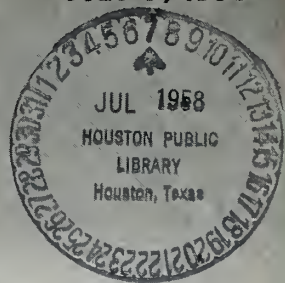


JULY 7, 1958




missiles and rockets

MAGAZINE OF WORLD ASTRONAUTICS

News and Business Edition

AN AMERICAN AVIATION PUBLICATION



A black and white photograph showing a hand holding a syringe. A single drop of fluid is suspended at the tip of the needle, about to fall into the eye of a person whose face is partially visible in the lower right. The background is dark and out of focus.

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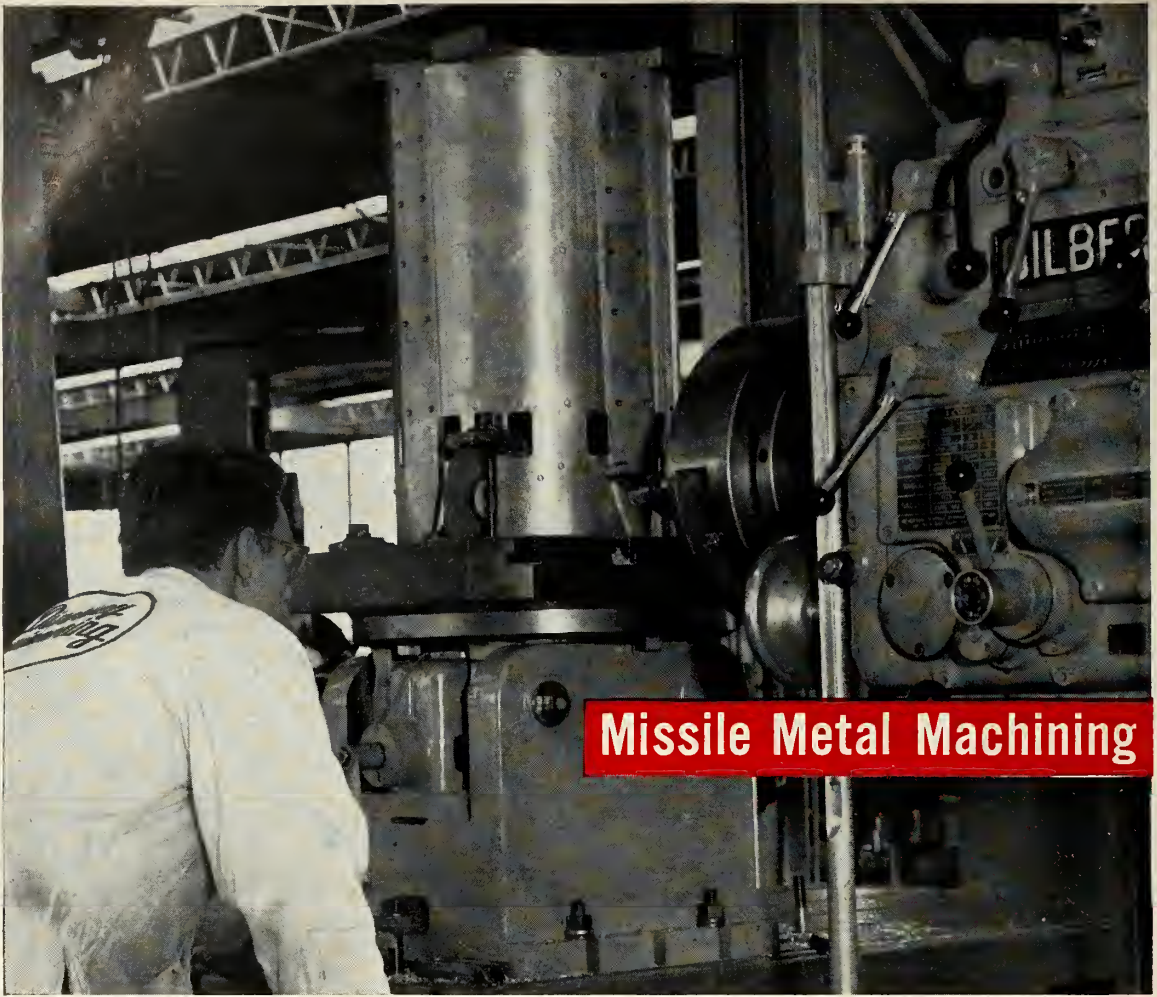


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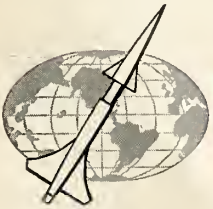
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missiles and rockets, July 7, 1958

editorial viewpoint . . .

Announcement by United Aircraft Corporation that it is creating two new missile divisions is good news.

United is the last of the great aviation industrial giants to take the plunge into the vast and growing field of astronautics.

In a dozen short years, every large aircraft firm in the country has thrown its resources and skills into the missile and space industries.

Immediately after World War II, two leading aircraft builders, North American and Convair, clearly saw the trend—rockets and missiles would inevitably supersede manned military aircraft for many purposes when these vehicles had passed through a few more speed and power cycles.

For five years after World War II, J. H. "Dutch" Kindelberger, for North American, and Tom Lanphier, Jr., for Convair, fought desperately for funds and programs to launch the missile era. But in those days, USAF had far more missions to perform than it had funds to work with. Only through the perseverance of the aircraft firms were the early missile projects kept alive.

As the early stages of astronautics attained recognition, when Korea forced the nation to re-appraise its defenses on a permanent basis, the aircraft industry, firm by firm, entered the missile field.

And now United Aircraft receives its "welcome aboard". Today, more than ever before, the missile industry needs the resources of facilities, mindpower and manpower—and in particular, the precision manufacturing skills—which United can contribute to expand the astronautics frontier and insure our survival as a free nation.

United will bring to the missile and space field the invaluable resources of more than 60,000 employees, some 12 million square feet of industrial space, and working capital in the hundreds of millions, all garnered through a quarter of a century of experience and contribution to aviation. It will continue heavily in aviation, of course, for the jet age is heavily dependent upon it, but we predict with confidence that United is destined to become a major factor also in the science of astronautics.

The cycle that began with North American and Convair is now virtually closed with the addition of United Aircraft. This is all to the good.

contents

news

| | |
|---|----|
| Soviets, U.S. Race for Moon . . | 9 |
| Killian Outlines Science Policy . | 11 |
| Missile Industry Meet | 11 |
| Thor Engine Reaches Production Tests | 23 |
| Army Plans Million Pound Thrust Stand | 26 |
| Labor Moves into Missile Field | 33 |
| Moss Attacks Snyder Censorship | 34 |
| Project Ammo Shows Missile Strength | 36 |

columns

| | |
|----------------------------------|----|
| The Missile Week | 7 |
| Propulsion Engineering | 18 |

The cover

The 150,000-lb thrust engine for the Thor IRBM is subjected to a hot firing at Test stand 1 on Rocketdyne Neosho's test facilities. Engines are currently being produced at Rocketdyne's nearby fabrication plant. Each engine is run for 15 to 30 seconds in a 'sample' qualification test before delivery to BMD (see engine test story pages 23-24).

departments

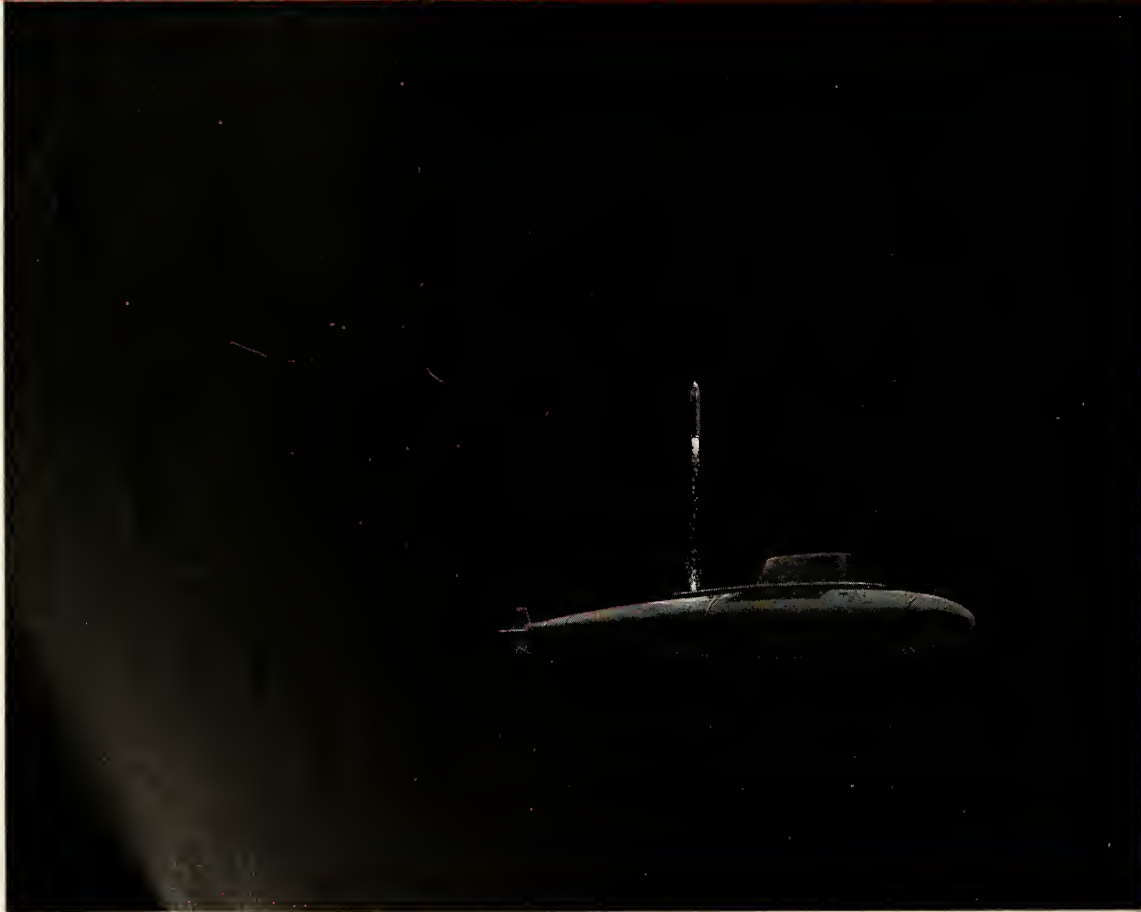
| | |
|------------------------------|----|
| Industry Report | 13 |
| Industry Countdown | 38 |



AEROJET for rocket power: the Navy's Polaris

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rocket engine developed and manufactured at our Solid Rocket Plant near Sacramento.



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missiles and rockets, July 7, 1951

An m/r staff report from WASHINGTON

- **The complete Fleet Ballistic Missile** submarine system should be in operation within 18 months, said Rear Admiral Rawson Bennett, Navy's chief of Research to the Senate Appropriations Committee hearings. Development and Production of both the submarines and the *Polaris* missiles are "in step". Bennett told the dollar-conscious lawmakers normal production cost of the *Polaris* will be about one half present costs.

- **Science fiction** reared its head (mechanical brain and all) and became reality this week when the Navy unveiled the first non-biological system capable of perceiving, recognizing and identifying its surroundings. The "Perceptron", as the system is called, closely parallels the "similarity" or recognition functions of the human mind. A conventional IBM 7C computer has been used to simulate the Perceptron system. The system, developed at the Cornell Aeronautical Laboratory, Inc., Buffalo, under contract for the Office of Naval Research, is seen to have numerous applications in aeronautical and space operations. Navy scientists say it is within the reach of the Perceptron to read print and script, and even respond to verbal commands.

- **According to ARPA**, Project Wizard is out of the picture as an anti-missile-missile system. The last \$3 million budget allocation was for BMEWA (Ballistic Missile Early Warning System), mainly for long range radar missile detection system. This gives added impetus to the *Nike-Zeus* development team, which is coordinating its investigations with the ICBM and IRBM flight tests program at Cape Canaveral.

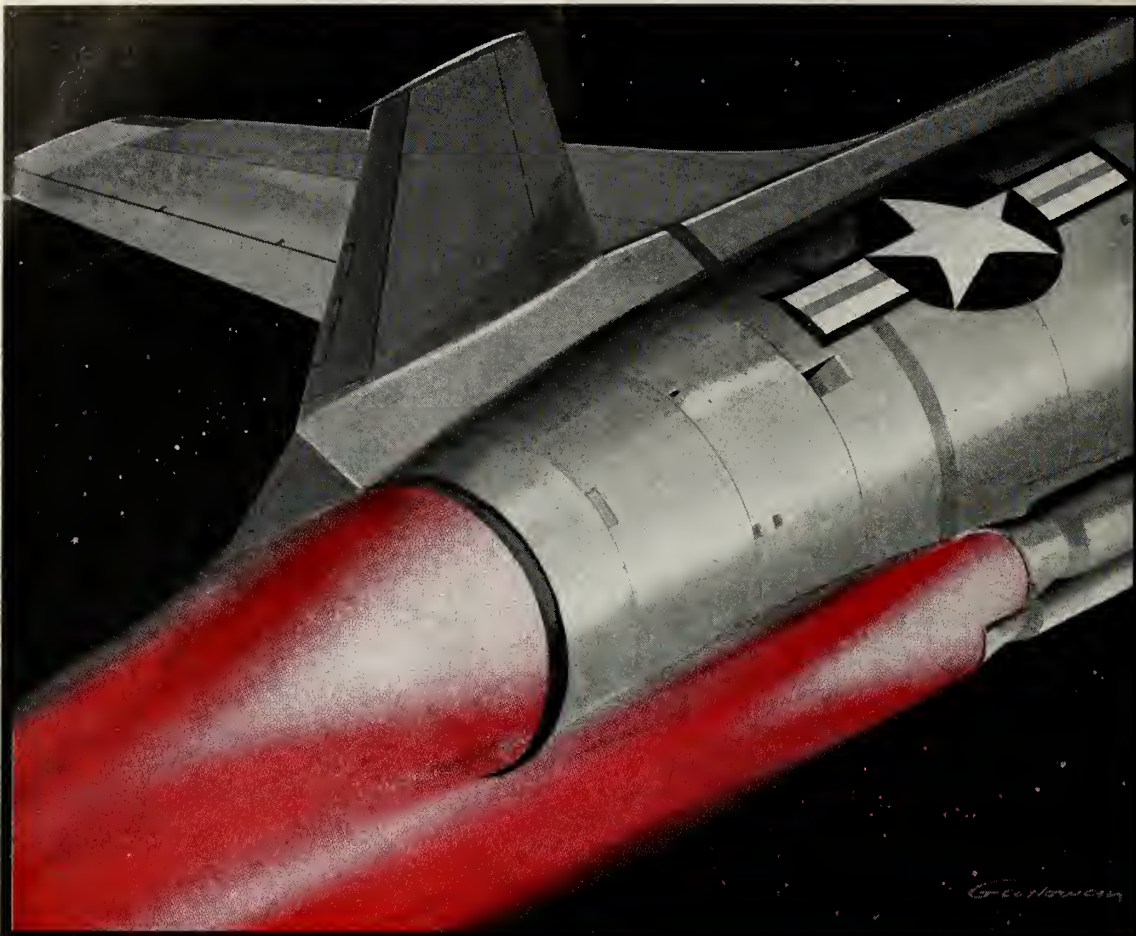
- **Senate and House conferees** can be expected within days to work out a mutual settlement on legislation which will create the new National Aeronautics and Space Administration/Agency. Neither committee has an axe to grind. The House position is that members want a strong leadership, with the director having almost complete authority and control. The Senate, on the other hand, is more inclined toward policy and advisory boards which would limit the NASA director. It can be expected that a "middle ground" will be reached, and legislation should be on the President's desk before mid-July.

- **There's not too much** name tossing for the new director of NASA except that of Dr. Hugh Dryden, present NACA director, and by all evidence, the leading contender. As one legislator put it: "we would like to have a man with Admiral Rickover's drive, Dr. James Kilian's scientific background, and Admiral John Hayward's clearness of vision. At this time, it looks like Dr. Dryden has some of the characteristics of all three."

- **Speaking of names**, you can put your money on one of three well-qualified men who have been suggested to become head of NASA's new Space Technology Division, under Dr. Dryden. They are: Dr. William H. Pickering of JPL; Dr. James A. Van Allen of the University of Iowa, and Dr. H. Guyford Stever of MIT, present chairman of NACA's Special Committee on Space Technology.

- **The President's reorganization** plans for the military received a major setback—at least in Congress—when DOD Secretary McElroy told newsmen at Quantico he was "disappointed" in Admiral Burke's testimony in opposition to some of the recommendations. He didn't mean it the way it was interpreted. Being relatively new to the Washington scene, the Secretary was saying exactly what he did mean. He was simply disappointed. In any case, he should have the sympathy of his predecessor who frequently suffered galloping attacks of the same ailment.

- **Postscript:** though new to the Washington scene, Mr. McElroy is learning fast about other facets of Capitol thinking. In reference to a question on what he expected the Senate to come up with in the way of a reorganization bill, he said he expects a better bill than the House provided. How so? "Well, I just think sometimes what you hear isn't necessarily entirely what they (the Senators) think." Sound reasoning, Mr. McElroy.



HOT PARTS FOR SPACE-AGE SPEEDS

Heat is the greatest single barrier blocking higher speeds for America's air and space craft. Not only the heat of air-friction, but the withering heat that seethes *inside* the mighty engines of the space age. Before our manned and unmanned aircraft can fly faster — in the atmosphere or out of it — power plants must be built whose components function with precision even in this metal-murdering heat.

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Ryan Aeronautical Company, San Diego, Calif.

ARPA Pushes Moon Try; Reds May Win

Red Moon Program in High Gear, Report Says; Army Gets Approval for Third Lunar Probe?

by Erik Bergaust

The U.S. Army and Air Force have been told to launch their lunar probes "as soon as possible." The Army has just been given the go-ahead for a third probe—according to a top Pentagon official—although Army officials, including Secretary Wilbur Brucker, claim they know nothing about it. Originally, the Air Force was to launch three, and the Army one or two moon rockets.

Unlike the satellite launching attempts, either service may go first when it is ready. The Army can be expected to launch its first probe around July 30, with the Air Force probably making the attempt about August 25. The trip will take 4½ days, and payloads will vary from 25 pounds, with an ultimate payload of 100 pounds expected.

However, the first Soviet lunar vehicle is being readied at a launching site near the Caspian Sea, probably the same site that the Russians use for launching their *Sputniks*. Reports from several of m/r's reliable European sources indicate Russia's moon program is in high gear, and that the West soon will be "stunned by a most remarkable, outstanding space flight achievement."

• **Mechanics**—Army will use *Juno II's (Jupiters)* with a cluster of three *Sergeants* for the second stage, and a single *Sergeant* for the final stage.

AF will use *Thor*, with second stage *Vanguard* and a solid-propellant third stage, probably being supplied by Al-legheny Ballistics Laboratory.

All probes will employ radar and radio tracking equipment, and will not be tracked optically. There will be experiments in escape velocity, and research in retro rockets for soft-landing in a later program.

Officials claim the U.S. is not trying to hit the moon for any world psychological reasons. The Defense Department will not make any advance release of firing dates to forestall bad publicity at home and abroad in case of failure.

One of the planned Army probes

will contain approximately 60 pounds of heavy cosmic ray detection equipment. One or more AF probes will contain what amounts to a mechanical TV system for scanning the moon's surface. This scanner is being developed by the Naval Ordnance Test Station at In-yokern, California. (Some \$200,000 has been authorized for the scanner). It is hoped that the device will give a first look at the other side of the moon.

One Army probe, and it probably will not be the first one, will contain one of the Land-type cameras which actually take a photograph that will be transmitted back to earth by electrical means. Another probe will determine its own location in space, and this could turn out to be a crude experiment for subsequent navigation in space.

Lunar probe payloads will also contain magnetometers for measuring the extent of the earth's magnetic field. They will also determine if the moon has a magnetic field, and what its measurements are. Nobody knows whether the moon has a magnetic field.



THE MOON—who gets there first? Air Force, Army—or Russians?

According to Dr. Herbert York, chief scientist, ARPA, "finding out whether or not the moon has a magnetic field and how large it is should help in determining why the earth has a magnetic field."

• **Funds for U.S. work**—Lunar probes are part of \$72 million requested by ARPA in its fiscal year 1959 budget under the heading of "Other advanced research." It is estimated that the six probes will cost in the neighborhood of \$60 million.

The Army and Caltech's Jet Propulsion Laboratory will receive \$25 million of this for their lunar probe work. Fiscal 1958 funds authorized \$11 million for *Jupiter C* probes and two or possibly three earth satellite launchings. Air Force was authorized \$10 million for the *Thor-Vanguard (Thor-Able)* probes.

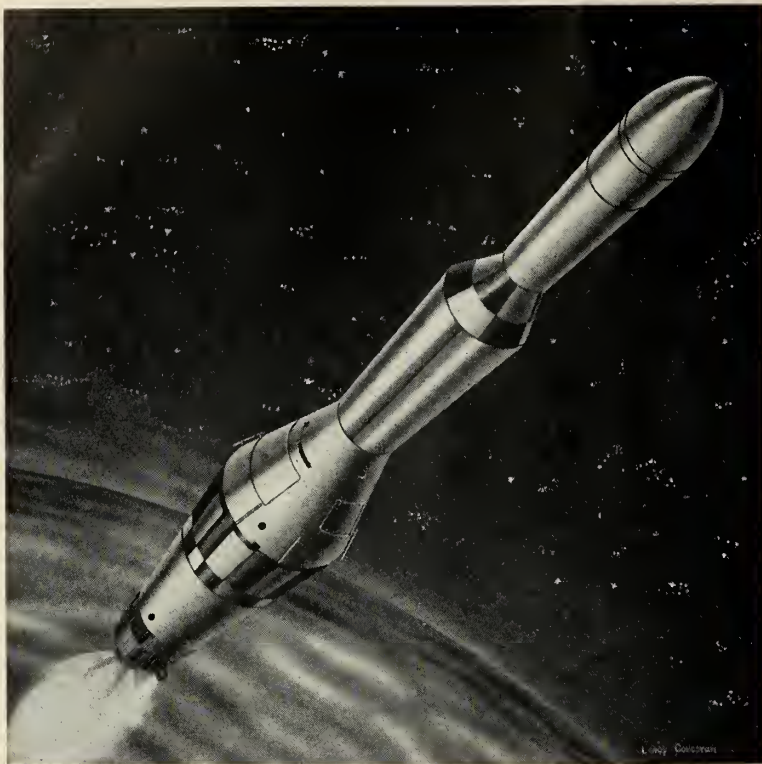
Of interest is that ARPA's method of circumventing the Pentagon's chain-of-command resulted in ABMA's Maj. Gen. John B. Medaris and AFBM's Maj. Gen. Bernard A. Schriever getting the go-ahead on the lunar projects in the phenomenal time of 12 days.

• **Target chances**—According to Dr. York, the chances of hitting the moon are about 25%, "even if we tried to." Chance of orbiting the moon is about another 50%, and the chance of missing entirely is about 25%. All percentages were given with the stipulation that there would be no rocket malfunctions.

If the probe is aimed to intercept the moon, and emerges from the earth's atmosphere at about 25,000 mph and then burns out, it will slow down gradually until about nine-tenths of the way to the moon.

Then, barely creeping forward, it will drift across the boundary line into the region where the gravity of the moon dominates. Accelerating slowly to 7,200 MPH, it will crash into the moon. If the rocket misses the moon by more than 2,000 miles, it may be accelerated past escape velocity by the moon's gravity, and not held in orbit. In that event, it would be carried off into space, or boomerang back toward the earth.

Lunar probes now under ARPA will be transferred to the proposed Na-



FIRST MOON PROBE? Army Jupiter with Sergeant second and third stages.

tional Aeronautics & Space Agency at a later date.

The optimum time for launching a rocket to the moon depends upon the type of experiment that is being conducted.

If a shot is attempted during the months of July and August, the most advantageous time would be during the new moon—July 30 and August 29. More specifically, if the shot is designed to scan either the near or far side of the moon, the shot should be timed so that the firing would take place just before the new moon and arrive in the vicinity of the moon shortly after.

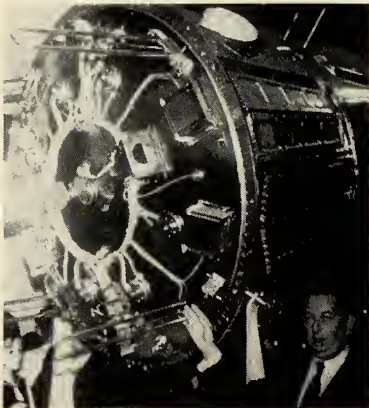
In this way, the moon would not be completely dark on the out-going journey and a continuous fix could be made of the missile's position. When going around the moon, pictures could be taken of the far side in a condition of near 100% sunlight.

If the shot were made at the exact time of the new moon, there might be interference with radio emissions from the sun (sun-earth-moon will be in line during this time).

• **Russian plans**—One American space flight expert, Andrew G. Haley, who returned from the Soviet last week after having spent several days with the Soviet Astronautics Commission's

members in Moscow and Leningrad, told m/r in an exclusive interview that the Red moon probe program appears to be progressing rapidly.

Last year, the Russians surprised the world by launching their first *Sput-*



IAF PRESIDENT Andrew G. Haley with full scale model of Sputnik III in Moscow.

nik during the International Astronautical Federation's congress in Barcelona. Some experts feel the communist government might copy this psychological approach this year and launch its first moon rocket just before this year's IAF meeting is held in Am-

sterdam, Holland, on August 25-30.

In m/r's report from the IAF congress, (Nov. 1957, p. 37) an interview with Russian Academician Leonid I. Sedov revealed that the Reds have the same approach as had been suggested in the U.S. for conquest of the moon. First, they intend to launch small impact probes or vehicles that will circumnavigate the satellite. Some vehicles will be equipped to take pictures of the moon's unseen side. Later, the Reds will attempt soft landings.

A successful lunar shoot is considered by many to be a greater feat—from a psychological viewpoint—than the launching of satellites. "For this reason," an ARPA official told m/r, "it must be assumed that the Russians will try to beat us. And they have the qualifications to do it."

Reds Illustrate Manned Version of Sputnik III

An artist's sketch in an east European newspaper is being closely examined in the west as a possible clue to Soviet plans for future manned satellites.

The sketch, appearing in the Bucharest newspaper *ROMANIA LIBERA*, shows a rocket nose cone based on the dimensions of *Sputnik III* and carrying a man. The dispatch accompanying the sketch was from the Soviet news agency TASS, but the source of the sketch itself is not specifically identified.

The occupant of the satellite illustrated is shown encased in what appears to be a pressure suit equipped with a bubble helmet and seated in a semi-reclining position on an acceleration couch. There was no elaboration on the details of the illustration.

ARPA Authorizes Space-Radio Antenna

Advanced Research Projects Agency has authorized U.S. Army Ordnance Missile Command to construct a radio antenna capable of maintaining communications with space vehicles. This ground equipment will be used in later lunar probes by the Air Force and Army.

The 85-foot antenna—similar to radio telescopes used to find and track radio stars—will be built by Cal Tech's Jet Propulsion Laboratory, and is expected to be in operation by the end of this year. The multi-million dollar antenna will be located at the Goldstone Test Station in the southwest corner of Camp Irwin, Calif.

The site was chosen because it offers extremely low background noise levels. Principal contractors will be the Blaw-Know Co.; Collins Radio Co., and the Rucker Co.

missiles and rockets, July 7, 1958

Killian Outlines Science Policy

A national science policy, which he said would help keep the U.S. strong militarily and economically, has been outlined by Dr. James R. Killian, Jr., chairman of the President's Advisory Committee on Science.

Commenting that his program would also contribute to U.S. intellectual and spiritual vigor, Dr. Killian was principal speaker last week at the opening of Texas Instruments, Inc. new \$5 million semi-conductor plant at Dallas.

The program, said Killian, should consist of:

1—"Adaption, as recommended by the President, of the organization and management of our military research and development to keep pace with changes in military technology.

2—"Achievement of a greater emphasis on the qualitative aspects of our national research efforts.

3—"Proclaim the importance of maintaining and increasing research and development in a time of recession, such as we now experience."

In connection with opening the new plant, Texas Instruments held an Industrial and Technology Day. The program was designed as a salute and tribute to the semi-conductor industry, in connection with the 10-year anniversary of the invention of the transistor.

Speakers included Brig. Gen. Earl Cook, chief of research and development, United States Army Signal Corps; Mark Shepherd, junior vice president, Semi-Conductor Components Division, Texas Instruments Inc.; Donald G. Fink, president, Institute of Radio Engineers; Wallace W. McDowell, vice president, IBM; J. A. Morton, director of Device Development, Bell Telephone Laboratories, Inc.; and Dr. Gordon K. Teal, assistant vice president, Central Research Laboratory, Texas Instruments, Inc.

The keynote address was given by M. J. Kelly, president of Bell Laboratories, Inc., where the first transistor was developed in 1948. In his speech, Mr. Kelly pointed out that transistors and diodes are now produced for a wide range of electronic applications.

"It is estimated that in 1957, there were some 30-million transistors and 60-million closely related semi-conductor diodes manufactured in the U.S.," said Kelly. "The dollar sales volume of these 90-million semi-conductor units was well in excess of \$100-million. Some 600 transistor and 1,300 diode types had been standardized and received industry codes in 1957.

"It is predicted that the combined sales of transistors and diodes will reach a dollar volume in excess of \$500-million by 1965. It is also expected that

in 1965, the dollar volume of transistor and semi-conductor diode sales will be greater than that of the older electronic tubes.

"By 1975, transistor and diodes will serve perhaps 90% of the active electronic device applications, while the electron tube will still serve 10%.

Missile Industry Meeting Draws 600 to Sessions

Though the argument may still rage in some quarters as to whether there is a missile industry, there is no doubt of the fact that there is a missile market.

If there was any one conclusion to be drawn from the First National Missile Industry Conference, this is it.

Sponsored jointly by the National Rocket Club of Washington and the National Capital Section of the American Rocket Society, the first NMIC was held at the Mayflower Hotel, Washington, D.C., in June.

The first national meeting of its kind, it emphasized the business aspects of missiles and astronautics.

• **Awards made**—Highlight of the three-day meeting was the Dr. Robert H. Goddard Memorial Dinner, where two awards were presented—The Borg-Warner Industry Award and the Dr. Robert H. Goddard Memorial Trophy.

Weekly Publication of m/r Begins

With this issue, MISSILES AND ROCKETS magazine begins a new page of its brief, but spectacular role as a major force in the creation of, and service to, the dynamic new missiles industry.

As a weekly publication, the magazine will now be placed in the hands of its subscribers every week, carrying a Monday dateline. The weekly issues will alternate between News and Business Editions (such as the current one), and larger Engineering issues, of which the July 14 issue will be the first.

The News and Business editions will contain latest news of the industry, plus regular weekly features such as the contract reports that appear on page 13 of this issue. The Engineering issues will contain news pages, contract reports, the regular editorial page, and a full complement of engineering features, picture stories, columns and the like.

The move from a monthly to a weekly frequency of publication is, of course, dictated by the fast-

The Borg-Warner award went to the Missile Systems Division of the Lockheed Aircraft Corporation for its work on *Polaris* during the calendar year 1957. The Goddard trophy, presented by American Aviation Publications, Inc., went to Dr. Wernher von Braun, director of Development Operations Division, Army Ballistic Missile Agency, for his work on *Jupiter* and *Jupiter-C*. Both awards are to be presented annually.

All-told, over 600 representatives of government, industry and the press registered for the conference.

• **Panel sessions**—The first panel session discussed Contracting and Negotiation.

The panel on Government roles and responsibilities concentrated heavily on the proposed National Aeronautical and Space Administration.

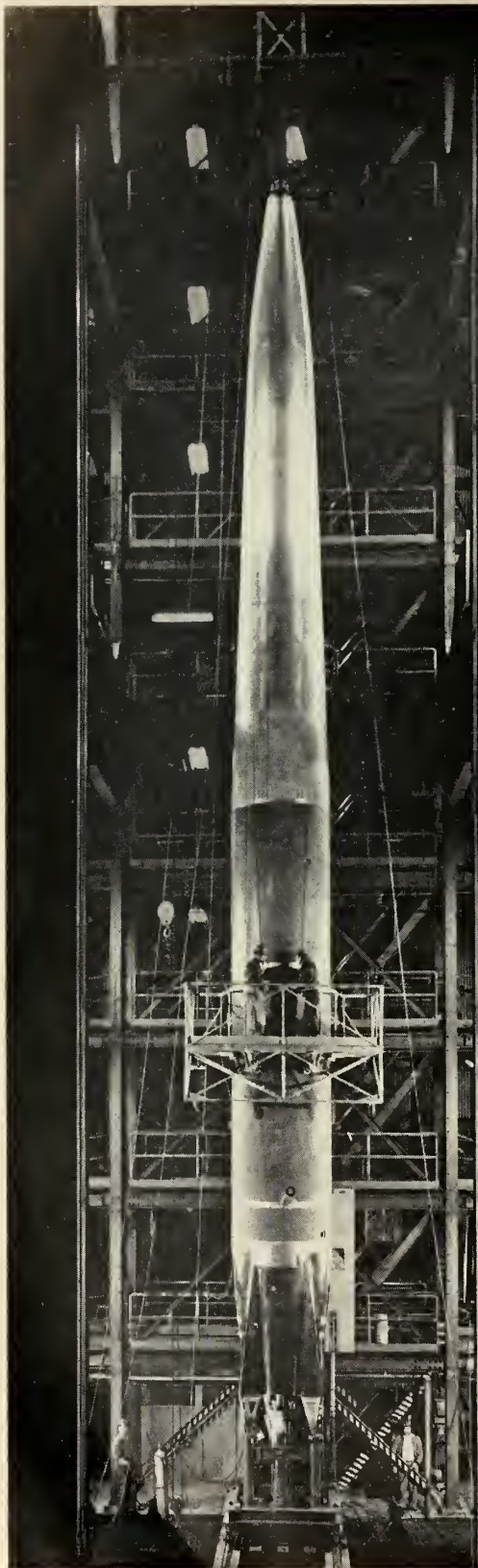
The panel on Research and Development discussed the balance between privately financed and government financed R & D and other subjects in the field.

The Commercial Markets Panel agreed that there would someday be a commercial market for the missiles, rockets and space flight knowhow, but that military proficiencies had to be developed first.

The final panel, Business Forecasting, reviewed the relative positions and roles of ARPA, NASA and the three military services.

moving industry which the magazine serves. With new concepts being proposed almost every moment, with major changes in design and materials causing a missile to become obsolete before it has reached the production stage, with business policies of the government changing overnight, with new legislation vitally affecting the industry, a weekly news and engineering magazine devoted entirely to the industry is a vital need.

In preparation for the transition, the magazine's staff has been nearly tripled. It now employs 11 full-time editors, who are backed by six contributing editors, an eight-member advisory board, news bureaus in Los Angeles and Geneva, Switzerland, 10 news correspondents located in strategic areas of the U.S., and the full leased-wire news service of United Press International Washington News Service. In addition, the full news-gathering facilities of the 15 other American Aviation publications are available to m/r.



No other missile test lab can do all the things we can do

Take our 100-foot test tower. With it we can simulate the pressure and aerodynamic loadings that occur during the actual launching and flight of a missile.

This is just one of the many specialized facilities and tools that we have built up in the last ten years. During this decade—because of our complete responsibility for the development of a major weapon system—we have also piled up a wealth of experience in many related fields.

The upshot of this is that we can handle any project from far-out basic research to static and dynamic testing of complete airframes.

For example, we can simulate aerodynamic heating and loading at the same time...on a complete wing or a large section of fuselage. We're old hands at applying heat gradients from leading to trailing edge and spanwise. And we are equipped to compute temperature differentials, and to predict specific area temperatures.

We're completely qualified to work with any kind of metals or nonmetals; materials and processes; electrical, hydraulic and pneumatic components and systems; structures; reliability; environmental testing (including re-entry); and instrumentation.

Now we'd like to solve your problems. The tougher the better.

Please write to E. R. Schenkel, Missile Division Test Lab Manager, North American Aviation, 12214 Lakewood Blvd., Downey, Calif.

MISSILE DEVELOPMENT DIVISION

North American Aviation, Inc.





missile business

by Seabrook Hull

A "Middle-Size-Business Protective Association" has seriously been suggested as a means of combating the privileges, perquisites, and political influence of both small and really big business in the missile field. Point is—and it seems valid—that between the sheer weight of size and employment, on the one hand, and political sympathy on the other, the middle-size company in the missile business faces an unfair competitive situation . . . and is just now beginning to realize it.

A number of these companies are beginning to have the feeling that they have lost important contracts not so much because they were on the wrong technological track or because they were bidding high, but because they were neither big influential business nor small politically protected business. No conclusions this time around, but it's worth considering.

And now a word to you who are getting frustrated with your efforts to become established in the missile business. This comment comes from the recent Connecticut Missile Sales Conference at Hartford, "We don't need new contractors as much as we need better contractors." Read and note the word "better."

New sciences are always needed in the missiles, rockets and space flight business, but the basic, really important requirement is for better methods of production—how to meet an operational requirement in the most reliable manner at the lowest possible price.

For example, there is a company that has made a solid rocket motor casing with a burst strength of 293,000 psi. Another company is designing and constructing a rocket nozzle made of molded plastic, with an electro-plated chrome finish to resist high-temperature, high-velocity erosion. These may replace current methods.

Advanced Research Projects Agency has an idea which may not be so bad after all. However, ARPA has a problem: how to implement it. ARPA's idea is that very often small companies can solve specific problems in the missile and space flight field with much greater speed, with greater expediency and at less cost than large, massive administrative complexes.

This, in fact, has been demonstrated on more than one occasion—for example, the Army's IRBM *Jupiter* reentry nose cone problem, which was solved for less than 1% of the money the Air Force has expended on a similar problem. Not only that, but the AF contractors on the reentry nose cone problem are finally turning to what amounts to Army's solution.

Getting back to ARPA and its problems, the question is: How can ARPA get word to those companies that may be able to do the job?

contract awards

NAVY

By Navy Dept., Bureau of Ships:

Westinghouse Electric Corp. received \$17,905,000 for reactor compartment components.

International Business Machine Corp. received \$4,163,856 for high speed general purpose digital computer.

Daystrom Systems, Div. of Daystrom, Inc., received \$60,573 for working bread-board model of a digital integrating and data processing system.

Computer Control Co., Inc. received \$38,871 for the design, development, testing and furnishing of two developmental models of electronic counter system.

General Dynamics Corp. received \$710,154 for design and engineering studies of reactor plant.

M. H. Treadwell Co., Inc. received \$260,193 for investigation to prove the feasibility of reducing the height of an electrolytic oxygen generator.

Beckman Instruments, Inc. received \$251,270 for atmosphere analyzer MK III. United States Testing Co., Inc. received \$400,000 for testing electronic components and undertaking various studies.

Westinghouse Electric Corp. received \$11,090,000 for the design and furnishing of reactor compartment components.

Raytheon Mfg. Co. Research Div. received \$182,280 for investigating design and fabricating spaciator.

Cannon Electric Co. received \$74,799 for design and development of a special missile miniature high temperature multi-contact connector.

By Navy Dept., Bureau of Ordnance:

Talco Engineering Co. received \$108,600 for 120-person ejection rocket catapults.

University of Virginia received \$30,600 for research studies in applying laboratory techniques to study problems in high speed gas dynamics.

Universal Match Corp., Armament Div., received \$75,000 for engineering services in connection with maintenance, overhaul, alteration and solving of industrial processes of missile launchers.

By Bureau of Aeronautics:

Bell and Howell Co. received \$61,550 for camera missile scoring, high speed, 16 mm in accordance with specifications.

Bell Aircraft Corp. received \$41,728 for development and publication of a manual for computation of aerodynamic heating effective of high speed aircraft.

American Optical Co. received \$63,825 for research of prototype full pressure suit assembly consisting of helmet, neck ring, neck section and tie down system.

Mine Safety Appliances Co. received \$92,241 for research of prototype full pressure suit helmet assembly.

Loral Electronics Corp. received \$142,280 for developmental models of ground track plotter.

By Dept. of the Navy, Office of Naval Research:

University of California received \$35,000 for research in digital components and systems.

Dunlap and Associates, Inc. received \$25,168 for research and survey of operational environment factors which effect crew efficiency in Polaris weapons systems.

Polytechnic Institute of Brooklyn received \$42,180 for research to investigate electron transfer process.

University of Chicago received \$74,576 for fundamental investigations of the thermodynamic transport and structural properties of both solid and liquid metallic solutions.

University of Oklahoma Research Institute received \$25,854 for research on grain boundary diffusion.

California Institute of Technology received \$35,000 for research on the fundamental aspects of materials pertaining to nuclear engineering.

Leland Stanford, Jr. University received \$30,000 for theoretical and experimental research in the area of self-adaptive control



Maj. Gen. B. A. Schriever and RAF Air Chief H. Broadhurst examine model.

Thor To Be Operational In England by End of '58

The *Thor* and its tactical ground support equipment will be operational in the United Kingdom by the end of this year, according to the Air Force Ballistic Missile Division.

Air Chief Marshal Sir Harry Broadhurst, Commander-in-Chief of the RAF Bomber Command, recently visited the Air Force Ballistic Missile Division for a detailed briefing on the status of the *Thor*. The IRBM's will be assigned to elements of Air Marshal Broadhurst's Bomber Command.

The briefing was conducted by Maj. Gen. Bernard A. Schriever, Commander of AFBMD.



GRASSHOPPER—Reaction Motors Division of Thiokol Chemical Co. has come up with this rocket-powered jump belt which will enable soldiers to leap distances up to 20 ft. carrying equipment to 30% of their own weight.

. . . industry report

systems.

Lowell Observatory received \$36,800 for research on three-color photometry of galactic clusters.

University of Michigan received \$40,000 for research of acoustics of structures. Northwestern University received \$40,000 for research on structures and properties of solid solutions.

Wayne State University received \$40,000 for research in automatic mechanical translation.

Indiana University received \$30,780 for research on the mechanism of hydrogen transfer in biological energy-yielding reactions.

ARMY

By San Francisco Ordnance District:

Aerojet-General Corp. received \$65,420 for ST-90 test vehicles rocket engine, igniter.

Stanford Research Institute received \$54,525 for standard analytic methods for cost, and to schedule budget control over missile system programs; \$25,000 to study aspects of radiating antenna systems research; \$99,989 for propagation studies (guided missiles & related equipment). University of California received \$25,480 for fundamental investigation of surface ablation during convection heating research.

Ampex Corp. received \$150,880 for recorder reproducer system.

Food Machinery & Chemical Corp. received \$140,000 for design of prototype and pilots of chassis for Vigilante "B" program.

By New York Ordnance District:

Acoustica Associates, Inc. received \$27,855 for control unit #CU-ICA and probe assembly, liquid level sensor #AT-26.

Air Reduction Co., of Air Reduction Co., Inc. received \$82,650 for developing circumferential welding fixture for *Jupiter* missile center sections.

Block Instrument Corp. received \$35,000 for Phase I feasibility study leading to design of T35 ballistic computer.

Western Electric Co., Inc. received \$511,240 for production engineering services for the preparation of miscellaneous ordnance documentation for the *Nike-Hercules* guided missile system.

Peat, Marwick, Mitchell & Co. received \$63,227 for study of the present accounting system at ABMA, and design of a complete budgeting, funding and accounting system on an accrual basis.

Federal Telecommunication Labs, Div. of International Telephone & Telegraph Corp., received \$49,376 for study of high resolution radar.

Ford Instrument Co. received \$398,802 for design and development of inertial devices.

Air Reduction Sales Co. received \$71,857 for development and fabrication of circumferential welding fixture for *Jupiter* missile center sections.

Bulova Research & Development Laboratories, Inc. received \$91,073 for accelerometer monitors for *Jupiter* guidance system.

By Pittsburgh Ordnance District:

National Electric Products Corp. received \$93,849 for research and development for supplies and services required for the design of modified T52 jato metal parts assembly.

Combustion & Explosives Research, Inc. received \$29,385 for research and study of the explosive hazards of liquid propellants.

By Philadelphia Ordnance District:

Western Electric Co. received 14 contracts totaling \$4,874,805 for *Nike* spare parts and components.

General Development Corp. received \$74,985 for development of ballistics measurement equipment.

Duke University received \$25,304 for research study, "Experiment at Liquid Helium Temperatures."

Radio Corp. of America, Defense Electronic Products, received \$449,980 for down range measurements program.

Hoover Electronics Co. received \$99,922 for engineering study on improvement of manufacturing techniques for guided missile wiring harnesses.

Philco Corp. received \$93,647 for components to be used in telemetering and tracking of satellites.

University of N.C. received \$66,100 for study of spin-stabilized rockets during burning.

Western Electric Co. received five con-

tracts totaling \$527,999 for *Nike* spare parts and components.

Askania-Werke, A. G., U.S. branch office, received \$97,740 for new KTH-53 cinetheodolites.

AIR FORCE

By AFMTC, ARDC:

Radiation, Inc. received \$50,000 for increase in funds.

Technical Engineering Co. received \$72,116 for increase in funds.

Alfred Hofmann & Co. received \$92,755 for eight additional inclosures, ballistic camera.

The Perkin-Elmer Corp. received \$130,736 for installation of ROTI Mark 11.

Milgo Electronics Corp. received \$37,974 for digital-to-analog converter for impact prediction.

Technical Engineering Co. received \$35,680 for increase in funds.

Consolidated Electrodynamic Corp. received \$57,060 for magnetic tape recorder.

Natural Gas Co. of Fla., Indian River Gas Co., received \$26,278 for increase in funds.

By AFMTC, Edwards AFB:

Electronic Engineering Co. of Calif. received \$82,543 for data transmission system; \$99,956 for time code and control pulse generator system.

Hycron Eastern, Inc. received \$26,550 for digital timing generator.

Minnesota Mining & Mfg. Co., Mincom Div., received \$45,344 for tape, magnetic instrumentation recording.

Westvaco Chlor-Alkaliks Div., Food Machinery and Chemical Corp., received \$39,200 for mixed U-deta 60% fuel.

Sandberg-Serrell Corp. received \$57,090 for study of high altitude test chamber diffuser.

Stanford Research Institute received \$87,677 for advance study of the high speed track vehicle shock and vibration problem.

Dynamic Research, Inc. received \$46,300 for testing and installing high pressure nitrogen booster system.

By AFMDC, ARDC:

Northrop Aircraft, Inc., Northrop Division, received \$69,068 for support services and parts for supersonic windblast tests, effects of supersonic wind blast on human tolerance.

Winzen Research Inc., received \$99,600 for modification of balloon capsule system and "Man High" III flight.

MB Manufacturing Co. received \$89,665 for electromagnetic vibration system, for use by the stratospheric branch high altitude test division.

Arthur D. Little, Inc. received \$81,127 for study of alkali metals as propellants.

Land Air Inc. received \$103,110 for range instrumentation.

By AF Cambridge Research Center, ARDC:

Armour Research Foundation of Ill., received \$41,936 for development of an ozone analyzer.

Philco Corp. received \$94,089 for investigation of the physical limitations upon current gain beta.

The Perkin-Elmer Corp. received \$30,000 for radiation measurement with Roti.

Massachusetts Institute of Technology received \$75,000 for research toward solution of fundamental electronic scanning and radar problems.

Stanford Research Institute received \$95,273 for research of ECM antennas and components.

William M. Wolf Co. received \$98,420 for design studies and analytical investigation on the configuration of centralized and forecasting operations.

The Ohio State University Research Foundation received \$49,488 for investigations on bi-static reflection characteristics of shaped objects.

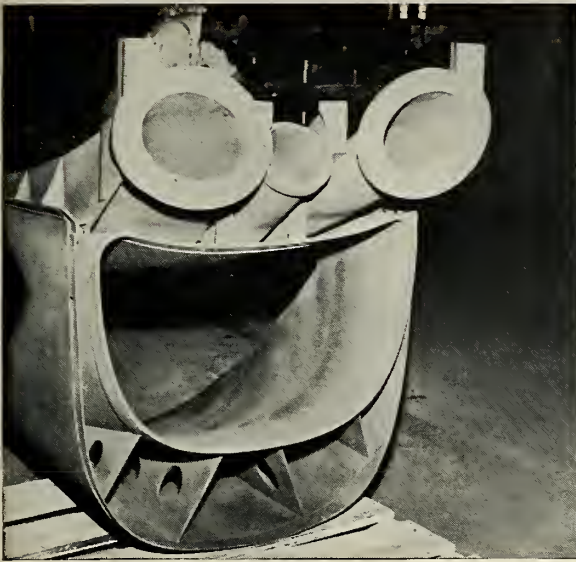
Sylvania Electric Products, Inc. received \$58,925 for investigation on non-linear phenomena.

Westinghouse Electric Corp. received \$51,197 for study of pulse transmission.

Harvard College received \$35,270 for research directed toward study of planetary atmospheres.

The University of Chicago received \$61,000 for studies on planetary atmospheres and lunar surfaces.

The Pennsylvania State University received \$35,000 for research on the structure of the lower ionosphere by means of a sweep frequency technique.



Engine air scoop casting made by R. H. Osbrink Mfg. Company, Los Angeles

MAGNESIUM "SUGAR SCOOP" HELPS REGULUS II BREATHE

Huge thin-wall magnesium casting satisfies appetite for air

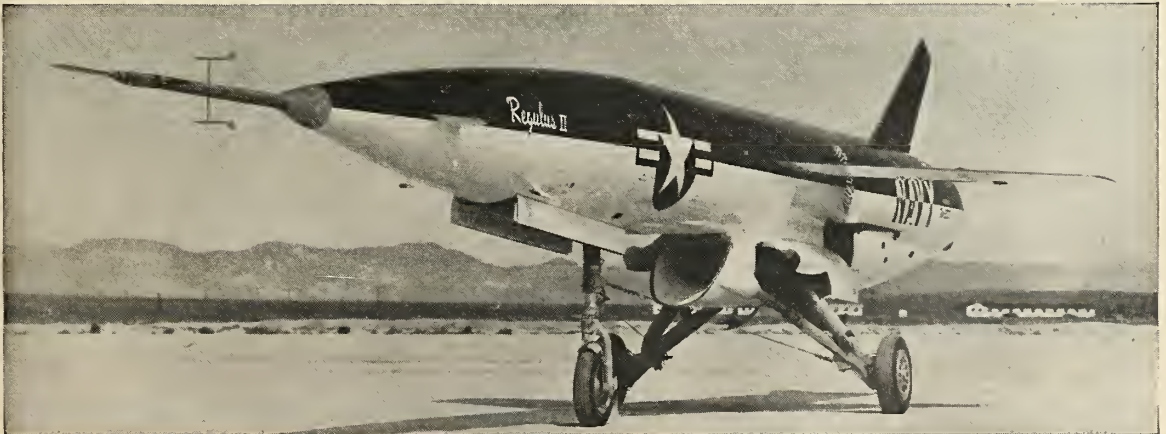
At supersonic speeds more than ten miles above the earth, Chance Vought Aircraft's Regulus II consumes enormous quantities of air through a 150 lb. magnesium casting.

This complex, close tolerance magnesium casting supplies air for the Regulus' powerful J-79 jet engine. It also provides ducting for boundary layer control and for air conditioning. Nominal thickness on walls and webs is 0.24 inch and the solid leading edge tapers to a 0.015 inch cast radius. Casting tolerance is ± 0.03 inch on dimensions up to 12 inches, with an additional ± 0.002 inch per inch

on dimensions above that. That's real casting accuracy!

This air scoop is an excellent example of the versatility and usefulness of magnesium alloy castings in aircraft design. Thin-wall casting designs can be produced in magnesium to replace complicated, costly fabrications involving several production operations.

For more information about magnesium sand castings and their use in aircraft design, contact your nearest magnesium foundry or Dow sales office.



MAGNESIUM DESIGN, a 235-page handbook, discusses in detail: properties, structural design, product design including castings and mill products, fabrication and finishing. Large section of tables on properties, sizes, tolerances, etc. For your copy contact a Dow sales office or write to THE DOW CHEMICAL COMPANY, Midland, Michigan, Department MA 1463L.

YOU CAN DEPEND ON

DOW



STRAIGHT TALK TO ENGINEERS

from Donald W. Douglas, Jr.

President, Douglas Aircraft Company

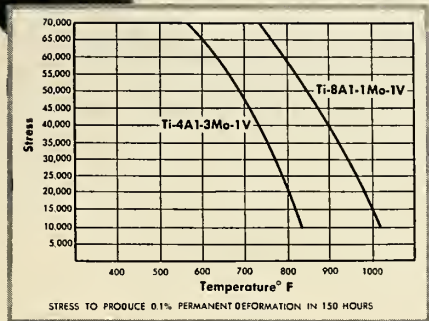
I'm sure you've heard about Douglas projects like Thor, Nike-Ajax, Nike-Hercules, Nike-Zeus, Honest John, Genie and Sparrow. While these are among the most important defense programs in our nation today, future planning is moving into even more stimulating areas.

Working as we are on the problems of space flight and at the very borderline of the unknown, engineering excellence in all fields is essential.

For you engineers who can help us move forward, opportunities are almost as limitless as space itself.

If you thrive on tough problems — and there are many — we'd like to discuss a future at Douglas with you.

Please write to Mr. C. C. LaVene
Douglas Aircraft Company, Box 620-R
Santa Monica, California



UNDER CONTINUOUS STRESS:

Creep can ruin your best designs!

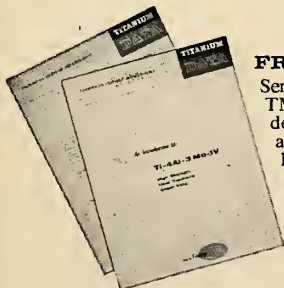
Whether your creep problem is sagging socks or stretching struts, the result is pretty much the same: Things don't hold their shape the way they should.

Garters we don't have. But we do have new titanium alloys which offer a rare combination of excellent creep resistance plus light weight (density 0.163 lb/cu. in.), great tensile strengths (to 175,000 psi), and outstanding corrosion resistance.


In bar and forging stock, there's Ti-8A1-1Mo-1V. Its short-time elevated temperature properties are similar to Ti-6A1-4V, one of the most widely used titanium alloys. Yet "8-1-1" offers as much as a tenfold increase in creep strength between 600° F, and 1000° F. This means that, for an equivalent stress level, Ti-8A1-1Mo-1V raises the effective operating temperature 150° F.

In sheet stock, there's Ti-4A1-3Mo-1V, which offers excellent formability because of good tensile elongation, bend ductility, and low yield strength in the solution-treated condition. Yet this alloy can be heat-treated to strengths of 175,000 psi.

At Toronto, Ohio, Titanium Metals Corporation of America is now operating the world's only plant designed and instrumented solely for rolling and forging titanium. With this facility, TMCA can furnish you the best quality metal, on the fastest delivery schedule, at the lowest possible price in the industry today.



FREE:
Send for TMCA Data Sheets describing physical and mechanical properties, heat treatment methods, and other useful information about the new creep-resistant alloys.

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Astrodyne Rocket Boosts F-100D

The close working arrangement of Astrodyne, a unit of Phillips Petroleum, and North American Aviation was shown recently at Edwards AFB, Calif. A combat loaded Super Sabre was successfully blasted off a zero-length launcher with the aid of a 130,000 lb. thrust solid propellant rocket.

The high thrust rocket, presumably an ammonium nitrate-synthetic rubber propellant combination, blasted off with a 40 ft. long flame, spewing forth clouds of black and gray smoke. The jet was accelerated to 275 miles per hour in less than four seconds.

GE Test Facility for Missile Radar Underway

Work is underway on a new test facility for the ballistic missile radar system being built by the General Electric Co.

The new facility will be used in engineering, developing and testing as well as for the training of personnel for installation and operation of the radar system. Construction is now going on at GE's Systems Center, Syracuse, N.Y.

Construction Underway for Snark, Polaris and Plato

An electronic test site is being developed for the Plato anti-missile missile system project, according to Sylvania Electric Products Inc. The site, located at Ft. Devens, Mass. Army Base, will not be used for missile firing.

Elsewhere, construction is underway on the U.S.'s first operational intercontinental missile launching station. The facility, to be manned by the Strategic Air Command, will be used for launching the *Snark*. The station is at Presque Isle AFB, Maine.

Navy has authorized additional construction at the *Polaris* development facility at Lockheed Missile Systems Division.

Man Survives Tolerance Record of 83 G's

Capt. E. L. Beeding, Jr. survived an 83 G loading at the U.S. Air Force Missile Development Center, Alamogordo, N.M. The human tolerance test was conducted at the Center's aeromedical field laboratory.

Captain Beeding was seated in an upright and backward facing position on a research sled. The test took place on the 120-ft. long "Daisy" track. Total force on the officer's body was equivalent to 11,620 lbs. For one-tenth of a second, he experienced an increase of 5,000 G.



propulsion engineering

by Alfred J. Zaehring

Best bets on boron blends: Olin Mathieson's HEF-2 is probably an ethylated pentaborane, while HEF-2 may be an alkylated decaborane; HEF-5 may be butyl substituted. Callery's HiCal may be alkyl derivatives of the lower borons such as diborane.

Liquid hydrogen is moving up fast as a rocket fuel. Present small scale tests with hydrogen are using LOX, but several stands are going up for liquid fluorine. If tests with hydrogen-fluorine motors continue to be successful, there will be a need for ultra low temperature pumps, valves, seals, containers plus scrubbers for absorbing HF exhausts.

UDMH-Di Tri was likely the fuel for *Jupiter-C*. A replacement for alcohol, the mixture is known as Hydne and has a reported composition of 60% unsymmetrical dimethylhydrazine and 40% diethylene triamine.

Production of hydrogen peroxide is high, but primary propulsion use is low. Estimated U.S. production for this year is 27,000 tons, but only a very small fraction of this goes into rockets. Most peroxide use is for auxiliary power on large liquid rockets. Other liquid and solid propellants continue to gain for APU use.

Newest oxidant: chlorine nitrate. ClNO_3 has been prepared at the University of Munich. Reaction is violent with inorganics and organics. This oxidizer may potentially be more valuable as a new nitrogen introducer for the synthesis of new oxidants or monopropellants.

Heavy elements will make the best ion propellants. According to a study program conducted by Rocketdyne for the Air Force, heavy positively charged ions make the best propellant. At the same voltage, $(\text{U}_{238})^+$ ions will produce over fifteen times the thrust that can be obtained from $(\text{H})^+$ hydrogen ions. Best thrust-to-weight ratio that can be expected is less than 10^{-4} G. Minimum voltage needed for an ion rocket is estimated at about 12,000 volts.

Ceramic-coated rocket engines will see great advancement. Super refractories in combination with new application techniques will rely heavily on the use of lithia as a flux. Gulton Industries has found that this material improves adhesion, impact resistance and thermal expansion.

Free radicals are not yet practical when considering thrust developed by a given engine and system weight. Aerojet-General figures that free radical solid or liquid propulsion systems do not appear promising.

Replacements for ammonium nitrate? Considerable research work is underway for evolving a more powerful solid oxidant. Present work stresses more oxygen content, low molecular weight exhaust products, and low combustion temperatures. Most likely prospects now include urea nitrate, acyl nitrates, and oxygen-substituted nitrogen compounds.

JET DIVISION

ELECTRONICS DIVISION

THOMPSON PRODUCTS, INC.

announces the new

TAPCO GROUP

PNEUMATICS DIVISION

fully-integrated facilities for design,
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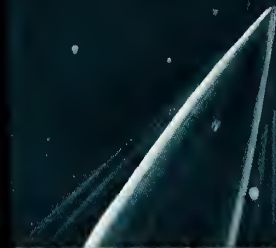
WEST COAST DIVISION

ACCESSORIES DIVISION



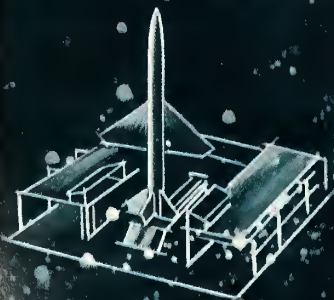
NEW Tapco Group offers integrated facilities for...

STRUCTURES



PROPULSION

CONTROL SYSTEMS



**GROUND-SUPPORT
EQUIPMENT**

Missile envelopes, air frames, pressure vessels, and other structures for every purpose can be designed, prototyped, built and tested within the Tapco Group. "Flotrusion", an unusual method of extruding steel tubing to produce structural parts with integral end features, has been developed by the Tapco Group.

Components and assemblies for main propulsion systems to operate on any liquid or solid propellant, and for auxiliary power units to provide electric, mechanical, pneumatic or hydraulic power are within the capabilities and experience of the Tapco Group. In addition, much experience with nuclear power has been built up by the Tapco Group.

Electronic devices, as well as hydraulic, pneumatic, and mechanical controls and actuators, are an important segment of the Tapco Group's activity. The men and the facilities to coordinate all units into a complete system are ready now to research and produce systems of all types and complexity.

The ground-support components for any project can be supplied in the complete services and facilities offered by the Tapco Group. These include ground-support control and guidance devices, shelters and their activating mechanisms, transporting devices, and all types of ground-support mechanisms and structures.



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consisting of Accessories, Jet, Electronics, Pneumatics and West Coast Divisions

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Tapco's Experience...

includes work in these fields...for these projects...

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NUCLEONICS

AIR-TRACKING SYSTEMS

**AIRCRAFT AND MISSILE
CONTROL DEVICES**

FUEL SYSTEMS

OPERATIONS SEQUENCING

**SECONDARY AND AUXILIARY
POWER SYSTEMS**

COMPUTER-DEVELOPED DESIGNS

**METALLURGY AND FABRICATION
OF UNUSUAL METALS**

HEAT-TREATING FACILITIES

TERRIER

HUSTLER

BOMARC

THOR

BULL PUP

JUPITER C

NIKE-HERCULES

707

ATLAS

PERSHING

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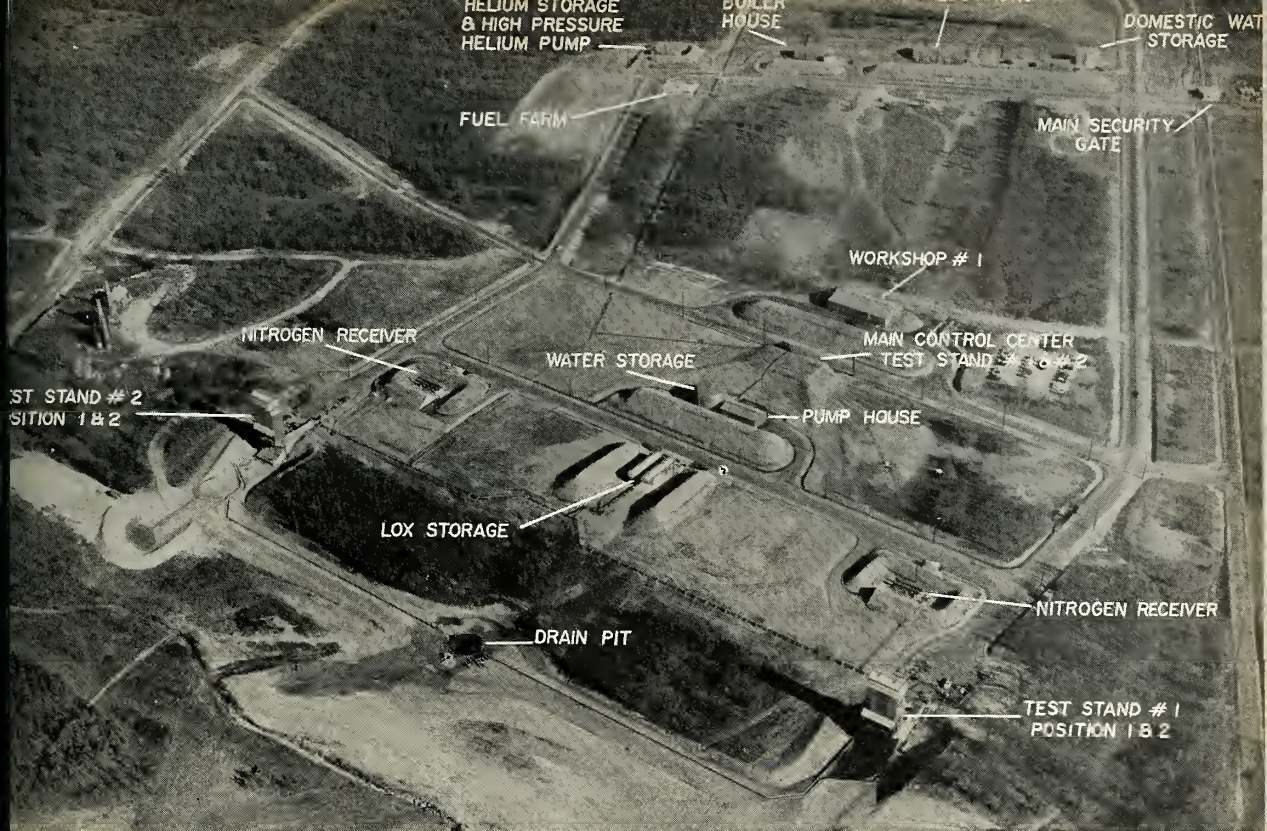
\$368 million in annual sales by Thompson Products, Inc., is proof of the financial responsibility and integrity of the Tapco Group to develop, produce, and deliver any project or part of a project entrusted to it.



TAPCO GROUP

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Thompson Products, Inc. CLEVELAND 17, OHIO



ROCKETDYNE NEOSHO'S *THOR* thrust chamber test facilities cover 200 acres of Missouri hills.

Thor Engine Reaches Production Tests

by Norman L. Baker

Neosho, Mo.—For the past few weeks, the low, rolling hills surrounding this small Ozark community have reverberated to the roar of the United States' largest rocket engines undergoing static tests at Rocketdyne's facilities a few miles away. Recently ordered into production, these engines, which are now rolling off the assembly lines, will power the Air Force's *Thor* IRBM.

Rocketdyne Neosho's development from initial facilities layout to delivery of the first production engine is a story characterized by the same demanding urgency as development of the intermediate range ballistic missile itself.

Seven months after DOD approval in November 1955, Rocketdyne delivered the first model of an entirely new engine system. Three months later, the first production model was delivered—three months before the first missile launchings in January, 1957.

A simplified and improved model of this new high thrust engine is now in

quantity production and testing—little more than a year after the ground was broken for the 200-acre test site.

The 228,000 sq. ft. manufacturing plant and nearby supporting test facilities is located on 1,785 acres of the old Ft. Crowder reservation lands. The plant now employs about 1,500—almost double the employment figure of six months ago.

Construction on the facility—started by Aerojet—was taken over by North American when the Air Force decided that Rocketdyne would operate the plant. The test area is located about two miles from the administration and production areas.

Major items of the test complex are the two high-thrust test stands, each capable of handling two engines. The stands are operated from a reinforced concrete control building equipped with batteries of electronic recorders and remote TV receivers.

Extensive earth revetments provide protection for personnel and isolate propellant and test stand areas. The



THOR THRUST CHAMBERS are calibrated with 1,000 psi water flow tests before leaving the fabrication area.

missiles and rockets, July 7, 1958



Think small

Mechanical brains for missiles must be as tough and tiny as possible . . . a design problem that calls for experts skilled in both electronic computers and miniaturization.

ARMA's computer group has shrunk a digital computer module until it's the size shown above . . . a feat comparable to squeezing the contents of a steamer trunk into a cigarette package.

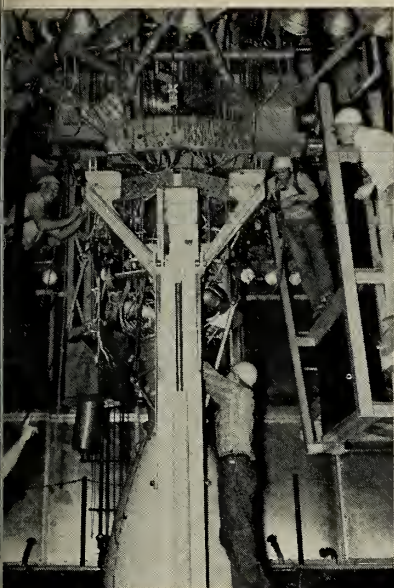
Right now, in fact, through new techniques

of solid state circuitry, systematic design and compatibility testing, *ARMA* is producing a family of airborne digital computers that are operational under the most severe conditions of vibration, temperature, noise, acceleration and deceleration, and nuclear radiation.

For information on our fully transistorized, airborne digital computers, contact *ARMA*, Garden City, N.Y. A division of American Bosch Arma Corporation.

5836

AMERICAN BOSCH ARMA CORPORATION



AFTER THE ENGINE is raised into a vertical position by the transporter trailer, the stand crew attaches the chamber to the thrust measuring brackets, and connects the many hydraulic and instrumentation lines and tubes of the stand system.

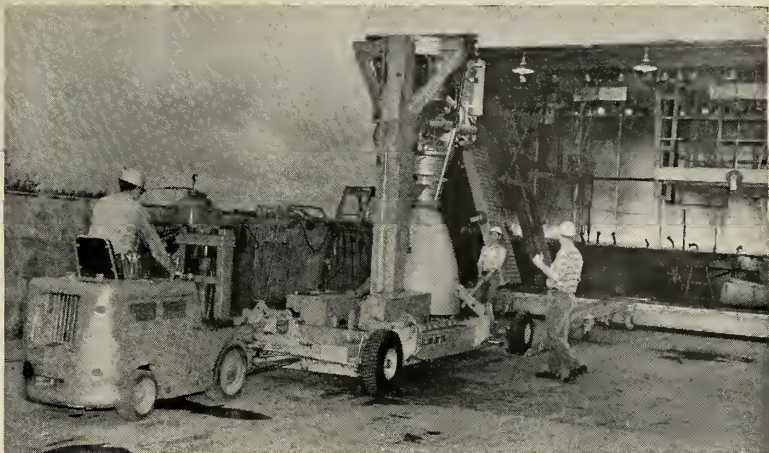
test area has its own water supply and distribution system. Engine fuel is stored on the base while the liquid oxygen is trucked in from Tulsa, Okla.

A major portion of the engines are hot tested for cycles ranging from 15 to 30 seconds. After several engines have been tested, the test stand is recalibrated with a 110-second run which approximates the total burning time for flight operations. The entire propulsion system, less the two vernier engines used on the *Thor* for added control, is mounted for each test. Propellants are pumped into the system by the power plant's gas generator system.

The engines are subjected to a hydraulic flow test before transportation to the test area. Water, under 1000 psi pressure, is forced through the more than 300 nickel tubes which make up the walls of the regenerative cooled thrust chamber. The tubes are secured in position by soldering, and held together with steel bands, welded at intervals to the outside of the chamber for rigidity and absorption of internal pressures. The water tests locate any holes accidentally produced by the welding operations.

Gas generators and vernier engines for the *Thor* are tested at a separate facility that has been in operation since the first of the year.

Test facilities currently operating on a two-shift status, are reported to be adequate for the present production schedule.



ENGINE IS JOCKEYED into position on test stand floor for attachment to mounting brackets prior to a captive test. The hinged platform, background, is raised when the engine is in place to give work area for stand crew during final operation.



PREFIRING CHECKOUTS are made from this remote control room. Several hours are sometimes involved in the countdown check. Hot firings are observed with television receivers and recorded by banks of instruments within the control room.



START OF HOT FIRING of *Thor* engine on test stand #1. Steam, formed by cooling the hot gases of the engine and gas generator, soon blankets the surrounding area. Visual observation of the firings are made from a point several hundred yards distant.

Million-Pound-Thrust Stand Planned at Army's White Sands

An m/r staff report

WHITE SANDS, N.M.—U.S. Army Ordnance has revealed that one of its 300,000 lb. thrust solid propellant rocket test stands will be enlarged to accommodate motors having thrust levels up to, and including, one million pounds of thrust.

(There are several other million pound thrust facilities, including those located at ABMA Huntsville, Aerojet, Rocketdyne, Thiokol, Utah.)

In addition, the Army has given m/r an exclusive view of its expanding rocket engine test capabilities at White Sands Proving Ground, N.M. Such a view indicates that the Army plans to keep in the high thrust rocket engine race now shaping up.

Three separate testing facilities are provided to test propellants and performance of various missile motors under all known conditions expected in flight. These facilities are equipped to perform developmental, engineering, and acceptance tests on both solid and liquid fuel propulsion systems, subsystems, and components.

The three major static test facilities are:

1. The 500,000 lb. thrust facility.
2. The 300,000 lb. thrust solid propellant facilities.
3. The 100,000 lb. thrust facility.

The rocket powerplant test facilities at WSPG are under the Propulsion Branch of Electro-Mechanical Laboratories, a division of Ordnance Mission. The Propulsion Branch is headed by a civilian engineer, Lowell Randall.

• **Facility operation**—The 500,000 lb. thrust test facility is one of the largest in the world, and presently can test motors for any known missile or rocket. Dug into solid rock, the 500,000 lb. test facility is built into unfaulted granite on the east face of a spur of the Organ Mountains, 4,400 ft. above sea level and 200 ft. above the floor of the Tularosa Basin.

A concrete flame pit extends 60 ft. straight down the side of the mountain, and 3,000 gallons of water per minute are used to quench the rocket exhaust. This is a liquid propellant rocket stand which can accept a test package of up to eight ft. in diameter.

Designed, and under construction from 1947 to 1950, the tower was originally built to fire 500,000 lb. motors at a 60° angle. It was rebuilt

to handle 125,000 lb. in a vertical plane, with a maximum motor package measuring eight ft. by eight ft. Four load cells are used to gage thrusts.

The control room is built below ground and is carved into the solid rock mountain. Four observation windows in the east wall face angular mirrors which allow indirect viewing of the test. The 936 sq. ft. control room is built in a T-configuration, with observational area and control console contained in a forward section.

Behind the control area is a huge instrumentation room which contains the banks of recorders. Included in the instrumentation are five remote camera circuits to provide recorded visual information at various angles.

Equipment is mounted on the tower to handle rocket motors or a complete missile. Hoists are installed on the tower. An elevator rising 45 ft. above the flame pit has a 2,500 lb. capacity.

• **Thrust equipment**—The 300,000 lb. thrust solid propellant test facilities are much different in design from the 500,000 lb. thrust liquid rocket facility described above. The 300,000 lb. facility consists of four concrete test bays, one open test pad, and a concrete control and instrumentation blockhouse protected by an earth embankment.

Two of these bays are designed to handle thrusts up to and including 300,000 lbs. The other two bays are equipped to handle thrusts up to 5,000 lbs., while the large open test pad has provisions for mounting units up to 100,000 lbs. thrust.

Each bay is 43 ft. deep and 25 ft. wide, and enclosed on three sides by 12 in. reinforced concrete walls 11 ft. high. The thrust plates mounted in concrete are in the center of the bays. Any unit up to 16 ft. in length may be clamped down in the bay.

Located directly between the two pairs of test bays is a 50-ft. square reinforced concrete open pad into which portable thrust mounts can be anchored. The thrust mount is removable so that equipment can be tested within the bays if desired.

A blockhouse, containing substantially the same instrumentation and electronic facilities as the one for the 500,000 lb. thrust test facility, is located 150 ft. behind the test bays.

The White Sands solid propellant rocket motor test facilities are equipped to handle about 30 large motors per



week and over 50 small motors per week on a continuous basis. Plans are now for enlarging one of the 300,000 lb. solid propellant stands to handle one million pounds thrust.

A 10,000 lb. test facility was partially destroyed by a propellant explosion late in 1955. It is to be rebuilt with a 40,000 lb. thrust capacity.

• **Static firing facility**—The last of the three separate static test facilities is the 100,000 lb. thrust facility. This is used for static firing of liquid propellant missiles, or missile systems in support of contractor and engineering user research. The facility is also used for acceptance tests and the gathering of associated operational data.

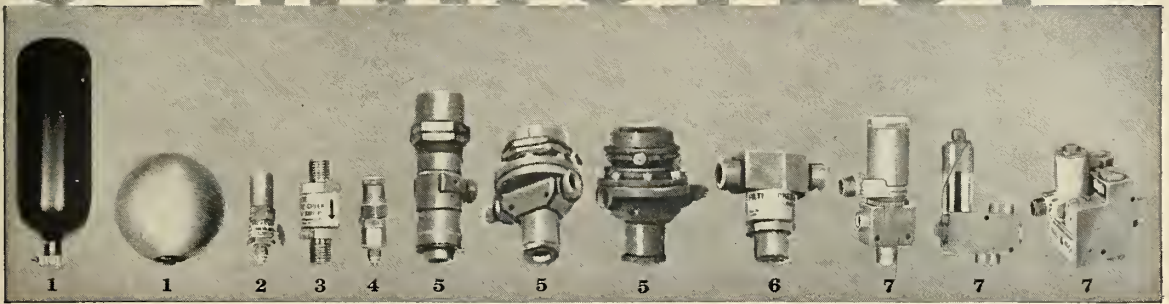
The facility was constructed in 1946 and used to static fire the German V-2 missile prior to flight tests during 1946 to 1949.

In 1956 an outrigger mount was added to this test stand to static fire the *Corporal* rocket motor independent of the missile itself, and at any angle between the vertical and horizontal positions.

Maximum test packages, including the missile itself, measuring eight ft. in diameter and 500 ft. high, can be fitted into the existing tower for vertical test firing.

The propulsion engineers and technicians assigned to the three facilities are all highly trained specialists. Frank Schultheis, civilian Army engineer, is chief of the static test section. In charge of the 500,000 lb. thrust facility is Carlyle E. Roberts. Alvin E. Howard heads the 300,000 lb. facilities. In charge of the 100,000 lb. test stand is John E. Durnin.

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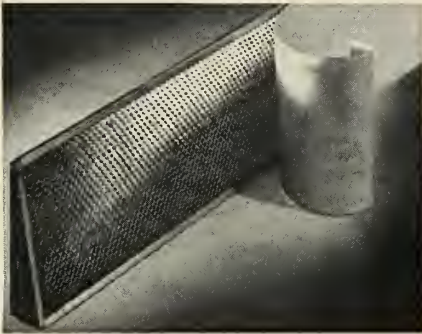
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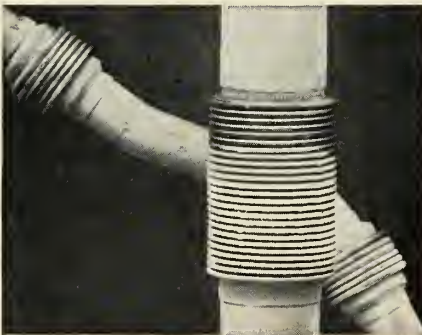
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detailed information about Solar's systems capabilities, or about any of the areas mentioned above, write to Dept. F-32, Solar Aircraft Company, San Diego 12, California.



missile people in the news

Dr. Nicholas A. Begovich, specialist in electronic scanning radar and landing and approach systems, has been appointed director of engineering of Hughes Aircraft Co.'s ground systems group. Other



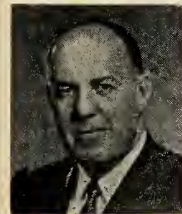
recent Hughes appointments include: **Dr. William T. Clary, Jr.**, as head of the systems analysis department; **John W. Bozeman**, director of the data processing laboratory; **Robert Polkinghorn**, director of the radar laboratory; and **Samuel Langberg**, head of engineering services department. All appointments are under Dr. Begovich.

Dr. Jason L. Saunderson, vice president, Chemical Instrument Engineering of Baird-Atomic, Inc. of Cambridge, Mass., has been awarded an Honorary Doctor of Science degree by Morning-side College in Sioux City, Iowa.

Bruce W. Kinney has been appointed quality control supervisor of Circuit Instruments, Inc., a subsidiary of International Resistance Co. **George T. Brent** has been appointed chief engineer.

W. S. Bobiler has been named chief engineer, Detroit activity of the Aero Hydraulics Division, Vickers Inc. He formerly was engineering section head for the component development section.

Kenneth M. Lord has been appointed director of engineering in the Electronic Division of Stromberg-Carlson, the division of General Dynamics Corp. He will have charge of all engineering activities in the company's Electronics Division, which manufactures a variety of equipment for civilian and military use.



Dr. Adolph Edward Patly was recently made supervisor, Alloy Development and Evaluation, of the Utica Metals Division, Kelsey-Hayes Co. He is the author of several technical papers on metallurgy.

Col. William S. Evans, public relations officer, has been named director of Information Services at the Air Research and Development Command, Andrews Air Force Base, Md. He was formerly information services officer for the air weapon research and testing installations at ARDC's Air Proving Ground Center, Fla.

Joseph B. Elliott, formerly executive vice president and general manager, has been elected president of Tele-Dynamics Inc. **George C. Liacouras** has been elected treasurer of Tele-Dynamics.

Dr. William H. Duerig was appointed vice president in charge of research and engineering by Midwestern Instruments, Inc.

Dr. Joseph C. Patrick, discoverer and pioneer in the production of Thio-kol oil-resistant synthetic rubber, has won the 1958 Charles Goodyear Medal, highest honor in rubber chemistry.

Frank Roodman has been appointed as the Austin's Company's engineering coordinator for missile projects.

John H. Reber and **A. K. Schiefner** were named as officers of the Instrument Corp. of Fla. Mr. Reber, formerly executive engineer, is now vice-president of Electronics Division. Mr. Schiefner, who was director of optics division, is now president of Optics Division.

John L. Devitt was named chief engineer of the Electro Chemical division of the Frank R. Cook Co. He will be responsible for design, development, quality control and service engineering of the company's miniature battery program, used in many of the U.S. missile programs to furnish in-flight electrical power.



M. Lee Rice has been elected vice president of Atlantic Research Corp. He had made significant contributions to the field of rocket, missile and solid propellant propulsion and ballistics.

Dr. William C. Cooley has now become assistant program engineer on the Rover program, the research activity aimed at achievement of a nuclear rocket engine now underway at Rocketdyne.

I. Nevin Palley has been promoted to senior vice president by Temco Aircraft Corp. and **Robert E. Galer** to vice president.

Dr. Kuang Lu Cheng has been appointed Associate Director of Research, Utica Metals Division, Kelsey-Hayes Co. His major activities have been the development of special analytical processes and the production of pure elements.



Edward J. Cousin has been appointed manager of space and missile programs for Allen B. DuMont Laboratories, Inc. He will be responsible for the planning and development of defense and military electronic programs in the missile and astronautic fields.



Robert E. Kemelhor has been named manager of future product planning and development for both Pesco Products and Wooster Divisions of Borg-Warner Corp. He will direct supplementary product development programs to increase diversification at both divisions.

Dr. C. L. Register has become manager, ballistic missile division, at Burroughs Research Center, Paoli, Pa. Three new positions at the Center are: **U. C. S. Dilks**, formerly manager, research division, is new associate director-commercial products; **Edward Lohse**, former manager, ballistic missile division, is new associate director-defense products. **J. H. Howard** has been promoted to manager, research and development division.

Dan W. Burns has been elected president of the Hufford Corp., a subsidiary of the Siegler Corp. He succeeds **Merrill L. Bengtson**, who is chairman of the executive management committee.

Herbert C. Cress has been appointed to the newly created position of vice president and works manager by Ford Instrument Co., division of Sperry Rand Corp. He was formerly with the Sperry Farrago Co., Division of Sperry Rand Co., where he was vice president for operations.



Col. Paul A. Campbell has returned to the School of Aviation Medicine, USAF, Randolph AFB, Texas, to take charge of an expanding space medicine division. Col. Campbell was formerly with the Office of Scientific Research of the Air Force, where he has carried on medical studies in astronautics for the past two years. The new division of space medicine, which Col. Campbell heads, is an extension of the internationally known department of space medicine that Dr. Hubertus Strughold created at the School in 1949.



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Test data: Model illustrated is tested to 15G's with tail pipe attached, and at temperatures to 900°F. Vibration requirements of MIL-E-5272A are met.

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schematic cross-section of standard coupling



schematic cross-section of flush coupling

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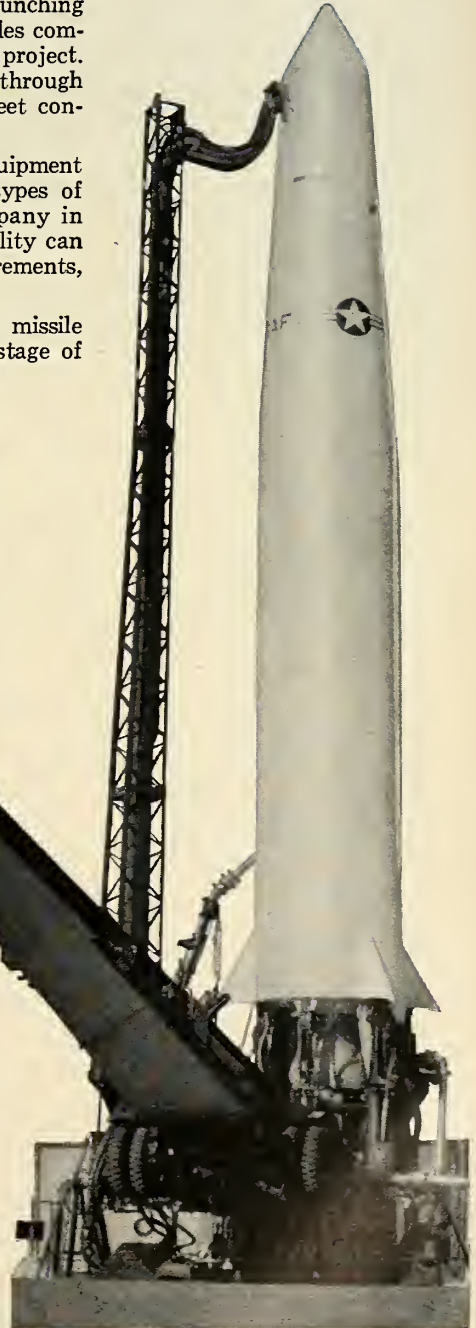
To assure fully coordinated development and delivery of missile ground support equipment, consult with FMC at the initial stage of project planning.

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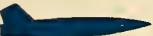


THOR transporter-erector, launching base and power trailer delivered by FMC in just eight months—2 months ahead of schedule—receives operational check-out.



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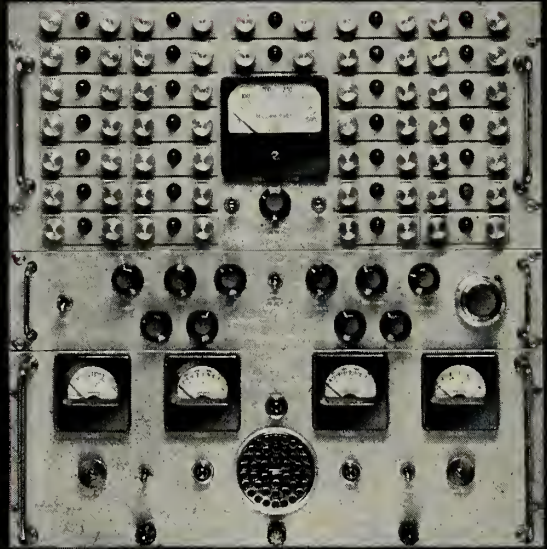
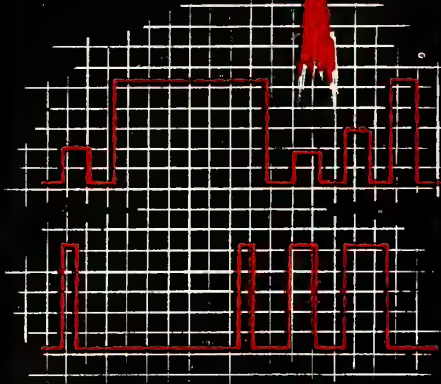
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- Miniaturization is the natural result of a new circuit design allowing the entire system to contain only 76 tubes as opposed to several hundred in competitive systems.
- Modular construction permits easy expansion of system to any desired channel capacity.
- Novel circuitry design does not reflect errors due to center frequency drift of sub-carrier oscillators, drift of discriminator D. C. output level, or tape playback speed errors.
- Built-in test selector permits visual inspection of waveforms throughout system for quick malfunction detection.
- Neon indicators on each gating unit give continuous visual indication of correct sequential operation.
- System accepts all standard IRIG inputs, either PAM or PDM, at any sampling rate from 75 to 900 per second.
- Overall linearity is within $\pm 1/2\%$ at maximum level. Long term level drift is within $\pm 1/2\%$. Gain drift is negligible.
- Modular plug-in gating units allow quick replacement of faulty channels.
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Labor Eyes Missile Industry

by Donald E. Perry

Two AFL-CIO unions, representing the majority of organized workers in the missile and aircraft industries, are patting themselves on the back for a job well done in 1958 bargaining negotiations. Those negotiations are now nearly completed, although several long-range proposals got swept under the table in favor of immediate wage increases.

But, despite recession and large-scale industry layoffs, which made strikes or walkouts impractical, the "Big Two"—the International Association of Machinists (IAM), and the United Automobile, Aircraft and Agricultural Implement Workers (UAW)—take pride in their negotiated wage settlements.

Here's the reason:

Before contract talks, an estimated four-fifths of the more than 500,000 organized workers in missiles and aircraft had no cost-of-living clauses in their contracts. Two-year settlements made so far for these workers, range from 18 to 30 cents per hour, with an average of 21 cents. For the estimated one-fifth who had the cost-of-living clause, settlements were in the 2 to 11 cents per hour class, with an average of 6 cents per hour.

"This is a remarkable achievement," commented one union official, "in light of the recession, layoffs and stiff resistance to wage increase demands."

• **What's cost?**—What does this mean in cost to the industries?

There are no accurate figures, but simple arithmetic brings the cost-of-living increases alone to nearly \$190 million annually. Add the fact that industry, with the exception of Republic Aviation, in 1959 will face a 3% increase with a minimum of 7 cents per hour. Republic next year will give a 10 cent raise across the board under new contract terms. Unions had sought a general 6% wage increase.

Major companies not having cost-of-living clauses before bargaining included Boeing (which has not settled but can be expected to follow the established trend), Convair, Lockheed, McDonnell, Republic, Solar, Rohr, Goodyear (Arizona) and Aerojet-General. United Aircraft settled late last year. Martin, which has the clause, is in negotiation and settlement probably will be made soon.

It's interesting that the industry had two strikes during negotiations, but neither apparently were for economic reasons. Seniority was the issue at the

week-long Lockheed-Marietta and the 27-day Convair-Pomona strikes.

IAM and UAW, which this year put strong emphasis on coordinated bargaining, feel they also accomplished two other objectives: An additional holiday, which will be the day before Christmas; and correction in most new contracts, of so-called "wage plan abuses." Union demands were for elimination of multiple job classifications and establishment of job descriptions with clear-cut lines.

• **Heavier demands ahead**—Long-range proposals, of which one top union official said, "we couldn't fight too hard because this was the bread-and-butter year," included severance and relocation pay, and per-diem. All, however, along with the formidable union demand for apprenticeship training, will be key issues in 1960 talks.

Bell Aircraft is the only company, according to UAW-IAM, which provides severance pay. Union objectives are one-half day's pay for each month of service on termination or layoff.

Polaris Re-entry Cone To Be Designed by CTL

A contract for the design and development of re-entry bodies for Navy's *Polaris* IRBM has recently been awarded to Cincinnati Testing and Research Laboratories. The award, said to be initially for \$500,000, was made by Lockheed Aircraft Corp.

CTL developed the material for the *Jupiter-C* test vehicle nose cone which was recovered May 18 in the Atlantic Ocean after firing from Cape Canaveral, Fla.

When the *Jupiter-C* nose cone was recovered, Elmer P. Warnken, president of CTL, said "the success of the *Jupiter* nose cone illustrates the critical re-entry problem of the IRBM has been solved."

Heat-Treatable Titanium Alloys Shown by Crucible

Crucible Steel Co., in a technical seminar at Pittsburgh attended by 40 industrial editors, announced the availability of three new heat-treatable titanium alloys.

One of these was disclosed as the first heat-treatable all-Beta titanium alloy to be produced, representing a major technological breakthrough for the titanium industry comparable to the development of austenitic stainless steel in the stainless steel field.

The three alloys have the unique

Basically, the unions feel that a federal policy of channeling new contracts into so-called "distressed" areas would at least minimize effects of lay-offs in slack periods. Another objective is relocation pay.

The unions can be expected to put increased emphasis on negotiated relocation pay to enable their members to move with the plant at the company's expense with same or better working structure and the same basic working conditions.

The per-diem objective is to include provision for temporary transfers to other company locations. With missile hardware today in an accelerated testing state, more transfers can be expected. The unions contend the government has unjustifiably cut off per-diem allowances, and disagreement essentially is not with industry. Unions point out, however, that company policies have a wide-range of per-diem payments, and the government has indicated it would not cut per-diem benefits.

Still another union platform is for increased attention to on-the-job training. President A. J. Hayes of IAM, contends the old skilled journeymen "are dying off faster than young men are being trained to replace them."

advantage of being readily formed in the so-called "soft" condition and then strengthened by simple thermal aging treatments.

Ion Propulsion Contract Awarded Vitro Labs

Vitro Research Laboratories, Inc., has been awarded a contract by the Combustion Dynamics Branch of the Air Force Office of Scientific Research to investigate applications of the Sheer-Korman high intensity electric arc. This would apply to design data for two kinds of ion propulsion. Vitro's West Orange, N.J., facility will handle the work.

The Sheer-Korman arc is a Vitro proprietary development. It is a self-stabilized arc, generating ion densities on the order of four-to-five times those found in water-stabilized arcs. The ion flux, for example, is in the ampere region, rather than milliamperes.

Vitro will utilize electromagnetic principles in its ion-propulsion work, hoping to increase current accelerations of 1-to-3 electron volts up to 1000 e.v. Current Sheer-Korman plasma velocities, that do not employ nozzles or other special acceleration devices, range from 150 ft. per second in air at atmospheric pressure to 1200 f.p.s. at 1/1000th of an atmosphere. Magnetic acceleration of the charged ions should raise these figures by considerable amount.

AF Research To Determine Radar Effects on Personnel

The Air Force has an extensive research program under way to determine radar effects on personnel and to collect "information about suspected injuries or deaths resulting from radar exposure."

Although there has been no serious injury or death in the Air Force from exposure to radar, Col. George M. Knauf of Griffiss AFB, N.Y., in a speech to American Medical Association delegates, admitted that microwave injury "may produce harmful effects through some means other than simple heat."

Research on animals indicates microwave exposure produces changes in eyes similar to cataracts.

Col. John P. Stapp, U.S. Air Force Chief of the Aeromedical Lab at Wright Air Development Center, said there is little doubt of man's ability to survive space flight and return to earth.

He told the Military Medicine Section of the conference that volunteers have withstood three Gs for one hour in a transverse, semi-recumbent position at right angles to the line of force. "If this were a constant vertical acceleration at three Gs for one hour, final velocity would exceed 200,000 miles an hour, or eight times the speed required to escape the earth's gravita-

tional field on the outbound space trip."

In an exclusive interview Stapp said, "We will have very good control of pullout forces in the North American X-15. A more sinister problem," he added, "is the decrease in blackout tolerance following 30 seconds or less of weightlessness. A 4.5-G pullout at the end of a zero gravity aircraft maneuver results in blackout of several times the duration experienced by the same subject after the same pullout, but not preceded by exposure to zero gravity."

Full-time Editor Assigned To ARPA-NASA Coverage

Two federal agencies which are important to the missile industry, as well as to the national welfare, are the Advanced Research Projects Agency and the proposed National Aeronautical and Space Agency. To give its readers up-to-date news coverage of these two agencies, MISSILES and ROCKETS Magazine recently assigned a full-time editorial staff member to cover activities of ARPA-NASA.

The editor assigned is Donald E. Perry, a member of m/r's staff for the past several months. Mr. Perry joined m/r after service with the Martin Co., and brings to the magazine total newspaper experience of more than 12 years, including a stint as aviation editor.

Subroc Systems Contract Goes to Goodyear Aircraft

Prime systems responsibility for developing the underwater-to-air-to-underwater *Subroc* weapon has been awarded to Goodyear Aircraft Corp., in a \$65-million contract awarded by the Navy Bureau of Ordnance.

Subroc combines ballistic rocket and torpedo capabilities in what will initially be an anti-submarine weapon. However, Navy considers this concept to be susceptible to considerable development, and contemplates that it will ultimately incorporate anti-aircraft/missile and anti-surface target capabilities. A primary advantage of *Subroc* is that it will utilize existing submarines as launching sites.

Principle subcontractors on *Subroc* are the Kearfott Co., Clifton, N.J., and Librascope, Glendale, Calif., who presumably will share responsibility for development of guidance.

Goodyear has named R. L. Burtner as *Subroc* systems manager; assisted by A. E. Bjerke, assistant project engineer; J. R. Stair, customer relations; W. H. Wood, manufacturing; W. F. VanBuskirk, master planning; J. S. Young, purchasing; G. E. Marquis, quality control.

Goodyear will work closely with the Naval Ordnance Laboratory, White Oak, Silver Spring, Md., which has been carrying out preliminary investigation and development.

Congressman Attacks Snyder 'Censorship'

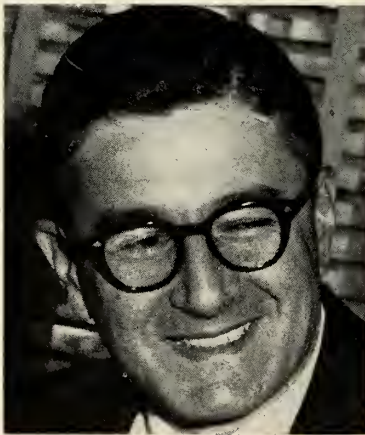
Spokesmen for the Department of Defense and the Administration have repeatedly cited a number of reasons for integration of the information services. These included objectives no one could argue with—such as elimination of duplication, greater efficiency, and speed-up in the flow of information. Interlarded are other terms—"timeliness", "public understanding", and most important of all, "policy".

"The objective in the public affairs area is to obtain unified policy direction, and not centralized operation."

Deputy Secretary of Defense Donald A. Quarles, said the above statement at closed sessions recently held at Quantico. These were the sessions at which Navy's CNO Arleigh Burke was reportedly brought into line.

Rep. John E. Moss made this comment in regard to Quarles stated objective:

"From Mr. Murray Snyder's first appearance on the scene, I have become increasingly convinced it is his job to create a spokesman on all matters of defense. Any policy as far-reaching as the one proposed was not conceived by accident. It is the most



Wide-World Photo

Murray Snyder

complete Pentagon censorship ever employed, including times of war.

"Timeliness", "security", and "policy" would be words to be defined by Mr. Snyder. He would be maker of the laws, judge of the courts, and hand down decisions from which there would be no appeal. His policy would be nothing less than an atmosphere of expediency determined from day to day, in accordance with the wishes of his superiors," Moss concluded.

New X-15 Inertial System Developed by Sperry

An advanced flight instrument system, which will provide the pilot of the hypersonic X-15 with inertial flight aids and sensing devices on outer space trips, has been developed by Sperry Gyroscope Co.

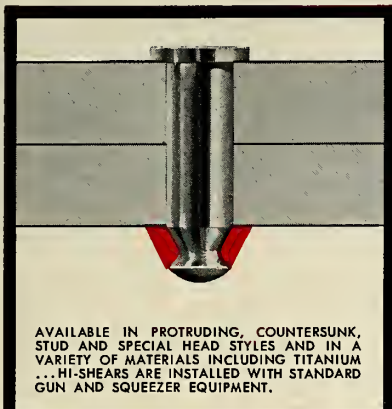
The new system will help control the rocket research plane to keep it from burning if it reenters the denser atmosphere too steeply.

The instrument system, which has been under development for about a year, will have its preliminary test this summer by the National Advisory Committee for Aeronautics. A McDonnell F-101 Voodoo fighter will be used as the flying rest bed. The X-15 is expected to fly at about 3,600 mph at over 100 miles altitude.

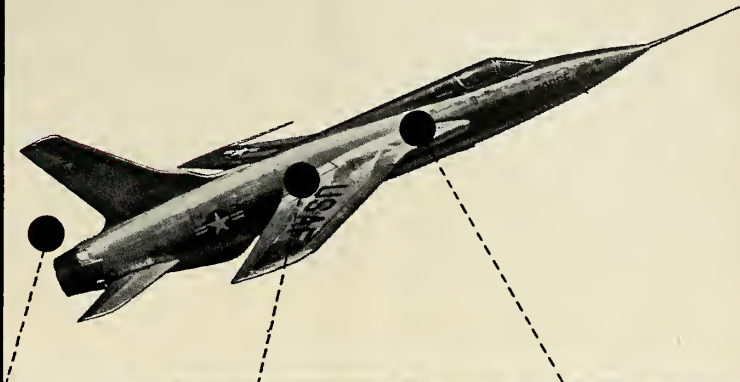
The new system is composed of a three-gyro stable platform which provides critical attitude, velocity, distance and altitude sensing and a lightweight computer to interpret data. Developed to withstand accelerations more than ten times the force of gravity, it cannot be jammed during operations.

The NACA pointed out that the system may be adaptable to other missile guidance and space experiments.

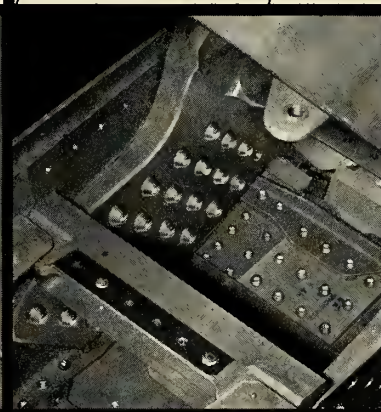
F105 USES *hi-shear** RIVETS TO SAVE WEIGHT RESIST HEAT AND CUT PRODUCTION COSTS



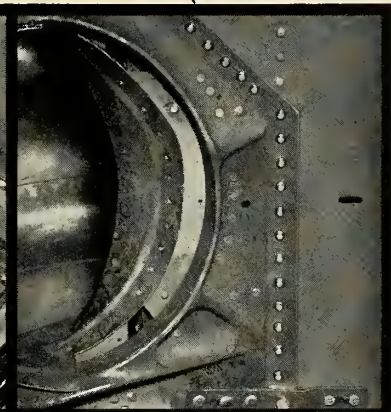
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The Republic F-105B, the world's most powerful fighter-bomber, delivers nuclear and conventional weapons and incorporates some of the most advanced innovations in the aircraft art.

To meet the critical strength and weight requirements of the Thunderchief's structural components, thousands of Hi-Shear rivets are employed in a variety of style and material combinations to attach primary structural members, to resist elevated temperatures and to eliminate production headaches ... typical Hi-Shear applications on the F-105B are shown above.

* "HI-SHEAR" TRADEMARK REGISTERED U. S. PATENT OFFICE. U. S. PATENTS 2,355,579; 2,355,580; D-138-579; OTHER U. S. AND FOREIGN PATENTS PENDING

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WHITE SANDS, NEW MEXICO—Army missile men have made a major breakthrough in Public Relations. And it should be noted that this was accomplished without any recourse to public relations personnel from ABMA.

They achieved the break with the most impressive missile show in the world to-date, last week's two-day missile firings in the hot New Mexico desert. The show, at the McGregor Missile Range near Fort Bliss, Tex., turned out 63 Army and Air Force generals, 4 Navy admirals, 13 NATO generals and admirals, 18 other Allied officers, 100 industry leaders and 120 newsmen and photographers.

The perfectly organized program was put on by the Army with the co-operation of the missile industry. The Army's Deputy Chief of Public Relations, Brig. Gen. "Ted" Clifton, fostered the idea almost a year ago.

The two-day field session was tagged AMMO—Army Mobile Missile Orientation. Scores of missiles, ranging from helicopter-mounted 2.75 in. rockets to the big *Corporal* missile were fired at White Sands, McGregor and Hueco ranges in the western Texas and southern New Mexico deserts. AMMO was planned as a demonstration of the Army's present missile capability both offensive and defensive.

• **Brass attends**—Secretary of the Army Wilbur M. Brucker topped the Army team which included Assistant Secretaries Dewey Short, George H. Roderick, and Hugh M. Milton II. General Nathan Twining, Chairman of the Joint Chiefs of Staff was the ranking military observer. Other top men in uniform included General Maxwell D. Taylor, Army Chief of Staff; Lt. Gen. C. E. Hart, Commanding General of the Army Air Defense Command; Maj. Gen. J. H. Hinrichs, Chief of Ordnance; Maj. Gen. J. B. Medaris, Commanding General, of Army Ordnance Missile Command, and Maj. Gen. Sam C. Russell, Commander of the Army Air Defense School at Fort Bliss.

Missile industry firms represented included Bell Telephone Company, Thiokol, Chrysler, Douglas Aircraft, Firestone, Curtiss Wright, U.S. Steel, Gilfillan Bros., Raytheon, Pratt & Whitney, Sperry Rand and the Martin Co. Also, Callery Chemicals, Western Electric, Radioplane Division of Northrop Aircraft, Bendix Aviation, American Machine & Foundry and Sikorsky Aircraft.

Army planners said the orientation was also designed to show industry observers fire power, and missile mobility. The Army feels, spokesmen said,

that industry lead time is too long in today's fast-moving missile age. Industry spokesmen questioned this point. The Army should be more specific in outlining missile needs, they said.

• **The show**—Demonstrations included *Honest John* firings after a *Chopper John* concept mission (*Honest John* airlifted to launching site, with launcher, by helicopter); *Nike Ajax* firing and direct hit on an airborne Air Force bomber; the *Corporal* impacted 48 feet left and 12 feet short of the target, which was 31 miles from the launching pad.; and a *Talos* firing.

Briefings were given on *Bredstone* and *Sergeant* missile systems, and on *Nike-Hercules*, *Hawk Dart*, *Little John* and *LaCrosse*.

Most impressive and possibly the most promising of the missile demonstrations was the showing of how the Army is marrying the rocket to the helicopter.

In May, 1956, the Commanding General, U.S. Continental Army Command authorized the Army Aviation School to conduct certain experiments to determine the feasibility of adapting existing weapons, including missiles, to helicopters. In early '57, the feasibility was established, and the Army now is inviting industry to submit ideas and proposals for an up-to-date helicopter-missile system.

In the free world, the French have held a leading position in this field, with their installation of the SS-11 (*Dart*-type) missile on the *Alouette* helicopter.

Atlas Will Boost Final Animal Carrying Capsules

Atlas boosters will be made available for launching of recoverable animal-carrying satellites in the early Spring, m/r has learned. Early tests, however, on recoverable satellites probably will be using the *Thor*.

Availability of an *Atlas* booster raises the premise that Convair will be sufficiently along in production of the ICBM to release it for biological experiments.

First passengers will be mice (a *Thor* has already carried one), and the *Atlas* booster probably will contain a well-trained chimpanzee. Reports indicate that the *Atlas* boosted satellite will make only one revolution of the earth before it reenters.

AVCO Research Laboratories, in conjunction with Convair, Aeroneutronic Systems, Lockheed, Boeing, Douglas, Republic, Northrop and Goodyear have put in bids.

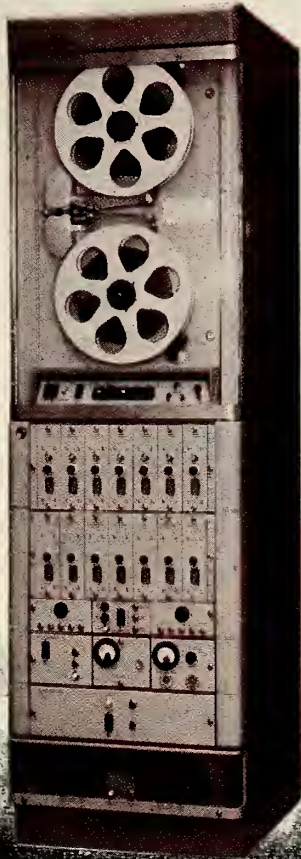
• **About missile spending**: The balance is tipping heavily towards missiles at the expense of aircraft. Official Pentagon figures: Aircraft dropped from \$8 billion in Fiscal Year 1957 to \$7 billion in 1958. Cash outlays for missiles in 1958 are pegged at \$2.955 billion, compared to \$2.09 billion in 1957 and \$3.44 billion forecast for 1959. Of the lot, AF will spend \$2.166 billion in 1959; Army, \$791 million; Navy, over \$487 million. These figures do not include electronics, ground handling, R&D, industrial facilities. Actual total's near double.

• **For a take-out on patents**, Trademarks and Copyrights in space age R&D, get a copy of the Senate Judiciary Subcommittee report on P., T. & C. on "the impact of the patent system on research", which concludes that the patent system has contributed little to the progress of science.

• **Defense Secretary McElroy** has ordered establishment of a Supply Support Center to monitor and coordinate the procurement of both "commercial" and "non-commercial" materiel common to all three services. To be operative by September-end, it will not do any actual buying. . . . **More red tape**: Defense Department Directive No. 4000.4 (June 10) concerning conservation of critical materials will shortly result in promulgating directives to the missile contractor—**Less red tape, maybe**: Defense Department has killed off 133 joint military service committees and given 94 others until August 1 to justify their existence. Some of those eliminated were concerned with such things as communications-electronics, logistics plans, aluminum forgings, close-tolerance bolts, extrusions.

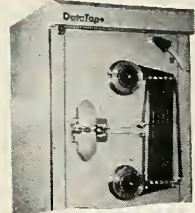
• **Around Capitol Hill**: It looks like Renegotiation Act extension will be delayed beyond present expiration date of December 31, 1958. House Ways and Means Committee wants more time to study proposed changes. Lapse won't mean a period free of renegotiation, however, since renewal will be retroactive. . . . **The House-passed H.R. 8002**, designed to return Government to an accrued expenditures accounting system, has been sent to Senate Appropriations Committee, with report required back in 15 days. Hearings are planned. Passage of this bill would help preclude the kind of spending limitations that were imposed last fall. . . . **House Armed Services Investigation Subcommittee** starts hearings today on

90%
of all U.S.
long-range
missile
test flights
are recorded
on CEC
DataTape



5-752 MAGNETIC TAPE
RECORDER/REPRODUCER SYSTEM

lowest
cumulative flutter
from 0 cps
assured with
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ADJUSTABLE TAPE LOOP
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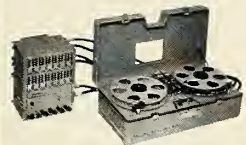
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5-781
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loop)



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The military and industry alike use the 5-752 in recording telemetered missile data, wind-tunnel testing, jet and rocket engine testing, shock and vibration studies, mobile and stationary structural testing, static and dynamic testing, sound measurements, and medical research.

Two exclusive design advances distinguish the 5-752 as a leader in the field of data recording and reproducing:

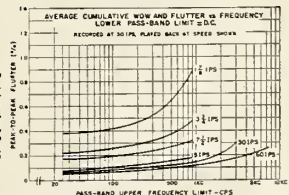


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The all-metal-surface of CEC's magnetic heads promotes a self-cleaning action and minimizes head wear. Oxide can't build up on heads to cause drop-outs or loss of high-frequency response.

LOWER FLUTTER EVEN AT LOW TAPE SPEEDS

At tape speeds of 1% and 3¾ ips, cumulative flutter in the 5-752 is about 50% less than the flutter found in other tape equipment. Accompanying chart shows flutter recorded at 30 ips and played back at speeds indicated.



For complete information, contact your nearest CEC sales and service office, or write for Bulletin CEC 1576-X25.

DataTape Division

Consolidated ElectroDynamics



300 North Sierra Madre Villa, Pasadena, California

OFFICES IN PRINCIPAL CITIES THROUGHOUT THE WORLD

. . . industry news countdown

Armed Services Procurement Regulations in an effort to cut Defense Department's overhead and simplify procurement rules . . . **Raytheon Mfg. Co. has asked Congress** to omit "patent rights section" from pending National Aeronautics and Space Agency bill, in order to give the agency some discretion as to who would own patent rights resulting from private or publicly-financed space age R&D . . . **Defense Production Act** has been extended for another two years. This is the law that provides for stockpiling of essential raw materials, granting of priorities, loan guarantees for government contractors.

• **Advanced Research Projects Agency** has been ordered by Defense Department to get busy with a solid propellants research program designed to give "specific impulses at least 10- to 20% higher than other propellants now under development for operational applications" . . . First **Titan ICBM** will soon arrive at Cape Canaveral for testing . . . **Brig. Gen. Homer A. Boushey** forecasts **manned outposts** on both Moon and Mars within 20 years; sees overwhelming urgency for military exploration of space. He spoke at a recent Rocket Fuel Chemists Meeting in L.A. . . . **ARPA** has ordered immediate establishment of a radar and communications fence across the southern U.S. to detect and track all satellites up to 1,000 miles . . . **AMC** has created an Electronic Support Subsystems division . . . **Navy's stepping up firing of Polaris test vehicles at Cape Canaveral** . . . **Defense Department missile czar W. M. Holaday** indicated (at IRE meeting) that free-fall nuclear bombs soon will be entirely replaced by **Rascal, Corvus, Hound Dog** and others in the works . . . **Holaday also named BuOrd** senior systems engineer E. E. Harriman as his chief scientific advisor . . . **AF Deputy Chief of Staff (Materiel) Lt. Gen. C. S. Irvine** told an Industry Missile and Space Age Conference in Detroit that contracts will be placed more and more on the basis of performance, rather than prestige.

• **Secretary McElroy** says **Fiscal Year 1960 budget** will go "somewhat" above 1959's \$41 billion level; also says he expects a decision between **Thor** and **Jupiter** as the IRBM by year end . . . **GE Board Chairman P. D. Reed** has asked that allowable Defense business profit margins be related to contract performance; agrees with some top-level Pentagon thinking . . . **Dr. P. D. Foote, Assistant Defense Secretary** for Research and Engineering, says that too little is being done to support basic research; that this effort will increase in the next and succeeding years . . . **Army Secretary W. M. Brucker** says of 38 **Jupiters** launched, 29 were completely successful; seven partially successful; and that two were of no scientific value at all, even though all 38 cleared launching pad.

• **Nation's first operational SAGE installation** (McGuire AFB) cost \$137 million . . . **Lockheed Aircraft Corp.'s Missile Systems Div.** is splitting R&D into three stages—advanced systems, spacecraft and missiles, communications and controls . . . **Litton Industries, Inc.** has signed an agreement to purchase **Airtron, Inc.** . . . **Thompson Products' Tapco Products** has created a new sales and marketing organization for missiles, aircraft, electronics, nucleonics . . . **Ramo-Wooldridge's STL Aeronautics Laboratory** has been redesignated as **Astro-vehicles Laboratory** . . . **Aeronutronics Systems, Inc.** has started work on a computer development building at Newport Beach, Calif. . . . **Sylvania Electronic Systems Div.** has announced plans for construction of a 70,000 sq. ft. computer plant at Williamsport, Pa.

• **Haller, Raymond and Brown** (recently acquired **Singer Sewing Machine Subsidiary**) has opened its new permanent headquarters at State College, Pa.—HRB specializes in R&D on infrared, radar, fire control, surveillance systems . . . **Hef, Inc.**, is building a multi-million-pound-per-year ammonium perchlorate production plant near Columbus, Miss. . . . **Mithra Engineering Co.** has been formed to work in experimental testing field . . . **Solartron, Inc.**, has been named exclusive U.S. sales representative for **Ericsson Telephones Ltd.** and **Goodmans Industries Ltd.**

• **American Electro Metal Div. of Firth Sterling, Inc.**, has released a price list of over 60 borides, carbides, nitrides, silicides and inter-metallic compounds . . . **Kaiser Aluminum & Chemical Sales, Inc.**, announces availability of high purity, high tensile strength aluminum casting alloy, X357.

Advertising correspondence should be addressed to Advertising Sales Manager, Missiles and Rockets, 17 East 48th Street, New York 17, N.Y.

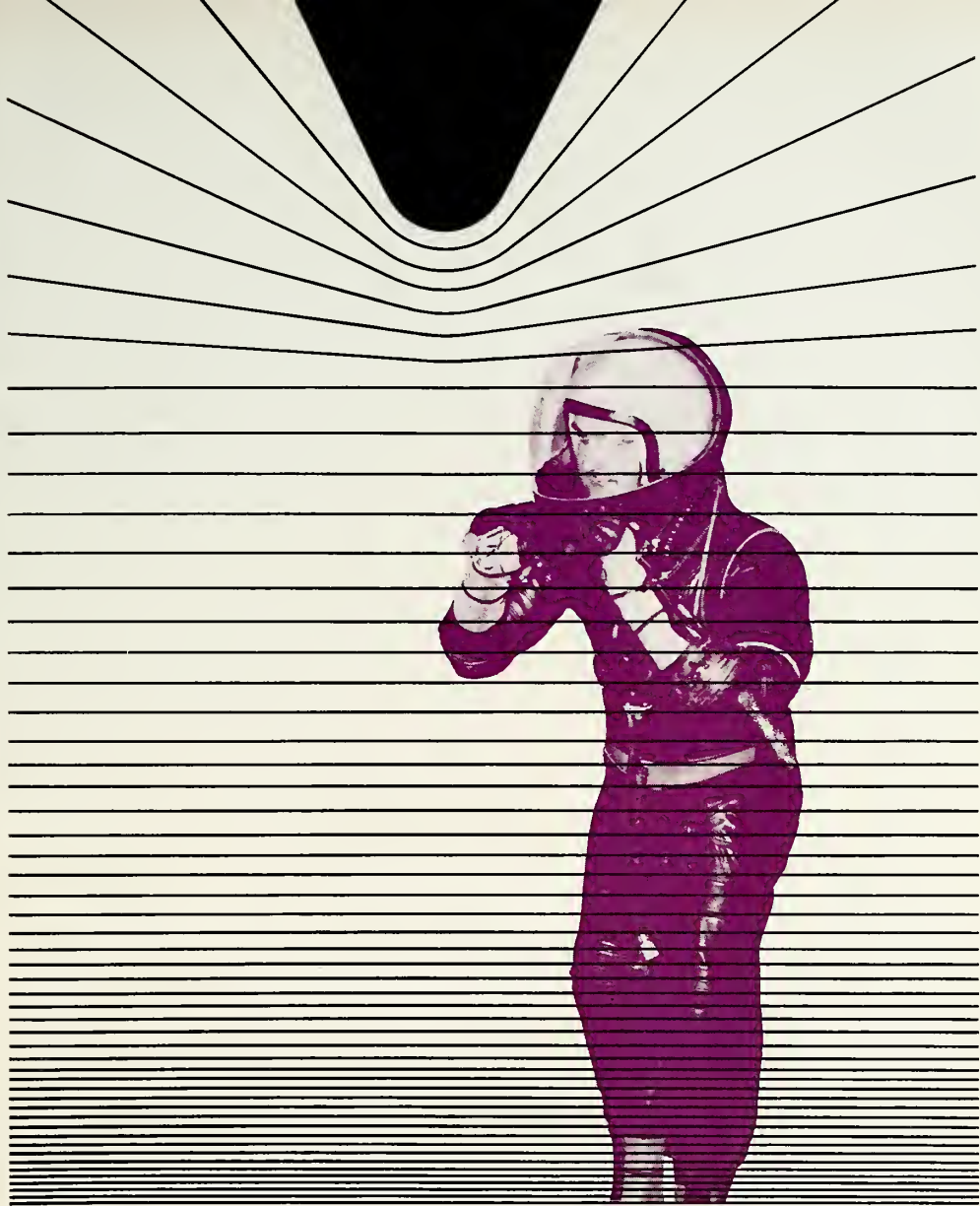
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advertiser's index

| | |
|--|----------------|
| Aerojet-General Corp., Sub. General Tire & Rubber Co. . . . | 6 |
| American Bosch Arma Corp. | 24 |
| Arnoux Corp. | 32 |
| Avco Mfg. Co. | 39 |
| Clifton Precision Products Co., Inc. . . . | 40 |
| Consolidated Electroynamics Corp. . . . | 37 |
| Diversey Engineering Co. | 4 |
| Douglas Aircraft Co., Inc. | 16 |
| Dow Chemical Co., The | 15 |
| Food Machinery & Chemical Corp. . . . | 31 |
| Hi-Shear Rivet Tool Co., The | 35 |
| Hydro-Aire, Inc. | 2 |
| Janitrol Aircraft Div., Surface Combustion Corp. | 30 |
| Walter Kidde & Co., Inc., Aviation Div. | 27 |
| North American Aviation, Inc., Missile Development Div. | 12 |
| Ryan Aeronautical Co. | 8 |
| Solar Aircraft Co. | 28 |
| Thompson Products, Inc. | 19, 20, 21, 22 |
| Titanium Metals Corp. of America | 17 |
| Transee & Williams Steel Forging Corp. . | 3 |

missiles and rockets, July 7, 1958



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in **PRECISION
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RESOLVERS**



Size 8
Wt.: 32 grams
Diam.: .750 in.



Size 11
Wt.: 90 grams
Diam.: 1.062 ins.



Size 15
Wt.: 160 grams
Diam.: 1.437 ins.

ACCURACY

Without any compensation or balancing, 60% of a recent production run of our precision computing resolvers showed functional errors of under .03%. Ninety-five percent of the units showed under .06% error.

Perpendicularity of axes is held to one minute of error in 90 degrees, or $\pm 3'$ on the full circle. Due to extreme symmetry of rotor and stator, nulls are excellent. Low phase shifts are an added feature.

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Many types of Clifton Precision computing resolvers are offered including:

- Sizes 8, 11 and 15
- Stainless steel housing and bearings (corrosion resistant) optional
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- The following compensation available in any or all units:
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- Units suitable for use with transistors
- Pin or screw terminals or lead wires
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