"MISSILE AWAY!"

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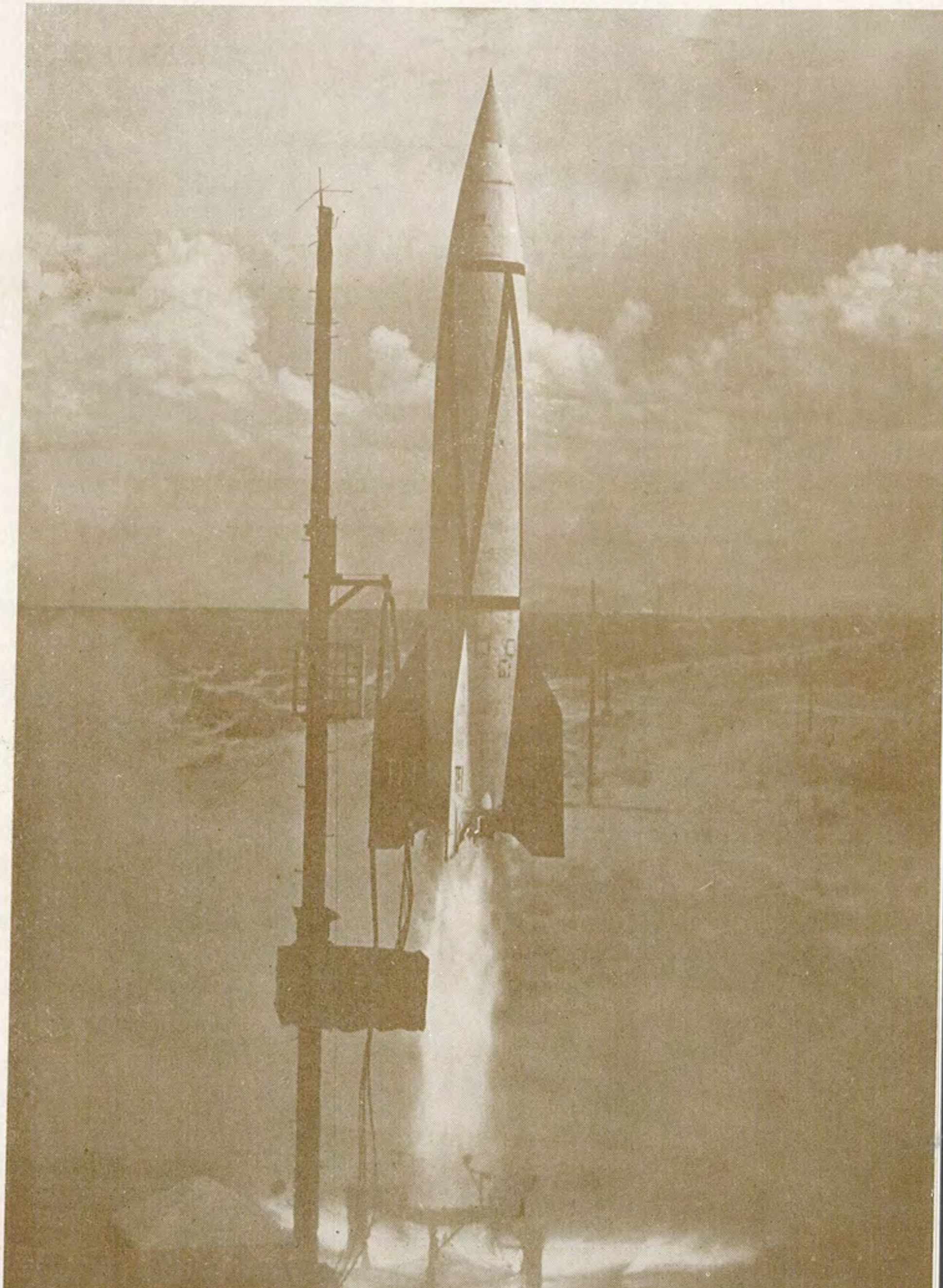
1954

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

VERGELTUNGSWAFFE ZWEI! . . . Page 21



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"MISSILE AWAY!"

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"WHITHER NOW, ROCKETEERS?"

AN EDITORIAL

With the January-February issue, the Journal of the American Rocket Society took on the title "Jet Propulsion." Shortly thereafter, a query card arrived from the Executive Secretary to be filled out by members to prove the circulation to potential advertisers. Nowhere on the query reply card was there any indication that the member might be engaged in rocket research, development, or testing.

We also note the enlarged section in the **Journal** (it is the **Journal** to us, and will remain that) devoted to developments in the air-breathing jet engine.

If these be any indication, it appears to us that the American Rocket Society has reached a crossroad.

Whichever road is taken during the coming year, we are certain that there will be some chuck-holes and traffic jams on both. But if the **ultimate** goal of the Society is kept strongly in mind, the decision at the crossroad will be much akin to that which a motorist must make in deciding whether to take Highway 80 or Highway 80 Alternate.

The need for this decision has come about because there are two groups with different ideas within the Society. A decision is also needed because the Society has now grown to such a point that a question similar to that of states rights has reared its ugly head.

Let us examine these two groups objectively and weigh their proposals.

Let's also discuss this National-Section question.

One faction is of the belief that the Society should be broadened to include the entire field of jet propulsion: ram-jets, pulsejets, turbojets, and propjets. This road has obvious advantages. The Society has always been devoted to the arts of propulsion, and many professional people working with air-breathing jet engines have an interest in rocketry as well. There is, therefore, a large potential membership in these people. In addition, the air-breathing jet engine field is well established commercially, and advertising for the **Journal** might possibly be easier to come by.

The major disadvantage to our way of thinking is the fact that the rocket may be subordinated to the air-breathing jet engines . . .mainly because said jets have a much wider usage, both military and commercial, at the present time. This road would also tend to propitiate the stress on propulsion engineering.

The second faction also believes that the Society should be broadened in its scope, but in a different manner. They maintain that the science (or art, if you will) of rocketry itself has enlarged in scope because of the progress in guided missiles. They prefer to think of a rocket as not only the power plant and propulsion system, but as a system of systems including guidance, control, radar, ground equipment, launching and handling equipment, flight instrumentation, and environmental testing.

Their plan is to ally the Society with these fields, since they are all **absolutely essential** to the successful

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EDITORIAL - - - Con't.

flight of today's unmanned missile and the potential manned vehicles of tomorrow . . . or next week. They prefer to stress the rocket as an entity, because a rocket engine alone does not make a missile, spaceship, or what-have-you.

There is a large potential membership to be gained here as well, perhaps a greater one because of the sheer, encompassing size of the missile field today. **Journal** advertising is readily available in terms of the whole guided-missile field—one look at a magazine specializing in electronics, mechanical engineering, or aeronautical engineering should point this out.

As we pointed out, both roads may be merely alternates to the final goal. Many of the tricks of the jet field are applicable to and need to be exchanged with those of the rocket field. And we do not hesitate to point out that guided missiles need not always remain weapons. For example, gunpowder certainly kills people, but it also allows us to blast highways and railroads through mountains and to mine the earth's interior for minerals. The guided missile is not the first weapon which had commercial capabilities by beating it into a plowshare.

Perhaps the real solution will be one of compromise between the two groups. The Society may eventually have a Rocket Group and a Jet Group, each devoted to their particular means of accomplishing the common end. But this is merely a compromise; the problem is still there.

Such a compromise solution is also affected by the "states rights" problem we mentioned earlier. The time has arrived when the majority of rocket work is no longer being conducted on the East Coast. Various Sections throughout the country are engaged therein.

Yet control of the Society remains in the vicinity comprised of a circle two hundred miles in diameter, with New York City at its center. Major policies are decided there.

Yet the Sections grow more powerful all the while, and naturally desire a voice in the affairs of the Society.

A study of the history of large, wide-spread organizations indicates that this sort of thing is commonplace. It brings on civil wars.

We have no pat answers or solutions, but we certainly have some suggestions.

All of us want to see both jets and rockets come to have widespread commercial as well as military uses. We cannot continue indefinitely as weapon-makers because our progress should not be dependent upon the rise and fall of the military needs in peace and war.

And we all look forward to the time when the theoretical science of astronautics becomes a practical one. There are military overtures to this, but we believe the commercial benefits — of which we can foresee more right now than the Wright Brothers could in 1903 — will be far greater in any case.

The ultimate, long-range goal of the American Rocket Society is the accomplishment of these ends, we think. The ARS was founded as the result of the revelation of a heat engine which was not dependent upon the atmosphere but which could work in a vacuum.

In time, we will use this engine for that purpose, but such an achievement will take the combined efforts of more fields, arts, and sciences than that of propulsion alone. We will **never** accomplish it otherwise. We may open the sky with rocket propulsion, but we will never hold it open unless we foster the alliance and cooperation of other engineers and scientists.

The air-breathing jets are, by definition, confined to the thin envelope of our atmosphere.

However, let us pick our road and stick to it. Fighting between ourselves over how we'll get there is imbecilic, immaterial, and immature. We need the wild, dreaming optimist as well as the careful, studious pessimist.

Our opinions on this whole matter might be well expressed in the words of Arthur C. Clarke, former Chairman of the British Interplanetary Society, who remarked to us when in Las Cruces several years ago, "Why get excited about anything that doesn't go straight up?" • • •

—G. H. S.

NOTES . . .

February Business Meeting

A meeting of the Board of Directors was called prior to the regular meeting of February 25, 1954. All members of the board were present and considered two actions:

The standing committee chairmen for 1954 and the chairmen of the special committees were unanimously approved.

Approval was requested for "Missile Away!" as an officially sanctioned publication of the Section. Unanimous consent was obtained for this, as well as permission to copyright said publication in the name of the Section, on the condition that the editorial contents and policies be reviewed each issue by the Board to assure that the publication is in accord with the opinions and feelings of the majority of the Section members.

At the regular meeting, committee reports were heard, and President Koen, in conjunction with Membership Chairman Wagner and Secretary-Treasurer Stine, urged that strong efforts be brought to bear on increasing the membership to over 400 by the end of 1954.

A unanimous vote of confidence was given to "Missile Away!" as the official Section publication. • • •

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UP THE WIRE

FLIGHT SAFETY AT W. S. P. G.

By
NATHAN WAGNER

TIME: 1944-1945.
PLACE: London, England.
CIRCUMSTANCES: Death, Devastation, Disaster,
REASON: Bombardment by V-2 missiles.
POSSIBLE DEFENSE: None.

Today at White Sands Proving Ground, N. M., V-2 missiles and others of even more advanced design have been and will continue to be launched. Today the consequences of a "wild" impact are still Death, Devastation and Disaster. Today the defense is still "None."

Guidance systems have been improved, engineering reliability has improved, propulsion systems have been bettered and many advances have been made, but human beings can still make mistakes and machinery can fail.

A failure of equipment or an error caused by the human element must not be allowed fatal. Engineers and scientists have tackled bigger problems, tougher problems and perhaps more interesting problems. None, however, have a more challenging outlook. Every missile fired requires someone and some mechanism to prevent a possible failure from becoming a disaster.

There is no way available to non-military personnel to know what is going on behind the "Iron Curtain." Information from the rocket proving grounds of our allies is also highly classified, so any ideas expressed in this article are those of the writer and any techniques or equipment referred to are specific to WSPG.

The firing of a high altitude research vehicle is an exciting and stimulating event. Weeks of work after months of planning culminate in the dramatic moment when a stentorian voice begins the final count-down—"Ten, nine, eight, etc., down to Zero"—then "Missile away!"

Like magic the tension eases and eager questions as to performance begin to pour into the proving ground control station. There is one group of engineers whose work begins only when the missile has cleared the launcher. Serious eyes are cast upon radar plotting boards; keen-eyed trackers peer through optical tracking safety screens. Other engineers sit at operating consoles backed by complex equipment with their finger "on the switch." Only a word, a twitch of the finger, stands between a successful firing and the explosion which will send the engineers back to their planning boards.

The seconds pass. While spectators watch the beautiful man-made meteor with its tail of fire rise into the sky, flight safety engineers watch carefully as automatic pens trace across the plotting boards. They dare not lift their eyes to watch this miracle of science glide through the upper air, but concentrate on the sliding pens and the movement of the speck on the radar screens that traces the rocket's path.

Quietly the reports come in from the safety communications net. "Take-

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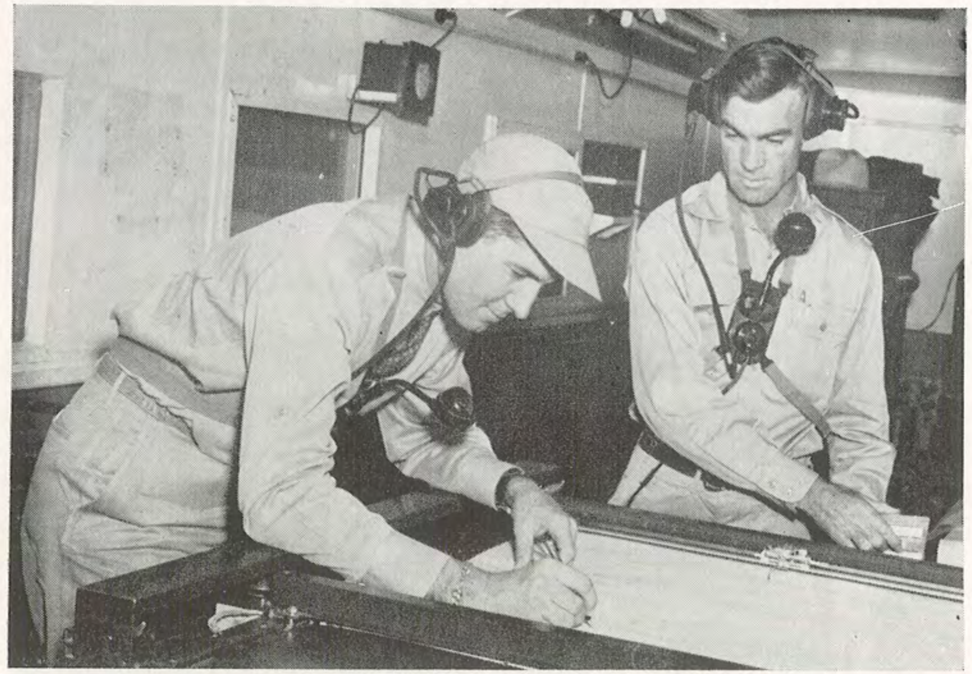


Herbert L. Karsch and Bon Burt on the radar safety net plotting boards during a firing. The vertical and horizontal projections of the missile's flight are automatically plotted from radar data, enabling the position of the rocket in space to be accurately determined in an instant. — (U. S. Army Photo.)

Left: The sky screen with its telescope and safety wires (too small to be seen here) manned by Robert Daly. The safe limits of flight are determined by the wires; if a rocket crosses a wire, it may land outside the range boundaries. — (U. S. Army photo.)

UP THE WIRE - - - Con't.

off normal." "East of the wire." By then the radar plots have steadied and the Flight Safety Director takes command. "Radars are in automatic" is announced from an east position and some of the tension eases. Impact is almost certain to be to the north.

Now it is a race against the clock. Expected burn-out is 45 seconds. A tone of urgency enters with the voice of South Sky Screen. "The missile is approaching the east safety wire." Meanwhile the more accurate radar plots corroborate this and hands grip the edges of the plotting boards more tightly. The impact computor shows predicted impact moving closer and closer to the east boundary. Is this a runaway?

At plus 20 seconds, plus 25 seconds, time seems to stand still, then races on like water from a bursted dam—30, 35, 40—burnout! Barely inside the safety grids. The predictor settles at three miles inside the boundary. Another experiment is on its way.

The work is not over yet. The instrumentation section must be separated from the main body for recovery purposes. Quickly the burnout velocities are read from the tapes. Burnout altitude and time is read from plots and nomographs are consulted.

Time to blow—at 263 seconds—is passed to transmitter engineers. The seconds tick by on the counters. "Two Sixty Three" comes up in the counters and this time the switch is thrown with the knowledge that final success is in the making.

"Telemetering out," is reported, confirming instrumentation separation.

Twenty miles up, two broken pieces of the once sleek missile flutter toward their final impact. It takes 300 more seconds for the exhausted tank sections to reach the earth. Trackers follow every move and an accurate plot is made of impacts. Immediately the information is sent to radio-equipped vehicles which roar away to recover instruments—all in less than 15 minutes.

All of the effort has been recorded on a handful of film and tape, but it is from these that new adavnces in science are possible.

Another day, another missile. This time a giant V-2 rests on the launching platform. Final preparations are complete. Twenty tons of steel, alcohol, and oxygen stand ready to carry a few hundred pounds of precision instruments into the unprobed regions above the earth. This is a light load and if expectations prove true a new high altitude record will be set.

"Ten, nine, eight, etc., to "Missile Away!" but then comes the dreaded shout from trackers at the sky screen: "The missile is leaning to the west!" This doesn't look like a record-breaker.

During the next anxious seconds the missile balances on its tail of flame like a juggler balancing a silver pencil on a fiery red stick. As velocity increases, the missile stabilizes, but even to the naked eye it is obvious that this one is dangerous.

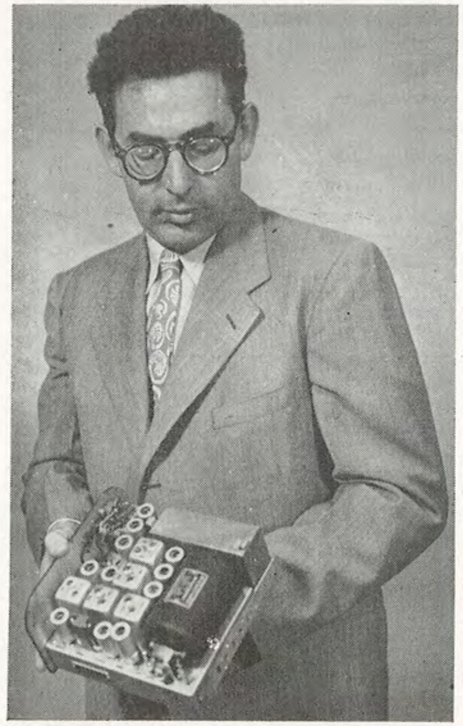
All indications are proven by the safety screens and plotting boards. Now it is a matter of how long the missile can be permitted to remain under thrust. Every second of burning means more seconds of valuable data for instrumentation. This is now a salvage operation—costly if it fails and costlier still if it succeeds too soon.

"Stand-by. Stand-by. Stand-by," chants the safety officer. Then, suddenly: "Cut!" In what seems like the same breath the flame is snuffed out and the instrumentation compartment is separated from the main body. A failure? Perhaps. The same scientific endeavor making the flight possible was used to prevent a possible catastrophe. There is much to be learned from records made. Every failure provides more knowledge.

A human is one of the best computing machines even if it is one of the slowest .It isn't fast enough to solve the problem of missile impact during the one minute of burning of a high-altitude rocket. Some kind of computing aid is necessary.

For most problems a computor starts with the data or questions and gives the answers. There is a kind of flight safety based on this data. Note the impact computor previously mentioned.

Since one of the absolute prerequisites of a safety system is reliability, a complex analogue computor is "hard to live with." Such devices are used, but they are not the primary flight safety tool. A very elementary system could be devised that would take the lack of an operator to make it fail. This, too, is used—but again not as the primary safety device—mainly because of the lack of accuracy of the elementary non-fail type of screen.



The author, Nathan Wagner, holds one of the rocket-borne safety receivers through which the radio signals to destroy the rocket or otherwise disarm it are sent. (U. S. Army photo.)

A bit of turnabout in the analysis of the problem is sometimes required. If you cannot solve the problem in time, solve the answer and wait for the problem to present itself.

This seems impossible to do. Actually the unsafe conditions can be plotted as families of curves. To further reduce the number of curves to a tolerable working number the more improbable unsafe conditions as defined by the missile capabilities are eliminated.

There are several ways to approach the problem as now stated. In general the method is constructed starting with expected performance and trajectories. High altitude missiles are tested differently than programmed guided missiles.

All that is needed then is a set of computations, an instantaneous presentation of the parameters that computations were based upon and a way of affecting the events that lead to flight safety. Perhaps "ALL" should be underlined. At WSPG it takes a multi-million dollar installation to provide it.

First the computations. After you have an advanced degree in mathematics it seems easy. The text books simply do not contain the necessary material. The design of a radar plotting board flight safety grid requires imagination not cultivated in college.

The only practical method yet devised that will track a super-sonic missile automatically is radar. At the same time radar will provide voltage output proportional to its position and with the aid of elementary analogue computors, x, y, and z of a missile in space

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UP THE WIRE - - - Con't.

can be derived. To increase the reliability the system is at least duplicated. With duplication of equipment the system is more reliable than the impact computor and a good deal simpler.

All the work until now has been necessary to get to the last step—that is, to do something about the missile flight. The tools and techniques required to do this would require another article twice this length to describe. Let us say that they exist and are probably the most reliable part of the system.

By now the reader is beginning to wonder how turning off the thrust can be used as a means of flight safety. Remember the solution has been worked out and the immediate position of the rocket in space becomes our problem. The secret is that the solution has been computed in such a manner that for all cases thrust termination at a specified time will result in a maximum range that will not violate a predetermined criteria.

Why flight safety? Exactly how many times the system has been needed is classified. However common sense dictates that if it were not needed it would not exist. • • •

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Space Happy?

Reprinted from Collier's for Feb. 5, 1954

"**IN The Last Two Years** Collier's has devoted a portion of seven issues to articles which discussed space travel, man-made space satellites, and possible human exploration of the moon. At times we have had to take a good bit of kidding from other publications whose writers seem to feel that the whole idea is fantastic, and that we have become a little space-happy.

"Well, we fell about space travel just as we did last year when we commented editorially on the panel of distinguished scientists who have written for us or advised us on the subject: 'They have, over the years, proceeded from the most abstruse equation to the most practical detail. They have examined every conceivable problem — mathematical, aeronautical, astronautical, mechanical, physical, emotional. And they have concluded that the mission of the great project can be accomplished.'

"We are pleased to say that we and our advisers are not alone in our belief in what some have called wishful thinking, escapism, or pure imagination. As evidence, may we quote the opinion of a pioneer aviator, a tough combat flier and distinguished military commander, an aeronautical engineer and doctor of science, and a successful businessman, Lieutenant General James H. Doolittle (ret.).

"On the occasion of the fiftieth anniversary of powered flight, the publication Planes asked General Doolittle to predict what the next half century of aviation might bring. The general complied, with the cautious foreword that 'I believe that if I have erred, it is in the direction of conservatism.' Here is his estimate of the possibility of creating man-made earth satellites:

'While many of the technical problems involved in the production of a successful earth satellite have not yet been solved, expenditure of sufficient effort and money should lead to the required answers. It is entirely probable that an earth satellite will be built within the next 50 years, and possible that attempts will be made to send missiles through space as far as the moon.'

"We hope that this admittedly conservative opinion from an experienced, practical-minded authority will help convince our skeptical friends that the conquest of the regions beyond the earth is the next great frontier that challenges man — and, incidentally, that maybe Collier's doesn't have bats in its space helmet after all."

A person sees many ads today, but take another look at the advertisements in this copy of "Missile Away!" All of these firms make possible this magazine; remind them you saw their ad here!

BEHIND EVERY GREAT MAN . . .

By
ORIN E. ROUSE

The officers and guest speaker, left to right: R. Gilbert Moore, G. Harry Stine, Nathan Wagner, Edward L. Brown, Dr. R. K. Sherburne, Mrs. Robert H. Goddard, Charles Mansur, Frank L. Koen, Jr., John S. Piech, and Edward E. Francisco, Jr.

(U. S. Army photo.)

MRS. ROBERT H. GODDARD, widow of the man whose early rocket experimenting aided today's vast guided missile program, was guest of the New Mexico-West Texas Section of the American Rocket Society in Las Cruces on the evening of the 22nd of January 1954. Mrs. Goddard, who now lives in Worcester, Massachusetts, where she is compiling information for today's scientists from her late husband's papers, was the featured speaker at the Society banquet meeting. About 50 members and guests were present.

She told the group of scientists and engineers of the pioneering in the field of rocketry that her husband pursued from the turn of the century until his death in 1945. Illustrating her talk with motion picture films of some of the first missile flights ever made in the United States—back in the 1930's—Mrs. Goddard described the hardships encountered in early-day experiments.

"My husband first explored mathematically the field of solid fuel propulsion in 1918 while at Mt. Wilson Observatory" she said. "In some of his early papers on the subject before he mentioned the word rocket, he made a footnote that propulsion of this type would be man's only means of ever attaining his dream of reaching the moon. This appeared in his 1919 Smithsonian Institute Report, **A Method of Reaching Extreme Altitudes.**

"The newspapers had a field day over this statement, and many called it ridiculous," she recalled.

She described his early experiments in Massachusetts before he sought a more uninhabited area in which to conduct actual test flights. It was in Auburn, Massachusetts on the 16th of March, 1926 that Goddard sent aloft the first liquid-fueled rocket. Later experiments in Massachusetts came to the attention of the local Fire Department who subsequently banned the firing of rockets as they were considered a fire hazard.

However, this publicity brought Dr. Goddard's work to the attention of Charles A. Lindberg who, after talking with Goddard, managed to enlist aid from Daniel and Florence Guggenheim.

Goddard moved to Roswell, New Mexico shortly thereafter and began the series of experiments which made history.

"During the depression, experimentation was halted about 1932", Mrs. Goddard explained. "In 1934 the Guggenheim Foundation made more funds available to Dr. Goddard and by 1935 he had developed and successfully test-launched a missile traveling slightly faster than the speed of sound. This missile also reached an altitude of 7,500 feet.

"You scientists from White Sands Proving Ground will find this statement amazing in the light of your elaborate equipment", Mrs. Goddard told members of the Rocket Society. "But through all those years we operated all phases of our tests and research on the Guggenheim Foundation's appropriation of only $18,000 a year.

"If my husband were alive today, he would see a great dream come true at White Sands Proving Ground, for it was his fear that rocket research instigated in war time would be dropped during peace. Therefore, he wrote profusely for the record. We are still in the process of publishing his notes and reports of tests." • • •

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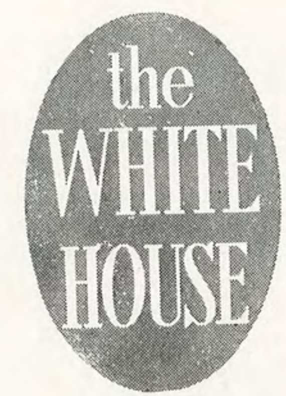

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THE STORY OF REACTION MOTORS, INC.

(ED NOTE: This is the first in a series of articles to appear in Missile Away featuring the people, history, achievements, and products of America's rocket engine manufacturers and research groups - - - - - - - .)

IN the December issue of "Missile Away!" we presented a photographic spread featuring the early experiments of the American Interplanetary Society — later the American Rocket Society — during the 1930's. Four rockets were actually flown by the Society during that period, and considerable work was done in the theoretical and practical aspects of combustion chambers, nozzles, cooling, and propellants.

Shortly after this country became engaged in World War II, the government grew anxious to get research started on rocket power plants for assisted takeoff of aircraft and other uses. Four of the members of the American Rocket Society who had taken part in many of the "Sunday experiments" banded together to form a corporation to assist in the accomplishment of these ends.

What followed is history — past, present, and yet to come. On December 16, 1941, those four men — Lovell Lawrence, Jr., the late James H. Wyld, John Shesta, and Franklin Pierce—incorporated in the state of New Jersey the firm of Reaction Motors, Inc.

They started work on a Navy contract immediately . . . in the basement of John Shesta's home. They didn't have much to work with except Wyld's regeneratively-cooled rocket engine principle. This engine, developed in 1938, used one of its propellants to cool the chamber walls.

Expansion was rapid during the war. RMI grew from the basement shop to a garage no bigger than a quonset hut in Pompton Plains, N. J., and the staff grew from four to about a dozen. Yet with these facilities they developed in nine months ten different types of rocket engines ranging from 50 to 1000 pounds of thrust. In 1943, they turned out a 3000-pound liquid-fuel RATO unit for the Navy, and by 1945 they had produced a 350-pound unit for the Gorgon guided missile, and a 620-pound unit for the Lark, in addition to doing extensive work on rocket-powered rotary-wing aircraft and pulse-jets.

1946 was a milestone year for RMI; they delivered to the Navy the famous 6000-pound thrust rocket engine, the first engine to propell a manned aircraft past sonic speed.

The money and space problems besetting RMI were solved in 1947 when they moved to Lake Denmark, N. J., and received the backing of Laurence S. Rockefeller. Progress was rapid thereafter. RMI produced a four-chambered, 8000-lb. thrust engine for the Air Force MX-774 sounding rocket, and, by the time they had moved to their present location at Rockaway, N. J., the 20,000-lb. pump-driven liquid oxygen-alcohol engine was pushing the Navy's Viking rocket to record altitudes.

RMI's list of achievements in rocketry is long. Their 6000-series engines have propelled the Bell X-1 and X-1A, the Douglas 556-II "Skyrocket", and

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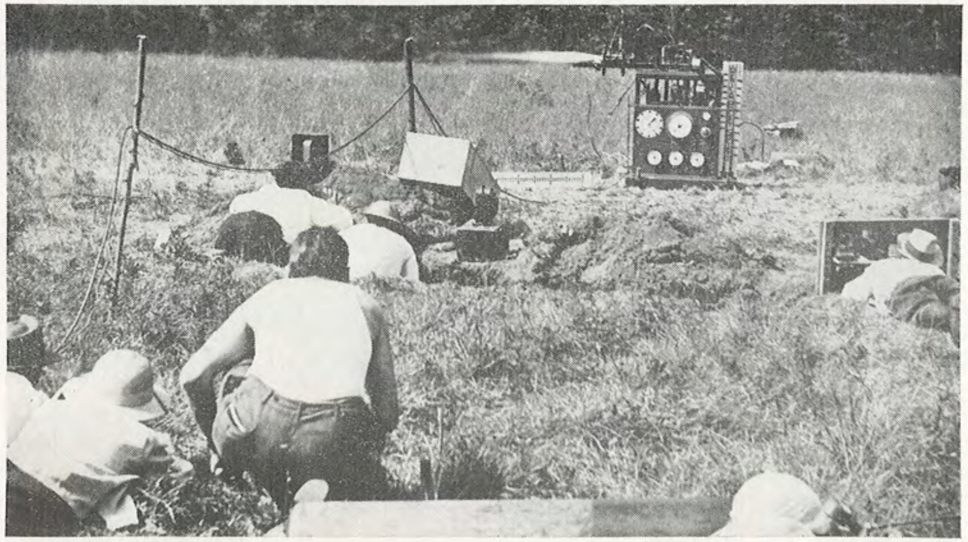
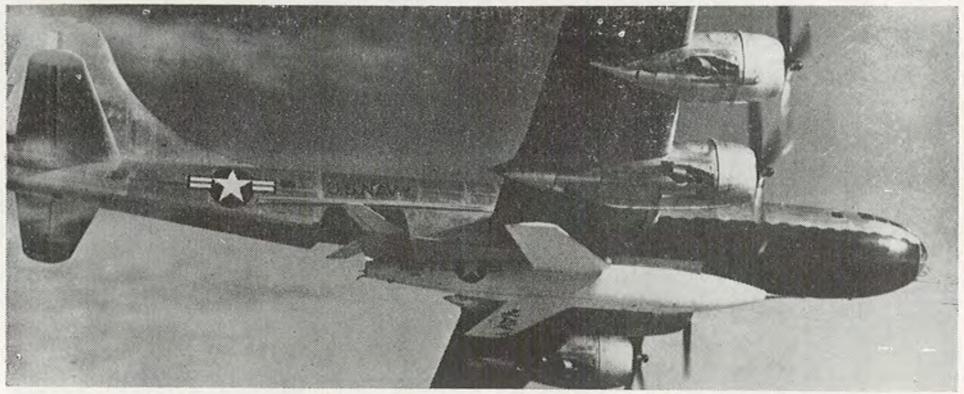


The Beginning: Members of the American Rocket Society conducting one of their "Sunday afternoon experiments" near Crestwood, N. Y., in the 1930's. From the shape of the rocket flame, the test was probably a success. (Photo courtesy Reaction Motors, Inc.)

The Result: The USAF Bell X-1, first airplane to fly faster than the speed of sound; powered by the famous RMI 6000C4 rocket engine, the direct descendant of the "Sunday experiments". — (Photo courtesy Reaction Motors, Inc.)



The First Rocket Ship Goes Aloft: The Douglas D-558 II "Skyrocket," the highest and fastest flying plane, nestled in the belly of the B-29 mother ship shortly before drop and ignition of the RMI 6000-series rocket engine with which it is powered.
(Photo courtesy Reaction Fotors, Inc.)

the USAF XF-91 supersonic fighter. In 1953, the in-flight refuelling method developed by Flight Refuelling, Inc.—"probe and drogue" type—was acquired. Other RMI products include radar antennas, turbojet compressor blades, landing gear components, special valves, and turbopumps.

The Mathieson Chemical Company, producers of such materials as hydrazine, caustic soda, bicarbonate of soda, sulphuric acid, anti-freeze, and pure anhydrous ammonia, acquired control of RMI in 1954 by purchasing 50% of the RMI stock. Both companies plan to derive mutual benefits from this, the major effect being a speed-up in RMI's expansion. A 3.5-million-dollar construction plan is now under way.

When you look back and consider that this all started in a basement shop and during Sunday afternoon experiments, there is no doubt that the achievements of RMI are indeed amazing. It is no mean trick to parlay a small business into a multimillion-dollar concern, nor is it easy to take drawing board ideas and develop them into production line items, particularly when the ideas are radically new, untried, and totally unprecedented.

The outlook in the years ahead is even brighter for RMI, and their attitude reflects this enthusiasm:

"The most stimulating of all scientific dreams is that of interplanetary travel—man's flight into space. Since the rocket engine is the only known device that can operate in the near-vacuum conditions found outside the earth's atmosphere, it seems certain to be the powerplant that will eventually make space travel feasible.

"Respected aviation spokesmen are now discussing on a basis of known facts the possibilities of both guided and piloted space vehicles powered by rocket engines. Definite satellite vehicle programs and two- and three-stage rocket projects are now receiving serious consideration by the Armed Forces in this and other countreis. Most authorities agree that only time, money, and technology now stand between man and his ultimate conquest of space." (From "Rocket Engines, Powerplants With a Future.")

When the first ship breaks free into orbit, never again to return, it is almost certain that RMI's knowledge, components, and ideas will be riding along with it.

(NEXT ISSUE: "Aerojet-General: From RATO's to Aerobees.")

Vergeltungswaffe Zwei!

By G. H. Stine

"GERMANY would never have built the V-2 had it not been for the Treaty of Versailles which did not allow the Germans to have heavy, long-range artillery."

So stated Konrad K. Dannenberg, power plant liaison engineer of Redstone Arsenal and formerly of Peenemunde, at the February 25th meeting of the New Mexico-West Texas Section. Mr. Dannenberg spoke on the early development of the V-2 (A-4) rocket at the rocket research center of Peenemunde, illustrating his talk with motion pictures, both color and black-and-white, of the early work.

The German War Office, he said, became interested in rockets as a possible replacement for the banned artillery in 1932. At that time there were in Germany a number of independent societies similar to the ARS which were conducting experiments, and after a survey of the state of the art at that time, the German Army — possibly urged on by General Dornberger—decided to invest in the research work of rocketry.

Much of the early work which preceeded the V-2 was carried on at the artillery proving ground near Kummersdorf south of Berlin. It was here that the missiles A-1 ("A" denoting "aggregate", or "missile"), A-2, and A-3 were developed. However, the Wehrmacht required more than a missile with a range of only a few miles and no payload.

It was after the base of Peenemunde was founded that the German rocket engineers proposed a missile with a range of 270 kilometers (about 170 miles) and a payload of one ton—

Konrad K. Dannenberg
(U. S. Army photo.)

a tremendous and almost fantastic missile at the time of the proposal in 1938. But funds were received, and work began.

The tremendous increase in size, thrust, and range required for the missile, dubbed the A-4, were so complex in their nature that a fifth missile in the series was actually built and flown first. The A-5 was a small versionsion of the A-4 and allowed the guidance system and carbon vanes to be perfected.

The first A-4 missile was a handmade job. Motor tests preceding this were carried out in a huge, mobile test stand which later held the entire missile. However, Dannenberg pointed

(next page, please . . .)

out that the first A-4 never flew; it found its end in the test stand. In order to clamp the missile into the stand without attaching the thrust mounts to the missile structure, a large steel corset was built. Unfortunately, the builders of this corset did not take into account the shrinkage of the missile components when the frigid liquid oxygen was pumped aboard. The first A-4 shrank, dropped out of the corset, and was a total wash-out.

The A-4's flew thereafter, however. The entire missile was assembled in a building which was over 100 feet high, allowing the missile to stand vertically. The Meillerwagen and other ground handling equipment was developed concurrently with the missile, and were used in transporting the early A-4's to the launching sites on the shores of the Baltic.

Dannenberg showed a short motion picture which was specifically made as a device to impress the Fuehrer. That this particular film was successful in convincing Hitler to grant high priorities to Peenemunde is now history. It is doubtful, Dannenberg remarked, that Hitler ever saw a V-2—with the exception that he might have seen one in the field.

Impressively evident in the motion pictures were the extreme ruggedness, flexibility, and maneuverability of the V-2's ground equipment—the Meillerwagen, the tanking vehicles, and the launching platform. "In two hours," Dannenberg told the group, "a trained field crew could set up, fuel and fire three rockets."

Peenemunde had its failures as well; a few of the more spectacular ones were shown in the last film presented, the first color film taken of V-2 rockets. Color film, Dannenberg said, proved much more effective in analyzing flame characteristics, cause of explosions, etc.

One color take-off shot particularly thrilled the audience. The V-2 rose from it's launcher—which was situated in a small, bowl-shaped depression—rolled, cocked over on its side, and flew horizontally under thrust to impact on the hardstands of the nearby Luftwaffe base. It was so familiar and realistic that a few of the audience who had had experience with the V-2's in this country practically dug foxholes in the tiled floor of the room!

Dannenberg was not connected with the mass-production facilities set up at Mittelwerk near Nordhausen, but he remarked that the assembly of the V-2 components, particularly the combustion chamber with its eighteen combustion "pots", was performed at Mittelwerk by Russian PW's with no technical experience other than a two-week training course.

By 1945, the propulsion and airframe problems of the V-2 had been fairly well solved, he went on. However, the problems of guidance and control were still giving them trouble. Accuracy of the V-2 was plus-or-minus one mile at 200 miles range; with another year's work, he said, that accuracy could have been improved to plus-or-minus one-half mile.

Reliability was good, almost 70% provided the missile were fired as ordered by General Dornberger: no longer than three days from the date of manufacture. A high percentage of missiles launched reached the target.

In concluding, Dannenberg recapitulated the progress of the Germans from 1932 until 1945, pointing out the tremendous strides that had been made in taking a mere idea and working it into the world's first large rocket.

"I believe that the time has come," he said, "to stop arguing about our ultimate goal, space flight, and start working with the hardware, even though great problems stand in our way. Right now, the answer seems to be a number of combustion chambers linked together to provide enough

thrust. Unsatisfactory as this may seem, remember that we built the V-2 from experience gained from smaller rockets; we could not get a large, 26-ton combustion chamber to work properly with an integral injector, so we clustered 18 of the 3000-lb. injectors which we knew would work, and produced the V-2 motor. The time has come to stop talking on paper and start working with hardware." ●

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This Ordnance scientific center is doing creative work in all fields of physical sciences and engineering. For example, aerodynamics, combustion theory, propulsion engineering and testing, electronic and guidance system development, etc.

All positions at this Proving Ground are Civil Service. All employees are on a 40-hour week with 8 paid holidays each year. Annual leave runs from 13 to 26 days a year, and 13 days of sick leave.

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Mathematicians
Meteorologist

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You are invited to contact

The Civilian Personnel Office At White Sands Proving Ground

New Mexico

for more detailed information

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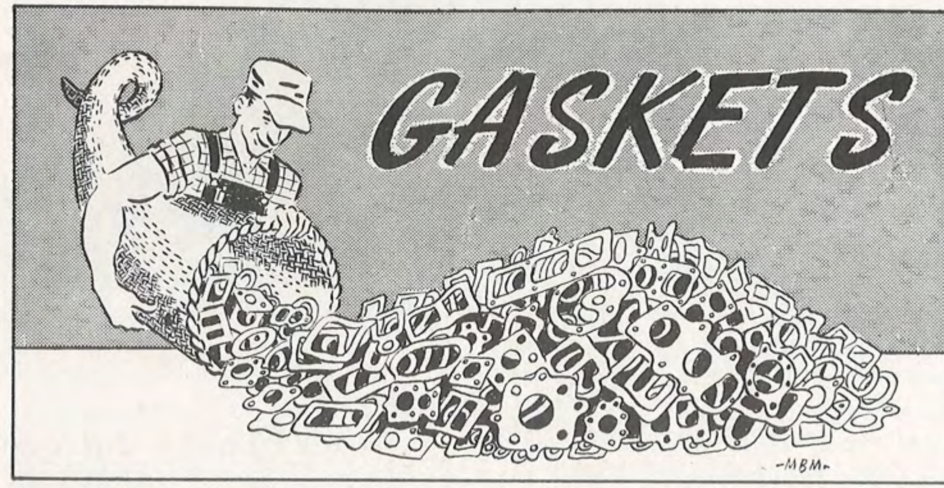

TO most of us a gasket is some sort of a packing gasket that keeps something from leaking. This is, to some extent, true. It would be nearer the truth were it said that gaskets were usually designed to exercise some degree of control over the rate of leakage. So what? Why should I be interested in gaskets?

Well, go back to your own arrival in this Gasketed Joint—which you call the World. You were one of the few items created in this world which comes less gaskets. But after that first slap on the back with which the Doctor started your compressor, one of the things which soon followed was a gasket installation, probably made by the neighborly old lady next door, who pinned it securely about your middle. The dear old soul had only a meager one or two initials to her name, but she knew just about what to expect in the way of flood control.

Then what about the apparatus on the suction side of your milk bottle. It did, of course, come off frequently during the ill-timed jerks with which you tried out your linkage system, conditioning it for the first experiment in self locomotion. And that was a bit annoying, eh what?

Sure—but a kindly Mother Nature realized that your budding research mind could scarcely cope with these situations, and by the end of the first year or so she had gradually rebuilt you into a non-condensing solid fuel intake model.

As you go on through life, you will not, for very long, get far away from gaskets. Your motor car, lawn hose, toothpaste tube, each has its quota, and your wife buys gaskets for her fruit jars.

Some will leak and some will not, but do not feel too critically concerned, for one way or the other, probably nothing serious will happen.

Remember that while commercial bakeries use over two square miles of sheet gasket material per day for the making of razzberry pie crust alone, no serious accidents have ever occurred.

You ask "What do they use for making gaskets?" Well, really you know, a gasket can be made from almost anything, and usually is. And don't worry about that either, because you will have lots of other things to think about as long as you live.

After that, you will be placed in a long narrow container. — Yes — it too will have a gasket, but if it leaks, you won't give a damn.

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Ten Chairs to serve Rocketeers

In The Heart Of The

ROCKET CAPITAL

Of The World!

Sam Zukerman's Barber Shop

THIS MAGAZINE IS SUPPORTED 100% BY ADVERTISING!

Misfires

ENGINEERED ENGLISH

Airframe: Ambiguous terminology. May mean either a frame constructed around a body of air, or a body of air surrounding something.

Alclad: Entirely clothed.

Artificial Aging: A phenomenon which occurs after approximatey seven hours association with the guided-missile field.

Astronomical: The boss' salary.

Base Metal: A term used by makers of aluminum products in referring to stainless steel, and vice-versa.

Brazier: A garment used to minimize the effects of flutter and vibration.

Bulkhead: A derogatory expression usually applied to persons of questionable intelligence.

Chief Engineer: A person totally devoid of all engineering knowledge who married the boss' daughter.

Fahrenheit: A system of measuring vertical distance above the earth's surface. One F a h r e n e q u a l s 0.53959 nautical miles.

Farad: A high official in the Egyptian government.

Fitting Factor: A process utilized in structural analysis whereby a factor is manipulated so as to fit a particular requirement.

German Silver: A type of silver containing any metal except silver.

Heterodyne Reception: A private gathering attended by a motley assortment of people.

Hydrogen: An alcoholic beverage consisting of water and gin.

Lightening Holes: The process of removing stuff from empty holes in order to restore the weight thereof.

Lock Washer: One who washes locks.

Mach Number: A quantity encountered in flight, one of which is enough.

Mating Jig: An animal husbandry accessory.

Maxwell's Theorem: States that coffee is "good to the last drop."

Microfarad: A small official in the Egyptian government.

Ohmeter: One who eats ohms.

Pylon: All aboard.

Race Rotation: Practised by totalitarian governments. Similar to crop rotation, but more fun.

Reynold's Number: Lackawanna 6-5972.

Stable Air: An atmosphere tinged with the odor of fertilizer.

Staff Engineer: The chief engineer's brother-in-law.

Stationary Front: The result of constructing an ideal truss around a set of characteristic curves.

Stress Analysis: The art of manipulating figures in such a way as to prove that a deficient structure is twice as strong as it is supposed to be.

Thermocouple: Newlyweds.

Trajectory. A sad event.

Uniform Load: The weight of one uniform.

Vacuum: A place with nothing in it.

Vacuum Pump: A pump used to pump nothing into a vacuum.

Vacuum Tube: A tube through which a vacuum pump pumps nothing into a vacuum.

Yield Point: To admit defeat.

Post-Shoot Conference

THE titanium loving cup goes to the Cleveland-Akron Section for having the guts to stand up and shout, in print no less, a straight-from-the-shoulder criticism of the national headquarters. We echo their sentiments: "What's wrong with those guys in New York? Don't they know how to run a Society?" Gentlemen, we are with you. **Illigitimi non carborundum.**

The Northeastern New York Section in Schenectady gave the December "Missile Away!" a fine write-up in their own bulletin, "The Impulse." In addition, they had a lot of nice things to say about the NM-WT Section. Thanks, friends, but let us give you credit for something, too: It was only after we saw "The Impulse" that we decided to pick a name for our bulletin.

Human interest note: Out in the desert at the blockhouse launching site of White Sands Proving Ground, the Douglas Aircraft boys who shoot the **NIKE** missiles had a bowl of goldfish sitting atop the firing console. When asked why the aquarium, they would answer, "It just reminds us that God invented a few things, too."

The Cleveland-Akron Section mentions in its bulletin that it is looking for a name for their publication. Gentlemen, here is our entry in the contest: "Rocket Trails," "Burn-out," or "The Injector." We might even suggest "The Cosmic Word." (Horrors!) Our compliments are also due to this Section for tipping us off on a new method of handling the awful job of addressing envelopes.

The bulletin of this Section comes once a month as regular as clockwork. It really takes work to do that; we **know!**

The manner in which correspondence in the form of publications is shuttling back and forth between Sections leads us to suggest this sort of thing be expanded. What is wrong with us sections passing letters back and forth discussing our various problems? Some of you guys 'way out yonder might certainly have some solutions to our problems, and vice-versa. At any rate, we'd like to get to know you better.

Invictus: Our heads are bloody, but unbowed. A total of six people worked and worked hard to get out this issue, some of them doing as many as three different jobs. And this in spite of our general and often-voiced pleadings for help and ideas. We believe in this magazine, and you indicated you did also by your vote of confidence in February. But "Missile Away!" cannot grow by itself. Certainly among the widespread and varied membership of the NM-WT Section there are people who are farsighted enough to recognize the potentialities of this magazine, and who could benefit both themselves and the Section by giving the editors a phone call. You don't have to be a William Allen White or a George Bernard Shaw. Surely you have two hours a month you could put in the pot.

You know, there are lots of opportunities; it isn't all drudgery.

What ever happened to the various aids to section activities that were discussed at the National Annual Meeting last December?

And what happened to the page in the **Journal** which used to be devoted to listing the sections and their officers?

If every member would recruit one more member for this Section, think what it would mean! We would have reached our goal: over 400 members by December 1954.

CONSTRUCTION PIONEERS

in

MISSILE FACILITIES

at

THE ROCKET CAPITAL OF THE WORLD

White Sands Proving Ground

* * * * *

ROBERT E. McKEE

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Temperature created by Ram Compression on the Skin Surface of an Airplane at Extreme Speeds

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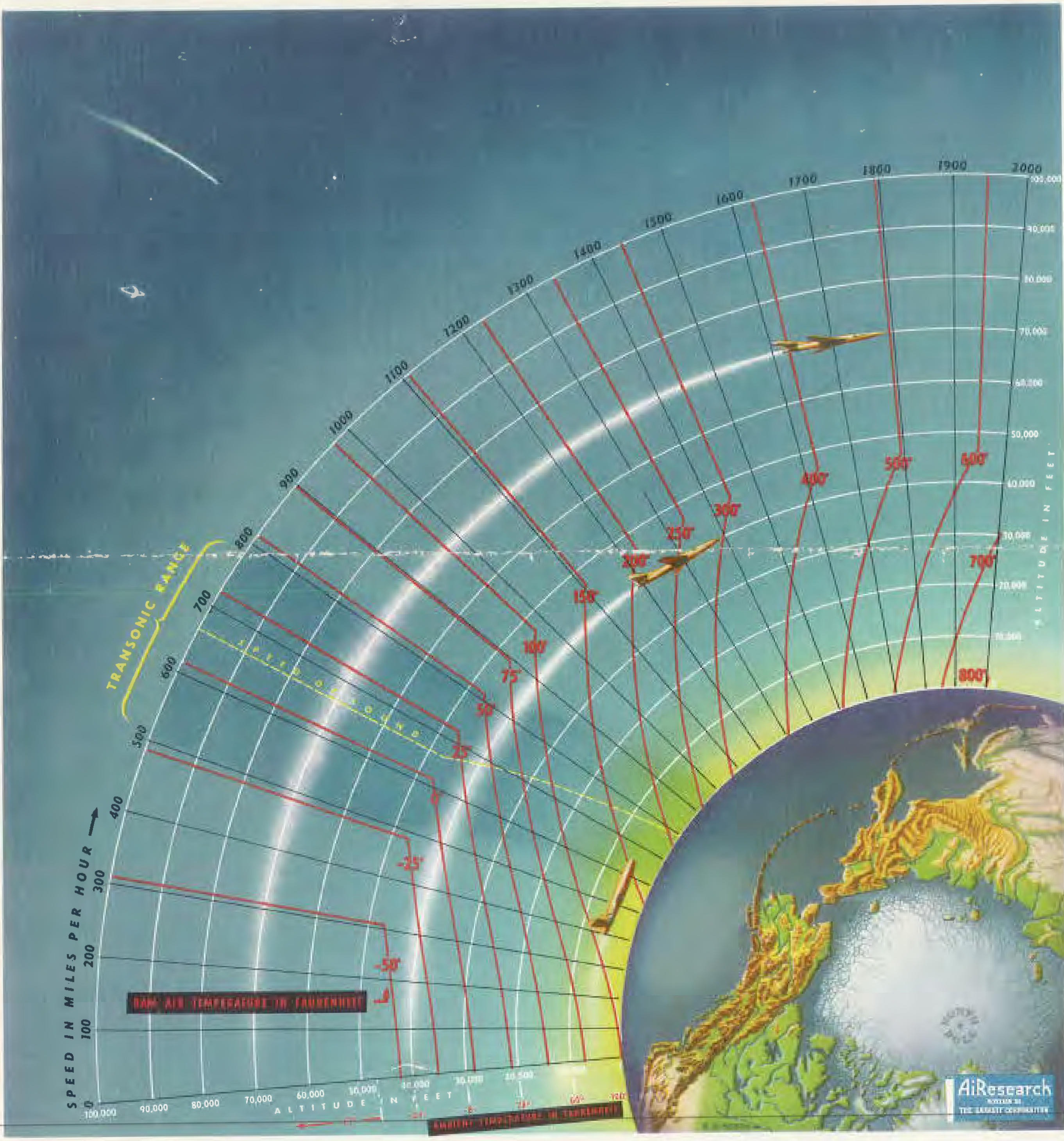

RED LINES — TEMPERATURE BLACK LINES — SPEED WHITE LINES — ALTITUDE

Red temperature curves on this Graph have been computed on the following basis: *The temperature at any altitude and speed is the sum of (1) the standard Army Summer Day temperature at that altitude, and (2) the ram temperature rise for the given speed. Ram temperature at any given point between the curves can be determined by this method. Ram temperature rise is found by subtracting ambient temperature from ram total temperature or by the following equation:*

$$\triangle T = \frac{V^2}{5650}$$

V is the true air speed in miles per hour.
$\triangle T$ is the temperature rise in degrees Fahr. due to ram.

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Supersonic Flight

RAM HEAT MAKES COCKPIT UNLIVABLE

The extreme temperature created by ram compression on the surface of the jet or rocket ship is one of the most critical problems being encountered as airplanes approach transonic and supersonic speeds. All air taken into the cockpit for the pilot to breathe is ducted from the leading surfaces (highest point of ram temperature). A high percentage of the heat of air friction is transferred through the airplane skin into the cabin. Initial ram air also picks up more heat before entering the cabin when compressed for cabin pressurization in the jet engine. Within the earth's atmosphere the faster the airplane goes the more unlivable conditions become for the pilot.

The Speed Temperature Graph plots ram compression temperature in relation to speed and altitude. Future high speed flight will be made at high altitude where the air offers less resistance, and where lower ambient temperature is a partially compensating factor.

HIGH RAM TEMPERATURE RECORDED BY SKYSTREAK

A ram compression temperature of approximately 165° F was recorded by the Douglas *Skystreak* during its record-breaking speed flight of 651 miles per hour, in August, 1947. Conditions were as indicated by the first airplane on the Graph, the flight being made at sea level on an Army Summer Day of 100° F. The flight was unpressurized, but a ram rise of 65° F, plus additional heat from electrical equipment and from sun radiation, raised the cabin temperature to approximately 180° F. The airplane's refrigeration system dropped cabin temperature to 100° F.

AIR EXPANSION TURBINE USED FOR CABIN REFRIGERATION

Livable cabin temperatures in today's high speed planes have been made possible by the air expansion cooling turbine. The AiResearch Manufacturing Company, manufacturers of turbine refrigeration systems used on the Navy-Douglas *Skystreak* and now in service on the majority of other high speed planes, developed the original equipment for the Air Force Lockheed F-80 and Republic F-84, America's first operational jets. Turbine refrigeration units weighing less than 16 pounds produce 4.2 tons of refrigeration. They drop the temperature of air passing through them over 600° F. By cooling the hot compressed air bled from the jet engine for cabin pressurization, the system supplies a constant source of cold air to the cabin.

RELATIVE FACTS

The speeds above the sonic range, at which the critical ram temperatures are encountered, will become possible only as fast as methods of airplane refrigeration are improved. While experiments by the University of California at Los Angeles showed that man can withstand a temperature of 250° F for several minutes, his mental and physical condition was far from that demanded of a pilot traveling at supersonic speed. Indicative of the problem is a ram air temperature of over 1500° F recorded at critical surfaces of the V-2 rocket and a ram air temperature of 5432° F created by the average meteor as it enters the earth's atmosphere traveling at a speed of 20 miles per second.