

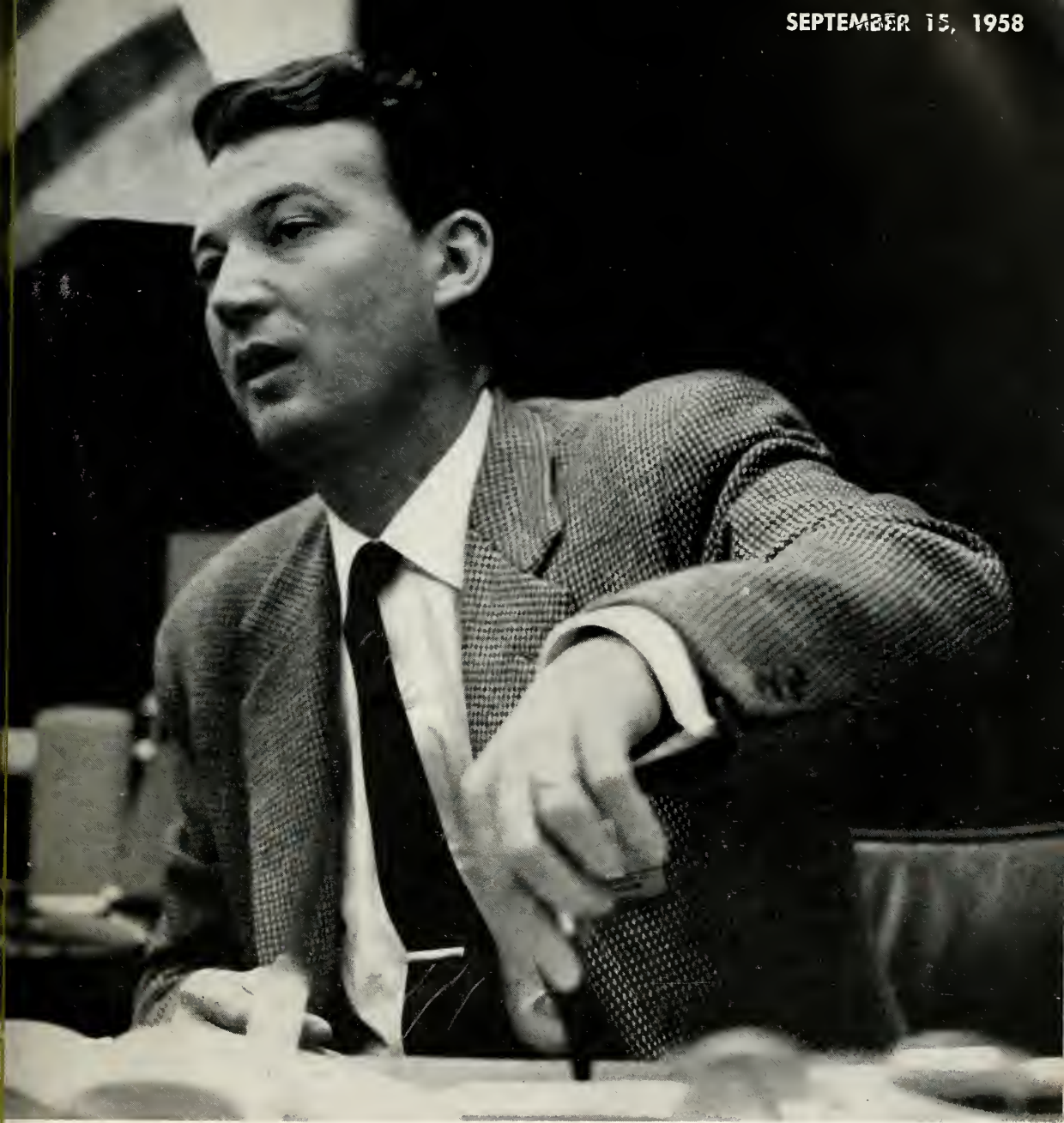
## CONRAD LAU

Conrad Albert Lau, aeronautical engineer, inventor, executive, known to his friends and business associates as "Connie", was born on February 8, 1921 in Port of Spain, Trinidad, British West Indies to Mr. and Mrs. Egbert Lau. He was one of a family of four, all boys. His brothers were Neil, Roy and John. He and his wife Nancy Page Lau had three children, Conrad, Jr., Sally and Michael.

Conrad attended school in Trinidad through his sophomore year at Queen's Royal College. He entered Massachusetts Institute of Technology in his junior year. He received his B.S. Degree in 1942 and his Masters Degree in Aeronautical Engineering in 1943. While at MIT he was on the Dean's List for high scholastic achievement, and he was elected to membership in TAU BETA PHI, National Honorary Engineering Fraternity. Also, at MIT, in recognition of his Christian leadership, he was elected Secretary of the Technical Christian Association, a student organization of all Christian denominations dedicated to practicing and encouraging the Christian life.

Conrad joined Chance Vought Aircraft, Division of United Aircraft Corporation, upon graduation from MIT in 1943. He devoted his entire professional career to the Company that had become Ling-Temco-Vought, Inc. at the time of his untimely death, April 18, 1964. Through his initiative, superb intelligence, and human warmth, he had advanced rapidly from the position of Junior Aerodynamics Engineer to Director of the U. S. Navy VAL Light Attack Aircraft program for LTV.

SEPTEMBER 15, 1958



# missiles and rockets

MAGAZINE OF WORLD ASTRONAUTICS

**News and Business Edition**

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**LIFELINES FOR THE AGE OF SPACE**

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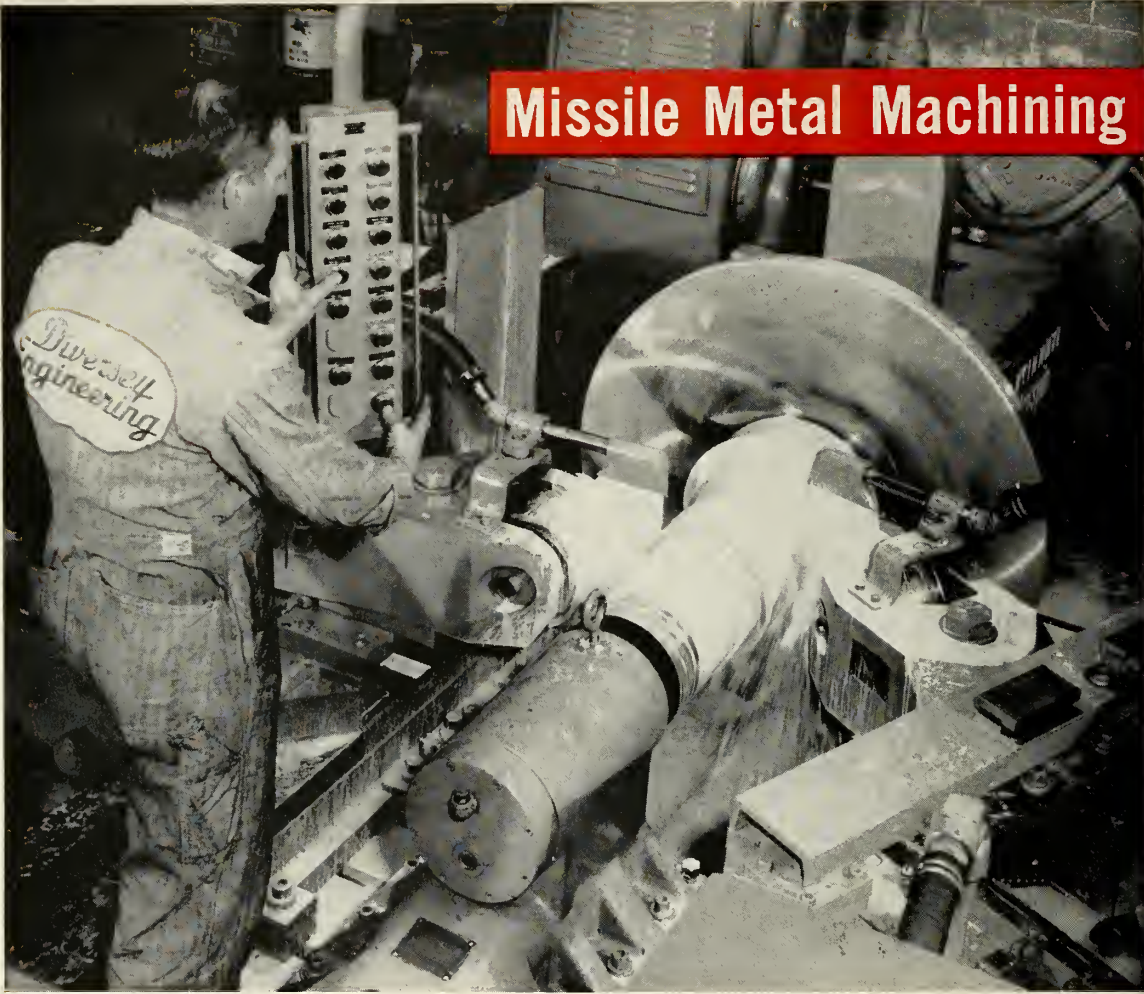
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missiles and rockets, September 15, 1958



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## editorial viewpoint . . .

It's much easier to comment on what has not been done than what has been done in appraising the President's leadership in the post-Sputnik era of almost a year.

After October 4, the Administration made flat promises that every effort would be made to give this nation a stronger defense and a hard-hitting space program; and that more money would be forthcoming for such a program. It was implied that prompt decisions would be made in the "gray" areas of civil vs. military projects; appointment of competent leaders, who could contribute materially to needed reorganization of thinking and action, would be made without regard to politics and Pentagon pressures.

But today there is a turnabout, and a new line. It is said that we are still stronger militarily than Russia, that we can win either a limited or a general war, and that we can't take the chance of spending ourselves into bankruptcy by buying unproven space-age weapons.

Senator Stuart Symington (D-Mo.) has picked up this reasoning, and challenged it point by point as a threat to the nation's security.

For one thing, says Symington, defense expenditures are up only 1.3% (about enough to account for depreciation of dollar value) since Sputnik I. For another, he doesn't believe the U.S. can match Russia in all categories; and that too much of defense is being built on the basis of tradition, rather than progress. He also points out that "incredible" lack of airlift hampered swift landings in the mid-East; and that the Army's Nike program is out of date, mainly because the ability to shoot down a bomber at 50 to 100 miles is not too effective against rockets air-launched 2,000 miles away.

Even though Congress gave the Administration more money for defense than it asked, there is no doubt that the military has found itself laced too tight in the financial straitjacket imposed upon it by a leadership that has bowed to "economy politics" in an election year.

If there is any apathy or complacency on the part of the American people, it is no less than the nation deserves, considering the lack of foresight of the Administration. The fault should be clearly placed at the doorstep of 1600 Pennsylvania Avenue.

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Maj. Gen. Bernard A. Schriever, commander, Air Force Ballistic Missile Division of Air Research and Development Command, ramrod for Air Force's lunar probe attempts. (see page 17)

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missiles and rockets, September 15, 1958



## washington countdown

**Army is worried** over the future for *Nike-Ajax* and *Hercules* programs. Pressure from a cost-conscious Congress will force Secretary McElroy to make a decision between *Nike* and *Bomarc*—which may result in a slowdown on one missile, rather than sudden death. *Nike-Zeus* probably will continue to have high priority as AICBM.

**The difficulty** of McElroy's decision lies in the really small differences between contending missiles. The current *Bomarc* model, for instance, has a slight edge over *Hercules* in range. But *Hercules* is simpler and cheaper to operate, and can be phased into existing *Nike* facilities.

**Seven more AF lunar probes** may be in the making. There will be many Allegheny Ballistics Laboratory-developed third-stage rockets of the *Vanguard* program delivered to Air Force for its *Thor-Able* combination. Note: The ABL rocket is untested on *Vanguard*, did not fire on the first lunar shot.

**Don't expect fast action** on the U.S.'s proposal (see also p. 27) for peaceful exploration of space. The plan, in detail, is even more complex than the centuries-old attempt to outline freedom of the seas. Many observers see the move by the U.S. As a political one to gain public-relations initiative. Some even see the move as dangerous to U.S., since it would apparently tend to freeze development in its present state—with Russia ahead.

**AF is bothered**, after its brass got a look at the October issue of *Army News Digest*. The pamphlet-sized *Digest* is entirely devoted to a well-presented discussion of Army's role in the space age. What bothers Air Force is that Army discusses space as a military realm—and one which it could handle adequately alone. AF says it has been abiding by a ruling that forbids discussion of space on military terms.

**Successful flight** of Australia's *Black Knight* rocket, from the Woomera Rocket Range, is being watched closely from Washington. Another major ally with rocket

capability of its own is welcome. Actually, *Black Knight*—first major experiment with a large ballistic rocket by the British Commonwealth—is rated a tremendous stride, after a very slow start. The new rocket (Saunders-Roe), is 35 ft. long, 3 ft in diameter, reached an altitude of 400 miles—well over any single-stage U.S. research rocket.

**Dissension** in the worst possible place—right at home—is reported in Navy's Bureau of Ordnance, over the BuOrd's Special projects team for *Polaris*. Non-team member civil service people are griping over higher salaries, less work (they say) for team participants.

**Matador might be first** U.S. missile used in a shooting war, if anything serious (from a U.S. point of view) develops out of current bombardment of Chinese offshore islands. With a range of up to 700 miles, and guidance centered around a hyperbolic grid system (and nuclear warhead capability), *Matador* is already based on Formosa.

**Signing of renegotiation act** extension for six months is counted as a victory by manufacturers, who fought hard against law during recent Congress. Although new act extends some provisions the manufacturers dislike, the "victory" comes in this way: As written, the extension carries an implicit promise that Congress will give the whole statute a thorough airing during the next session. Permission to appeal Tax Court decisions to the U.S. Court of Appeals is one of the things industry may get out of any restudy of the law.

**Heavy emphasis on space** is obvious in announced program of closed-session discussions of the Air Force's Logistics Discussion Group at Maxwell AFB next week. First-day speakers will include Dr. Hugh L. Dryden of NASA; Dr. W. R. Dornberger, of Bell; Dr. Krafft Ehrlicke, of Convair—and J. A. Johnson, Air Force general counsel, who will discuss space law. Maj. Gen. L. I. Davis will talk later on reliability and environmental testing.





OCT. 20-30...PROJECT WILLIAM TELL...

## **RYAN FIREBEES TEST AMERICA'S AIR DEFENSE IN FIRST WEAPONS MEET TO USE JET TARGETS**

Ryan Firebees are the exclusive flying "bull's-eyes" for the Air Force Project "William Tell"—first weapons meet to use free-flying jet targets. 100 Firebee jet drones will test the pilots, planes, and missiles of America's air defense system under the most realistic "combat" conditions ever achieved.

Firebees will not only draw the fire of the nation's crack Air Force pilots: they will score the results in mid-air with a new electronics system. A running record of hits, misses, and near-misses will be instantly transmitted from Firebees to scorekeepers on the ground. Other Firebees will photograph missiles boring in—or streaking away if they don't score a "hit."

Pitted against the Firebees in this world-wide

weapons meet will be the top Air Defense Command squadrons, flying Convair F-102, Northrop F-89J and North American F-86L interceptors. They will fire deadly Falcon guided missiles, and Genie and "Mighty Mouse" rockets.

Only the Firebee—the most advanced target drone—has the high performance, reliability, and extended duration needed for realistic weapons evaluation. In service with the Air Force, Navy, and Army, Firebees are flying in greater numbers and for more hours than any other jet target drone.

The Firebee is another outstanding example of Ryan skill in blending aerodynamics, propulsion, and electronics knowledge to produce a superior product.

# **RYAN BUILDS BETTER**

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## industry countdown

### paperwork down

Mountains of paperwork for missile manufacturers might dwindle a bit. Gen. E. W. Rawlings, Air Materiel Command chief, gave the tipoff in orders to materiel areas in which he said he wants reports from industry limited to those "urgently needed." Missile makers—recently upset over plans for voluminous Missile Makers Planning forms (m/r August 4, p. 12)—could breathe "amen." The general's prime example: one major contractor is now submitting some 81 Budget Bureau reports, 141 other reports. Spending time is equivalent to the work of 700 persons a year.

### price redetermination

DOD proposals to modify price redetermination contract clauses worry Electronics Industry Assn., Aircraft Industry Assn., and others. Reason: an "undue emphasis" on obtaining cost information, which industry insists gives contracting officers a blanket authority to demand any information they might consider to have a bearing on price redetermination. Under such authority, a whole new set of accounting records—in addition to regular financial records—could be required. Another reason for worry: DOD's new proposal, in effect, might convert fixed-price contracts into cost-type contracts.

### buy British?

English manufacturers reportedly are making yet another attempt to break U.S. policy of buying only U.S. products to support its forces stationed in Britain. Latest effort centers around the offer of British-produced rocket launchers made of fibre glass.

### personnel

Three high-ranking military men, with background and experience in missile-related fields, beefed up top missile makers this week. RAdm. John A. Scott, with a long naval record in aircraft and undersea missions, joined Link Aviation as Coordinator of Military Requirements; Maj. Gen. Arthur W. Vanaman, former commandant of the Industrial College of the Armed Forces, became assistant to President Dan A. Kimball of Aerojet-General Corp.; Col. Harry G. Spillinger, former chief of production engineering staff division, Air Materiel Command, is now manager of systems reliability and safety control for Boeing Airplane Co.

### business in satellites

Emphasizing the continuing importance of earth satellite programs for business is Lockheed Missile Systems' assignment of top weapons management men to Air Force satellite development. J. H. Carter, who heads the satellite program, has been given two assistants—one for systems management, the other for "future applications." Systems aide is D. J. Murphy, who headed the division's project systems branch; "futures" aide is R. M. Salter, formerly assistant project manager.

### money tightens

The inflation-wary Federal Reserve System had news for businessmen: discount rates at two more of its branches—Chicago and Minneapolis—will go up from 1¾% to 2%. That makes a total of six (out of 12) Fed branches that have raised rates—which means a tightening of money available to commercial banks and business borrowers.

### money eases

The Office of Civilian Defense Mobilization has ok'd accelerated amortization on seven missile research and development projects for the Martin Co. (involved in development of the Titan); and approved similar fast amortization for J. C. Carter Co., Costa Mesa, Calif., for development of aircraft and missile parts.



# Here's First True Underwater Guided Missile

Wire-Guided Torpedo—With New Type Propeller For High Speed —  
Seen Major Breakthrough in Anti-Submarine Warfare Techniques.

by William O. Miller

The U.S. Navy shortly will begin to receive its first real underwater guided missile.

Though the project has been under development for several years, the first concrete evidence that success is near came with the announcement of the Mark 39 wire guided torpedo, developed for the Bureau of Ordnance by Vitro Laboratories of Silver Spring, Maryland.

Coupled with the almost simultaneous announcement of development of a supercavitating propeller, the Navy has made what amounts to a major breakthrough in anti-submarine warfare. This is in addition to advantages against surface targets.

Evasive action, the best defense a submarine has against torpedoes, is more or less nullified by the ability of U.S. submarines now to transmit signals to the Mark 39 torpedo to guide it to an enemy vessel. Time for the evasive action will be materially reduced by the supercavitating propeller which will permit underwater torpedo speeds in excess of the present efficiency limitation of about 50 knots.

• **Wireguide**—The fine wire over which the signals are transmitted plays

out from a spool in the torpedo and a spool in the submarine. While presently in only limited production, a number of U.S. submarines have certain parts of the system already built into them which will permit their employment of the Mark 39 as soon as it is made available.

The controller had a keyboard of small switches by which he controlled the torpedo and exploded it. It was built for a European power but manufacturing rights for two were sold to the U.S. Navy.

• **Super prop**—The supercavitating propeller recently demonstrated at the David Taylor Model Basin was the direct result of work done in the field of hydrofoils by Marshall P. Tulin while at the Model Basin.

Cavitation is the formation of cavity of water vapor on the surface of the rapidly revolving propeller blades. As the propeller turns faster, the cavity builds up. There is a reduction of the efficiency as the cavity collapses causing vibration, noise and erosion of the blade. The hydrofoil section of the Tulin blade elongates the cavity and as it becomes longer than the width of the blade, supercavitation is said to exist. This turns the former detri-

## Navy Makes Vessel Subsystem

It's more than a play on words that the Fleet Ballistic Missile submarine is a subsystem. For the first time the Navy is making a vessel a subsystem of a weapons system. The five subsystems of the nuclear powered, *Polaris*—equipped, system (now officially designated SSBN . . . Submarine Ballistic Nuclear) are:

1. The missile.
2. The fire control equipment.
3. The navigation equipment.
4. The launching equipment.
5. The submarine.

mental effect of cavitation to an advantage with a much higher efficiency rating and higher rotational speeds.

## Bendix Dyna-Soar Role Outlined

According to Dr. Russel D. O'Neal, Bendix divisional general manager, Bendix Aviation Corp.'s Systems Division at Ann Arbor, Mich., will head the company's participation in the Martin-Bell *Dyna-Soar* project.

*Dyna-Soar*, a joint Air Force-industry project, is aimed at developing a manned vehicle capable of circling the globe in approximately two hours. The Martin-Bell team, as well as another team headed by Boeing Airplane Co., is currently performing the necessary research and development work to design a practical model of the *Dyna-Soar* "booster-glider" in approximately 12 months.

Bendix will work on communications systems, telemetering systems, hydraulics, electrical power conversion, cabling, and electrical connectors.

In addition to the Systems Division, the following Bendix affiliates will participate in the program: Bendix-Pacific, North Hollywood, Calif.; Bendix Radio, Baltimore, Md.; Scintilla Division, Sidney, N.Y.; and Red Bank Division, Eatontown, N.J.

In his statement, Dr. O'Neal said: "The man-machine combination to be evolved in this program must be designed to withstand extremes of temperature and other extraordinary environmental conditions that, up to now,



Wraps have been taken off of the Navy's first real torpedo breakthrough in several years with the announcement of limited production of the Mark 39, wire-guided torpedo. The range of the Mark 39 has not been released.

have never been encountered in piloted flight.

"For example, a major problem will be radio communications through the electrically charged, or ionized, particles that surround an orbital vehicle. Bendix has had these environmental problems under investigation for some time, and it is in this area that we hope to make a major contribution to the *Dyna-Soar* program."

The Systems Division's *Dyna-Soar* Project Office will be headed by Robert H. Johnsen. Thomas E. Lynch will coordinate Bendix activities in the study of radio propagation, communication, and navigation.

The torpedo and its director, in addition to the wire technology, were developed by the Silver Spring Laboratories of the Vitro Corporation of America. While Vitro is manufacturing the directors, the Mark 39 torpedoes are being produced by the Philco Corporation.

Vitro has been on the Bureau of Ordnance's torpedo and guided missile program since the company was formed in 1948. The company's contracts have included not only underwater weapons such as torpedoes, mines, (and mine counter-measures), but through successive contracts, Vitro has taken part in every Navy ship's system with the exception of the USS Gyatt, which was the first destroyer to employ the *Terrier* missile.

Vitro has been most active in the development of weapons systems engineering for the Navy. As one company spokesman put it:

"It is our job to eliminate the gross incompatibilities of the components of a weapons system. Our goals are reliability, simplicity and a reduction in the cost of a given system."

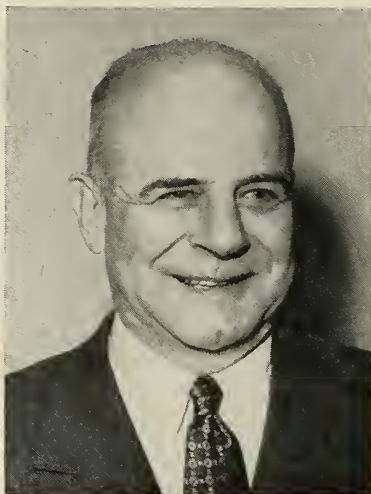
While maintaining a continuing interest in *Terrier* and *Talos* programs, the company has been more active in recent years in coordinating the control systems for various type ships and in several phases of the *Polaris* Fleet Ballistic Missile program.

The company was among those who recommended and pushed for an underwater ejection system for the *Polaris*, and for the Navy's activity in the solid fuels field for the *Polaris* and other missiles.

• **Underwater Interests**—The company's interest in underwater weapons and systems has been heightened in recent years. Emphasis has been placed on all phases. As an adjunct to other programs, Vitro has developed for the Navy in-service training programs in underwater sound and underwater television.

No other firm is performing exactly

## Named to Space Council



**APPOINTED MEMBERS** of the important Space Council of the National Aeronautics and Space Administration are: (top, right): Dr. Alan T. Waterman, director of the National Science Foundation; Dr. James H. Doolittle (left) chairman of the National Advisory Committee for Aeronautics; (right): Dr. Detlev W. Bronk, president, National Science Foundation; William M. M. Burden, (left) former Assistant Secretary of Commerce. Other members include the President, Secretary of State John Foster Dulles, Defense Secretary Neil H. McElroy, and Atomic Energy Commission Chairman John A. McCone.

the same function Vitro does for the Navy, but all of its contracts have been obtained in competition. Unlike the system employed by the Air Force with Ramo-Wooldridge, Vitro has no voice in the selection of the contractors for the various parts of the weapons system it coordinates.

Incidentally, the idea of the wire-guided torpedo goes back to 1877 when John J. Lay held a public trial

of the Lay torpedo in Cleveland, Ohio. The Lay torpedo was steered by a double rudder controlled by means of electricity through the cables which, as Harper's magazine reported, "lies coiled like a harpoon line in a whale boat and is paid out as the boat pursues its way. This cable," the report continues, "may be of any length desired, and connected with the shore or a vessel."



# Getting Set For Pershing

## Army Outlines Procedures for Spending Billion

by Donald E. Perry

HUNTSVILLE—The *Pershing* missile—Army's "in-between" approach to weapons development—spells good business ahead for big and little firms.

The reason: some 60% of the Martin Company, Orlando Division's prime contract dollar—unofficially expected to exceed \$1 billion in the next three years—will go for outside procurement. There's even a contract guarantee to allow new firms to participate. Further, this method of doing business should aid in shortening development from a weapons system norm of seven to four years.

Let's look at the Army philosophy back of *Pershing*. There are two principal methods in weapons development. One is the prime contractor approach, where the major share of funds go out on contract to industry, which in turn fabricates. Only standards requirements and monitoring are performed by the government.

The other is what has been referred to as the Army's "arsenal concept," the system used for the *Redstone* and *Jupiter* programs. This is a complete in-house capability to act as a prime contractor to carry a system from concept, through design and development, to prototype and manufacture. Industry then receives the volume production task.

Army, often criticized by industry for its arsenal approach, believes an optimum approach for government is somewhere in between, and *Pershing* is the test. Assistant Army Secretary for Logistics, F. H. Higgins, says "this approach will set the standards for future Army systems development."

• **Prime responsibilities**—*Pershing's* development will work this way: AOMC, which conceived the system, will guide, manage and monitor the prime contractor with its in-house technical competence. Army feels strongly about retaining this competence instead of relying on what often has been referred to as "Pentagon Engineers," the quasi-competents who often hold up decisions when they tangle with industry personnel.

On *Pershing*, industry is wondering how much of a whip-hand the Army is wielding on selection of major subcontractors. Also, whether Martin and the major subs will be virtually free—as under the prime concept—to choose and monitor the work of minor suppliers.

Army Ordnance Missile Command at Huntsville answers this way: Martin and AOMA "cooperatively" selected major subs with Army retaining rejection rights. It is not contemplated that the Army will have to provide technical concurrence beyond that tier. Martin, in most instances, will retain its prime individuality.

However, AOMC has insisted on a contract clause with Martin and major subs which should have far reaching effect. They will have to furnish documentation "necessary to enable a manufacturer experienced in industrial production, but new in the missile field, to undertake production in any area of the *Pershing* system." This, Army feels, should guarantee that at least 35 to 40% of the dollar volume will go to small business.

Martin, according to its Procurement Director C. A. Blaney, is assuring this will be done, not only in the *Pershing* program, but in other areas of company business. He furnishes these facts:

When the Orlando division was set up less than two years ago, Martin wrote almost every small supplier in the southeastern U.S., asking their capabilities. This has provided a remarkable source file of more than 2,000 firm names, which has been kept up daily.

Martin, which issues 6 to 7,000 purchase orders a month, has spent \$58 million in procurement. Twenty percent of this was spent in Florida.

Facility teams, comprising inspectors, procurement and shop technicians, have inspected several hundred firms desirous of doing business with Martin and have given capability evaluations. This system has resulted in new supply sources.

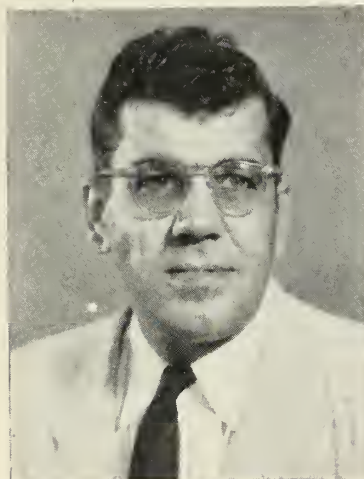
Teams of new procurement specialists have been established to deal with more than 100 vendors who visit the plant daily. Specializing in new ideas, these specialists refer representatives to appropriate Martin departments, such as structures and guidance.

A commodity buying team for all indirect items has been established, allowing more procurement attention to individual projects such as *Pershing*.

Blaney explains that it's the desire of both Martin and the Army to eliminate any costly duplication of end items in the *Pershing* system. For example, if an item from *Redstone*, *Jupiter*, *Nike* or any other Army system can be used in *Pershing*, it will be.



Assistant Army Secretary Higgins ". . . *Pershing* will set future standards"



Martin Procurement Director C. A. Blaney . . . he'll spend \$1 billion.



*Pershing* Operations Manager Sid Stark ". . . no engineering problems"

...speaking of

Missile Ground Support

**MOBILITY**

## WE HANDLE THE COMPLETE MISSILE LAUNCHER PROJECT

...from design through production

In January 1957, Douglas Aircraft Company, Inc., contacted FMC regarding the design of ground support equipment for the IRBM-THOR they were developing for the Air Force. That same month, FMC engineers went to work in the Douglas plant—and the THOR transporter-erector, launching base, and power-pack trailer preliminary designs were developed.

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*Creative Engineers: Find stimulating challenge at FMC's Ordnance Division.*

THOR transporter-erector, launching base, and power trailer were delivered by FMC in just 8 months—2 months ahead of schedule.



U. S. AIR FORCE PHOTO



*Putting Ideas to Work*

**FOOD MACHINERY AND CHEMICAL CORPORATION**

**Ordnance Division**

Missile Equipment Section-1E

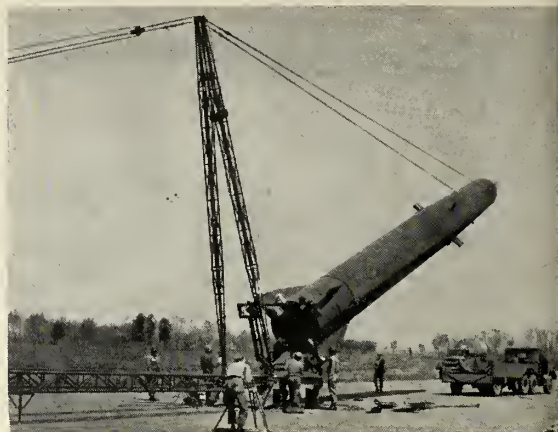
1105 COLEMAN AVENUE, SAN JOSE, CALIF.



# . . . spending billion for Pershing



**EIGHT THOUSAND VENDORS** and potential suppliers—many of whom are used in the *Pershing* program—are listed by the Martin Company's Orlando Division. Catalogue files in the background contain detailed information and sources.



**LIGHTWEIGHT GROUND HANDLING EQUIPMENT**, used in the *Redstone* system, will be employed with the Army's new solid-grain *Pershing*. Army expects to modify these frames, giving simplified mobility and readiness to the *Pershing* system.

This may result in a cost savings of five to 10%.

Martin is continuing its search for more suppliers, even though thousands have already been chosen for *Pershing*. "What we are searching for now are the bits and pieces close to our plant, because we like to do business in our own backyard," Blaney said.

• **Standardizing procedure**—Toward this goal, Army has provided Martin with lists of manufacturers, parts furnished, and drawings. Test results also are available. ABMA's Industrial Operations Division feels this is standardizing supply and engineering services, and will provide a lower cost weapon system. This may result in a one-third savings in the cost of preparing engineering drawings.

Army is also insisting that Martin and major subs come up with more stabilized design, so that items can be farmed out for formal advertised bidding. Sole sources of supply are being eliminated as much as possible.

Standardization is an Army byword for *Pershing*—starting with Assistant Secretary Higgins and continuing down the line. But new approaches to development will not be stifled by over-standardization. Higgins is not sure how this effort for standardization will work out.

"Our standardization efforts should make it a lower cost weapons system, but we also realize that this missile is expected to do more sophisticated things. We can save on standardization, but new developments—more precise range and so forth—might take up the difference. When a production

norm is 20 to 30 missiles a month, you can't get overly enthused by standardization," he said.

Surprisingly enough, according to Sidney Stark, *Pershing* Operations Manager for Martin, no major engineering problems have cropped up. One area which has normally been a problem is liaison with subcontractors, but this has been remedied on *Pershing*. Resident

teams have been set up at each subcontractor's facility. Team personnel include engineers, quality control and procurement personnel. Army also has a resident project engineer at Martin. In order to insure that *Pershing* gets proper attention, key personnel at Martin and each of the principal contractors can not be transferred without Army approval.

## 50 Prototype Models Planned

Army plans to produce 50 *Pershing* prototype models, with tactical testing scheduled for late 1960 or 1961. *Pershing* was conceived and designed by the Development Operations Division of the Army Ballistic Missiles Agency, Huntsville, Ala. Proposals were asked from some 30 firms in late 1957, with the award of a prime contract to the Martin Company.

Development under the Army Ordnance Missile Command was authorized by Secretary of Defense Neil H. McElroy, who eased Secretary Charles E. Wilson's previously-ordered 200-mile range for Army missiles. Decision has yet to be made whether Army will have operational use of *Pershing*.

*Pershing's* test vehicle will have two stages, a 30-ft. length and a 24-in. diameter (m/r May, 1958, p. 72). Both solids reportedly will generate the same amount of thrust, with first stage separating at jet stream altitude. The test vehicle will have parachute recovery. A camera

will be mounted in the final stage to take photographs within a four to five mile radius of the impact area. *Pershing* will have an inertial guidance system.

The missile will carry a nuclear warhead, probably exceeding the *Polaris* warhead of 650-lb. Warhead development is under supervision of Picatinny Arsenal. All components, except engines, will be tested on Martin-Orlando property. Test firings will be at Cape Canaveral. Ground support equipment will be simple, with possible adaptations of existing *Redstone* items.

Major subcontractors are: Bendix Aviation Corp., Eclipse Pioneer Division, Teterboro, N.J., inertial guidance stable platform and associated equipment; Bulova Watch Co., New York, fusing and arming systems; Thiokol Chemical Corp., Huntsville, Ala., design, development and production of propulsion system; Thompson Products Accessories Division, Cleveland, transporter-erector-launcher.

# Industry Fights Contract Change

Martin, which won the contract in a competition with six finalists (Army had asked 30 firms to submit proposals), did not have to add key personnel to the *Pershing* project. Personnel who were responsible for the proposal effort constitute the present team.

• **Final development**—Army's shift from liquid to solid propellant ballistic missiles understandably calls for more mobility and less ground support equipment. Engineers are stressing environmental control for the solid propellant.

Stark points out that below temperatures of -25 degrees and above 125 degrees F, there may be a problem of propellant grain cracking. With burning time more sensitive to temperature, designers may be forced to create environmental control kits for temperature extremes. It may be as simple as putting a plastic bag around the motor with thermal conditioning equipment inside.

*Pershing* can be handled in any attitude, and, importantly, can be checked out while horizontal. The system, which will use a small number of standard Army vehicles when these vehicles are developed, will be helicopter-aircraft-transportable and will have good cross-country maneuverability.

Due to Orlando's proximity to the Cape Canaveral test range, Martin will be able to avoid off-site field crews. All preliminary countdown and check-out will be at Orlando, allowing an early date for simulated tactical firing.

## Nike-Hercules Tested For Mobility at Eglin

Results of recent Army *Nike-Hercules* test firings at Eglin Air Force Base, Florida, indicate that the air defense weapon has mobility to support Army operations in any part of the world, according to the Army.

An Army task force from Fort Bliss, Texas, commanded by Brigadier General John T. Snodgrass, tested the mobility of the anti-aircraft system using both air and ground transportation. The tests proved that every piece of *Hercules* equipment can be airlifted easily and quickly, the Army said.

The *Hercules* was fired at target drones flying in formation and successfully picked off the lead F-80 drone. It was the first firing of *Nike-Hercules* with live warheads near a populated area; and the first firing of two *Hercules* missiles simultaneously in salvo.

Current Department of Defense proposals to modify price redetermination contract clauses is causing widespread concern among military contractors as evidenced by the recent submittal of briefs by two industry spokesmen, the Aircraft Industries Association and the Electronic Industries Association (see also p. 9).

Both associations point out that an "undue emphasis" on obtaining cost information, stemming from certain reports submitted by the Controller General to the Congress as a result of isolated investigations, is causing the basic concern.

AIA and EIA, while fully recognizing that the goal of obtaining a fair and reasonable price for products is the basic purpose of price redetermination, charge that current clauses "have a tendency to give undue importance to the elements of price of components and subassemblies."

The real excuse for price redetermination, they say, is to arrive at a fixed price as soon as possible and to hold the administrative burdens involved to a minimum.

An important point argued by the associations is that fixed-price contracts should bear little or no relationship to cost-reimbursement types. Effect of the new clauses would be in large measure to convert the fixed-price contracts into cost-type contracts, through the use of price redetermination techniques.

• **Get a price**—One of the more important factors to industry is that the final price be fixed as soon as feasible, but in the current proposal, no definite time limit is set in which the Government must ask for additional cost information.

Because of this, industry is asking that a cut-off date be agreed to in advance both for the submission of cost and performance data. Otherwise, it appears that the Government could ask for the extra information right up to the date of the actual price redetermination agreement.

In this case, the contractor's only relief would be under the disputes section of the contract, under the terms of which a cut-off date would be provided. But here again, the contracting officer may delay in setting a cut-off date, with the end result that the entire fixed-price concept could be defeated.

The form and nature of the contract performance data itself is another point of contention. Spokesmen say that the information that a contracting

officer is entitled to ask for ought to be agreed to when the contract is negotiated. One company says, "A contracting officer should not have a blank check for any information which he considers might possibly have some bearing upon price redetermination negotiation. Further, the form in which such information is supplied should be such that it can be readily determined from contractor's financial books and records and not perhaps require a whole new set of accounting records."

Actually, the yards and yards of records now being required as a result of such contract clauses are of mounting concern. A recent study showed that five contractors were forced to submit a total of 222 reports, only 81 of which has been approved in accordance with the Federal Reports Act.

Because of the strenuous objections voiced by the AIA and EIA, the Defense Department, in line with established procedures, will restudy the proposed price redetermination clauses before any action is taken.

## Testing Failure Forces Lunar Shot Postponement

A failure during static testing of the Air Force's second lunar probe vehicle makes it unlikely that any firing attempt will be made this month. Firing date for the probe had been set for September 14.

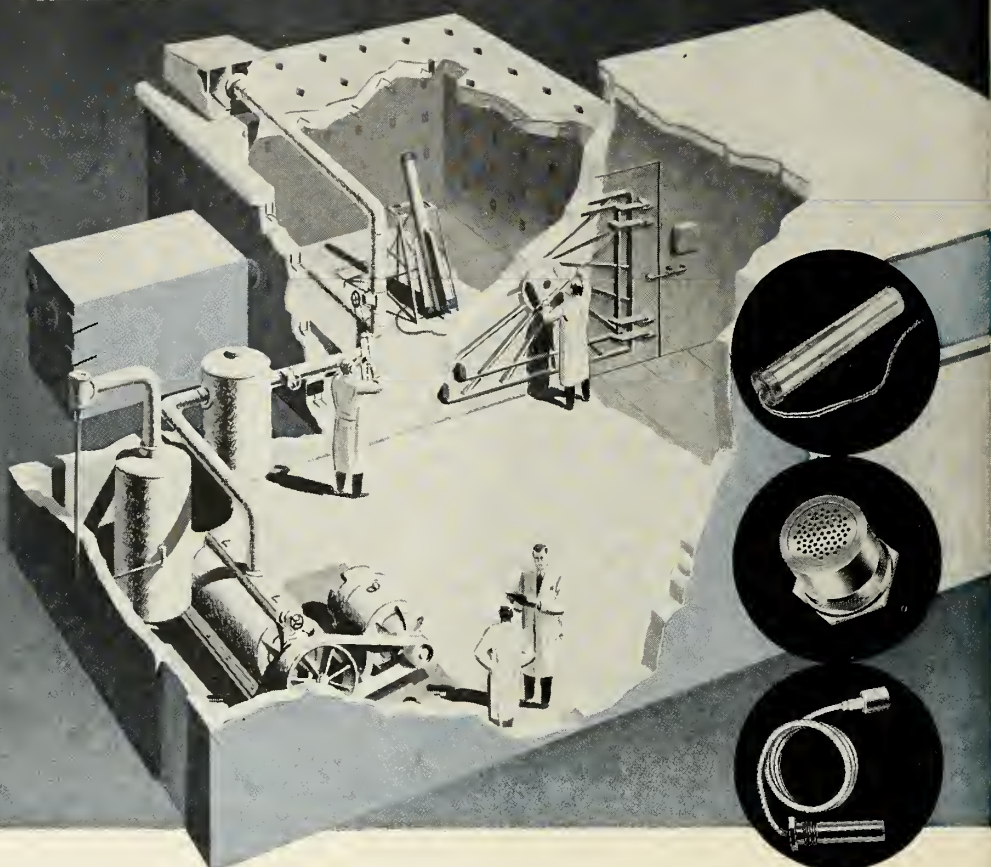
Advanced Research Projects Agency told m/r that the failure could not be remedied until at least September 17—three days beyond the optimum firing time—and this would weaken chances for the probe's success.

ARPA Director Roy W. Johnson, when informed by Air Force Ballistic Missiles Division of the trouble, issued orders that the probe would not be undertaken unless there is a maximum probability of success. ARPA declined to discuss the failure except to say that it has no connection with the failure of the first lunar probe vehicle. No official Defense Department explanation has been given for the August 17 failure but it has been speculated that it was caused by a rupture of tankage in the first stage *Thor*.

The next most opportune time for a lunar probe attempt will be the three-day period starting about October 12 when the moon again swings close to the earth. Russia—theoretically at least—will get two chances to reach the moon before the U.S. tries again. Best times for the Soviet Union are September 13 and October 11.



# SETTING THE STAGE FOR RELIABILITY IN OUTER SPACE



## How **National Northern** assures dependability in high altitude performance of ignition devices, pyrotechnics, and explosive components.

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## Schriever Proved Long-Range Prophet

A forecast made 18 months ago in m/r—more a dream than a reality then—is coming true for Maj. Gen. Bernard A. Schriever, featured on this week's front cover.

It was then that the boss of the Air Force's present lunar probe program indicated to m/r that pioneering military research with IRBM/ICBM rockets would lead the way for the first peaceful scientific exploration of the lunar satellite.

Often criticized, often praised, often disappointed, but more often hopeful for full success of the nation's ballistic rocket and space exploration programs—of which he has been among the most-critical—Gen. Schriever, along with a free world, now waits and wonders.

The hybrid rocket poised at Cape Canaveral will be launched

for a second try at circumnavigating the moon. The technological odds still are stacked overwhelmingly against success, but hopes and aspirations are not.

It seems fitting that m/r should paraphrase what Schriever said: . . . Out of the tremendous IRBM/ICBM effort will come a wealth of design information and hardware that will be useful for other things beyond that for which they were designed . . . Airframe, propulsion, and guidance subsystem developments and the data which will become available as ballistic missile test flights are made, will make possible a whole series of follow-on programs . . .

The second lunar probe attempt is just a small part. More ambitious programs will be the result.

Dr. H. E. Newell, Jr., NRL  
Capt. Charles F. Gell, ONR  
Brig. Gen. D. D. Flickenger, ARDC  
Mr. Robert D. Demoret, The Martin Co., Denver  
Lt. Col. Rufus R. Hessberg, A.F. Missile Development Center, Holloman AFB  
Mr. Vincent Blockley, North American Aviation, Inc., Inglewood  
Mr. Charles L. Barker, Jr., ABMA

## Space Flight Expert Boosts Solar Sailing

The "solar sailing" theory was given another boost recently by space flight expert Herb R. Lawrence, who predicted its use for interplanetary flight.

Lawrence, associate director of the Astrovehicles Laboratory of Space Technology Laboratories, likened the effect of the Sun's rays on spacecraft's aluminum-plated plastic "sails" to that of the wind on a sailing vessel.

The lab executive, who described the solar propulsion method to the Los Angeles Chamber of Commerce Research Committee, estimated it would take 20-acre sails to run a space craft.

(The June 19th issue of MISSILE WEEK described the solar propulsion theories of Dr. George Gamow of George Washington University, who proposed a combination of solar and nuclear energy. Columbia University's Richard L. Garwin's theory of solar sailing was also discussed.)

## Thor Engine Shipping Containers Developed

Air Logistics Corp. is now delivering newly designed plastic shipping containers for Thor IRBM rocket engines to North American Aviation at its Rocketdyne division plants at Canoga Park and Neosho.

Called Mobil-Tainers, the new shipping containers weigh 2,386 pounds, as compared to 6,436 pounds for the heavy pressurized steel cans formerly used. Cheaper to build, they are designed for use in Air Force planes, but they are also adaptable for use in field areas, since they can be towed by tractors or trucks.

At Neosho, Rocketdyne is now loading Thor engines into the Mobil-Tainers, trucking them to the Douglas plant at Tulsa (only airport in the Neosho vicinity able to handle Air Force C-124s), and flying them to Santa Monica.

Although the Mobil-Tainers were designed for complete engine systems for the Thor, they also will handle other engines in the missile program, or even combinations of engines. They are expected to be used widely in the near future.

## Packaging-Handling Meet To Stress Space Logistics

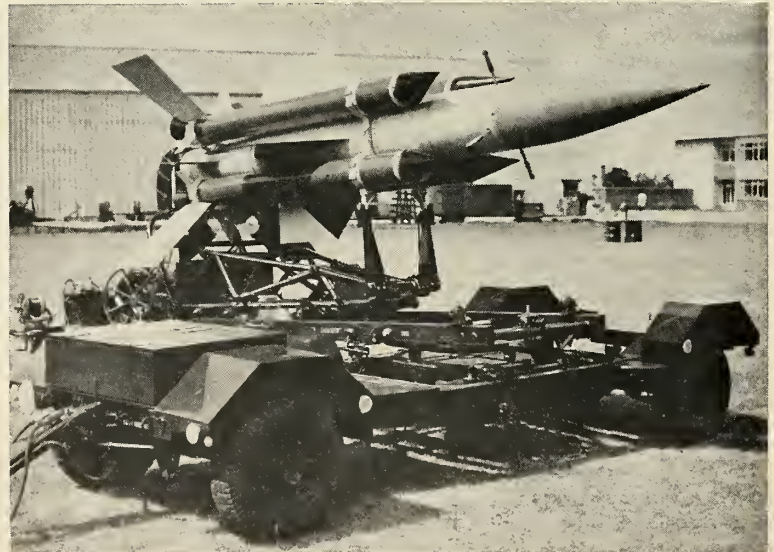
The 4th Joint Annual Military-Industry Packaging and Handling Symposium, sponsored by the Department of the Navy, Office of Naval Material, will be held in Washington on September 30, October 1 and 2.

At the opening session, September 30, Dr. Gilford G. Quarles, chief sci-

entist, U.S. Army Ordnance Missile Command, will talk on "The Challenge of Outer Space."

The afternoon session will be devoted to a panel discussion on "Space Logistics." The panel, under the chairmanship of H. Herman Koelle, ABMA, will have the following members: Professor Hermann Oberth, ABMA; Dr. Ernst Stuhlinger, ABMA; Dr. Otto Schmitt, University of Minnesota

## British Missile Entry



LATEST PHOTO of the de Havilland Firestreak AAM. It is shown fitted to a de Havilland Sea Vixen of the Royal Navy. The missile will also be stationed on the English Electric P.1 and the Gloster Javelin fighters of the Royal Air Force. Firestreak's infra-red guidance system, control power and fusing systems, propulsion motor and warhead are housed within a body tube 10 ft. 6 in. in length, with four wings and four control fins.



MISSILE CHECK-OUT



TEST STAND OPERATION



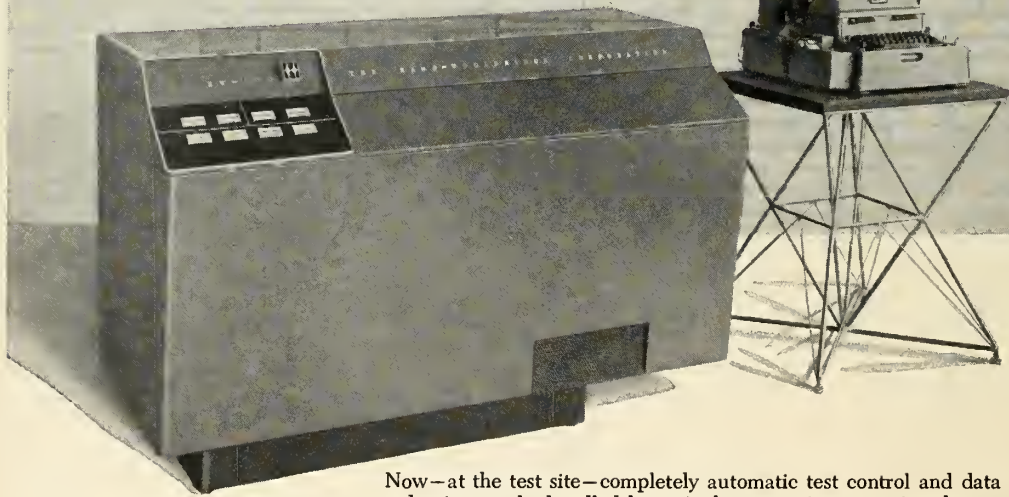
WIND TUNNEL INSTRUMENTATION



TELEMETRY DATA REDUCTION

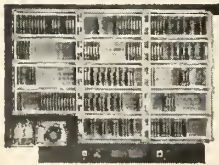


## The RW-300 is the first digital computer for test control and data reduction



Now—at the test site—completely automatic test control and data reduction can be handled by a single system incorporating the Ramo-Wooldridge RW-300 Digital Control Computer. The new RW-300 can schedule and closely control test routines, and it can collect, analyze, and record test data.

The versatile RW-300 utilizes input data as feedback to modify control actions, thus substantially shortening many test routines. In addition, the RW-300 directly logs both instrument data and complex relationships among these data. Thus, test results are available immediately. The time-consuming task of processing raw data through a separate computer, often remote from the test facility, usually can be eliminated.



For technical information on automatic test control and data reduction with the RW-300 and with special digital systems which utilize solid-state components exclusively, write: Director of Marketing, The Thompson-Ramo-Wooldridge Products Company, P.O. Box 45607, Airport Station, Los Angeles 45, California, or call OSBorne 5-4601.

**THE THOMPSON-RAMO-WOOLDRIDGE PRODUCTS COMPANY**

# Did High-Energy Fuels Launch Sputnik?

A Hungarian publication has claimed that *Sputnik III* was launched with boron fuels and strongly indicates that the Soviet Union is giving top priority to development of a nuclear rocket engine.

The publication, HETFOI HIREK, said: "*Sputnik III* was propelled by a special fuel called boron, which is a compound consisting of boron and hydrogen. Other compounds are also being made in the Soviet Union through the aid of which the capacity of rockets can be increased by 40-50%."

(Russian scientists have denied that any high-energy fuels were used.)

"Soviet scientists are engaged intensively with the construction of rockets with a nuclear propulsion system. In this case they will install an atomic reactor into a furnace which is capable of substantially increasing the temperature of the propellant gas," the report said.

Also commenting on *Sputnik III*, HETFOI HIREK noted that "the shell of the Soviet satellite moons was made of a special aluminum alloy. In spots where the moon is expected to become hotter than the rest of the shell, due to the high degree of friction, a special protective coating is added. Part of *Sputnik III* was coated with magnesium, but silesium and a special coating of synthetic materials are also suitable."

"According to present concepts titanium and molybdenum will be used to protect the shell of rockets returning to earth . . . by supplying artificial moons with these protective coatings, they could be made suitable to return to earth the first experimental animals and maybe man himself from the first trip among the stars."

• **Bigger Sputniks?**—Another Iron Curtain publication, Berlin's DIE TECHNIK, said in an article by V. V. Dobronravov of the chair for Theoretical Mechanics at the Moscow Higher Technical School, that "it is possible to launch additional satellites of the same type as *Sputnik III* but larger and with greater launching velocities."

"It is quite possible that the first problem to be solved will be that of producing so-called guided or recoverable satellites. In such a case . . . the satellite must be oriented in relation to the earth . . . the flight of the satellite on its orbit must be in stages. This satellite must not rotate on its own axis."

In event that an alternative method is used (extension of control surfaces on reentry), "It is necessary that the

landing on the earth be computed in such a way that it will not take place at some point X, but at a previously determined point within the Soviet Union. This problem is, without doubt, very complicated, but, in view of the present state of development of science and technology, automatic control, television engineering, radioelectronics and instrumentation, it can be solved in stages."

A vehicle of the *Sputnik III* type, only somewhat larger, can be converted into a space ship. Inside the vehicle, which is 5 to 6 meters long and 2.5 to 3 meters in diameter, space can be provided for one or two human fliers, and everything required for a ten-day trip to the moon and back can be installed. The required velocity of 11 km. per second is already a reality for Soviet science and technology."

## Army Instructors Prepare For Hawk Training

The Army Ordnance guided Missile School is adding 83 instructors to its faculty in preparation for resident courses in the new *Hawk* surface-to-air missile system, Col. H. S. Newhall, commandant, has announced. The new courses will begin early in 1959.

The corps of new instructors, one of the largest groups ever to be added at one time to the Missile School teaching staff, has been training in special courses conducted by Raytheon and ARGMA here for the past six months.

Since finishing the courses, the group has been working in the New Missile Intelligence Branch of the Research and Curriculum Division of the Missile School to prepare texts, lectures, films, and training aids.

## 2,000 Watt Solar Units Feasible For Space Power

Solar energy converters capable of delivering up to 2,000 watts are now feasible as power supply sources for space stations and satellites, according to James D. McLean, president of the Laboratories Div. of Hoffman Electronics Corp.

McLean said such converters, utilizing silicon solar cells, offer man the best solution to date to the problem of generating continuous power in outer space.

The use of solar cells, the most practical means yet developed for converting light energy directly into electricity, was demonstrated in the Hoffman exhibit at the recent WESCON show in Los Angeles. The exhibit showed a model of a space

satellite in which a bank of solar cells operated a miniature radio transmitter.

Already in use in the Navy's *Vanguard* satellite, the silicon solar cells are tiny wafers of highly purified silicon containing minute quantities of arsenic and diffused with boron. By means of these cells, it is possible to convert up to 10% of the light energy falling on a given area into usable electrical power.

To achieve the 2,000 watt output proposed, it will be necessary to expose some 20 square yards of solar cell area to the sun. In the 6.4-in. *Vanguard*, six clusters of 18 solar cells each are distributed over the satellite's skin to supply its radio voice with approximately 50 milliwatts (0.05 watt) of power.

The results of the Hoffman research on solar energy converters indicate that such a high-power converter can be developed, McLean said. Two proposed configurations for such a converter are a balloon, which would inflate after the vehicle reaches outer space, and a planar arrangement which could be unfolded from the launching vehicle after it is placed in orbit.

Hoffman recently completed four months of successful operation of a solar-powered radio repeater station atop Santiago Peak in Southern California. In this installation, tested for the U.S. Forest Service, a receiver-transmitter was powered by batteries kept in a charged-state by a large solar energy converter containing 500 cells.

## Sub Environment Studied As Space Prototype

Some 200 of the world's leading authorities in environmental medicine met at the U.S. Naval Submarine Base in New London last week for the First International Symposium on the problem of environmental medicine under conditions of confinement in a true submersible, or a sealed space cabin.

Captain Joseph Vogel, MCUSN, officer in charge of the Naval Medical Research Laboratory, host for the symposium, cautioned that science must determine whether prolonged exposure to such things as cooking odors and perspiration odors would be a hazard before man can safely venture into space or take long voyages on submarines.

The symposium was sponsored by the American Institute of Biological Sciences and supported by the Advanced Research Projects Agency of the Department of Defense. There were representatives from the United States, Brazil, France, Italy, Sweden, Germany, Japan, Great Britain, Switzerland and Canada.

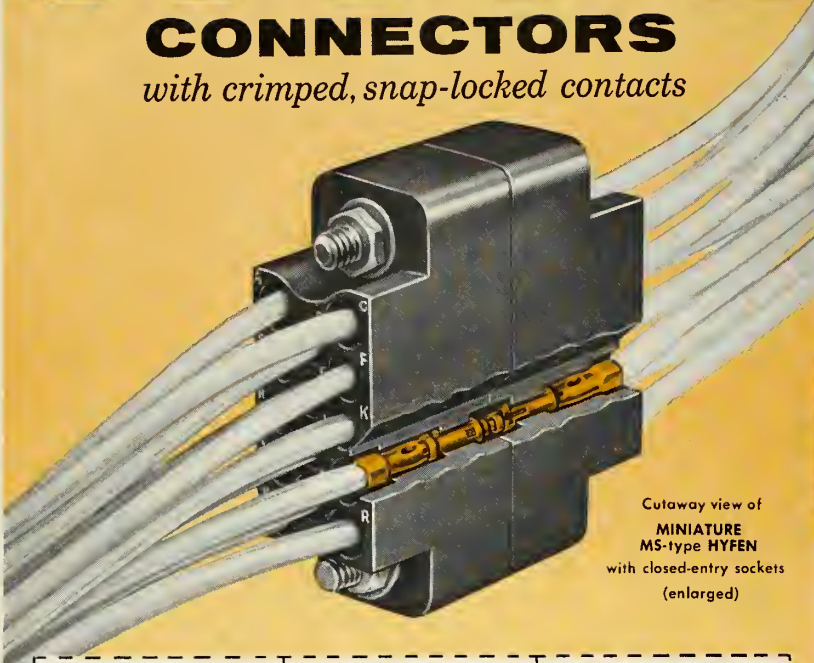


# HYFEN

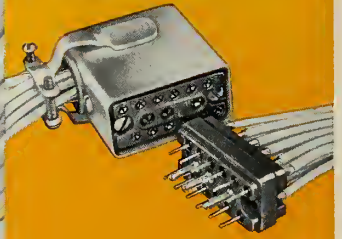
T.M.

## CONNECTORS

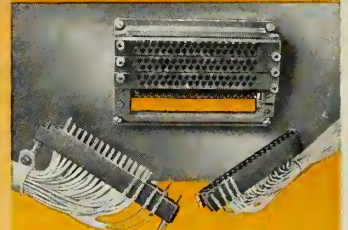
*with crimped, snap-locked contacts*



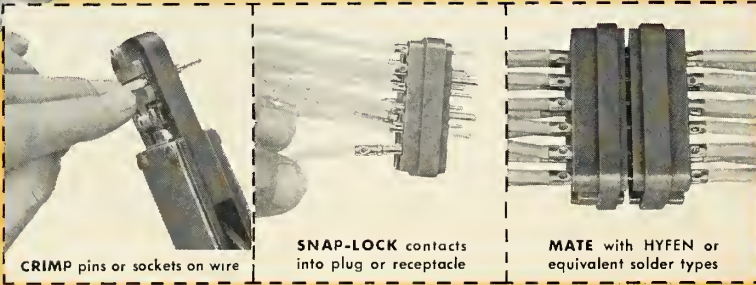
Cutaway view of  
MINIATURE  
MS-type HYFEN  
with closed-entry sockets  
(enlarged)



15 contact, multi-purpose connector. Mates with, or replaces existing solder connectors.



Feed-thru, modular design, multiple insert connector. 35 contact inserts, can be removed from frame for easy contact insertion or removal. 5 or 8 insert frames available.



CRIMP pins or sockets on wire

SNAP-LOCK contacts into plug or receptacle

MATE with HYFEN or equivalent solder types



AN-type HYFEN connector, showing HYFEN method adapted to round design.

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The HYFEN method ends the high rejection rate inherent with the use of solder...especially important in today's continuing trend toward miniaturization.

*HYFEN types illustrated are typical of those already supplied to the Industry by Burndy. HYFEN connectors are engineered to meet specific requirements. For other types and sizes, contact Burndy.*

OMATON DIVISION

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58-14

## missile business

A twilight-area is in the making for the missile business—divided about equally between heavy government spending for defense, and heavy pressure from the administration to hold spending to “reasonable, sensible” levels.

This condition is apparent when you compare DOD Secretary McElroy’s statements to the American Legion (m/r Sept. 8, p. 17), with general predictions of improving business health coming out of Washington.

Almost every business barometer, public or private, looks for an upsurge in all lines, particularly in defense-based industries. The reason, of course, is the whopping \$40-odd billion defense budget, plus the fact that the government is in a deficit-spending period—in itself an inflation-making factor.

McElroy’s statement at Chicago—obviously a carefully-planned policy dictum—was aimed specifically at the missile field. He made it very clear that DOD will make every effort to hold down spending.

Spending hold-down will be on production contracts for new missiles and their supporting systems. Said McElroy: Moving into production too far ahead of research might result in “unusable duds—drugs on the weapons market, and a drag on defense resources.”

Heavy emphasis will be on research and development—if at all. The Pentagon wants assurances that thorough testing and research is completed, before it will commit money to manufacture. Emphasis on research, by the way, makes a lot of the recent merger deals look smart, as companies seek to widen their R&D capabilities.

Further evidence of the spending dilemma is a statement last week by U.S. Budget Director Maurice H. Stans, who commented that “the incredible cost of new weapons will plague us as long as it is necessary to buy both today’s and tomorrow’s technology.” Forecasting (for an American Bankers Association meeting) an \$80 billion budget for Fiscal 1961, Stans added that the only way he could see to reduce spending was for a tight hold-down on “civilian” demands for government services.

Plant expansions include Lockheed’s Missile Systems Division’s huge 4,000-acre rocket engine test site, in the Santa Cruz mountains about 20 miles from Santa Cruz, Calif., where two separate complexes will test the Navy’s *Polaris* engine, and various Air Force missile powerplants . . . **Horkey-Moore Associates** added space at its Torrance Calif., plant for testing missile high pressure pneumatic equipment, and specialized cleaning facilities for cleaning LOX components . . . **Miniature Precision Bearings, Inc.**, added 25,000 sq. ft. to its Keene, N.H. operation.

**Callery Chemical Co.** is pushing ahead on schedule in building what will be the first large-scale high energy fuel plant at Muskogee, Okla. Now 80% complete, the \$38 million facility will produce liquid high energy fuels for the Navy.

**Merger of Calidyne Co.** of Winchester, Mass., and **Ling Electronics, Inc.** of Culver City, Calif., now makes Ling the biggest U.S. manufacturer of complete vibration testing systems. Under merger terms, all vibration testing systems and components will be sold and serviced in the East by Calidyne, in the West by Ling . . . **Chromalloy Corp.**, of New York City, has acquired **Propellex Chemical Corp.** of Edwardsville, Ill., thus adding Propellex know-how in solid propellants and cartridge-actuated devices, to its own patents on diffusion of chromium into primary metals.

## contract awards

### LAST MINUTE AWARDS

Technical Products Division of **Waste King Corp.**, Los Angeles, contracts totaling approximately \$300,000 to manufacture heat exchangers and accessory equipment for the *Atlas*, *Thor* and *Jupiter* ballistic missiles . . .

**Douglas Aircraft Co.** awarded Research Laboratory of **Servomechanisms, Inc.** \$101,672 for additional money for SMI’s continued research into the fields of solid state physics . . .

Air Force awarded the Georgia Division of **Lockheed Aircraft Corporation** a contract to study power operated hydraulic and pneumatic systems to be used in space vehicles . . .

Corps of Engineers, U.S. Army, Jacksonville, Fla., issued a \$483,517 contract to **R. E. Carson, Inc.**, St. Petersburg, Fla., for construction of *Stark* training facilities at Patrick AFB . . .

**Koehler Aircraft Products Co.**, Dayton, Ohio, a subsidiary of the **New Britain Machine Co.**, received a contract to produce a series of special liquid oxygen valves for use in the USAF *Titan* ICBM.

Navy’s Bureau of Ordnance awarded **Yardney Electric Corp.**, New York, \$394,800 for the manufacture of its Silvercel silver-zinc batteries . . .

**Temco Aircraft Corp.**, Dallas, Texas, was issued a contract for manufacture of the wings and elevons for the Army’s *Hawk* surface-to-air missile.

### AIR FORCE

By Cambridge Research Center, ARDC:

**Texas A & M Research Foundation**, College Station, Texas, received \$90,000 for design and construction of mobile micrometeorological stations and study of the physics of the atmospheric boundary layer.

**Pickard and Burns, Inc.**, Needham, Mass., received \$50,600 for research and development on accurate methods for tracking and communicating with space vehicles.

**Minneapolis-Honeywell Regulator Co.**, Boston, Mass., received \$45,529 for recorder, reproducer, modular magnetic tape, seven channel instrumentation type.

### NAVY

By Bureau of Aeronautics:

**Reaction Motors Division** of **Thiokol Chemical Corp.**, Denville, New Jersey, received a letter contract for production of four internal combustion catapult powerplants.



## ... contracts

By Office of Naval Research:

**George Washington University**, Washington, D.C., received \$25,740 for study in the field of mathematics.

**University of California**, Los Angeles, Calif., received \$60,000 for research on the effects of high pressure and temperature on transformations and constitution of metal and inorganic solid systems.

**University of Washington**, Seattle, Wash., received \$205,784 for research on a drifting station on the polar pack ice of the Arctic Ocean.

By Purchasing and Contracting Division, White Sand Missile Range, N. Mex.:

**Reeves Soundcraft Corp.**, New York 22, N.Y., received \$40,011 for magnetic tape.

By Ordnance District, Los Angeles:

**Zenith Plastics Co.**, Gardena, Calif. received \$50,286 for research and development on battle group weapon system projects.

**California Institute of Technology**, Pasadena, Calif. received \$352,800 for engineering research and development regarding guided missiles, free rockets, materials and wind tunnel operation.

**North American Aviation, Inc.**, Canoga Park, Calif. received \$63,000 for rocket engines.

**Solar Aircraft Co.**, San Diego, Calif. received \$48,790 for gas turbine generator.

**Douglas Aircraft Co., Inc.**, Santa Monica, Calif., received \$27,766 for blue streak and emergency repair parts for the Nike system.

By Boston Ordnance District:

**Brown University**, Providence, R.I., received \$35,352 for basic research on reactions of basic reagents with aromatic substrates.

## ARMY

By District Engineer, U.S. Army Engineer District:

**Nabholz Construction Corp.**, Conway, Ark., received \$56,980 for construction of receiver building satellite tracking station.

By Purchasing and Contracting Division, White Sands Missile Range:

**Yuba Systems Division** of Yuba Consolidated Industries Inc., San Carlos, Calif., received \$138,860 for Purchasing and Contracting Div., White Sands Missile Range, N.M.

**Douglas Aircraft Corp.**, Santa Monica, Calif., received a contract totaling \$4,693,536 for the Nike Hercules program.

**International Business Machines Corp.**, New York, was awarded a contract totaling \$2,631,122 for automatic data processing equipment.

**Republic Aviation Corp.** received a contract for \$1,318,825 for short range surveillance drone engines.

## Douglas Centralizes Missile/Space Activities

A director of missiles and space systems engineering has been named by Douglas Aircraft Co., Inc., in a move to unify its control over all missile/space activity in the firm. The company has also realigned engineering division functions and the personnel assigned to them.

The new director is Elmer P. Wheaton, former chief missiles engineer. In his new position, he will report to Arthur E. Raymond, vice president-engineering.

R. L. Johnson will replace Wheaton as chief engineer of the Missiles and Space Systems Division.

In an effort to reflect the increasing importance of its Charlotte Division, which is producing missiles for the Army, A. D. Jamtass has been advanced from engineering manager to chief engineer.

In announcing the changes, Raymond said: "The scope and technical complexity of the company's activities have increased to the point where a more unified control of functions, regardless of geographical location, seemed desirable."

## Beckman Instruments Form Semiconductor Subsidiary

Beckman Instruments Inc., Fullerton, Calif., has announced the formation of the Shockley Transistor Corp. as a subsidiary company. The subsidiary will expand development and manufacture of specialized components for electronic instruments, communications equipment and control systems.

Dr. William Shockley, Nobel prize winner and inventor of the junction transistor, has headed a group operating at Palo Alto since 1956 as the Shockley Semiconductor Laboratory of Beckman Instruments. Dr. Shockley has been named president of the new subsidiary corporation.

The Stanford Industrial Park facilities at Palo Alto have been expanded to permit a ten-fold increase in output of the Shockley four-layer transistor diode. Dr. Beckman, president of the parent firm, said this diode is capable of replacing five related components and is finding wide application in electronic digital computers, telephony and missile control systems.

## X-7 Missile Breaks New Speed Record

A Lockheed X-7 ramjet missile has been flown in excess of four times the speed of sound to become the fastest air-breathing missile in the Free World,

the Air Force announced. It broke the old record, also held by an X-7.

The record speed flight was so fast that heat generated by the supersonic velocity, coupled with normal engine heat, caused part of the ramjet to burn away.

Launched from a specially-modified B-50, the X-7 was air-dropped over the desert test range at the Air Force's Missile Development Center at Holloman AFB. A large booster rocketed the 37-ft.-long missile to a faster-than-sound speed where the ramjet took over. Within seconds the bird had accelerated to fantastic speed.

The engines flown are built by the Marquardt Aircraft Co., Van Nuys, Calif.

## Summers Gets Contract For Quail Components

Summers Gyroscope Co. has received an additional contract in excess of \$150,000 from McDonnell Aircraft Corp. of St. Louis for electronic components of a guidance subsystem for the GAM-72 project.

J. S. Warshauer, executive vice president, said this is the so-called Quail diversionary missile. He said the Summers Co. has been engaged in preliminary work on the Quail project in the last year, providing sensing instruments.

McDonnell is the Air Force prime contractor for development of the Quail weapons system.

## NDA Moves Operations Into 63-Acre Facility

Nuclear Development Corp.,—a company that began operations 10 years ago with a staff of three employees—this week occupied its third major facility, a 63-acre research and development center in the Eastview section of Westchester County, N.Y.

The center, before year's end, will house research and development personnel and executive and administrative departments. When the move is completed, the company's present headquarters in White Plains, N.Y., will be devoted exclusively to engineering, experimental and fabrication activities. The company occupies other quarters at a 1,200-acre site at Pawling, N.Y., 40 miles to the north of White Plains.

The company has worked in the field of nuclear power and related activities. Particular emphasis has been on development of power reactors, using various materials — including heavy water and sodium—as moderators, to produce electrical power, and possibly to produce power that could be used for space applications.



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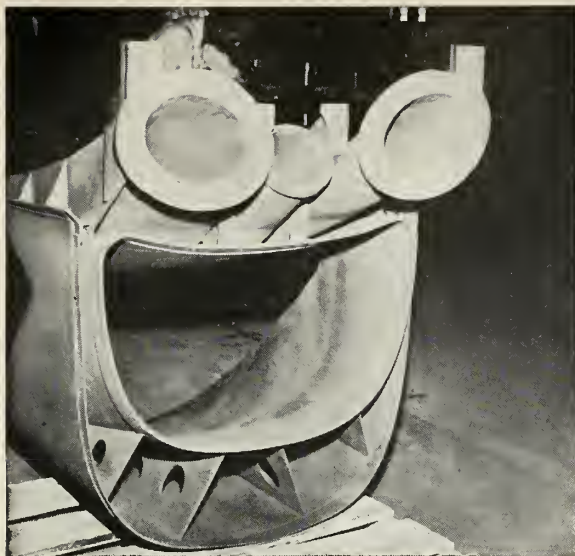
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Engine air scoop casting made by R. H. Osbrink Mfg. Company, Los Angeles

## MAGNESIUM "SUGAR SCOOP" HELPS REGULUS II BREATHE

*Huge thin-wall magnesium casting satisfies appetite for air*

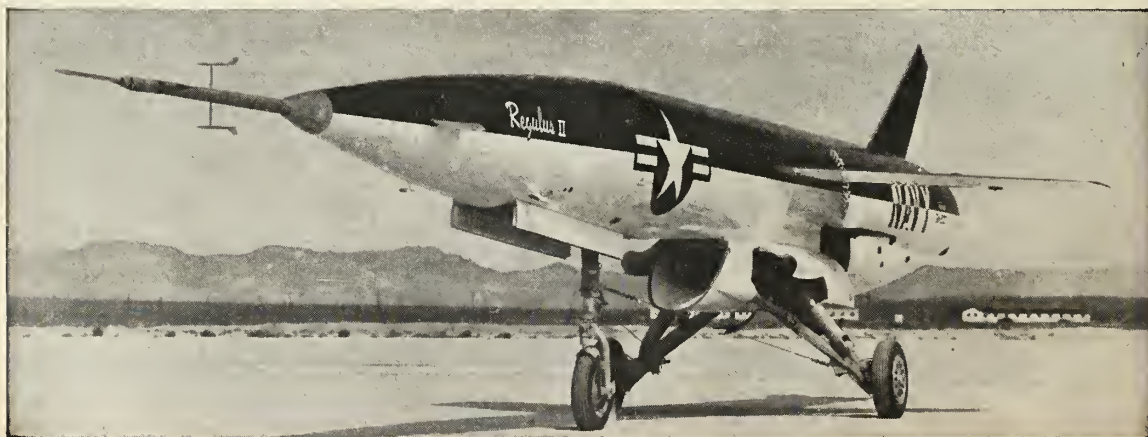
At supersonic speeds more than ten miles above the earth, Chance Vought Aircraft's Regulus II consumes enormous quantities of air through a 150 lb. magnesium casting.

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  $\pm 0.03$  inch on dimensions up to 12 inches, with an additional  $\pm 0.002$  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-1.

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# propulsion engineering

by Alfred J. Zaehringer

More work on nitric acid propellant systems is being carried out at NOTS China Lake. Tetranitromethane, nitroethane, 2-nitropropane, and gem-dinitropropane are being burned with 99% nitric acid. Addition of small amounts of potassium nitrate or nitrogen tetroxide seems to smooth the "humps," or steps, in the propellant consumption rate curve.

Nitrogen tetroxide can now be produced directly from ammonia in the "Hoko" process, which can also produce high concentration nitric acid. High density  $N_2O_4$  is being seriously considered as an immediate substitute for LOX in large missiles. Reason: relative ease in handling and use at normal temperatures. The oxidant can be stored.

Liquid hydrazine makes a good monopropellant, particularly for low-temperature auxiliary power units. Hydrazine itself is reported to have a performance comparable to cheaper ethylene oxide. Advantage of  $N_2H_4$  over EtO is clean exhaust, however cost is still in dollars per pound. APU tests with monopropellant hydrazine are being carried out by Thompson Products and Sunstrand.

Propellant vaporization is a good parameter for determining rocket performance. Work by NACA at Lewis Flight Propulsion Lab indicates that the characteristic exhaust velocity is related to the percentage of oxidant and fuel vaporized and burned. A  $c^*$  efficiency of 70-90% theoretical results when half the fuel is vaporized. Hydrogen fuels give the highest efficiencies.

Fluorine rocket motors of high thrust and long duration will be handled at a new test facility at Edwards Air Force Base, California. NACA, Rocketdyne, and Bell Aircraft have all fired low thrust, short duration fluorine propellant combinations. Though not mentioned, the Edwards fluorine facility might be able to handle 165,000-lb. thrust for up to 155 seconds. Elaborate decontamination techniques are proposed.

Perchloryl fluoride (PF) may be near for use as a rocket oxidant. Storable at room temperatures under slight pressure, liquid  $ClO_2F$  has a calculated  $I_{sp}$  of 270 seconds with hydrazine at 500 psia. This compares with the 320 seconds offered by fluorine and hydrazine. Safe PF is non-hypergolic with common materials such as clothing, wood, tissue, metals; however, it gives easy ignition and extremely smooth combustion with rocket fuels. Pennsalt is making PF available in tonnage quantities.

Double base propellant material, ethylene glycol dinitrate, is being researched at Hercules Powder Co., Allegany Ballistics Laboratory. Low pressure, flat flames of this material have been stabilized and may point to low operating pressure homogeneous propellants.

Solid potassium metal may be useful as an ion propellant. Low in cost, it offers higher performance than lithium or sodium but less performance than rubidium or cesium. Low availability of the latter two may prove serious stumbling blocks and give the nod to potassium.

Liquid ion propellants may be evolved from work done at New York University. Some alkali metals—particularly potassium and cesium—dissolve in ethylene glycol dimethyl ether to form electrically conducting solutions. Potassium is a medium ion rocket performer, while cesium is near tops for ions.

Ozone flames are stable in the 50-100%  $O_3$  range, but are unstable for small temperature fluctuations at about 33.3%. Shell Development Co., Emeryville, Calif., has been studying ozone flame propagation.

## Italian Edition of m/r To Start in October

Publication of MISSILES AND ROCKETS magazine in the Italian language will start on a monthly basis in October, following an agreement between American Aviation Publications and Dr. Giuseppe Stifani, publisher and editor of ALATA.

The Italian version of m/r will be entitled "MISSILI E RAZZI," and will be a monthly selection of articles which appear in the weekly editions of m/r. The only exclusions will be articles of a strictly local nature.

Editor of "MISSILI E RAZZI" will be Dr. Franco Fiorio, who will coordinate and screen the articles from Washington. Executive editor will be Dr. Glauco Partel.

Printing, editing and distribution will be from Milan, under the direction of the publisher, Dr. Giuseppe Stifani.

## Soviet Deceit Cited In Sputnik Weights

There is increasing reason to believe that an intentional deception is being practiced by the USSR in regard to satellite weights. Western scientists who have consistently maintained that *Sputnik II* and *Sputnik III* were essentially the same have been given more ammunition by the Soviet Academy of Sciences.

In the JOURNAL of the Academy of Sciences of the USSR, Prof. G. V. Petrovich writes on the main problems in "cosmonautics" and cites progress in the development of rocket engines.

"Let us recall," he says "that *Sputnik I* weighed 83.6 kilograms; the weight of the scientific equipment, sources of power, and the experimental animal carried by *Sputnik II* was 508.3 kilograms; and the weight of *Sputnik III* was 1,327 kilograms."

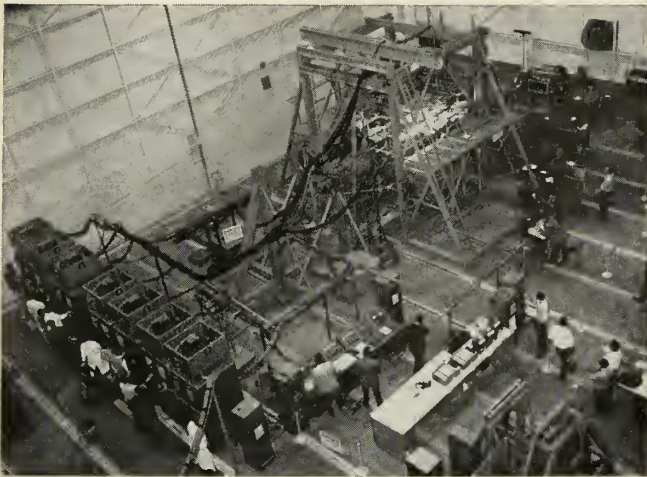
This obvious reluctance to cite the total weight of *Sputnik II* has led to the conclusion that because a greater psychological gain would be made, the USSR deliberately understated the weight of its second satellite in order to make the third appear much larger. Actually, it is maintained, the two satellites weighed the same.

Prof. Petrovich also states in his article that "in the near future, the perigee of the trajectory of artificial satellites will be located at an altitude of more than 1000 km. (about 622 miles) above the earth's surface. As a result, the final stage of the carrier rocket and the satellite will not return to earth and may be used for the construction of stations outside the earth."

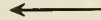
Just how literally the phrase "in the near future" is used could be the key to future Soviet space plans.



# Missiles in the News



**Bomarc**—An Air force IM-99 *Bomarc* missile section undergoes simulated flight condition tests in Boeing Airplane Company's big new structural test laboratory. The section being tested is subjected to varying loads at elevated temperatures. *Bomarc*, rapidly approaching operational status, has made two remote flights from Cape Canaveral during the past month.



**Nose Cone**—A machine developed by Miller Research Laboratories for measuring physical properties which determine the dynamic characteristics of a ballistic nose cone in flight. The properties measured by the machine: moments of inertia, products of inertia, C. G. location, and weight. The equipment is also used to check performance of the guidance system and attitude.



**Lunar Vehicle**—As m/r went to press, the second Air Force lunar probe attempt had not been scheduled. Take off of the ill-fated *Thor-Able I* vehicle on July 17 is shown as it left its pad for a 77-second flight.



**Jupiter**—The Army recently delivered to the Air Force the first tactical *Jupiter* Intermediate Range Ballistic Missile during a short ceremony at Redstone Arsenal, site of the Army Ballistic Missile Agency which developed the giant weapon system. The operational-type missile was handed over to the 864th Strategic Missile Squadron (IRBM-*Jupiter*), now in training at the Arsenal approximately one month ahead of schedule. Two research and development prototypes equipped with full-scale nose cones were successfully launched recently, and both cones were recovered in undamaged condition by the U.S. Navy.





# Britain Struggles for Balance Between Aircraft and Missiles

an m/r staff report

FARNBOROUGH—The United Kingdom's air show here didn't give too much new information about Britain's missile program. The main concentration was on manned aircraft, specifically civil. Missiles were dealt with in vague terms.

Most British missiles are still in the developmental stage and security precautions are generally more stringent than in the U.S., with fewer performance figures either available or deducible.

Prospective foreign customers are reported to have been impressed with the performance figures released to them on a confidential basis, although discussion of delivery dates and costs were scrupulously avoided, due to the uncertain nature of British government backing of some missile projects.

The Defense "White Paper" of 1957 has left its mark upon the British aircraft/missile industry. The reduced work-potential inherent in the British government's decision to utilize missiles as much as possible, in lieu of manned aircraft, has left the industry with the alternative of switching to civil aircraft manufacture and striving for a greatly increased export market.

• **Fewer, but better?**—In contrast to the massive missile arsenal built by the United States, Great Britain has, whether for economy or out of wisdom, built her defenses on a lesser number of missiles, thus eliminating many of the overlapping functions appearing in the American programs.

A total of eight missiles is publicly recognized as comprising the entire British arsenal.

Six of these are tactical weapons: *Bloodhound*; *Short SXA-5*; *Seaslug*; *Firestreak*; *Vickers 891* and the *Thunderbird*. Seventh is the *Blue Streak*, a long-range strategic missile, and the last is the *Black Knight*, a ballistic missile believed used for re-entry tests connected with the *Blue Streak* program.

There has been a noticeable absence of the terms IRBM or ICBM in regard to the *Blue Streak*, so it is presumed that its range lies somewhere between the generally-accepted capabilities of these weapons, probably 2,500 to 3,000 miles.

Production of these eight weapons could not possibly supplant the production drop anticipated if the manned aircraft is entirely phased out.

Britain's Minister of Supply has estimated that the present 14 major airframe firms and five engine manufacturers will drop to three or four major airframe firms and two engine manufacturers within the next few years. Over the next five years it is also thought that Britain's aircraft/missile industry will drop from the present employment level of 250,000 to about 150,000.

This situation will depend on three sets of circumstances: how well the industry can hold its own in the fiercely competitive export market for civil and tactical aircraft; the future requirements for manned aircraft (a subject just as hotly debated in Britain as in the U.S.); and the amount of money put into research and development.

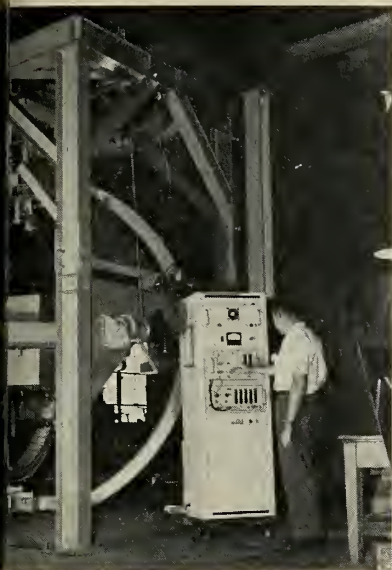
• **Balance**—The choice of manned aircraft vs. missiles has been balanced a bit more since the Defense White Paper of 1957. It is more convincingly argued now that there will be further developments of manned craft beyond the present generation.

Sir Dermot Boyle, chief of Air Staff, argued that missiles, due to their inflexibility, simplify the defense problem for the enemy, who can concentrate his countermeasure efforts against unmanned weapons. Manned aircraft, Sir Dermot declares, will be kept in service "until we are satisfied that its successor can do the job."

A standoff missile developed for the V-series of strategic bombers now in use with RAF has been developed by A. V. Roe & Co., which is developing still another better version of the weapon. Supplementing this air-to-surface weapon system will be the U.S. *Thor* IRBM, a 1,500-mile weapon which will probably be replaced by Britain's own *Blue Streak*.

The *Blue Streak*, with a 2,500 to 3,000 mile range, is Britain's first long-range ballistic missile, and is being developed by deHavilland Propellers. Rolls Royce has the propulsion system contract; Sperry is responsible for guidance. Systems development is underway at Hatfield, Hertfordshire.

The weapon will have a liquid propellant rocket engine, probably quite similar to American models, since Rolls Royce has a cooperative agreement with Rocketdyne in the United States. Light weight is being achieved by structural techniques, and it is believed that the missile's structure will be pressurized to gain rigidity.



**Regulus II**—This Navy missile is another rd being rushed to operational status in sts at Edwards AFB, California. Two long-ge proving flights were made last month om Point Mugu and Edwards to inland rgets. The missile is now being launched om a four-wheeled mobile launcher, which, th a tractor to pull it, can shift *Regulus* om one place to another via highway, fueled d "ready to go" at all times. The missile ould be launched in less than ten minutes ter shoot order. *Regulus II* is guided by ther of two systems, the command system the inertial navigation system with assist. urrently, the missile is produced in two rsons—tactical and recoverable training.



## U.S. Proposes Plan to UN For "Peaceful Use" of Space

by Frank G. McGuire

In what State Department spokesmen described as a "political move to get the United Nations to set up a body to explore the peaceful uses of outer space," the United States has handed the UN a proposal to insure peace in space.

The President's proposal was given to Secretary-General Daj Hammarskjöld by the U.S. Ambassador to the U.N., Henry Cabot Lodge. Lodge had previously commented on the plan in a speech delivered to an American Legion convention in Chicago, but as m/r went to press, there were still no real details available.

The United States' proposal asks the U.N. to include the plan, entitled "Program for International Cooperation in the Field of Outer Space," on the agenda of the 13th General Assembly session beginning September 16.

An explanatory memo accompanying the letter asked that the assembly declare itself "on the separability of the peaceful uses of outer space from disarmament; support the principal of the peaceful utilization of outer space and come out in favor of setting up "appropriate international machinery" to deal with outer space questions. Apparently, this last item is the core of the American proposal.

The door was left open for Soviet participation in the plan. Lodge pointed out that "we trust our proposal will get the support of other nations and that, together, we can move forward toward this goal with the courage and vision of our early pioneers."

The American ambassador added that "We will continue our efforts to reach agreements, consistent with our

national security, which will increase the prospects that outer space will not be used for military purposes."

Lodge said the U.N. should consider what projects can be undertaken and what sort of organization it can set up for the nations of the world to work together in such explorations. "The United States wants to see outer space used so as to enrich the lives of all people who live on this planet," he added.

"Progress in this field would be faster, cheaper and more efficient if all the nations concerned agreed to work together," he said, adding that all scientists in the world have something to contribute, but that all of us have much to lose if outer space is subjected to national rivalries. "No matter what happens, study and exploration of outer space will go on and will take man where no human being has been before. This will affect every man, woman and child in the world," he declared.

## Tests Show Conditioning For Space Feasible

Recent high-altitude tests indicate that man can be partially "space-conditioned."

In an experiment at Fairplay, Colo., six volunteers, after strenuous mountain-climbing conditioning, were able to take a 55,000-foot-altitude simulation. Before the test none could go higher than 49,000 feet.

The project, arranged by the School of Aviation Medicine, covered 40 days during which volunteers ascended and descended 14,260-foot Mt. Evans.

Although a final analysis of the test is not complete, Dr. Balke has come to some tentative conclusions: Potential space men should be between the ages of 30 and 45, and must be in top physical condition.

The reason for the 30-year age minimum, according to Dr. Balke: "It will take a space man that long to get all the necessary training and education."

## de Havilland Announces Liquid Propelled Engine

Development of the *Double Spectre* liquid propellant rocket has been announced by de Havilland Engine Co. The *Double Spectre* has been undergoing intensive testing as a missile and interceptor main propulsion unit since 1957.

The engine comprises a fixed-thrust *Spectre* D.Spe.4 mounted above a variable-thrust *Spectre* D.Spe.5, both units operating on their normal propellant combination of high-test hydrogen peroxide and kerosene.

Several hundred runs of the *Double Spectre* have been successfully performed, involving single and double unit firings equivalent to many hours of rocket operation.

The upper and lower *Spectres*, essentially independent units, are carried on a common tubular frame with tubing connections. The vertical arrangement of the units was chosen to avoid the yaw thrust component which would be incurred in a horizontal alignment when one engine is either shut-down or operated at a partial-thrust setting. The angular relationship of the individual units is arranged so that thrust lines intersect at the center of gravity.

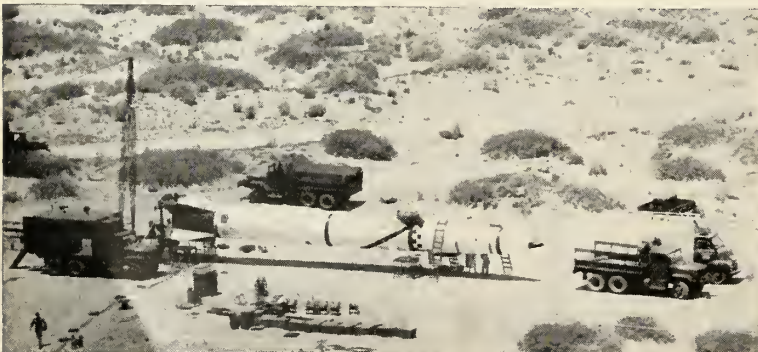
The *Double Spectre* does not require an external source of power for its operation. To run the engine, the lower rocket is started first. This unit, a variable-thrust *Spectre*, is equipped with a spherical starter bowl fed with nitrogen from the small pressure bottle on the starboard side. With the lower unit operating, a small bleed of hydrogen peroxide is fed across to energize the pump-turbine of the upper *Spectre*. The complete starting procedure occupies a matter of a few seconds.

At start, both *Spectres* may be brought instantaneously up to full thrust and then either unit may be shut-down. The lower unit can also be fired initially.

Thus there is a controlled variable-thrust range between the idling-output of the lower unit through to its maximum thrust; or alternatively, the output may be variable over the upper portion of the thrust range from approximately half thrust, with the lower unit idling and the upper unit at its fixed maximum thrust.

*Double Spectre* dimensions: overall length, 58.6 in.; maximum height, 37.5 in.; maximum width, 36.6 in. No data on performance has been released.

## Troops Test Redstone



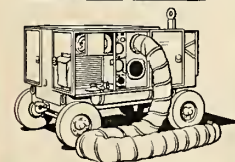
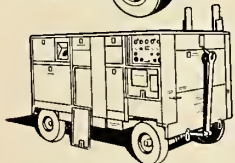
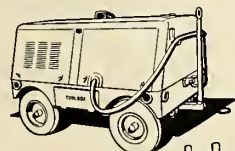
ARTILLERY, 1958—Troops of the 40th Army Field Artillery Group (Redstone) give the giant missile a horizontal checkout before pulling it into vertical position for firing at the White Sands Missile Range. The first simulated firings of Redstone were made with a dummy warhead, though the missile can carry either conventional or atomic warhead.

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**AIRCRAFT ENGINE DIVISION**

MUSKEGON, MICHIGAN





# Northrop-Arma: New Missile Giant?

by Raymond M. Nolan

Rumors continued strong this week in Washington concerning the projected merger of Northrop Aircraft and American Bosch Arma Corp. While no details of the financial mechanics were available, some indication of the structure of the projected new organization could be reported.

The new organization will retain W. C. Collins of Northrop as chairman of the board, and Charles W. Perelle of Arma will become president. Organization of the individual companies will remain largely unchanged, but one Arma official says that the name of the new organization will be completely changed.

Some speculation has occurred about the compatibility of Northrop's Nortronics Division and Arma, but when the companies were queried, neither thought that any competition would arise from the merger. Even though the primary mission of each of the organizations is guidance, the nature of the mission in either case means that it is more likely that a complementary situation will result.

Arma has three major projects at present: the all-inertial *Titan* guidance system; the same system for future use on the *Atlas*; and tail turrets for the B-52 bomber.

Nortronics has several defence-supported projects, among which are: stellar-guidance for the *Snark*; airframes, loaders and launchers for the *Hawk*.

• **How it works**—It is not too difficult to determine how each of these projects will fit with others in the future.

## NRL Reports Explorer IV Tracking Transmitter Dead

The U.S. Naval Research Laboratory announces that the 108 MC transmitter in the Army's *Explorer IV* was last heard at 7:15 p.m. EDT on September 8, by the Navy's Mini-track Station at Lima, Peru.

Prior to that time, signals were becoming progressively weaker, indicating that failure of the transmitter was near.

The satellite is still transmitting on the telemetry channel at a frequency of 108.003 MC.

The Army satellite was launched on July 26, 1958.

One of the company-financed projects being pursued by Nortronics is a sub-miniature stable platform, something Arma could certainly use on its inertial guidance program where the stable platform is encased in a housing that is probably heavier than the whole unit which Nortronics is developing.

Another area is computer circuitry. Arma currently has a guidance computer in its system which weighs 180 lbs. A five-year program is expected to reduce this to 60, and then 20 pounds respectively. However, Nortronics has been looking into this situation for some time and now has one of the only lightweight, all transistorized digital computers in existence.

One of the tricks Nortronics is using which might very well find its way into the Arma system is encasing transistors in vacuum bottles and then electronically cooling them to eliminate one of the really serious hot spots in an electronic system.

Another area might be the Cueball system developed by Nortronics. This is an angle of attack and sideslip indicator to determine exact vehicle attitude and transmit intelligence to the guidance system so that objects such as nosecones can achieve reentry at the proper angle to insure minimum heating and preburnation.

• **Coast to Coast**—Of course, overriding all this is the significant fact that this merger brings together R&D and production facilities on both coasts, capable of executing any mission in connection with a major missile program. Arma has the proven capability and excellent productive capacity which any successful program needs, and Northrop has unlimited research and production facilities in most of the areas where Arma is lacking such as airframe and ground support.

Some of the company-financed, experimental projects now in progress at Northrop include such diverse items as space power sources, infrared devices, and advanced optical applications.

Of further note is the qualification program which Arma has initiated with components it plans to use in its systems. Many thousands of semi-conductors, for example, are always in test in the extensive quality control laboratory of Arma. Arma, in addition, has been subjecting many of its components to radiation at Brookhaven National Laboratories to determine the effects of an atomic warhead or power source on guidance systems.

## First Thor IRBM Arrives in Britain

Reports that the first *Thor* IRBM has been delivered in Great Britain have been confirmed both by the U.S. Air Force and the British Air Ministry.

Air Force said the *Thor* deployment is "going forward as planned," with one full RAF squadron to be equipped by the end of December.

First of 60 Britainbound *Thors* was airlifted two weeks ago by the giant Douglas-built C-124 transport, but by last week, had not yet been transferred to the RAF.

Four *Thor* squadrons, with 15 missiles each, are planned for eastern and northern England.

One specific criticism of the 65-foot liquid-propelled *Thor* is that its above-ground site leaves it more vulnerable to attack while Britain's *Blue Streak* will be deployed in less exposed concrete pits. However, *Blue Streak* is still in the development stage and it is expected it will be several years before it is operational.

To date 22 *Thors* have been tested at Cape Canaveral, with 13 rated "good" by the Air Force; five "failures."

Prime contractor for *Thor* is Douglas Aircraft Co., Inc.

Meanwhile first British trainees have arrived for *Thor* indoctrination at Douglas Aircraft Co., Inc.'s Tucson facility.

## Martin Contract Confirms Earlier M/R Prediction

A Navy production contract for \$2,438,449 has been given the Martin Company's Orlando, Florida Division for the air-to-surface guided missile *Bullpup*. This confirms increased production as mentioned in m/r (p. 13, Sept. 1). No information regarding the number of units included in the contract was in the official release. M/R had said production would be increased from 30 missiles per month to 600.

*Bullpup* is a tractical guided missile designed for use in glide and dive bombing by carrier-based Navy aircraft and shore-based Marine planes. Martin made the original research and development tests flights of *Bullpup*.

In one early test a Navy pilot who launched the missile in his first try hit a four-inch square target two miles away. A non-nuclear weapon, *Bullpup* is designed for use against comparatively small targets—pillboxes, tanks, truck convoys, bridges, railroad tracks, and the like.

*Bullpup* is 11 feet long and weighs about 565 pounds. It operates in the visual range of the pilot.

## Douglas, Hughes, FMC Form Minuteman Team

Douglas Aircraft Co., Hughes Aircraft Co. and Food Machinery and Chemical Corp. have jointly submitted a bid in support of their proposal for the assembly and testing of the Air Force *Minuteman* ICBM missile. The *Minuteman*, a solid propellant land-based missile, is destined to be a top member of the second generation of ballistic missiles, succeeding those now being tested.

As major subcontractors to Douglas, Hughes would be responsible for electronics and FMC for ground handling equipment of the system. To provide major policy direction to the program, Douglas has formed what will be known as the *Minuteman* Assembly and Test Policy Board.

The board is comprised of President Donald W. Douglas, Jr. as chairman; A. E. Raymond, vice president-engineering, Douglas Aircraft; L. A. Hyland, vice president and general manager, Hughes Aircraft Co.; J. M. Hait, executive vice president and director of Engineering, Food Machinery and Chemical; E. P. Wheaton, Douglas director of missiles and space systems engineering; Kenneth B. Bingham, general manager, Douglas Aircraft *Minute-man* Division.

The *Minuteman* Board will meet at least twice a month to conduct complete program reviews and establish major program policy direction.

To provide direct program management, Douglas has also formed a separate division to be known as the *Minuteman* Assembly and Test Division. It is constituted on the same basis as the rest of the Douglas Divisions and will be assigned sole responsibility for management of the *Minuteman* Assembly and Test Program under guidance of the Policy Board.

Douglas currently has the major responsibility for the airframe, systems integration and for supporting ground equipment for the *Thor* IRBM. Hughes Aircraft's missile experience dates back to 1946 when they began studies of missile techniques that culminated in the *Falcon* series of air-to-air missiles. As prime contractor of *Falcon*, Hughes has developed the *Gar-1D*. Radar seeking version and the *Gar-2A* infrared seeker. Also under development is the *Gar-9* version of the *Falcon*. This will be a guided missile that carries an atomic warhead.

Food Machinery and Chemical Corp., long a leader in the manufacture of diversified machinery and equipment, has designed and built more types of military-standardized tracked vehicles than any other firm in America.

## Rocket-Boosted Radiosonde Probes Weather

Convair Division, General Dynamics Corporation, is currently developing a rocket-boosted radiosonde for ARDC's Wright Air Development Center, Dayton, Ohio.

The radiosonde will gather weather data by probing the atmosphere 29 miles above the earth, and will be used by Air Weather Service forecasters as a meteorological sensing device and as a research tool for studying and recording high altitude weather phenomena.

Designed to be launched from a weather reconnaissance plane at an altitude of 40,000 feet, the radiosonde will travel into the upper atmospheric regions, carrying with it instruments to record temperature, humidity, pressure, and other meteorological information.

• **How it works**—The accompanying drawings illustrate the two sequences involved in the operation of the radiosonde, the launching cycle, and the component separation cycle.

In the launching sequence, the reconnaissance plane drops a nine foot long, 194-pound cylindrical container (1) in which is packed a launching tube housing the rocket and the radiosonde. After the unit clears the plane, a deceleration parachute is deployed (2) to stabilize and slow its descent.

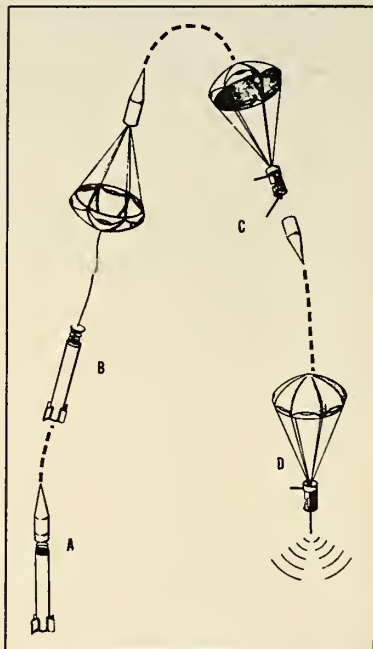
Several seconds later, a small charge blows the outer casing free, the drag chute is separated (3), and a cluster of three parachutes opens above the rocket launching tube (4). The three chutes, grouped together with lanyards, form a triangle—with an opening in the center—to steady the launcher in vertical position (5).

After stabilization, a pre-set timer

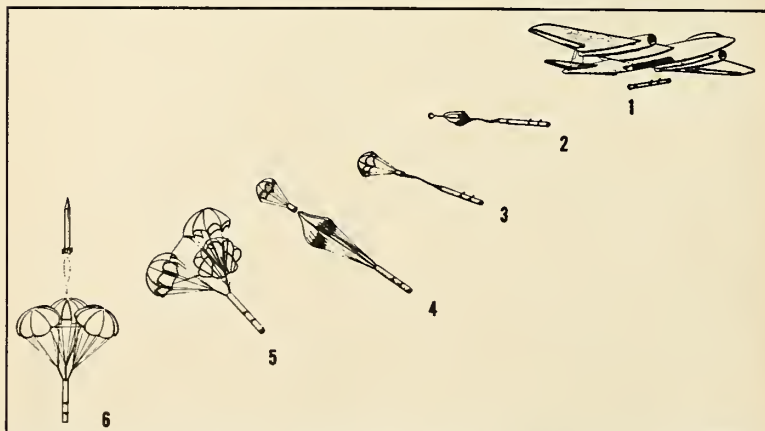
launches the rocket which blasts up through the center of the chutes.

At the peak of the trajectory, the rocket ejects the nose cone containing the radiosonde, a stabilizing parachute is deploying (a and b), and the radiosonde is thrown free (c).

Antennas are erected, and, as the vehicle makes its descent to earth, the gathered data is telemetered back to the airplane for later evaluation (d).

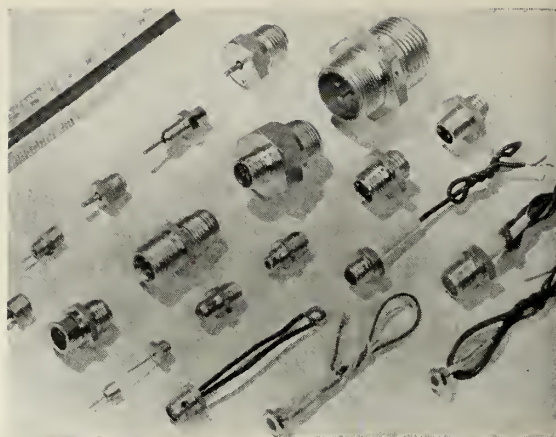


Component Separation Sequence, after ejection of rocket nose cone.



Rocket-Boosted Radiosonde Launching Sequence, after drop from reconnaissance airplane.





Out of precise operations like these . . . come fine precision products like these, as . . .

## McCormick Selph Diversifies For Growth

by Richard Van Osten

DIVERSIFICATION seems to be a current keyword in the missile industry. Acquisitions, mergers and other corporate machinations are announced every day—all for the broadening of an organization's capabilities.

Across the fence, there are companies with a product line of specialties which have such broad application that it becomes a problem to stay flexible within their respective fields, deliberately avoiding diversification. It's not a simple thing to stay in your own backyard, yet continually expand a product line for greater application and increased sales.

McCormick Selph Associates, Hollister, Calif., is a good example of the case in point.

The company's bread and butter is an extensive line of explosive ordnance products: explosive bolts; pressure cartridges; gas generators; solid and liquid-propellant igniters; initiators and high-pressure electrical connectors for use in guided missiles; ordnance rockets and aircraft.

With one or more of its products on practically every missile and rocket manufactured in this country, including prototypes and development models, the company's principal concern is to limit its activities to components.

"When we see how some of our products are used," says Don McCormick, president and general manager, "it's a great temptation to build equipment for, or to improve, other fields."

•**Basic hardware**—Diversification is not overlooked, but it is applied to the company's own product line. Over 600 items are produced by McCormick Selph. This includes special modifications to standard line items. As a result, there may be as many as 14 different versions of a single item—mostly changes in explosive charges or electrical requirements.

The basis of the company's seven years of existence is its initiator. This has led to the large line mentioned above, and a monthly gross of \$130,000, with 95% for the missile field.

Initiators are broken down into three types: electric primers, squibs and detonators, all of which may be actuated electrically by a battery, condenser discharge or a generator source. The units consist of an electrical connector, case, installation provisions as required, and an internally heat-sensitive primary explosive. The primer types are loaded to produce a brisant, hot flash. The squib types produce a hot flash and a little brisance, while the detonator carries supplementary explosive loads to produce high-velocity shock waves.

From this basic hardware, McCormick has developed solid and liquid-propellant igniters for the missile manufacturers. These are complete ignition systems consisting of either a percussion or electric initiator and a deflagrating material of a pyrotechnic or solid-propellant type. For some type of liquid propellants, the igniter consists of a liquid catalyst and a pressure cartridge. All the company's igniter de-

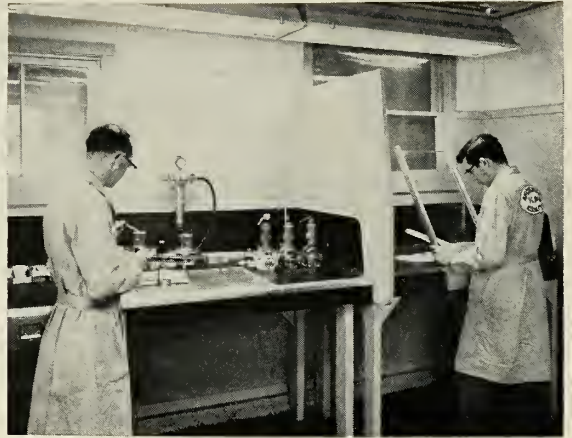
signs are controlled by the parameters of the motor design and the propellant to be ignited.

•**Plus items**—Other items that develop from the initiator include the pressure cartridges, which use either a primer or squib-type initiator, and a pressure-producing propellant. The standard pressure-producing time for these items is one-half second and pressures as high as 70,000 psi can be produced. A second product is a large line of explosive bolts with either an integral or separate explosive.

Still another line is offered—high-pressure electrical terminals for introducing circuitry into pressurized chambers. Capable of withstanding 60,000 psi, the terminals have been used in a solid-rocket engine at 4,500 psi for six minutes with a propellant-flame temperature of 3,300°F.

Newest addition to the McCormick Selph line are gas generators—small, solid-propellant rocket engines consisting of propellant, initiator, igniter, pressure-regulating nozzle, canister, initiation connector and gas outlet fitting. Activation for the generators may be produced mechanically or electrically and the energy requirements tailored for most any system.

In this field, the company has recently introduced a service of cool-gas generators, which produce gas with controllable densities and temperatures as low as -25°F. A typical application of the gas generator is for pressurization of the hydraulic accumulator in



**WELDING BRIDGE WIRES** requires special tools, almost surgical cleanliness and care.

**LABORATORY CHECK** is a must for many of the tiny parts required for missile components.

one highly-touted Navy missile.

• **The unknowns**—Although McCormick Selph has some of their devices on the *Jupiter-C*, *Sidewinder*, *Atlas*, *Titan*, *Falcon*, *Snark*, *Regulus*, *Terrier* and *Polaris*, company officials say that it is sometimes difficult to “sell” explosives.

“People are frightened every time you mention the word,” they say, “but explosives and pyrotechnics are no different from anything else, if you have knowledge of their characteristics.”

Many unknown factors exist in propellants for which the company has supplied igniters, particularly in burning rates and temperatures, as related to the balance of the system. The problem of classification also enters the picture, and McCormick is often asked to produce a specific type of igniter without the benefit of knowing just exactly what the system is or what the propellant characteristics are.

However, McCormick does not feel they are alone in this area, as many of their customers have propellants in the development stage and are not yet completely certain themselves about all the things they are doing.

The company has done a considerable amount of research and development in formulating its products. One very successful program was to increase the burning rate of ordinary, dependable black powder, which seemed to be completely unsatisfactory at altitudes over 30,000 ft. This was accomplished by a coating process using zirconium, and the new formula is now being used at altitudes in excess of 100,000 ft.

Stress is placed on reliability and

quality control. The former has become less and less of a problem, but the latter requires constant emphasis because of the precise timing, electrical and charge requirements.

### **Atlas Set for Full-Range Test**

One of the two *Atlas* ICBM's currently undergoing final checkout within their gantrys at Cape Canaveral, Fla., may soon be slated for a full range test-shot.

According to a program spokesman, a full scale firing at a range of about 5,500 miles is expected within the next three or four weeks. The second successful launching of a full-powered bird on Aug. 28 was indicative of the exceptional progress being made in the accelerated flight program.

A weld in the outlet elbow of the main liquid oxygen line (extending from tank to turbine) held up the last firing approximately five days. The elbow, which collapsed during a pre-flight pressure check, was removed, repaired and replaced within record time.

The latest *Atlas* test-shot reached only a fraction of its design range, due to overloading with instrumentation and telemetry gear. It was pointed out that although a successful full range shot may be realized within the next month, an operational ICBM with the required accuracy characteristics is two to three years away.

The August 28 firing was guided to a pre-determined target area by a radio-command guidance system developed at General Electric's Missile Guidance Section.

R. L. Shetler, section manager, termed the launch a “giant stride forward”. Referring to the *Atlas* guidance

system, Shetler said: “In addition to greater on-target accuracy, command guidance allows continuous ground control during the powered flight phase. The ICBM's course can be continuously corrected during early flight. If signals indicate the missile has strayed from its programmed flight pattern, an immediate automatic correction is made to put the missile back on the prescribed course.”

The *Atlas* radio command guidance has been reported to be virtually jam-proof. Coated anti-jam filters which reject all outside interferences, are of a highly selective space, time and frequency nature.

The radio signals control *Atlas* only during the first five minutes (total engine burning time) of approximately thirty minutes flight time.

The radio command is also utilized for arming of the warhead. A ground base computer determines whether or not the missile is following its planned trajectory, and if the warhead will fall in the predetermined target area. The radio arming signal is not given until computer indicates this trajectory is being followed.

### **Russian Scientific Works Available in English**

Approximately 60,000 pages a year of key Soviet scientific and technical journals are being made available in English translation to United States scientists and engineers by the National Science Foundation.

In releasing a compilation of the translations, NSF indicated that there are now 53 English editions of Russian journals, four series of abstracts, and four series of partial translations of important Soviet journals.



# missile people in the news

## Honors

**Max A. Pape**, senior research engineer for Lockheed Missile Systems Division, Sunnyvale, Calif., was elected as an officer of the New Interamerican University Alumni Association. He will be secretary-treasurer of the Association.

Membership in the American Rocket Society has been extended to **Maj. Ben I. Funk**, USAF, head of the Ballistic Missiles Office of Air Materiel Command at Inglewood, Calif.

**Dr. Anthony J. Cacioppo**, human factors specialist for Goodyear Aircraft Corp., has been appointed to the U.S. Air Force-sponsored Committee on Life Sciences, a division of the National Academy of Sciences.

**Dr. Knox Millsaps**, chief scientist at the Air Force Missile Development Center, Holloman Air Force Base, N.M., has been granted a special Honorable Mention Award by the William A. Jump Memorial Foundation.

## Sales

**Saul Padwo** was named assistant to the vice-president of Yardney Electric Corp. Padwo, who was manager of sales and products application at M. Ten Bosch, will work with **Martin E. Kagan**, vice president

of the firm, concentrating on sales in the commercial markets.

**Paul Sturm** has taken over the post of manager of Military Marketing for Motorola's Military Electronics Division. He was previously manager of the Washington office for Military Marketing.

**Dale S. Samuelson** was appointed sales manager of the Instrumentation Division of the Applied Science Corp. of Princeton (AS-COP). He will direct the nationwide sales program for the Division's line of data handling systems and components. Samuelson joined ASCOP in March 1956 as a sales engineer, and

has been Southwestern District sales manager for the past year. He opened the company's first sales and service office in Dallas, Texas.

**Robert A. Bailey** is now director of marketing for the Industrial Products Division of International Telephone and Telegraph Corp. He joins ITT from Norden-Ketay Corp., where he was marketing manager for the Data Systems Division and Western Division.

## Engineering

**J. V. Howell, Jr.** has joined Packard-Bell Computer Corp. as a project engineer. His first assignment will be to direct the development of a missile impact prediction system for Cooke Air Force Base, under a contract awarded Packard Bell Electronics by Aerojet-General Corp., Azusa.

**John A. Rhoads** has become associated with Packard-Bell Electronics Corp. as director of engineering in The Technical Products Division. Rhoads replaces **Dr. George J. Mueller**, who will remain at Packard-

Bell temporarily as a consultant.

**Karl H. Eppe** has been appointed director of engineering, and **Edward W. McLaren** director of manufacturing for the Heli-Coil Corp., Danbury, Conn.

**Frederick P. Huston** has been named to the position of chief methods engineer with Tube Reducing Corp., Wallington, N. J. **Scott N. Randall** is new chief product engineer.

## Top Brass

**Bruce L. Mims**, formerly chief engineer of the Barden Corp., has been elected vice president—engineering.

**Rear Adm. Earl E. Stone**, USN, who retired from active Naval Service in January, 1958, has become a director of HOLEX Inc., producers of packaged explosive power, Hollister, Calif. He was formerly superintendent in command of the United States Naval Postgraduate School at Monterey and served as Director of Naval Communications in the Navy Department, Washington, D. C.

Three vice presidents and an assistant comptroller have been appointed

at ITT Laboratories, U.S. research division of International Telephone and Telegraph Corp. Assistant vice presidents: **Ivan Sattem**, **John E. Kahelin**, **J. Eugene Bower**; **Russell C. Irish** is the assistant comptroller.

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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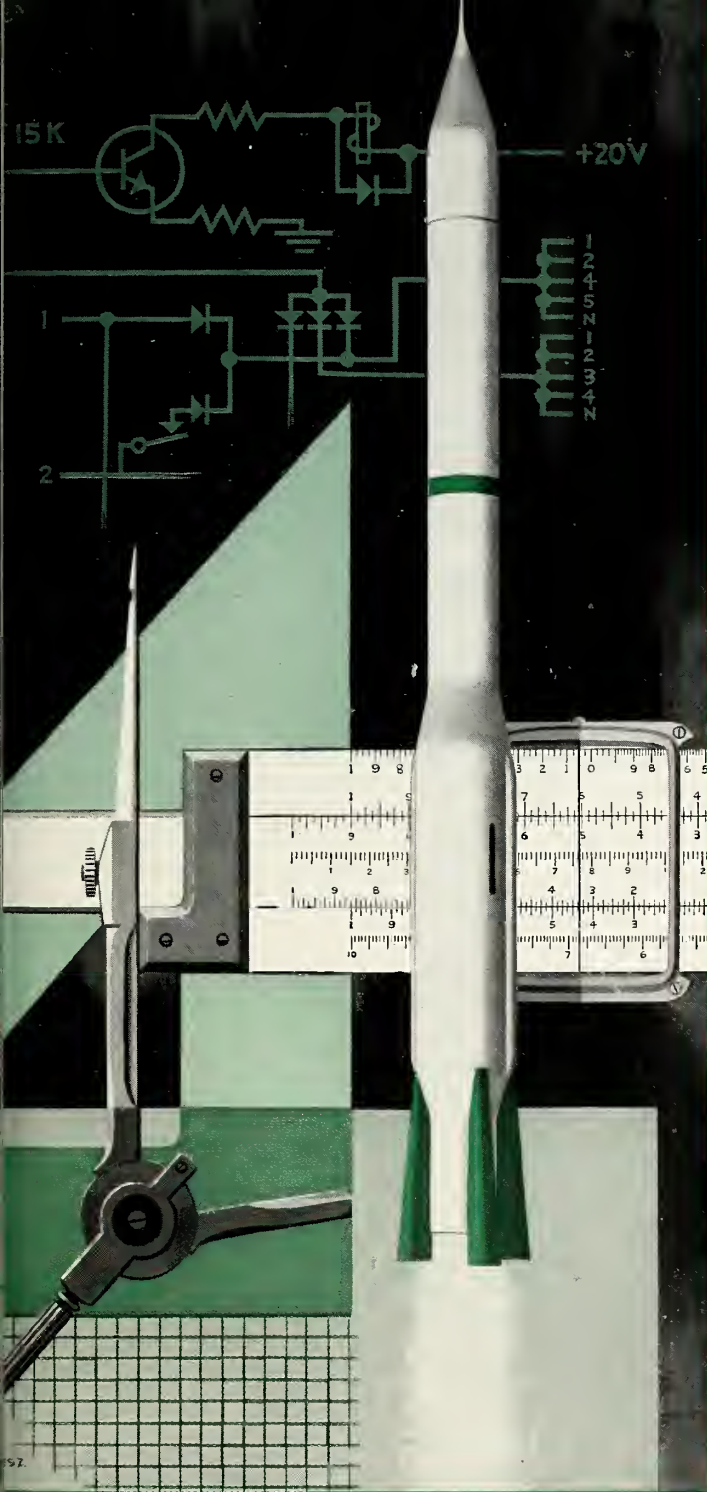
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## From layout to launching pad... Crosley

Only the most highly developed and technically proficient industrial organization can keep pace with America's swiftly changing defense needs. Crosley is such an organization—efficient, experienced, esteemed.

Crosley creative systems management insures speed and discipline during every phase of every project—no matter how complex.

Its extensive design and manufacturing facilities include advanced techniques in stainless-steel contour honeycombing, metal bonding, and chemical milling.

This combination of creativity and technical know-how has already proved itself in many defense projects: in Crosley's MD-9 fire control system, in its *Falcon* air-to-air missile components, in its research and development of the *Volscan* air traffic control system, in fuzing mortars, shells and missiles.

### **Avco-Crosley Missile Capabilities**

Complete facilities for research, development, and engineering design of: *nose cones, air frames, electronics control systems, telemetering, automatic test and support equipment, ground handling equipment and logistics.* Production and manufacture of complete missile weapons.

*For further information, write to: Vice President, Defense Products Marketing, Crosley Division, Avco Manufacturing Corporation, Cincinnati 25, Ohio.*

**Avco** // **Crosley**



# Lithium and the lighter alloys...

The lighter side of metallurgy is characterized by lithium-bearing alloys, particularly for advanced scientific applications. The exceedingly important properties accruing to these special alloys by the inclusion of lithium, and described here, further indicate the unique role of lithium metal in making laboratory probabilities commercial possibilities.



Ballistics is making good use of the ductility, toughness, and very low densities achieved by alloying lithium with magnesium and aluminum. In gages under 1" it has proved to be effective as armor plate, absorbing energy and preventing fragmentation. More important, 1" of magnesium-lithium-aluminum

alloy can replace  $\frac{3}{4}$ " steel—yet is  $\frac{1}{2}$  lighter. Dow Chemical's interest in the cubic structure of magnesium-lithium alloy led to modifying the basic binary system by the addition of a third element—aluminum—producing a very high strength-to-weight ratio.



## ALUMINUM COMPANY OF AMERICA

Jet aircraft traveling 1600 mph at operating altitudes develop "skin" temperatures of approximately 350° F. Conventional aluminum alloys employed in aircraft construction begin to lose physical properties in the 250-350° F. range, limiting their usefulness to speeds below 1300 mph. Stainless steel and titanium are alternate solutions but add immensely to cost and weight of airframe structures. Alcoa's

new X2020 aircraft alloy utilizes the rare-earth element lithium to push ahead the thermal barrier in supersonic aircraft by about 100° F. Not only does it serve to maintain aluminum's strength at high temperatures, but this aluminum-lithium alloy is 3% lighter and has 8% greater modulus of elasticity which adds to structural stiffness.

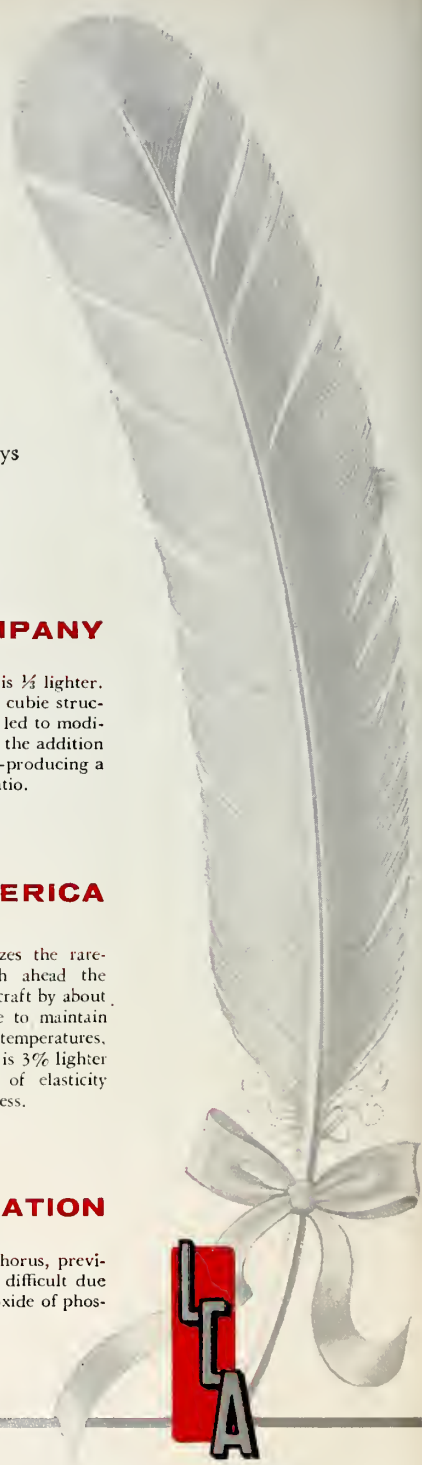


### General Plate Division

## METALS & CONTROLS CORPORATION

Lithium is also used as a deoxidizer in the gold melting process to prevent the contamination of molten gold by oxygen in the pouring operation. Metals & Controls found lithium metal a

stronger deoxidizer than phosphorus, previously used. Polishing, formerly difficult due to particles resulting from the oxide of phosphorus, was simplified.



Cooperative research on special lithium alloys is available to interested parties under our joint working agreement with Brooks & Perkins, Incorporated of Detroit, fabricators of magnesium and other light metals. Letterhead inquiries should be addressed to our Technical Service—Sales Department.

## LITHIUM CORPORATION OF AMERICA, INC.

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