods of magnetic storms upon the sun's surface present an opportune time for the study of aurora, cosmic ray activity, weather, radio propagation, ionospheric conditions and other phenomena affecting climatic, atmospheric and terrestial conditions. These international geophysical studies are conducted at intervals of approximately twenty-five to fifty years. The designation "polar year" has become associated with the International Geophysical Year as a result of previous periods of study. During these times, exploration and studies were conducted in, but not limited to polar regions. The cost of equipping and financing and the personnel problems associated with these polar expeditions permitted these undertakings only at infrequent intervals. As a result, the international geophysical studies became associated with and known as polar years.

The years 1957 and 1958 have been chosen for the next international period of study. This period was selected and an accelerated program of preparation undertaken for study at this time because it is a period of peak sunspot activity. A grant of thirteen million dollars has been approved by Congress for the support of programs of the thirteen scientific groups participating in the United States. Approximately two million dollars of the amount supplied by the United States has been alloted to National Science Foundation for the financing of the rocket phase of the year's study. Of this amount approximately 1.3 million dollars will be obligated this year for the purchase of rockets, instrumentation and launching facilities.

Five groups within the United States interested in basic research will participate in the rocket program of the year's activities. These groups are the National Science Foundation, Washington, D. C., the Naval Research Laboratory of Washington, the Signal Corps Engineering Laboratory of Ft. Monmouth, New Jersey, the Air Force Cambridge Research Center of Harvard University and the State University of Iowa, Iowa City, Iowa. The National Science Foundation has the primary responsibility for the overall program with the Naval Research Laboratory acting as the fiscal agency and conducting the Navy's research program. The Air Force Cambridge Research Center will conduct the Air Force program and the Signal Corps Engineering Laboratory leads the Army program. The State University of Iowa will conduct a program coordinated with the several military agencies.

The site for the land based rocket launchings will be Fort Churchill, Manitoba, Canada on the shore of Hudson Bay. This site was selected from the several considered because of its proximity to the Arctic regions and because it is well within the area of greatest auroral activity. Another and equally important reason for the selection of this site is the availability of transportation. A railroad connects the area with the United States through Winnepeg, Canada. This sim-

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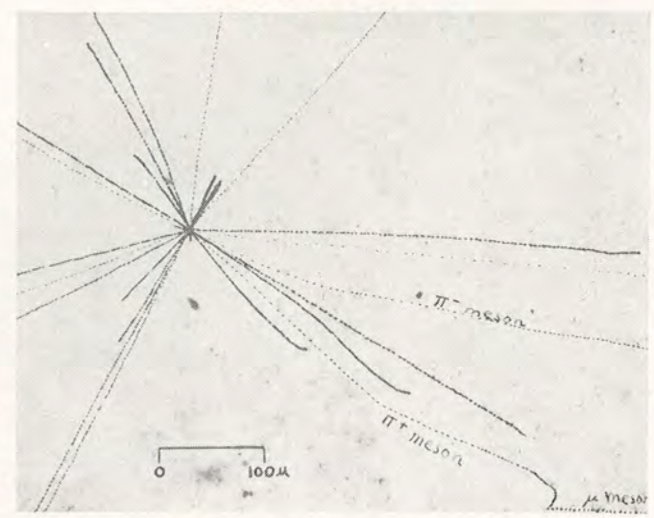
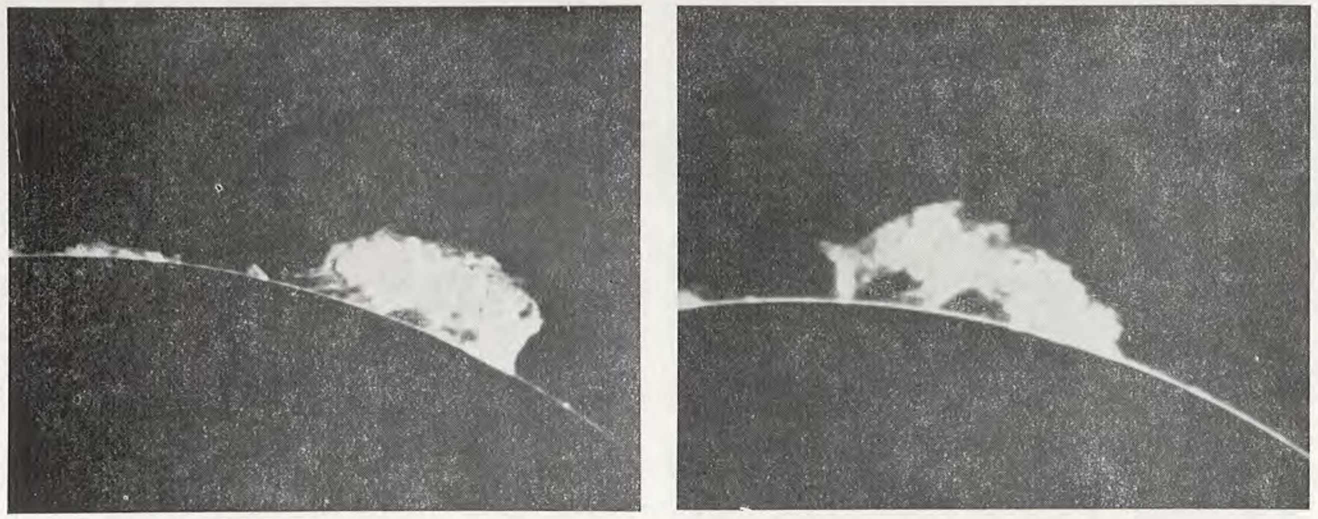


A cosmic ray burst as taken from a sensitive plate flown in a high-altitude sounding rocket (photo courtesy Dr. Yagoda.)



Sucessive photographs of a prominence eruption on the Sun. During the International Geophysical Year, scientists hope to gain a better understanding of what causes these solar outbursts. (photos courtesy USAF Cambridge Research Laboratories, Sacramento Peak.)

plifies to a considerable extent the transportation of supplies, launching facilities and crews traveling with the launchers. Some consideration had been given to two Alaskan sites with the possible use of the Alcan Highway for trucking supplies and materials. These sites were eliminated due to the remoteness of the sites, transportation difficulties, inadequacy of facilities, and heat and power difficulties with a truck caravan. Thule, Greenland, was suggested but eliminated for similar reasons.

The three services, Army, Navy, and Air Force will be equally represented in the Fort Churchill expedition with responsibilities for the major requirements assigned as best fitted to that service's capabilities and experience. The Army Signal Corps will be responsible for communications and timing networks, radar facilities, geophone network, and power facilities. Transportation of launching facilities, ballistic and optical tracking networks and work and storage spaces will be the responsibility of the Army Ordnance Corps. The Army Engineers will construct railroads if needed and conduct surveys. The Canadian groups will probably provide housing, messing, medical, shop and meteorological services. Propellants and compressed gas will be provided by the Army and Navy activities. Transportation of personnel will be furnished by the Air Force and Navy. The Navy will provide the launching and missile handling crews.

The problem of construction of the launcher and associated material installation will be an unusual one for rocket activities. Because of the fluid nature of the tundra around Fort Churchill, no heavy, permanent construction can be built. Surveys have shown that at some places the surface of the earth has flowed as much as eight feet in a one year period. The perma frost beneath and the water and moraine above which thaws somewhat in summer present a very unstable platform. As a result, serious consideration is being given to building the launcher, missile servicing, propellant stowage, messing and berthing facilities at the launcher on a railroad train. The train could be moved from the construction site in the United States to Fort Churchill by existing railways and spotted on the spur rails to be constructed at the launching site. The launcher may possibly be constructed so that it can be lowered to a horizontal position for loading the missile, then erected to firing position in a matter of minutes.

A short time interval is mandatory for the fueled and instrumented missile to be exposed to the elements to prevent chilling of the solid and liquid propellants, batteries and other components of the rocket. The Aerojet-General Corporation of Azusa, California has been given the contract for designing and fabrication of the launcher or service train. This company manufactures the Aerobee rocket which will carry the greatest load of the International Geophysical Year rocket program.

Plans are being made to fire a total of at least twenty-four Aerobee rockets during the period. These will be divided between the Naval Research Laboratory, Signal Corps Engineering Laboratory agency, and the Air Force Cambridge Research Center. The Aerobees will carry experiments including ionosphere, pressure and temperature, day and night glow, winds, magnetic field, ion composition, ozone, ultra violet ray and cosmic ray. Prior to the firings at Fort Churchill, the several experiments will be checked out in Aerobee firings at White Sands Proving Ground. Training for the Churchill crew will be conducted there also.

In addition to the Aerobee firings, programs are being formulated by the Naval Research Laboratory and the State University of Iowa for the firing of Rockoons. The Rockoon is a combination Skyhook balloon and Deacon rocket developed by Dr. J. A. Van Allen of the State University of Iowa. The Deacon rocket is carried suspended under a Skyhook balloon to an altitude of the order of 70,000 feet when it is fired with a barometric switch. The feasibility of this system was proven at the U. S. Naval Ordnance Missile Test Facility, WSPG in 1952 and several firings have since been conducted by NRL and SUI from Coast Guard and Navy ships in the vicinity of Greenland. The Rockoon firings will probably be conducted at sea from the Bahamas to Greenland as well as at Fort Churchill during the Geophysical Year.

The Air Force will also conduct a Rock Air launching program during the year. This program consists of launching small research rockets from aeroplanes flying at high altitudes. The Rockoon and Rock Air experiments will include ultra violet and cosmic ray, aurora and other instrumentation.

Coincident with the U. S.-Canadian program at Fort Churchill, other countries will be conducting parallel programs for the International Geophysical Year. Little information is available to the writer about any rocket phases of these programs though there undoubtedly will be some.

The Fort Churchill site is north of the 58th parallel on the western shore of Hudson Bay and is situated approximately two miles from the town of Fort Churchill. The town and military installation are near the historic site of old Fort Churchill and Hudson Bay trading outpost. The land mass surrounding the area is comparatively flat with the highest elevation being approximately one hundred and twenty-five feet above sea level. The land area is marshy tundra dotted with innumerable lakes of varying sizes and averaging approximately four feet in depth. Permafrost exists under the land at depths varying from eighteen inches to six feet. This permafrost does not permit the surface water to percolate through the ground or drain off the surface. During the summer months the existence of this marsh and the decaying vegetable matter encourages the breeding of vast numbers of mosquitos, flies and other insects. During the winter the area is frozen from late October to May.

The few hills that do exist in the area are the result of glacial activity in the past. The movement of this ice mass has pushed up ridges of gravel and earth into moraines. These moraines are covered with a growth of pine trees reaching twenty feet in height and approximately six inches in diameter. The trees, though small, have been calculated to be many hundreds of years old. Eskars also exist as a result of glacial activity. These are beds of gravel deposited by under glacial streams. Eskars make a fairly stable bed upon which vehicles can travel. Between the eskars and moraines the tundra is covered with grasses, mosses and a variety of very low bushes.

The vegetable growth supports small animals and birds which in turn support predators. Foxes and bears are in evidence. Several foxes were seen by the party which visited the area in mid-November. A polar bear was seen during the same period on an ice flow in the bay near the camp site. Animal tracks were seen in the snow at many places. The country supports many trappers who are licensed and granted trapping areas by the Canadian government.

The town of Fort Churchill has two principal industries. A whale factory processes white whales caught in the Churchill River on which the town is situated as well as in the adjacent Hudson Bay. The principal industry is a grain elevator which processes twenty-five million bushels of grain annually. Thirty-three grain ships were loaded during the three summer months of July to September this year. The elevator is now being enlarged to handle twice its present capacity of grain. The grain shipped from Fort Churchill is grown in areas of Manitoba and other Provinces farther to the south. It has been found to be cheaper to transport the grain by rail to Fort Churchill for further shipment to Europe than to ship from the better-known Atlantic coast ports.

The housing to accommodate military, civilians and

The general region around Fort Churchill, Manitoba.

dependents is of unusual construction. Quarters are triple insulated, frame two story buildings covered with asbestos shingles. Family quarters are built in blocks of four six-room apartments. The unusual feature of construction is that each block of four quarters is connected with each other block by an enclosed hallway. The buildings are so constructed because of the intensely cold weather conditions during the winter.

The temperature at times has been as low as sixty below zero Fahrenheit. This low temperature is made more uncomfortable by prevailance of winds up to forty miles per hour. A unit of measure of the chilling effect of this low temperature and high wind has been developed and is known as "wind chill". Zero wind chill condition is said to exist when the temperature is seventy degrees Fahrenheit with winds from zero to twenty miles an hour. This figure was arrived at by measuring the cooling effect of these winds blowing over water at this temperature. The wind chill number increases as the temperature falls and the winds increase. The maximum wind chill number has been determined to be 2400 at temperatures of —60 degrees and 40 mph winds. Men have been known to do some work outside with a wind chill of 2100 existing.

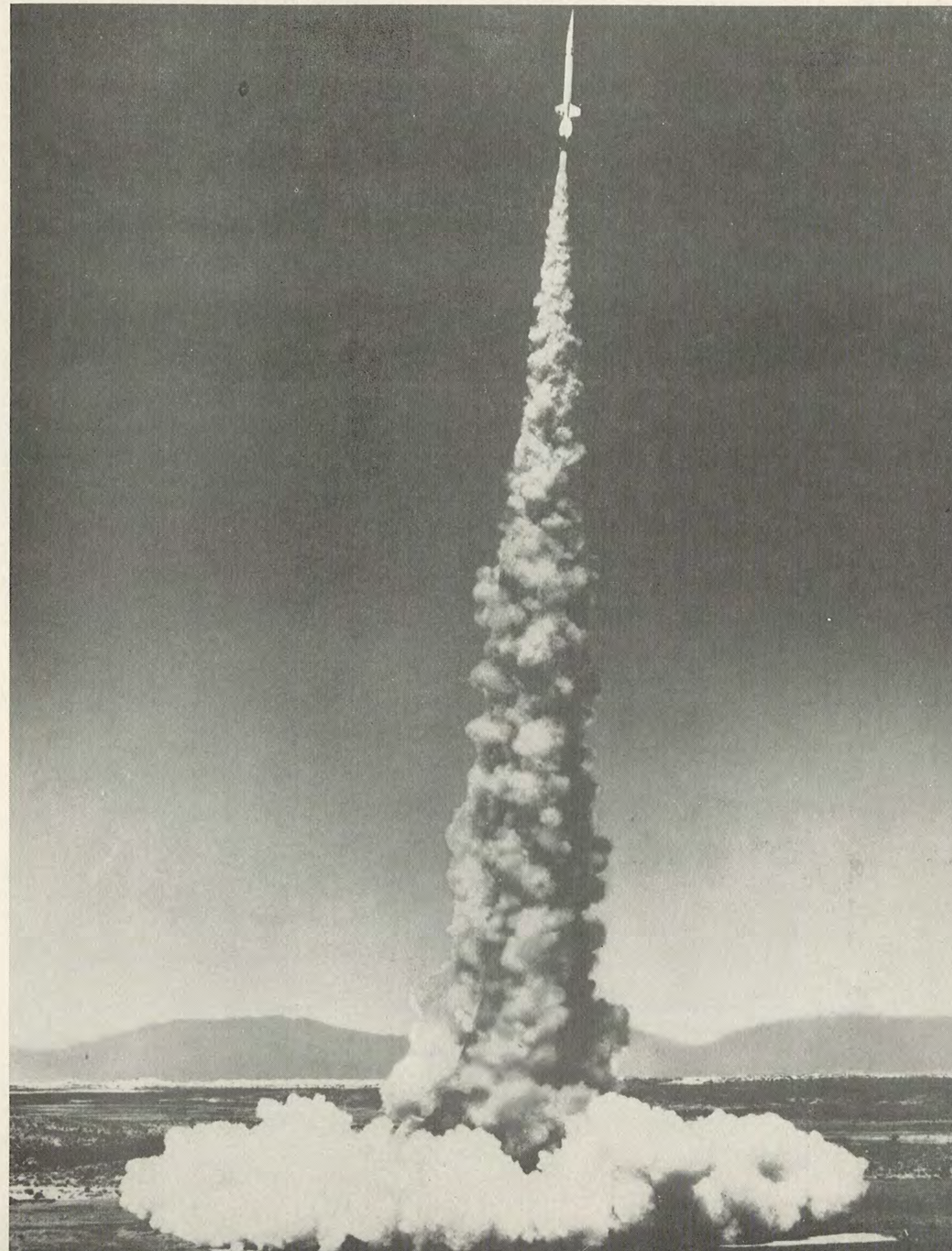
Supplying proper clothing for survival under these conditions is a tremendous problem. Caribou hide clothing with the hair is the best protection known. However, this is not available in sufficient quantity to satisfy all needs. The military has designed fabric clothing for its use. A man dressed in this clothing will wear a suit of long, heavy underwear, nylon "wind shell" pants with an inner lining of terry-cloth-like material, woolen shirt, woolen muffler, nylon "wind shell" parka with the same terry-cloth-like liner as the trousers, hair-cloth-lined jacket or vest, fur-cloth-lined hat with ear flaps, leather mittens with inner liners and heavy woolen sox under boots. The boots worn will vary with the weather. For temperatures to —20 degrees, rubber mukloks are worn. Below —20 degrees a pair of canvas covered felt boots are worn to prevent frostbite.

Frostbite is an ever present and insidious hazard during the winter. This results in tissue damage similar to that caused by burns. The degree of frostbite is rated as first, second, and third degree. Persons experiencing frost bite have said that they did not realize they were being affected and experienced little immediate discomfort except for some burning sensation. The pain and discomfort during recovery is intense however. A person once frostbitten is more sensitive to the cold.

It can be understood from the preceding information that a rocket program in a sub-arctic region will be a major undertaking. Not only will the handling of propellants, instrumentation and missiles require the development of new techniques, but personnel and logistics problems will be great. The problems are not insurmountable, however, and vast amounts of information and experience will be gained through the undertaking. ● ● ●

geophysical workhorse

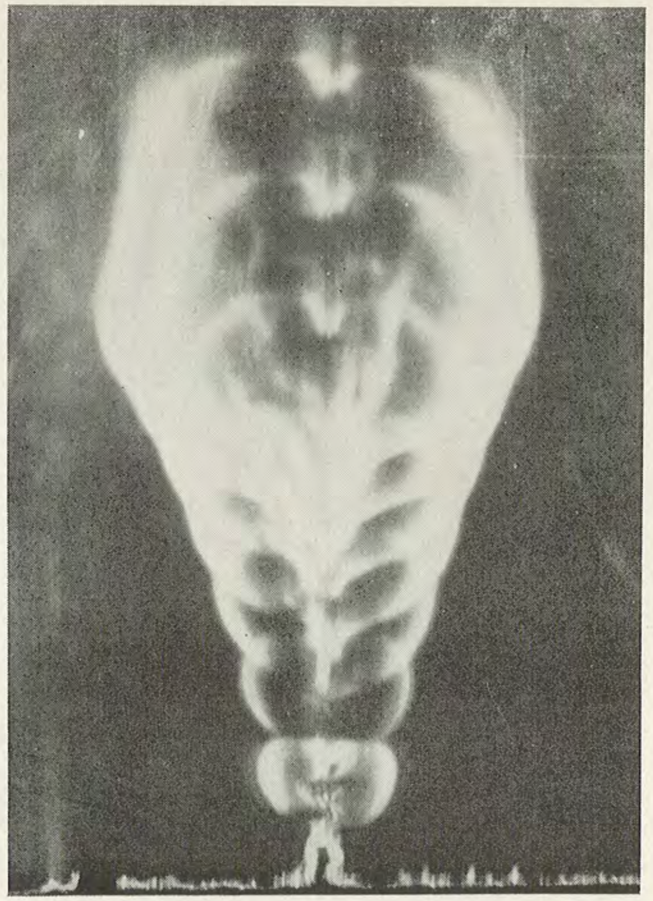
The **Aerobee** high-altitude sounding rocket (Aerojet-General photo)



BURNED UP!

by

DR. RUSSELL K. SHERBURNE



A schlieren photograph of a combustion research experiment conducted by the author. Although it looks like an X-ray photograph of a Martian, research men can determine combustion characteristics from studies such as this.

This is not an editorial! It is, instead, an article on the elements of combustion theory written by a combustion research scientist. Certainly, fire comes out of a rocket engine. But why? And what is oxidation? And why are some propellants "hypergolic"?

TWO longs and a short! That would be on the Potash Hill Road! Before the last siren blast died away, I had run across our neighbor's lawn and had opened the door to the fire house. Others poured in, and within a few minutes the Tyngsboro Volunteer Fire Department was careening along the Potash Hill Road. Soon we saw it—a grass fire out of control and moving toward the woods. Rakes, shovels, extinguishers, and backpacks quickly squelched it, however.

Events of this nature were repeated frequently during the 1930's, giving me my first direct interest in combustion. Of course I had had some earlier contact with burning processes such as shoveling coal into the two furnaces which heated our houses. This could hardly be classed as "interest in combustion" however, since my thoughts here were directed only toward completing the job. And by now my thoughts in this field have undergone a complete reversal since those days fifteen or more years ago. Then I was interested in putting fires out whereas now I like to start them and keep them going (please read the rest of the article before calling the insurance company).

During this same period, tremendous advances were made in rocket development. These improved missiles were made possible by increased knowledge in a number of fields, one of them being the study of propellant combinations. Combustion or burning is often thought of as the combination of oxygen with another material in some process which is self perpetuating once it has been started. This process may proceed quite slowly or may be very fast, behaving very nearly like an explosion, in the latter case. However it is not necessary that one of the reactants be oxygen, since in a more general sense combustion can be regarded simply as a chemical reaction in which sufficient energy is released to keep it going until the reactants are exhausted. Generally speaking more energy is released than is required for continuing the reaction and this excess energy can be put to some useful purpose. This is where the rocketeer becomes interested. He makes use of the excess energy to raise the combustion products to a high temperature and then allows these same products to expand out the rear of the missile, developing the thrust which drives it. Further, the rocket engineer usually wishes to expel the product gases at as high a speed as possible in order to obtain a large thrust with a minimum expenditure of mass. It is found that the jet speed which can be achieved depends to a large extent on the temperature of the jet gases in the combustion chamber before they are expanded and on the reciprocal of the average molecular weight of these gases. The combustion chamber temperature is determined by the amount of excess energy released in the chemical reaction of the propellants and the average molecular weight depends on the nature of the products. Hence it is desirable to use highly energetic combination which result in products of low molecular weight. A number of such combinations have been investigated and are now in common use.

Until comparatively recently all rockets used solid propellants which were closely related to gunpowder mixtures. In spite of certain limitations which make them undesirable for some applications, particularly for large missiles, the improvement of solid propellant combinations has maintained their importance in many rocket applications. However, the introduction of the liquid propellant rocket has greatly broadened the scope of rocketry.

Even though the use of liquid propellants was suggested much earlier, Dr. Goddard was the first person to experiment extensively with their use. His Roswell rockets were powered by gasoline (approximately C_8H_{18}) and liquid oxygen, O_2. The performance of this combination is comparable to that of methyl alcohol, CH_3OH, and liquid oxygen which is now more widely used. Another combination which gives very good results is nitric acid, HNO_3, and aniline, $C_6H_5NH_2$. Naturally there are others, but notice in these few examples the presence of the low atomic weight elements carbon and hydrogen with oxygen and nitrogen of fairly low values. As a result these reactions give products of low molecular weight. It also goes without saying that the combinations are also highly exothermic.

The improved methods for the production of hydrazine, N_2H_4, have recently increased its importance as a propellant. This highly reactive compound was the fuel employed in the World War II German rocket planes.

The liquid oxygen-liquid hydrogen combination often appears in articles on propellants. It has very good performance characteristics but the low density of liquid hydrogen necessitating a large rocket structure counters most of its advantages.

The possibilities of such materials as ozone (O_3), activated compounds, and free radicals for propellants are enticing, but these must be regarded as still in the experimental stage.

The common types of propulsion systems use two chemicals which react when brought together in the combustion chamber. A more simple scheme is to use a single compound which decomposes in its "combustion" process.

There are relatively few such mono-propellants, ethylene oxide, C_2H_4O, being one of the most promising.

The actual choice of propellants for a particular application is not quite as simple as these few comments might indicate. Here we have jotted down the qualities which would be most interesting to a propulsion man. However there are other properties which affect the selection when the entire rocket project is considered. Such things as toxicity and stability are important for safety; corrosiveness, ignition characteristics, behavior on storage, state at ambient conditions, availability as well as others must receive their share of attention. But whatever the propellants may be, the improvements which we have seen to date are probably only an indication of what we may expect in the future

Information Theory at White Sands

By

PAUL BLAUSTEIN AND WALTER MICHAELBARG

With the ever-increasing amount of technical data and information available today, how can it be written in its simplest form, yet convey all the infcrmation needed? How does a Chemist explain in writing to a Mechanical Engineer what he needs in the way of an insulator which will withstand certain toxic liquids? Information theory is beginning to show the way!

The purpose of this paper is not to present a thorough description of the subject matter in Information Theory. It is to present one type of a scientific problem which is part of a larger national one—this can be stated as follows; "With a rapidly expanding technology how can the quality of engineering man-hours be improved?

As applied to White Sands Proving Ground, the problem becomes how a knowledge of a certain high level, scientific subject can be presented and applied to Proving Ground activities to increase the quality of engineering man-hours expended, and hence, advance the progress of the technical projects on Post. The general problem is to increase the effectiveness and quality of engineering man-hours; a specific proposal to help solve the problem is to present Information Theory and provide means for personnel to achieve some mastery in the subject and increase their technical proficiency.

The reader may ask himself, "Well, what is Information Theory?" The following description is not intended to satisfy the curious scientist. It is not a complete exposition of any portion of the subject, but merely a brief general description thereof.

Information Theory is concerned with expressing in mathematical terms three primary concepts: First, the accuracy of transmitting symbols; for example, if a signal with an amplitude of twenty-five units is to be transmitted, how close to twenty-five units is the amplitude of the received signal. Also, what is the closest distinguishable signal that can be transmitted. These are comparable to sensitivity and selectivity. Second, the accuracy of transmitting the desired meaning with symbols; for example, how much of the message can be compressed, abbreviated or coded and still convey the original meaning. Third, the effectiveness of the received meaning in achieving the desired conduct; for example, the case of a television program producing a desired audio-visual effect. Hence, one of the uses of Information Theory is in designing equipment for optimum performance.

"Information" as defined and used in Information Theory is not "meaning". It is a measure of the difficulty in transmitting messages. It could be defined as the ratio of the probability of an event after and before a message is received. An illustration of this would be if the weatherman tells us it is going to rain tomorrow at White Sands Proving Ground. Before we received the message, there was a given probability that it would rain tomorrow based on past experience. After we have received the weatherman's message there is another and much greater probability that it will rain tomorrow. Here we have received information in the narrow sense given above that there is a change in the probability of the event taking place. If the message we receive increases our knowledge of the probability of an event taking place, we have received a certain amount of information. This is a very elementary presentation of Information Theory.

A more difficult problem that could be handled by Information Theory is the desired amount of redundancy in a message. How much redundancy would be necessary in a message to have a certain desired accuracy with a given amount of noise in the system? Information Theory is able to indicate a solution in terms of rate of transmisison, channel capacity and language as a statistical construction.

Intuition is no longer sufficient to deal with the complexity of the problem of communication. Information Theory is able to present and permit operation of the fundamentals in mathematical terms.

Informal discussion with scientists and engineers at the Proving Ground indicated that further study of possible educational and training programs in Information Theory was desirable. Studies of work in different technical projects led people to need a further knowledge of the subject. Since application of the theory in many projects is necessary, the problem appeared as how to provide more knowledge to the personnel at White Sands Proving Ground.

A group was set up called the Information Theory Group with a three fold objective:

1. To assist personnel of White Sands Proving Ground in handling of subject matter in technical projects.
2. To organize the information available and provide means of distributing future information.
3. To understand better the application and theory of the subject.

The organization of the Information Theory Group at White Sands Proving Ground is flexible. In the past, individual members have presented prepared lectures at meetings held once a week. Some of these lectures were: "Basic Philosophy of Information Theory" by Claude Pyle; "Elements of Information Theory" by Dr. Russell Sherburne; "Philosophy of Pulse Code Modulation" by Joel Simmons; "Statistics and Applications" by Ivan Carbine; and "Stochastics Processes" by Harry Davis.

Future work will be in the nature of a formal course with small discussion groups in a special fields discussion of project work, and once a month a general discussion will be held. The information of small discussion work groups is eagerly anticipated. Since there is a wide educational and technical background of the members, these groups will allow many new ideas to be considered.

This group points out some definite trends in modern science and development. A good background in any one field is sufficient for participation in these discussion groups. A sound general background with a specialization in several fields is the desirable background for future engineers.

For instance, the engineer with a good background in mathematics and physics who can master Information Theory, may be able to apply the theory to his electrical or mechanical systems. Men engaged in rocketry can benefit greatly from the knowledge of aspects of electrical engineering. A good general background can help to understand specific projects in many diverse fields; a knowledge of the various applications of Information Theory to different systems can be beneficial in completely unforseen ways.

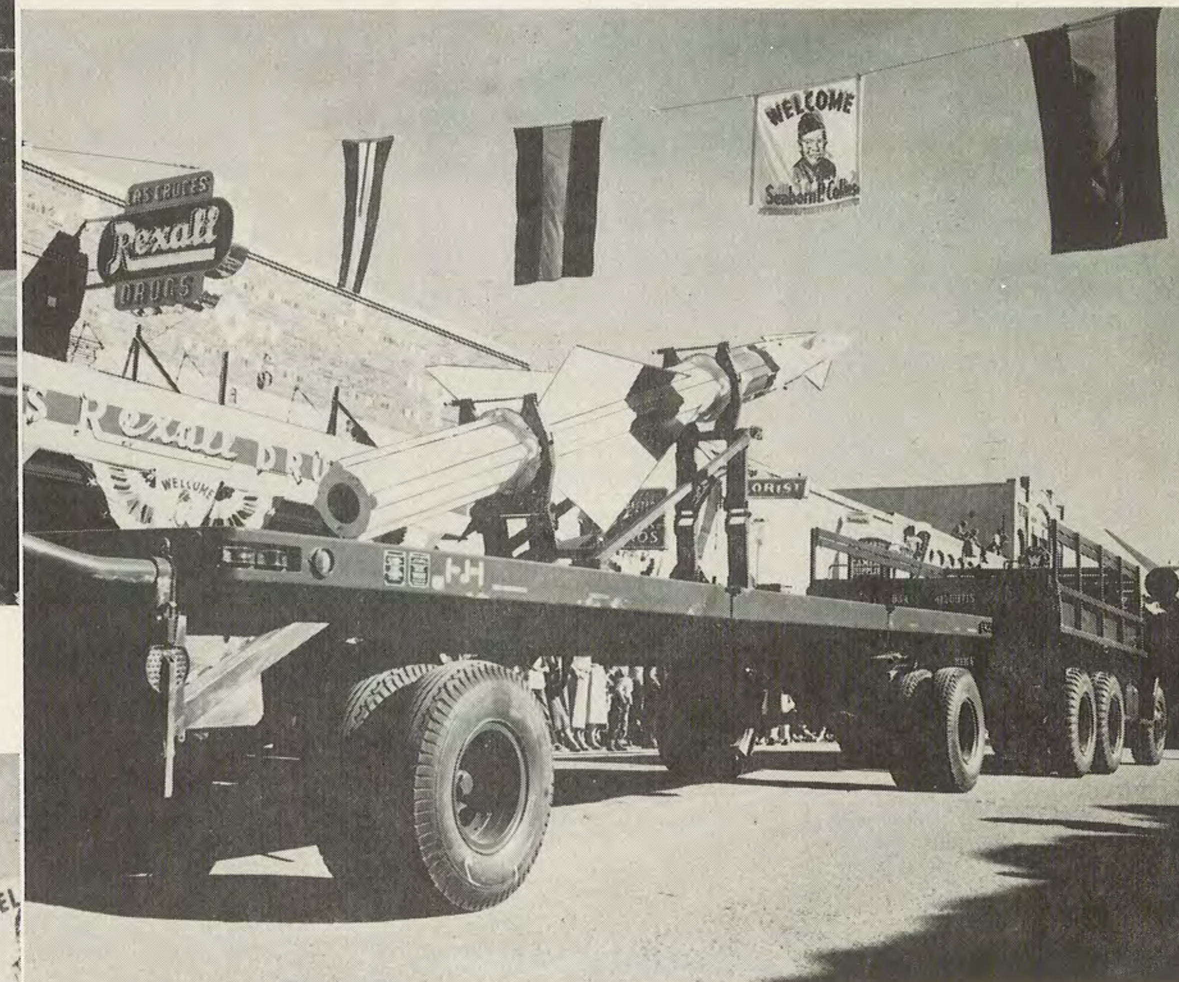
Information Theory has appealed to many because of its interdisciplinary nature. In a way, this article is an example of the synthesis of the fields of science. Many members of the Information Theory Group at White Sands Proving Ground are members of the Institute of Radio Engineers; at present, a section of the Professional Group on Information Theory of the IRE is being formed. Several members of the group belong to the American Rocket Society, The American Society of Mechanical Engineers, The American Institute of Electrical Engineers, and the Institute of Aeronautical Sciences.

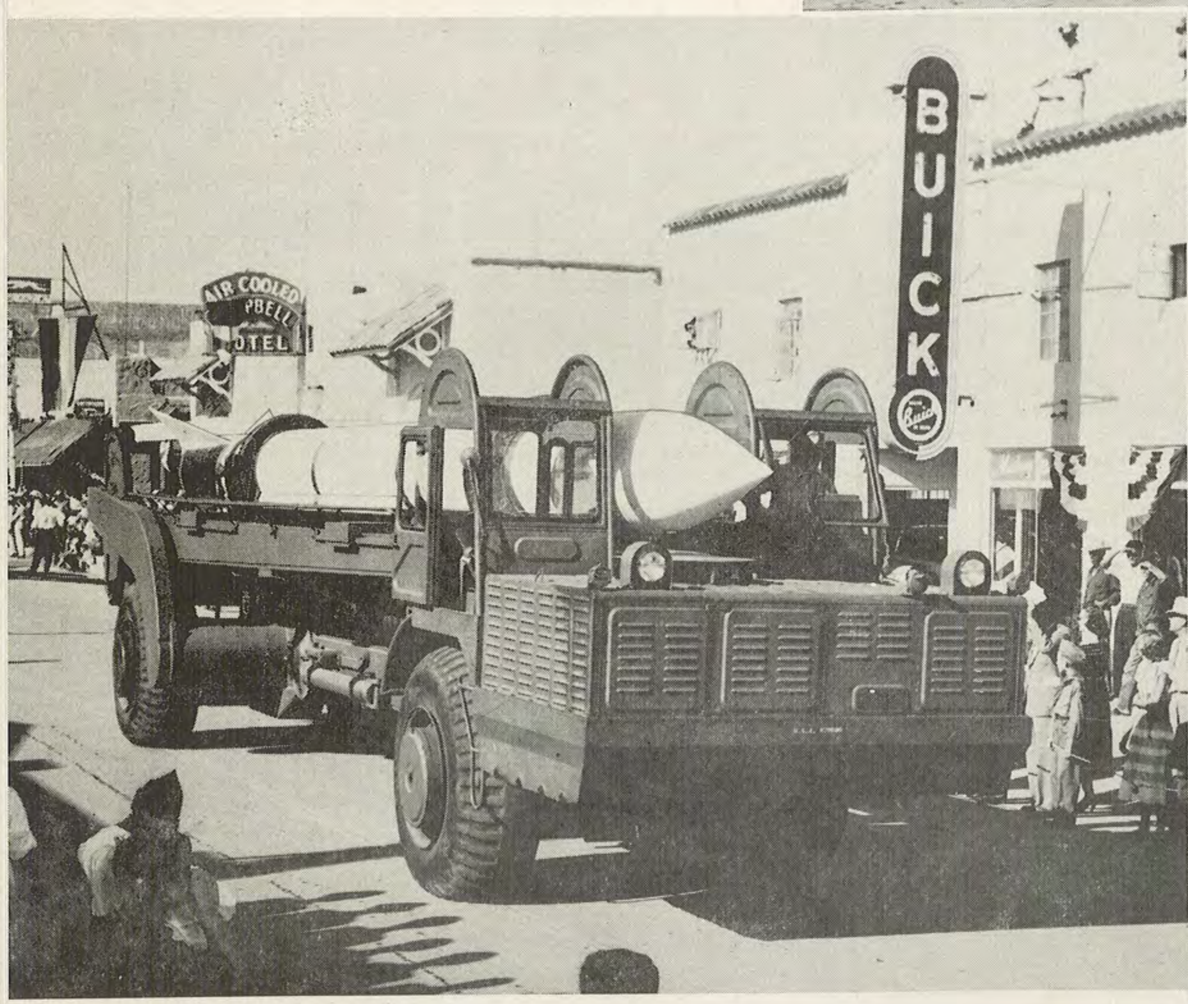
One of the side products of the group comes from the fact that representatives of the various divisions on Post get together at the meetings. Interdepartmental activities of this sort help increase the effectiveness of the communication system within the organization. Men from various divisions have many common technical problems, and such meetings can lay the framework for technical discussions, formulation of ideas, and actual accomplishment.

The benefits that can be obtained by new approaches, and the sharing of ideas are of value not only in research and development projects, but also in improving the relationships between departments and individuals who are responsible for the work on a Guided Missile Proving Ground. • • •

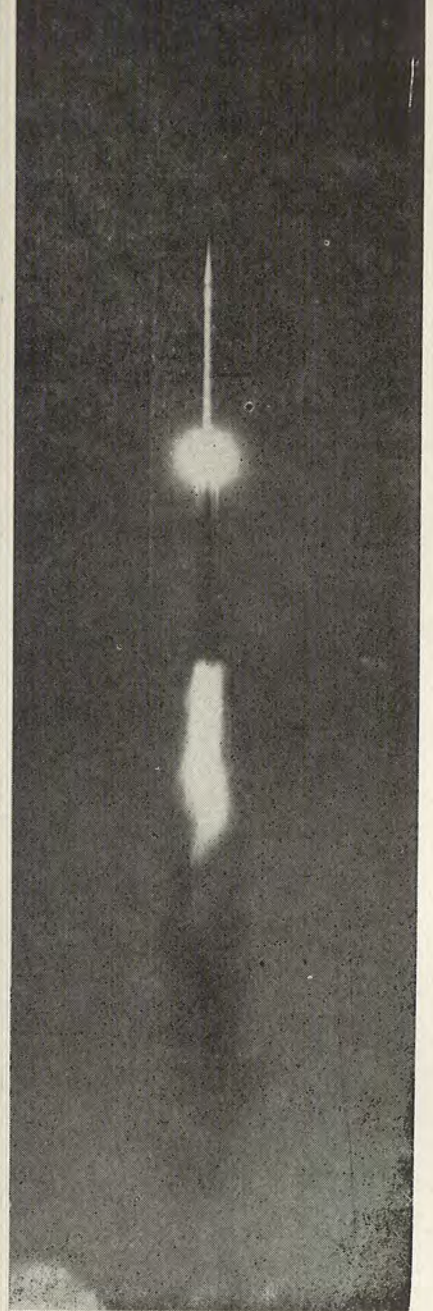
"Missile Away!" Presents:

When Seaborn P. Collins, National Commander of the American Legion, returned to this home in the Rocket Capitol of the World, what could be more fitting than to include the nation's latest rockets and guided missiles in his homecoming parade?





Missiles on Parade



OPERATION POGO

by
gilbert moore

Sometimes the simplest device imaginable can perform a very difficult task. Such is the case with Operation Pogo, which is so beautifully simple in concept that it might cause someone to wonder why it wasn't created before!

For the past few years, one of the secondary problems facing the designers of anti-aircraft guided missiles has been the procurement of suitable targets at which to fire their missiles in proving ground testing. Since it is obviously not economically wise to fire at our own high-performance research and development aircraft of the type which these missiles are designed to combat, several different substitute targets have been developed. Among these are the surplus conventional aircraft which have been converted into radio-controlled, pilotless drones, such as the B-17, the F6F, and the F-80. Another target class consists of those which were designed from the beginning for use **only** as targets, with subsequent savings in size and weight, since it was not necessary to make provision for a pilot or crew in the initial design. Examples of this class are the RCAT, or Radio Controlled Aerial Target, the Plover, and the Firebee. Still another class is that of the missile converted to target use, such as the Regulus.

Each of the above-mentioned targets has its own special attributes; low cost, maneuverability, high speed simplicity of operation, etc. However, all of the above targets fail to simulate the ultimate guided missile target in one respect: altitude performance. Therefore, one more class of targets is being added to the field; the high-altitude target. Since the exact altitude required of this class has not been released, we shall simply refer to it as the very high-altitude target.

In January of 1954, the Physical Science Laboratory of the New Mexico College of A & M A was requested by the Applied Physics Laboratory of the Johns Hopkins University to design and develop a very high altitude radar target. The design work was to be carried on under an existing Navy Bureau of Ordnance contract and all target testing was to be conducted with the close co-operation of the U.S. Naval Ordnance Missile Test Facility at White Sands Proving Ground in New Mexico. The final target was to be inexpensive, easy to produce, and simple to operate. It was not required that the target be able to move rapidly, since the high-speed maneuverable targets were already available at lower altitudes.

The Physical Science Laboratory began work on the high-altitude target under the project name OPERATION POGO in February 1954, and by March 1954 a design was settled upon. This design consists of a 20 ft. diameter silk "Baseball" parachute which has been coated with an extremely thin layer of pure metallic silver. This parachute is packed in a highly compressed condition into the forward section of a small solid-propellant rocket. The rocket is fired from a mobile rail-type launcher to the desired target altitude. At trajectory peak, an electronic timer triggers a release mechanism which causes the rocket nose cone and parachute to be thrown free of the afterbody. The parachute inflates, and, with the nose cone as its stabilizing load, descends slowly through the target region. The parachute thus serves as both the supporting device and, by virtue of its thin silver coating, the radar target itself.

Due to the non-rigid structure and discontinuous geometric shape of a parachute, the POGO target possesses considerable radar scintillation and glint characteristics. It thereby rather effectively simulates the radar characteristics of an aircraft. In addition, the radar cross-section of the POGO target is approximately equal to that of a medium bomber.

It is readily apparent, of course, that the POGO target is practically stationary, since its maximum descent rate at high altitude does not exceed 1,500 ft/min. and its maximum horizontal velocity due to wind drift rarely will exceed 100 miles per hour. The POGO target is therefore an **addition** to the family of missile targets presently in use rather than a **substitution** for any particular target. Its special high-altitude features make it useful for certain special requirements that cannot be met by the other target classes.

A more detailed description of the POGO system will be given with the aid of the figures. Figure 1 illustrates the appearance of the POGO rocket. It is 13½ ft. long and 6½″ in diameter. Its four square tail fins are very slightly cocked so that the rocket is spun at about 100 rpm in order to average out thrust and aerodynamic misalignments and thereby reduce trajectory dispersion.

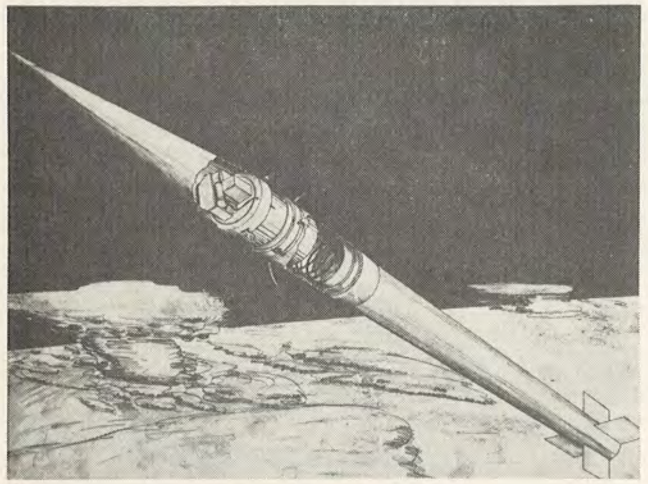


Figure 1: POGO cutaway.

The rocket is fired from a portable launcher. The launcher is loaded in a horizontal position, then is elevated to the vertical by means of a gas-activated hydraulic system. Since this unguided rocket weathercocks into the wind during flight, adjusting screws and level bubbles are used to tilt the launcher in a direction to compensate for this weathercocking. Balloon runs are made just prior to flight to determine the magnitude of the compensation required. The tracking flares are visible at the rear of the rocket.

Figure 1 shows the rocket as cutaway. Shown here are the nose cone, electronic timer, parachute section, latching mechanism, ejection spring, motor section, and tail assembly. This parachute pack and ejection system are based upon a unit designed by Bendix Research Laboratories of Detroit, Michigan, and General Textile Mills of New York City. The Bendix-General Textile unit was flown a few years ago in a meteorological rocket program at White Sands Proving Ground. The POGO parachute ejection system has been designed by the Physical Science Laboratory as a simplified version of the aforementioned unit, with the major difference being that the POGO parachute is silver coated and no special instrumentation is flown.

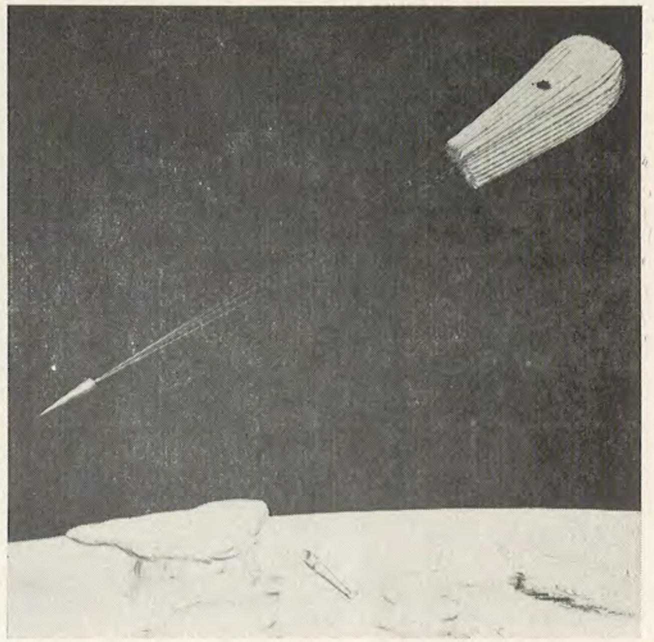


Figure 2: Artists conception of POGO radar target shortly after separation.

Figures 3, 4 and 5 illustrate the performance of the ejection assembly at trajectory peak. The electronic timer, which has been set for peak time, explodes an electric detonator. This detonator severs a thin steel band which has been retaining three over-center latches, thereby securing the nose section to the afterbody. Upon release of the latch-holding force, a strong steel spring throws the nose cone and parachute can forward of the afterbody at approximately a 20 ft./sec. separation velocity. Since the spring is attached to the rear of the parachute can and to the front end of the motor section, the parachute can is stopped after traveling about ten inches. The nose cone, which has been thrown free, then pulls the parachute out of the can. A 6-lb. weak link retains the crown of the parachute in the can until the parachute is fully deployed. This link then breaks, and separation is complete. The parachute inflates, the afterbody falls away, and the target is available for use. A composite photograph of this operation during an actual POGO flight test is shown in Figure 2. In this example, the parachute was ejected two seconds before the rocket reached peak.

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Figure 3.

Figure 4.

Figure 5.

When the parachute has fallen to a low altitude, a small observation airplane flies to its vicinity and follows it to impact. The pilot then directs a recovery party to the impact point. The parachute, nose cone, and timer are recovered, installed in another rocket, and reflown.

This description of the POGO target system illustrates its simplicity and resultant low cost. A six-man crew can easily transport the launcher to any desired point on a proving ground, assemble the missiles, load the launcher, and fire at a rate of about once every ten minutes. A higher rate of fire could, of course, be achieved by the use of more than one launcher.

One other attractive feature of the POGO system is its high degree of time resolution. When a guided missile is ready for firing, the weapons control center requests by radio that the POGO crew provide a target. Sixty seconds later, the target blossoms out at the desired altitude. This exceedingly short time for the climb to altitude is a material advantage in these days of crowded proving ground schedules.

The basic POGO system lends itself to modification as a target for missiles using other than radar guidance systems. A stabilizing load different from the nose cone can be carried beneath the parachute.

Although the POGO radar target is still under development, a sufficient number of successful flight tests have been conducted to show that a large number of existing target requirements can be satisfied by this system in its present stage of development. • • •

ANALOGUE COMPUTER METHODS

..wheels..

..cams..

..cogs..

by Morton Norman

Analog Computer Section

EML, White Sands Proving Ground

In a system where a large number of complex variables interact with one another, it may be next to impossible to determine them all by actual testing. In this situation, along comes the analog computer, a device which is not really new to science.

In recent years the techncial and scientific fields have been making increased use of computing machines to solve a large number of problems. Digital and Analog computers are the two basic types of machines used. We will briefly compare the two types, which represent completely different approaches to the solution of mathematical problems, and then the Analog type of machine will be discussed in greater detail.

Digital Computers:

All digital machines perform the type of computation which can be carried out by the familiar desk calculator. In other words, such machines perform simple arithmetic operation (such as the addition of numbers) to obtain solutions to any given problem. Large digital machines perform additions and similar operations on numerical data with great speed and usually in a preset sequence. The difficulties encountered in the use of digital computers are primarily:

1. The high initial cost of digital equipment.
2. Complicated methods of numerical analysis which must be used to solve some practical problems (such as simple differential equations) which are encountered.
3. The difficulty of giving a direct physical interpretation to results for a practical engineering problem. The problem in this case is that of interpreting columns of tabulated numbers in terms of a physical problem.

Despite these difficulties digital machines are indispensible in many problems because of their one great advantage, high accuracy. Answers are commonly obtained to five and six figure accuracy, and even more accuracy can be obtained.

Analog Computers:

Analog computers represent a completely different approach to the solution of equations than that of numerical analysis. The basic method is to build an electrical or mechanical analogue of the system to be considered. Thus in an analog computer certain quantities called "machine variables" are made to behave in a fashion similar to the manner in which the variables under consideration themselves vary. In this approach machine variables (which may be voltages, shaft positions, or similar quantities) can be easily studied and controlled in the computer. It should be stated that the analog computer solves equations set into it whether they have a direct physical application or not. In most cases analog computers are used as scientific tools and the behaviour of machine variables in such problems is directly analogous to that of quantities which have a physical significance.

It is known that an electrical circuit and a mechanical system both exhibit resonance effects. In fact, if one is given a particular mechanical system he can build an analogous electrical circuit. That is, the differential equations describing the mechanical system and electrical circuit which is constructed are identical in form. In such a way it is possible to study the effect of changing the mass present in a mechanical resonant system by observing the change in characteristics of an electrical resonant system in which the value of inducance is changed.

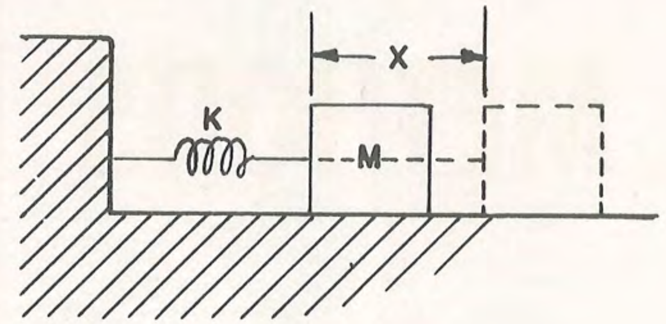


Figure 1.

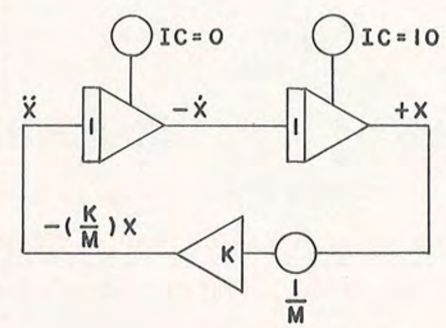
We can show this by studying the above system (Fig. 1) of a horizontal sliding mass oscillated by a spring constant. Disregarding friction we have mx as the inertial force exerted upon the mass by constant K. Then by considering forces acting on the mass we say:

Where x is the displacement of the mass from it srest position, the initial conditions given are:

M=25

K=61.5 x(0)=10 x(0)=0

The equation is circuited electrically and shown by the following schematic.



$$\ddot{X} = -\left(\frac{K}{M}\right)X$$

Figure 2.

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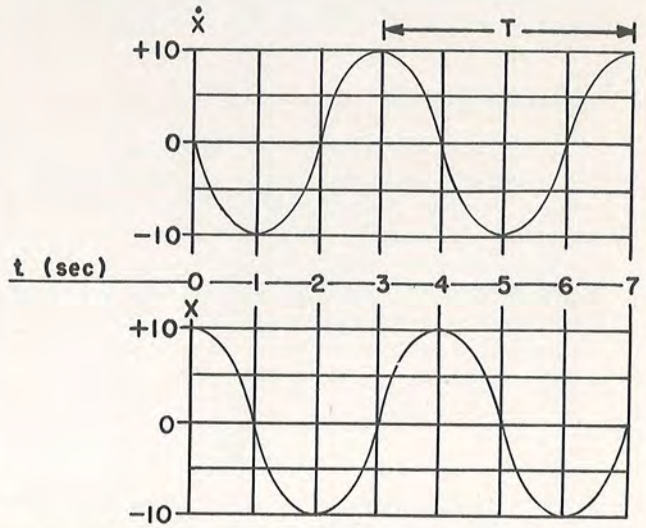
analogue computer methods

Voltages in the machine versus time are shown in (Fig. 3), checking theoretical analysis of the given problem.



NOTE: Freq. $= \frac{1}{4}$ cps $= \sqrt{\frac{K}{M}}$ rad/sec

Figure 3.

There are many other examples possible of how complex systems can be studied by reducing them to their equivalent form of electrical circuitry by which they be easily investigated. The electrical method of analog computing is stressed since it is by far the most common method in use today. Most modern analog computers use d-c voltages to represent variables being studied.

The present rapid development of analog computers is due to the fact that the fields of automatic industrial control, missile systems, and the like pose problems of analysis which are impossible by older methods. Rather than trying to guess at performance characteristics of a system or attempting to solve complicated differential equations, which may not even have a classical solution, the engineer can investigate system behaviors by observing the manner in which voltages in the analog computer act. The direct physical interpretation of results is a primary advantage of using analog computer methods. Results such as missile trajectories, response of a mechanical linkage, or filtering action of a given network are observed directly on a recorder. The change in such graphical results obtained by making simple adjustments on the computer indicate how the original system will behave if it is altered. The disadvantage in analog computation is that of limited accuracy. At their present stage of development analog computers cannot be relied upon in problems which require more than 0.1 per cent accuracy.

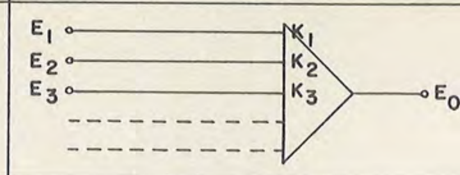
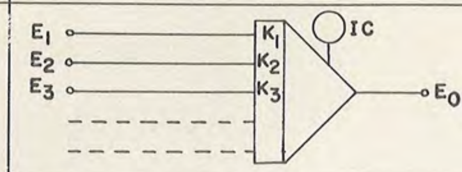
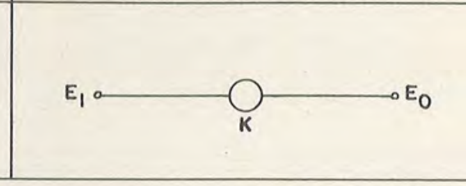
COMPUTING ELEMENTS	SYMBOLS	EQUATIONS
Summing (Sign Inverting) AMPLIFIER		$E_0 = -(K_1E_1 + K_2E_2 + K_3E_3 + \ldots)$
Summing (Sign Inverting) INTEGRATOR		$E_0 = -\int(K_1E_1 + K_2E_2 + K_3E_3 + \ldots)dt$ Where IC = Initial Condition = value of E_0 when $t = 0$
POTENTIOMETER		$E_0 = KE_1$ $[0 < K < 1]$

Figure 4.

Computer Components:

Although analog computers can solve a variety of problems, their most important use is in the solution of differential equations. It has been found that to solve most problems encountered it is necessary to have the following components in an analog computer:

1. A summer, which yields an output voltage equal to the sum of two or more input voltages.
2. Devices which multiply a voltage by a constant.
3. Integrators, which integrate a voltage with respect to time. For example, a constant voltage input to such a device results in a ramp function out.
4. Multipliers which yield an output voltage proportional to the product of two input voltages.

There are many other types of special devices and auxiliary equipment that are used. However, with the basic components described above it is possible to solve most problems encountered. For components in 1, 2, and 3 above it is easy to use high gain d-c amplifiers with input and feedback R-C networks to give the desired results. The multipliers described in 4 above are more difficult to obtain but both servo motor devices and electronic pulse systems have been developed to multiply two voltages. Perhaps to the list of components above should be added components which can generate arbitrary functions of an input. For example, it is possible to plot aerodynamic drag versus altitude.

A special purpose computer such as a gun director, a net analyzer, or similar device will employ a specific number of the components described above and will have these components permanently wired together to solve the same type of problem every time the computer is used. There are many general purpose computers containing a large number of components which may be wired together with patch cords. Thus analog computers can be used as general tools in the technical fields, particularly in the solution of differential equations.

Analog Computers at WSPG:

At WSPG an analog computer laboratory is now being developed, its primary purpose to evaluate missile systems as thoroughly as possible. For example, climatic effects, target maneuvers, and atmospheric effects not easily obtained on the range can be included easily in the analog computer set-up representing the missile system. The general plan is first to duplicate firings which have been made here. This will insure that the mathematical model as set up is a valid description of the missile system. Then confidence in the results of any computer solution to a problem not yet achieved in actual firings is established. The goal is to pinpoint the critical missile system components to save the number of firings which would be run to establish this information. Analog computation will help plan those firing conditions which test the most crucial tactical conditions which are placed on the missile.

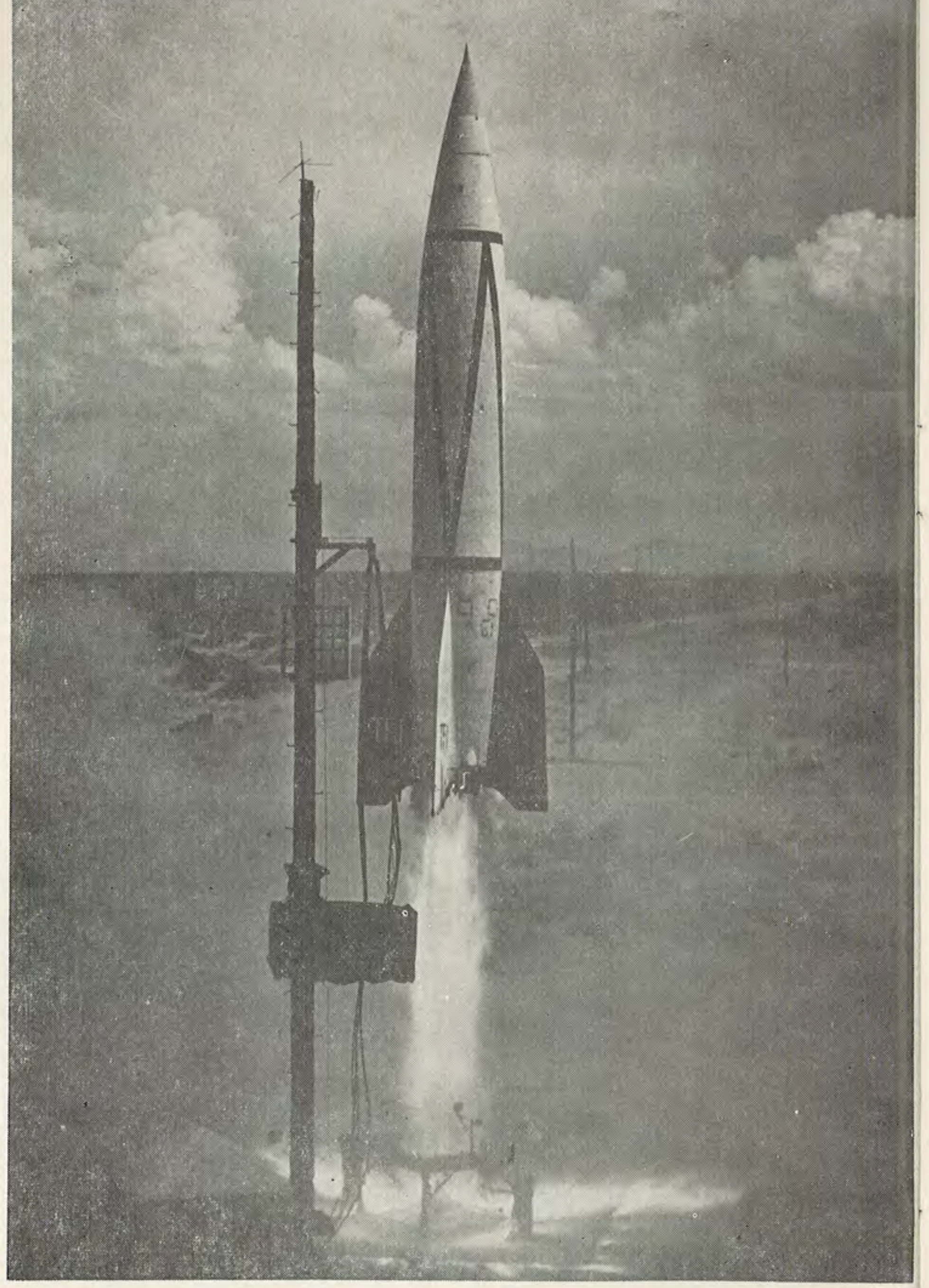
In consideration of the urgent missile problems to be investigated there are the incentives of adding to the amount of information yet collected concerning complicated control systems in general and missile systems in particular. The accumulation of such knowledge largely determines the extent to which further scientific progress will take place. Analog computers are tools used to meet the challenge of the increasing complexity that science faces. • • •

V-2 At White Sands

by

HENRY F. FLAMM

The V-2's are long-gone from White Sands Proving Ground, and so are the men who fired them. But here are some of the memories left behind at the closing of an era, written by a man who was a member of a team which cannot be forgotten.



During the last stages of World War II as the allied armies swept across Western Europe, a group of U.S. scientists stood by prepared to enter the conquered areas. These scientists had been alerted as to the location of devices which could possibly be of value for future technical developments. Naturally enough the German V-2 missile was one of the items of utmost importance and locations of storage areas and component manufacturers had been outlined as part of the program.

The results of the operation proved highly rewarding with both Great Britain and the United States getting a share of complete missiles. Our country obtained the major components for approximately 100 missiles and associated launching equipment. A program was initiated which required launchings of a number of V-2 missiles to provide transport for instruments in upper atmosphere research. In August 1945 the Service Engineering Division of General Electric Co. implemented this program by establishing a crew at WSPG working under Project Hermes.

At that time WSPG facilities were extremely slim. Buildings consisted of unpainted converted barracks buildings and a few canvas covered shacks which housed a small number of military personnel. Tools and materials were difficult to obtain so soon after the end of the war making it necessary to dismantle unusable German electrical equipment in order to obtain wire, switches and other electrical items.

The first few months were spent in preparing components for a missile propulsion system to be static tested in a specially built frame on the mountainside above the base. As part of the crew prepared the propulsion system others worked on gyros, autopilots and electrical systems with the German Scientsits. These operations aided the crew to become familiar with the missile equipment and to gain some assurance that all would work properly when the first missile was launched.

The day arrived when the static test stand was completed and the first propulsion system ready for test. When the fuels were released and ignited there followed a roar backed up by nearly a half million horsepower which rattled windows in Las Cruces 20 miles away. The flame pit beneath the motor had been lined with one-half inch thick boiler plate to reduce erosion by flame on the concrete walls. After a few seconds of burning these plates, glowing red hot, burst from the flame pit and floated out to the desert floor.

This was a successful test, however, and plans were carried out to put the missile in the air.

By April 1946 preparation had been completed and the first V-2 was ready for flight. Pre-launching tests of missile and ground equipment required several days until finally everything was working to the crew's satisfaction.

On launching day final tests were bound in a tightly organized schedule in an attempt to simulate expected flight operations as closely as possible. With successful tests completed the fueling operation began. To fuel a V-2 required more than 4 tons of alcohol and 5 tons of liquid oxygen plus other chemicals to power the turbine and pumps. This was a very carefully controlled procedure since any one of the propellants had a high hazard potential.

After fueling, the oxygen resting in the feed lines to the motor caused layers of frost to form. Vapors drifted through the tail section accompanied by a continuous creaking caused by the extreme cold.

From the beginning of fueling until all hatches were closed observations were made to detect any leakage which could have resulted from the temperature change. When all was satisfactory, the hatch covers were installed and preparations were made to remove the ladders and working platforms which permitted access to the missile.

With the missile clear, the pin wheel igniter was installed and all personnel retired to the protection of the blockhouse. An interminable wait of ten minutes ensued during which all missile equipment was energized and checked for proper operation. At X-1 minute the desk key was turned to the "shoot" position. At X-30 seconds the preliminary stage button was pushed beginning pressurization of the oxygen tank and finally allowing fuels to enter the motor to meet the burning igniter. Smoke and flame spewed from the missile with a roar that shook the blockhouse. A few seconds of burning was allowed before the main stage button was pushed. The roar and vibration increased as the 12 ton missile lifted vertically from the stand and headed skyward.

Unfortunately the missile had other ideas than to continue on its skyward path for it veered off in the wrong direction when only a few hundred feet above the ground.

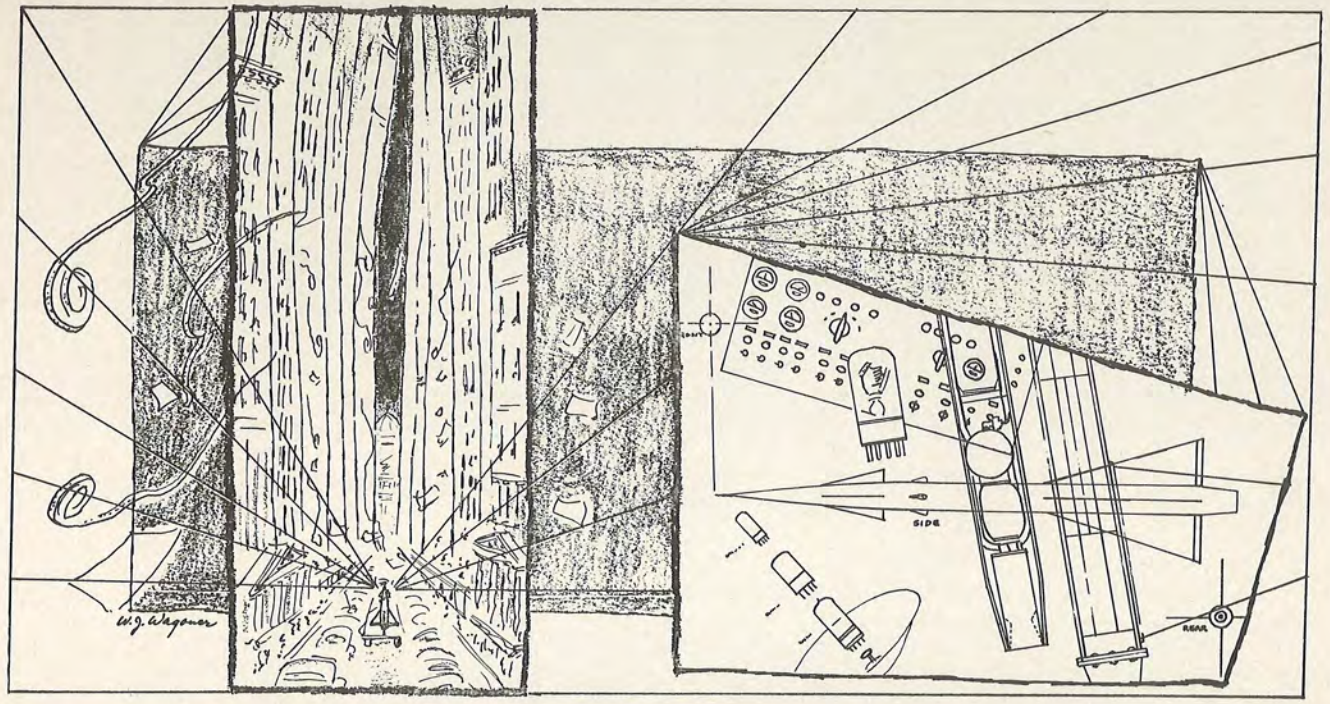
You can be sure that half a million horsepower and tons of explosive alcohol and oxygen commanded instantaneous respect from exposed observers who had even the slightest thought the missile would pass near them. People ran for cover in all directions. One man forgot he was holding a telephone when the demand for action came and was violently reminded when the slack was taken up. Another, keeping his eye on the missile by watching over his shoulder ran into a telephone pole. No harm was done but basic respect had been established.

Successive V-2 launchings produced valuable results by carrying instruments for upper atmosphere research. Several of the missiles reached altitudes greater than 90 miles although the altitude strived for was a function of the research requirements.

When the V-2 program was finished the Hermes crew continued their activities with other missiles forming a highly cooperative team so necessary in the launching of a complex missile.

V-2 missiles are a thing of the past but there will continue to be many stories told of the thrills associated with their launchings and the elation of a "good shoot." ● ● ●

guided missiles



& Wall Street

By CHARLES DONIVAN

The stock market is continuing its upward surge. With the Dow-Jones Industrial averages near the 400 mark one continually sees headlines that all time highs (since the 1929 days) are being reached. This rise is inspired by continued favorable financial news; reports of increased earnings and profits, placing of huge government contracts and in general a bright outlook for 1955.

The Western Electric Co. received a new Army contract for $20 million for the manufacture of Nike Guided Missiles. The missiles covered by this new contract will be manufactured in the Company's new plant at Charlotte, N. C. Production at this plant is expected to begin in 1955. The Nike is presently being manufactured by Douglas Aircraft Co. and Western Electric Co. in plants at Los Angeles, California, and Burlington, N. C. It was announced that a $164 million continuation contract has recently been awarded to continue production at their two plants.

Douglas Aircraft Company's prosperity is reflected in the price rise of its common stock from 86 in July to a recent high of 125. This rise is probably the greatest of those stocks comprising the Guided Missile Group.

Aerojet-General Corp. is planning a several million dollar expansion program at its plant near Sacramento, California for the manufacturing and testing of liquid-fuel rocket engines. Initial construction will consist of two test standings, a control room and a service building with future plans for an administration and engineering building, and a fuel storage building.

Lockheed Aircraft Corp. has appropriated 10 million dollars for a new scientific laboratory for advance research by its missile systems division in Van Nuys, Calif. Research in the nuclear field is to be emphasized under the direction of R. E. H. Krause who has resigned as Associate Director of Reseach, Naval Research Laboratory, Washington, D. C.

Lockheed's missile systems division now with 700 employees deals with complete missile devices including airframes, propulsion, guidance, and warheads.

Beech Aircraft Corp. of Wichita, Kans. is creating a new division in its engineering department for designing guided missiles and target aircraft. This division will be headed by Dr. James F. Reagan formerly Senior Project Engineer on Missile Programs for Bendix Aviation Corp. in its Pacific Division. For the last six years he was Chief Engineer for Radio Plane Co. of Van Nuys, Calif. The field of guided missiles is a new endeavor for Beech Aircraft.

Stockholders of Reaction Motors Inc (maker of Rocket Power Plants) have approved a two for one split of the common stock. This will make a total of 244,052 shares outstanding. The Company is also considering a "rights" offering for the purchase of additional shares.

There is speculation that Firestone Tire and Rubber Co. (manufacturer of the Corporal Missile) will soon approve a stock split.

Chance-Vaught (producer of the Navy Regulus guided missile) reports of a back-log of 248 million in unfilled orders. They recently received a 45 million dollar contract for continued development of a new Navy day fighter.

Business prosperity is likewise reflected in Curtiss-Wright's three months earnings report of 48 cents a share for the like 1953 period. They report a back-log of 736 million dollars in unfilled orders. • • •

Poems and Thoughts

DEDICATED TO THE IDEA THAT ENGINEERS AND SCIENTISTS MAY ALSO BE POETS

SATELLITE SEARCH

The astronomers wise of outer skies
Search spaceward and mark
A light that shifts, a glare that drifts,
Computing thus and thus
The orbit of a second moon for us.

—C. F. Capen, Jr.

It is cold and lonely at night on Mars Hill at the Lowell Observatory in Flagstaff, Ariz. But such detachment breeds thinking. So Mr. Capen, a co-op student from N. M. College of A. & M. A. and one of Clyde Tombaugh's assistants in the search for nearby statellite of the earth, penned above words on the spot, proving at least to some of us that poets, writers, scientists, and engineers have one thing in common: they are creative.

MJS fires . . .

Operation Saucer

A newly developed interstellarsphere research vehicle has been released recently and is claimed to be the greatest engineering achievement since the discovery of the endoplasmic mechano-cosmic eye.

This vehicle is known as the Magnetic-Flux Force Driven Saucer (XPPM-1). Its interim guidance system employs an amorphical phase-stabilized rectilinear radar in conjunction with an anticipatory sequential analyzer capable of reversible equilibrium midflight guidance. Midflight guidance is maintained upon reception of the coordinated collinear collimating computations derived from the dual Doppler discerning differential discriminator. The terminal guidance employs the Monroe guidance of simple sensual navigation.

The power plant employs collineated fourth-dimensional force fields pulsating with reciprocating heterocyclic pitch planes. Further repulsion of the terrestrial gravitational forces by an oblique spheroidal ectoscosmoline surface of revolution, wherein the polarization varies assymetrically with the uninhibited foci of the heterocyclic pitch planes located in the fringe zones.

The (XPPM-1) has unparagoned "H-Ray"* radiation for its stellar defenses. If this vehicle is sighted immediately notify . . . Well, don't if it isn't worth it.

* Hallucination Ray

ADDENDUM

Saucer Radiation Pattern

$$E = \frac{G'\left(\frac{2}{\cos x} - \frac{4}{\text{sine}\,\rho}\right) + \int_0^{-3.005} \cos X \tan X \sec^2 x\,dx}{r^2\sqrt{\frac{a^2}{\beta^2} - 96} + \frac{c}{u} + 69\frac{\beta}{\theta}(Kp)}$$

E = energy in urges
r = is indeterminate
G = the acceleration due to suavity, i.e. (Smoothing factor)
a = the first letter of the alphabet
c = the "Constipation Constant" used only when X is lacking
"d" = the "Dimming Factor" expressed in Angstrom Units (Not to be taken lightly).
kp = the "Kinsey Perversion Index" (Used only when either "theta" or "beta" is absent.
u = is thrown in for good measure.

"White Sands to Moon Rocket! Please repeat your last message! What KIND of cheese?"

BIG CONTEST!!! Can you write a caption for the above cartoon? The Editors of "Missile Away!" will pay you $5 if you submit one which they decide to print. The above cartoon will appear each issue with one of the original captions submitted!

Rare Birds of the American Southwest

Compiled by R. K. AUDOBURNE

SQUARE TAILED SWIFT:* Presbyter Parvus

Field Marks: A little over 13 feet long and about 6 to 7 inches across. Coloring varies but variations do not seem to follow any predictable pattern. Some combinations are; white body with black and white tail, white body with red tail and red nose (this might result soon after any holiday season), entirely bright orange. Some reports have described a body marking that looks like a little possum but this is not confirmed.

Similar Species: Seems to be in a class by itself.

Range: Found in both northern and southern New Mexico in continually increasing numbers. Eastern observers have reported sightings in the neighborhood of Wallop's Island.

Comments: Usually a bird that gets off the ground in a hurry but in northern New Mexico it has been seen going around in tight circles close to the ground much like a model airplane at the end of control wires. In southern New Mexico the species often flips its lid at high altitude with its lid then coasting gently back to earth. Once on the ground it has the ability to grow another body and tail whereupon it soon repeats this strange performance.

Other Names: Moore's Swift, Deacon, Pogo.

*For further details on this strange bird see page 18 of **Missile Away.**

ED. NOTE: Dr. R. K. Audoburne was recently elected President of the New Mexico-West Texas Section of the American Bird-watchers Society. His acute observations of the rare birds of the American Southwest have been internationally acclaimed.

POST-SHOOT CONFERENCE

"Missile Away!" started small, but much of the credit for its success goes to our retiring president, Frank L. Koen, Jr. (shown above being presented with a Fifth Anniversary trophy by Brig. Gen. W. L. Bell, Jr., Commanding General, WSPG). He has been the handler of the black-snake whip many times when we might have slacked-off on the job; he has shown courage, initiative, and clear thinking; and he has been a wonderful leader and a fine person to work with. In handing down the president's gavel, we don't think Frank will fade into the background in National and Section affairs. We're looking forward to working with him for a long time. But the least we can do right now is tell him how much we've enjoyed working under him, and wish him all the luck for the future.

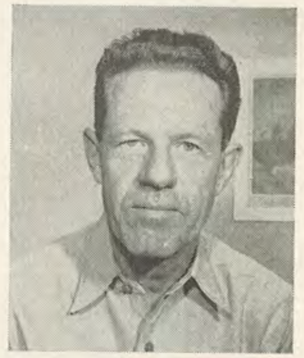
If this magazine ever had a justification for trying to integrate the far-flung aspects of rocketry and those things which bear upon it, it is certainly stated on page 418 of "The Story of Man," by anthropologist Carleton S. Coon, just published by Alfred A. Knopf. The book is the always-interesting story of ourselves and how we got the way we are, but it is done in a style that is neither ponderous nor below the level of an intelligent reader. To quote:

"We need not only men who can handle complicated machinery and read dials, but also men who can think in large terms. The more specialized branches of learning become, the harder it is for individual men to master the essentials of them all, but the problem is not insoluble. In response to this need, science writers . . ., editors . . ., and publications . . . have arisen. Such men and magazines are essential to make it possible for the heads of states to direct intelligent planning. Until recently, the world has gone its own way innocent of planning except for the most essential rules of human relations as expressed in the most fundamental doctrines of religion. Now it can no longer leave things to chance because . . . a climax in history has been reached."

The book is worth while reading in its entirety. It presents a new concept of the human race.

The magazines "The New Yorker" and "Newsweek" both carried excellent stories on the National Convention early in December. For a wonderful picture of what went on, go back and read the "New Yorker" article.

Tombaugh



White

The New Mexico-West Texas Section has reason to be proud when two of its members are selected to receive Fellowships in the ARS. Clyde W. Tombaugh, long prominent and active in Section affairs, being one of the charter members, walked forward at the Honors Night Banquet in New York in December to receive his Fellowship for "outstanding work in instrumentation of long-range rocket vehicles". Our other Fellow, Leo D. White (known to all and sundry as "Pappy") was selected for the simple reason that Pappy has probably fired more big rockets than any man in this country; he was key-man in General Electric's WSPG V-2 firings, the Hermes Project, and Operation "Sandy". The congratulations of the "Missile Away!" staff goes to both these men for the recognition they have received. We are proud of you both, Clyde and Pappy.

One of the most unusual bits of information that we collect like garbage, flies, and junk to clutter up the place is this recently-learned, seemingly-useless fact: the WSPG Army launching area is built upon the ruins of an ancient Indian village. Wandering around the area, you can pick up bits of broken pottery and arrowheads as well as expended rocket hardware. We filed the datum under "Local Color".


MISSILE SUSTAINERS by RMI
TARGET-REACHING
MISSILE POWER...
Rocket power sustains the flight of
guided missiles on their military mission.
RMI rocket engines of advanced design
provide unfailing power for defense.
Missile boosters and sustainers
Aircraft powerplants
Ordnance rocket propulsion
Special propulsion devices
Launching and ejection devices
Auxiliary power units
Boundary layer control
RMI
RMI ENGINES POWER THE
BELL X-1A
REPUBLIC XF-91
DOUGLAS D558-2
MARTIN "VIKING"
FAIRCHILD & CONVAIR "LARK"
and various classified projects
ROCKAWAY, NEW JERSEY
Special Products
Test Areas
DOVER, NEW JERSEY
REACTION MOTORS, Inc.
DENVILLE, NEW JERSEY
Engineering Research Administration
AFFILIATED WITH OLIN MATHIESON CHEMICAL CORPORATION