JULY 21, 1958

missiles and rockets

MAGAZINE OF WORLD ASTRONAUTICS

News and Business Edition

AN AMERICAN AVIATION PUBLICATION

Sequence of a typical photo reconnaissance mission with the Radioplane SD-1 drone

Eye in the Sky

SITUATION: *A range of hills screens enemy activities.*

TACTICAL PROBLEM: *What is on the other side of the hills?*

SOLUTION: *Aerial drone surveillance—puts an "eye" in the sky.*

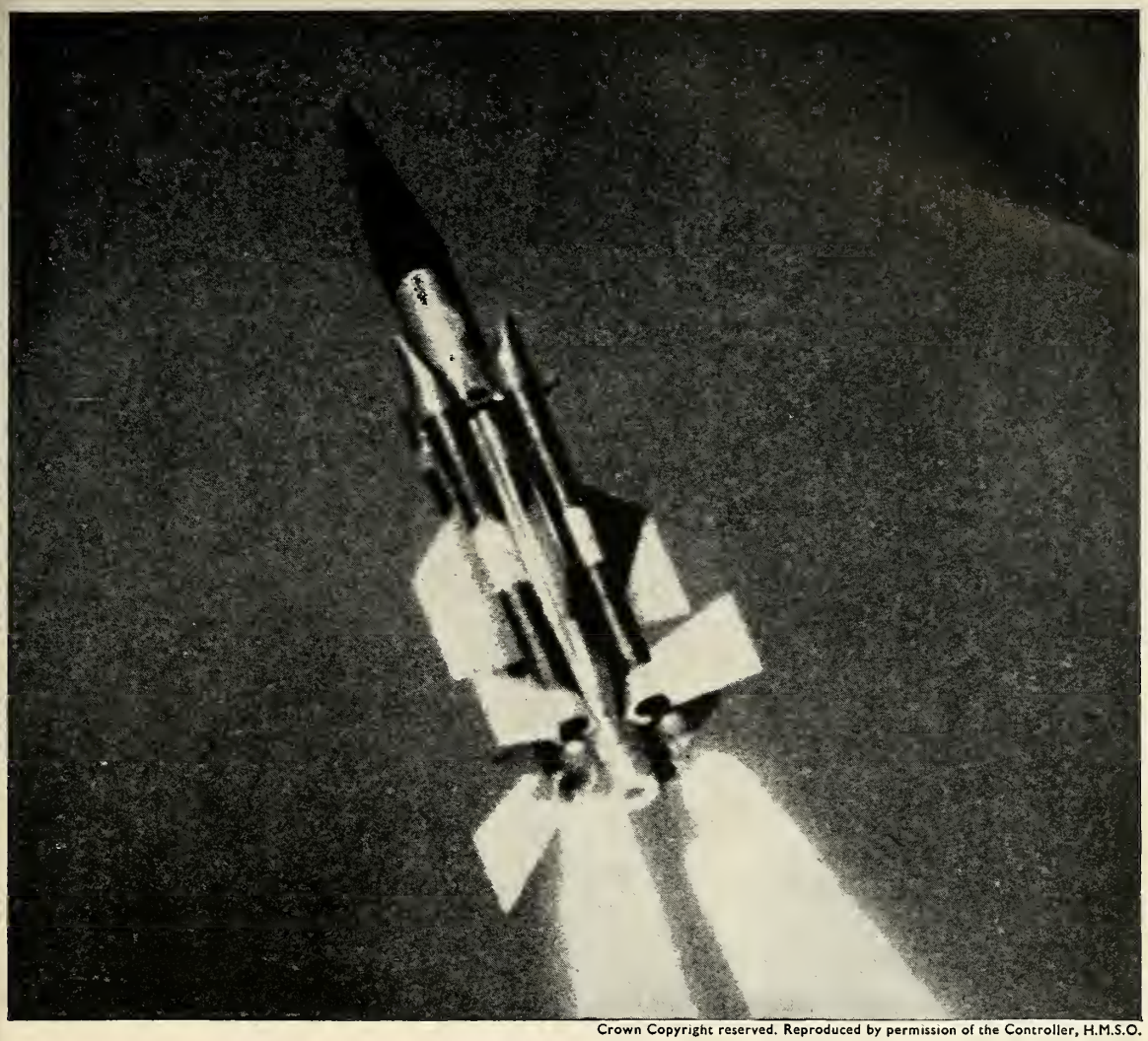
Radioplane, in conjunction with the U.S. Army Signal Corps, developed and is producing the SD-1 surveillance drone system. Highly mobile, the camera-carrying SD-1 may be zero-length ground launched in rough terrain from a camouflaged position and flown by remote control over enemy installations on photo reconnaissance missions. After the drone's camera has exposed its film by radio command over the target, the SD-1 is then flown to a pre-designated area for parachute recovery. The camera is removed, the film is processed, and prints are delivered to the requesting unit within minutes after the entire operation began and the mission is accomplished without risking a pilot's life or a large man-carrying aircraft.

The Signal Corps SD-1 surveillance drone system is another example of Radioplane's constant refinement of the art of producing radio-controlled drones. First to manufacture target drones exclusively for military use Radioplane has a world-wide field support organization with personnel qualified to assist in all phases of drone field activities.

RADIOPLANE

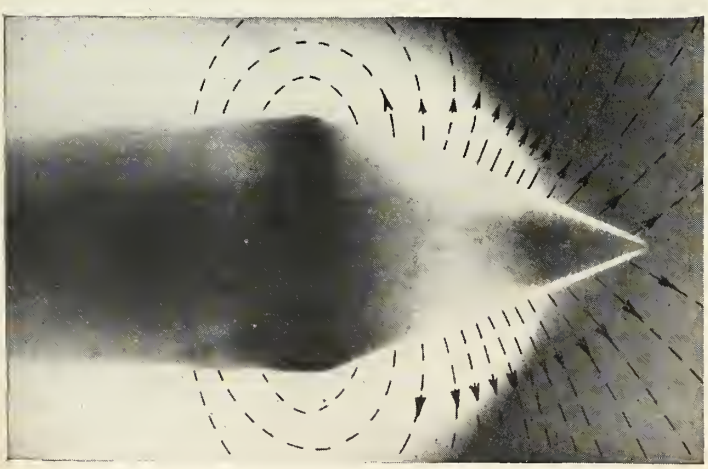
A Division of Northrop Aircraft, Inc.

VAN NUYS, CALIFORNIA AND EL PASO, TEXAS



NEW LIGHT ON MHD*

NO MAGNETIC FIELD. This shock tube photograph, taken by emitted light only, shows the typical shock wave configuration formed by high-velocity gas flowing around a pointed cone.



WITH MAGNETIC FIELD. Here is shown the magnetohydrodynamic displacement of the shock wave. The magnetic field is caused by electric current flowing through a coil of wire within the cone. This experiment qualitatively demonstrates the interaction of a high-temperature gas with a magnetic field. This effect would be expected to produce drag and reduce heat transfer to the body.

The Avco Research Laboratory was founded a little more than three years ago for the purpose of examining high-temperature gas problems associated with ICBM re-entry. The success of this research led to the birth of a new corporate enterprise, Avco's Research and Advanced Development Division.

The Research Laboratory, now established as a separate Avco division, has expanded to embrace all aspects of physical gas dynamics. We are currently gravid with several embryonic projects which we anticipate will likewise grow into new corporate enterprises. Our work in the physics, aerodynamics and chemistry of high-temperature gases is growing in the following areas:

Magnetohydrodynamics—
Flight and industrial power-generation applications

Space flight—
Manned satellites
Electromagnetic propulsion

These developments have created a number of openings for physicists, aerodynamicists and physical chemists. If your background qualifies you to work in any of these areas, we would be pleased to hear from you.

Arthur Kantrowitz

Dr. Arthur Kantrowitz, Director
Avco Research Laboratory

P. S. A listing of laboratory research reports indicative of the scope and depth of our activities is available. Address your request: *Attention: Librarian, Avco Research Laboratory, 2385 Revere Beach Parkway, Everett, Massachusetts.*

***Magnetohydrodynamics,** the study of the dynamics of electrically conducting fluids interacting with magnetic fields.

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editorial viewpoint . . .

It seems that a candle has been brought out from under a bushel basket. The public is becoming interested in our missile programs. It was brought out in the July 14 edition of the WASHINGTON POST AND TIMES HERALD, which called attention to a situation and a basic fallacy that has long been apparent to those in the missile field.

For a long time now, the missile men have realized that there is a fallacy in publicizing the current ICBMs as weapons of massive retaliation for a sneak attack. With the flight time of an ICBM estimated at 30 minutes, it is folly to think that our ICBM bases would be in existence for the necessary two hours to fuel, check out, program and launch the *Atlas* . . . or the *Titan*.

In an editorial, the newspaper said: "The further development of missiles of the *Atlas* type is not promising. Before too much more is invested in this project, there ought to be an intensive re-appraisal of more promising systems, such as the relatively less vulnerable . . . submarine-launched *Polaris* missiles."

With the publication of this realistic viewpoint, the POST has focused attention upon a previously little-known situation. It is quite likely that millions of people in this country were blithely assuming that the operational status of *Atlas* would insure safety from sneak attacks. Examination of the pre-launch requirements of *Atlas* shows that this could not possibly be, unless by some fantastic stroke of stupidity, the Soviet Union did not choose to list our ICBM bases among the prime targets of its missiles.

The editorial in the POST is one sign that the public realizes that some of our missiles are not what they are cracked up to be. This public interest in missiles is good and it is important.

It is becoming known to John Q. Taxpayer that we have been hiding behind a Maginot Line of fixed-base IRBMs and ICBMs. We have even been foisting this concept upon our allies. With a more interested public watching, our missile planners are bound to pay attention in the future to sound and practical weapons systems.

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Technician from Minneapolis-Honeywell's Ordnance Division assembles fuzing and arming device for ballistic missile warhead. See p. 15 for a report on the company's defense activities.

An m/r staff report from WASHINGTON

• **HAVE GREENHOUSE, WILL TRAVEL** might well be the slogan for future space pilots. Not long ago, former Secretary of Defense Wilson had some unkind remarks about the AF's interest in why potatoes turned brown. The interest was very valid: One of the biggest problems in planning manned satellites or space travel is an adequate supply of breathable oxygen. Man breathes in oxygen and exhales carbon dioxide. Plants take in carbon dioxide and emit oxygen. Low forms of plant life, including potato sprouts, were, and probably are, an important part in basic research to develop such a regenerative environment for man in space.

• **PIED PIPER HAS A NEW NAME.** An AF witness told members of the Joint Committee on Atomic Energy that Pied Piper now is called SNAP (Secondary Nuclear Auxiliary Power). Which leads to the possible conclusion that nuclear power will be employed in a future reconnaissance satellite vehicle.

• **PENTAGON CORRIDORS CRACKLED** this week with speculations and claims of the service's cold war, limited war, and general war capabilities as the pro-Western regime in Iraq fell. All hands admitted the Navy carrier "Task Force" is the best way to show force, but Army and Air Force planners insist it will take more than that to fight even a limited war.

• **WHILE ADMITTING** it's psychological and deterrent value, both Army and Air Force spokesmen warn against putting all the nation's missile capability in a submarine—namely, the *Polaris*-carrying Fleet Ballistic Missile submarine. "Not enough punch," they argue. One AF representative pointed out the *Polaris* with its .1 megaton (correct) payload can't compare to the 20 megaton capability of a SAC bomber. Which probably was part of the argument that swayed Congress to up the ante for the B-52 program . . . or was it the 3 megaton payload on *Atlas* . . . or the 1 megaton payload on *Thor?*

• **DEVELOPMENT AND IMPLEMENTATION** of the *Talos* missile moved ahead as Vitro Laboratories got a Navy Board contract for systems engineering in conversion of three heavy cruisers to *Talos* and *Tartar* capability. In this respect Vitro is the Ramo-Wooldridge of the Navy.

• **THERE'S NO REST FOR THE WEARY** budget planners who sit in Washington trying to figure out how to make the financial pie go around. Example: the payroll for Army or Army-supported activities at Redstone Arsenal was over $95 million for the year ending July 1. Col. Keith T. O'Keefe, post commandant, said if rate continues upwards, the Redstone payroll will top $100 million by fiscal year 1959. The past year's spending set an all time high for the big ABMA installation.

• **ALL OF WHICH MEANS** that there probably will be efforts made to cut down on building of prototypes of other missiles in arsenals, and then having the job done again by the contractor with a resulting double production and tooling costs. That's the biggest objection to the *Jupiter.* According to one AF source, a *Jupiter* squadron will cost an estimated $122 million as compared with $57 million for a *Thor* squadron. *Thor* started and continues in the Douglas shop. Incidentally, the four-*Thor*-missile-squadron program is to cost $250 million and has been approved by the pentagon.

• **POPULAR NAME FOR CONVAIR-ASTRONAUTICS** new $40 million plant opened last week is "Dempseyland," in tribute to 36-year-old (former AF man) J. R. Dempsey, manager of that division of General Dynamics.

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BIG RUSSIAN BASE is Mirny, at bottom of the world. From this point . . . .

Reds Plan Satellite Launch From Antarctic

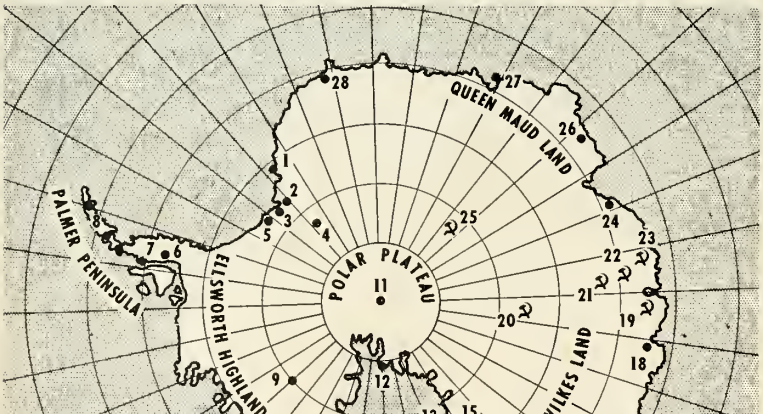
by Seabrook Hull

"We will eventually launch satellites from Mirny."

This statement was made by U.S.S.R. Academy of Sciences President Alexander Nesmyanov in reply to questions concerning Soviet rocket launching plans in Antarctica by a visiting American businessman.

Mirny is Russia's big—and permanent—base situated at Wilkes Land or, as Russian maps call it, the Pravda coast of Antarctica. Nesmyanov made his forecast of Russian Antarctica satellite launchings in the presence of three other top-ranking Soviet scientists, who enthusiastically supported his statement.

An important aspect of the Mirny base, in addition to its size, is its permanence. Unlike most of the other Antarctic bases set up by other countries, this one shows no signs of being abandoned at the end of the IGY. In a word, the Russians have moved into Antarctica to stay, and if Nesmyanov's words are any indication of the future, the Reds are establishing major missile-handling and launching capabilities.



HERE ARE THE MAJOR ANTARCTIC BASES now manned by the eight nations participating in the South Polar International Geophysical Year program: **1, Royal Society—U.K.; 2, Sheckleton—U.K.; 3, General Belgrano—Argentina; 4, South Ice—U.K.; 5, Ellsworth—U.K.; 6, 7, and 8, twenty-two IGY stations established by Argentina, Chile, and U.K.; 9, Byrd—U.S.; 10, Little America—U.S.; 11, Amundsen-Scott—U.S.; 12, Scott—N.Z.; 13, McMurda—U.S.; 14, Hallett—U.S.-N.Z.; 15, Skelton Depot—N.Z.; 16, Charcot—France; 17, Dumont D'Urville—France; 18, Wilkes—U.S.; 19, Oasis—U.S.S.R.; 20, Vostok—U.S.S.R.; 21, Vostok I—U.S.S.R.; 22, Pionerskaya—U.S.S.R.; 23, Mirny—U.S.S.R.; 24, Davis—Australia; 25, Sovietskaya—U.S.S.R.; 26, Mawson—Australia; 27, Showa—Japan; 28, Queen Maud Land—Norway.**

The Antarctic, in one sense, may be destined to become Russia's answer to the U.S. Strategic Air Command bases that now ring Russia, Europe, Africa and Asia, as well as in the U.S. It will provide her with a landing or launching site for full-range tests of her skip bombers, and poses a deadly threat to the U.S. from her unguarded south.

Once it's aloft, it doesn't really matter where a satellite was launched from, since it circumnavigates the globe anyhow. However, what is significant is the size and complexity of rocket-launching and support facilities that are required to place a satellite in orbit and the fact that Russia's number one scientist says these are being established in Antarctica.

The same base that can launch satellites can also launch 10,000-mile range ballistic rockets and 12,000-mile-an-hour rocket-boosted skip bombers, or provide landing facilities for them when fired from the Russian homeland.

From a strategic point of view, a Russian ballistic missile base on the South Polar continent will outflank North American defenses, virtually all of which are oriented to the North—facing Russia over the Arctic.

And even though the present DEW line, the mid-Canada line and the Pine Tree line are limited to intercept-detection of vehicles traveling at under Mach 3.0, when BMEWS (Ballistic Missile Early Warning System) is installed, it will utilize much of the communications structure of DEW line, etc., and,

according to present plans, it too will be facing north.

Advanced Research Projects Agency has ordered construction of special, giant radar scanners in the southern United States in order to be able to track satellites, even though they are not visible and are not transmitting tell-tale radio signals. However, these could scarcely be used to detect Intercontinental Ballistic Missiles and activate in-time defenses—even assuming there were any that could be fired southward.

The Russian move in Antarctica must almost inevitably require that the U.S. install anti-ICBM systems in the southern U.S., but also strategically beyond U.S. borders in the Caribbean and on the South American continent. The route from Mirny to the continental U.S. extends roughly over the South Pole and South American for a distance of 10,000-to-12,000 miles. Facilities in Antarctica to detect launchings might also be necessary.

Russia has previously announced that she will launch rockets in support of the International Geophysical Year from Mirny (66° 35′ ss, 93° e.), Russia and the Arctic. Original plans called for launching 30 rockets from Antarctica during the IGY. Even these upper air research rockets must require considerable in the way of launching facilities if altitude and payload are any indication. On February 21, the Russians fired an upper air research rocket to an altitude of 264 miles with an instrument payload of 3,344 pounds. It was this flight, incidentally, that first discovered the electron (X-ray) layer around the earth, later also discovered by Explorer III. At that altitude, the Russians reported an electron concentration of one million per cubic centimeter.

The only published reports of Russian IGY rocket firings in the Antarctic have been of shipboard launchings from the diesel-electric ship, Ob'.

Russia now has seven bases in Antarctica: Mirny, Pionerskaya, Vostok-I, Oazis, Komsomol'skaya, Vostok and Sovetskaya. Only Vostok-I is officially listed as "temporary." Since February 13, 1956, when the Russians landed at Mirny, a large permanent base has been constructed—replete with Persian carpets for the floors, central steam heating plant, mechanized land transport, and both aircraft and helicopters. Originally 20 basic buildings were put in place, including special magnetic, seismic and aerological centers; geophysical, geological, glaciological, gravimetric, aerophotogrammetric and other laboratories. Both men and women are stationed at Mirny. Listed as in charge of Russia's Antarctic expedition is Ye. Tolstikov.

industry countdown

• **Discount reports of a possible merger** of Thiokol Chemical with another company. Thiokol does need working capital, but is right now finalizing plans for a small additional stock issue "so as not to dilute present issue too much," plus a long term loan . . . **Reports are circulating that** *Minuteman* **propulsion system contracts** are in final stage, with Aerojet-General, assisted by Thiokol, responsible for first stage engine; Aerojet alone, second stage; and Aerojet assisted by Allegany Ballistics Laboratory, third stage. Thiokol denies any knowledge of this . . . **More reports** that a contract will be issued to develop wholly new propellant for *Polaris*, perhaps a composite double-base by ABL.

• **Lockheed says** *Polaris* **is a year ahead** with delivery to fleet possible in 1959 instead of 1960 . . . **Donald W. Douglas, Jr.,** speaking before L.A. Transportation Club, said that the most important space-age problem today is development of propulsion systems with 10-to-100 times present thrusts . . . **Curtiss-Wright Chairman & President** Roy T. Hurley forecasts no major economic changes in aircraft industry in next six months, but major technical changes due to new weapons requirements.

• **The Budd Co. will research** non-destructive testing of solid propellants for Thiokol-Utah . . . **Northrop Aircraft will** participate in construction of the operational *Snark* base at Presque Isle, Me. . . . **Construction of first** *Titan* **ICBM launching pad** has been started at the new Pacific Missile Test Range . . . **Corps of Engineers** Maj. Gen. W. K. Wilson says 25-to-30% of Corps' constructions work is now devoted to missile sites compared to 15% in 1957 . . . **Ramo-Wooldridge** V.P. Burton F. Miller, at IAS L.A. meeting, said short-lived satellite vehicles may be used to improve air-ground communications and air traffic control.

• **AEC plans to test Kiwi-A** reactor for *Rover* after August 1, probably in November; AEC deputy chief Aircraft Reactors Branch says nuclear rocket would probably be needed to put 20,000 pounds or more payload in space . . . **Japan's Mitsubishi Electric Co. will build** Swiss Oerlikon anti-aircraft missile under license . . . **Sweden has ordered** substantial number of French SS-10 anti-tank missiles . . . **Joint U.K.-Australian** missile test program is scheduled for another five years . . **NAA Missile div. has received** two Army contracts to study simulated micrometeorites, and interaction of surface materials and high-temperature boundary layers.

• **On Capitol Hill,** Senate Small Business Procurement Subcommittee has ordered a new investigation of Pentagon procurement policies; hearings to start July 22 and run three days—Committee's concerned with decline of small business participation in government prime contracts . . . **Bill to indemnify government contractors** in unusually hazardous work for up to $300 million has been dropped for this year.

• **Air Force is starting** program to broaden its research base and to improve technical education of its officers . . . **L.A. Chamber of Commerce claims** military procurement policy favoring areas with labor surplus unnecessarily penalizes L.A. for its success . . . **California considering** holding International Space Age Exposition in 1962 and establishment of permanent space-age museum at Sacramento.

• **Lockheed Missile Systems Div. plans** to double size of its space communications lab with completion of 8,000-sq.ft. addition in mid-August . . . **AC Spark Plug will build** West Coast headquarters building in L.A. . . . **Work has started** on $1-million engineering and production center for R-W subsidiary Pacific Semiconductors, Inc., at Redondo Beach, Calif. . . . **Marquardt Aircraft Co. is spending** $1.5 million to double size of its Ogden, Utah, Bomarc engine plant to 250,000 sq.ft. . . . **AF Air Training Command** will give *Atlas, Titan* and *Thor* training at Kessler AFB, Miss.; Chanute AFB, Ill.; Sheppard AFB, Texas . . . **Magnavox Co. has formed** Magnavox Astro-Physics Laboratories, Inc., Rochester, N.Y.

• **Convair-Astronautics** formally opened its new $40-million 1,220 million sq.ft. *Atlas* production plant at Kearny Mesa, July 12 . . . **Aeronca Manufacturing Corp.** renamed its Baltimore facility as Baltimore Div., where Aeronca does electronics work, particularly computers, logger, comparators.

NACA to Boost Electronics Industry Dollars

by Donald E. Perry

MOFFETT FIELD—The electronics industry is scheduled to get a healthy boost when the national Advisory Committee for Aeronautics becomes the nation's civil space agency.

During last week's triennial inspection of Ames Aeronautical Laboratory, NACA officials made it clear that the new national aeronautics and space administration, now lacking an electronics capability, would utilize the research potentials of industry rather than build extensive facilities. NASA will have a first year budget of approximately $300 million, and some believe it will approximate $1 billion annually within five years. A healthy percentage of the budget will go to electronics.

The inspection, attended by more than 500 leaders in the military services, the aircraft, missile, space craft, and related industries, was geared to explain NACA's present research activities in space and its capabilities to become the nucleus of the civil space agency.

Expansion plans of NASA, it was learned, will include construction of a multi-million dollar electronics data reduction center in the Washington, D.C., area; acquisition of an equatorial satellite launching site; expansion of launch complexes at Wallops Island, Virginia and enlargement of existing facilities at Ames, Cleveland, and Langley Field.

At Ames, nearly $2 million has been programmed for construction of a 12 x 12-inch hypersonic helium tunnel for the study of flow phenomena of missiles in the 12-20 Mach range. Another $1.5 million is programmed for expansion of Ames' hypervelocity research laboratory, which will be used to study the basic properties of high-temperatures gases. Two IRBM-type launching complexes will be built at Wallops.

• **Research work**—The inspection pointed up these research activities in space technology by NACA:

Propulsion: Lewis Flight Propulsion Laboratory's work on nuclear rockets include nozzle design, and selection of materials and design to minimize weight. In chemical rockets, an injection method to improve performance, cooling, weight, combustion stability, and fabrication is being researched. In the field of nuclear-electric propulsion, NACA is researching lighter weight conversion of thermal energy into electrical energy, and new cooling methods for the magnetic field electrodes and energy sources.

• **Entry research**—NACA has developed an atmosphere-entry simulator to simulate the entry of ballistic missiles, satellites, and space craft. Models are launched by a high-velocity helium "gun." In tests of copper, which was used to absorb the heat associated with the simulated atmosphere entry, researchers found the metal to be considerably altered by flight. Small craters were observed in the metal after firing, and NACA believes they were caused by small particles of dust in the air stream.

Another research development is a ballistic range, which is being used to take a close look at the effects of flight at selected pressures or altitudes. By testing scale models at the true flight speeds in air at appropriate pressures, the aerodynamic heating and forces encountered by actual missiles and space vehicles will be duplicated. Models are shot at a speed of 16,000 mph into a 500-foot-long pressurized tank.

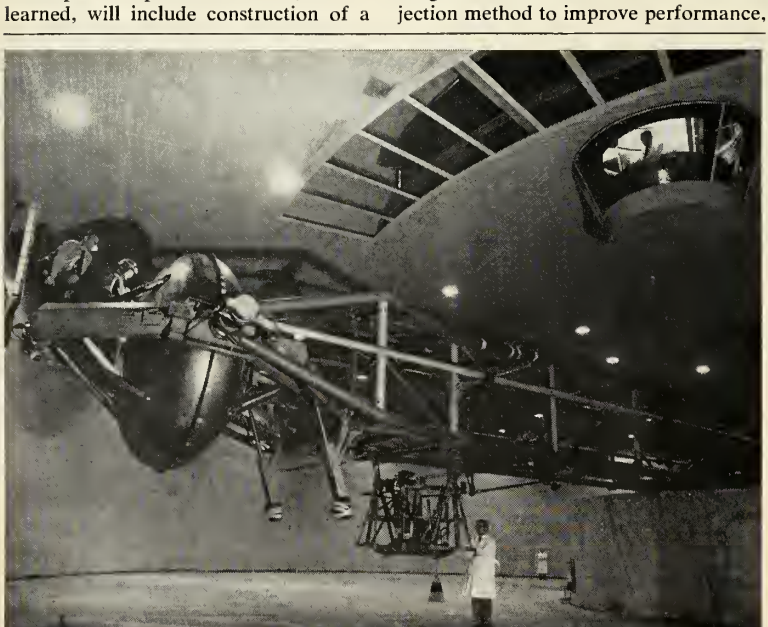
• **Satellites**—NACA had developed extremely lightweight inflatable satellites made of micro-thin plastic covered with aluminum foil. They will be used as radar targets, and for measuring air density and other characteristics of space.

The satellites, including 30 inch and 12-foot spheres, and a 12-foot corner reflector, will be propelled into space in a deflated condition, ejected into orbit and automatically inflated by a nitrogen gas cartridge.

• **Space craft flight research**—NACA is evaluating relative merits of a variety of promising materials. In operation are several high-temperature air jets that duplicate high speed, high temperature environment.

Materials being tested include zirconium dioxide, crystalline glass, graphite, copper, fibreglass and plastics.

• **Space craft piloting problems**—Research is being made in five problem areas: reduced damping; large and rapid changes in dynamic air pressure; flight reaction controls; interaction between space craft controls; and better programming of information to the pilot.



THE WORLD'S LARGEST human centrifuge at the Naval Air Development Center, Johnsville, Pa., is a keystone in the training of pilots, both from industry and the military, who will fly the nation's first space craft. The program is a joint operation of the Navy, Air Force, NACA, and North American Aviation Corp., manufacturer of the X-15. The first press demonstration was held last week. Scotty Crossfield of North American entered the testing operation, during which the centrifuge produced acceleration and gravity forces equal to those which will be experienced on the X-15 flight into space and re-entry, presently scheduled for early next year. The gondola is equipped with an actual X-15 control panel, and is flown by the pilot in response to signals from an analog computer. Centrifuge flights also permit placement studies of instruments and controls.

German Returnees Sketch Red IRBM Power Unit

by Alfred J. Zaehringer

EVEN THOUGH THE USSR has not shown its operational IRBM, the T-2, or its *Sputnik* launcher, a glimpse behind the ballistic iron curtain has been provided by the German rocket "collectives" which worked for the Reds from the end of World War II to 1950.

So far, the Russians have shown off only obsolete long-range weapons. Notable among these is the T-1 medium range rocket, a redesigned V-2 that is in the *Redstone* class.

• **Soviet goal**—Using the German accounts and coupling this with the view given during the last Moscow parade, the Soviets' immediate goal was to standardize on propellants and count on performance gains through high thrust rocket motors, high pressure operation, simplicity of design, and improved guidance techniques.

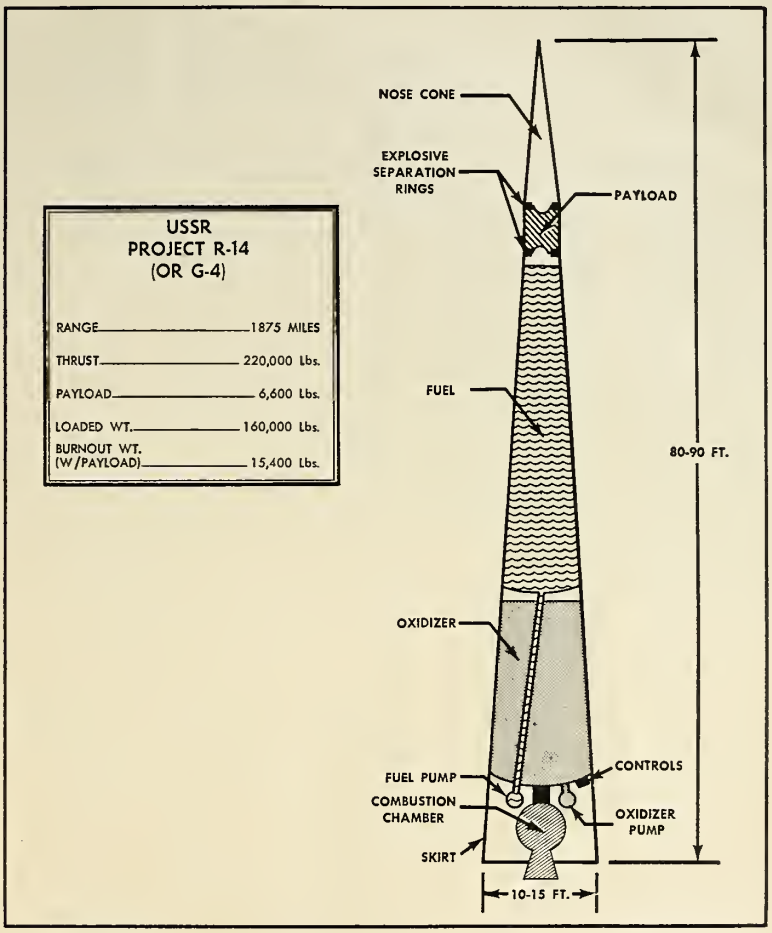
For this reason, emphasis was placed on LOX as the oxidizer and kerosene or watered alcohol as the fuel. Some work was also done on acid systems. Higher energy or "exotic" propellants were left for the laboratory.

What may be the prototype for the T-2 IRBM or the *Sputnik* vehicle was the German rocket collective study program known as Project R-14 (or G-4). This was to be an IRBM of 1,875 miles range and carrying a payload of 6,600 lb. Thrust of 220,000 lb. (a single 100 metric ton rocket engine) was generated by the combustion of standard propellants at a pressure of 60 atmospheres (900 psi).

The aim was eventually to operate at even higher pressures. The 60-atm system was to operate via a two-stage turbopump, while higher pressures would be developed by a three-stage system. Cooling for the nozzle came directly from the fuel tank. The combustion chamber itself was cooled by fuel from the first stage pump, while the chamber head was cooled by the output of the second stage pump.

Other performance gains were to come from a radical shaving of weights. Integral tanks were selected, and the design studies showed that it was possible to build a ballistic rocket with a burnout weight of 10% of the launching weight. Moreover, the payload fraction of the empty weight was to be 40%.

Initial guidance was to be via a beam rider system. The warhead was to be separated by explosive rings and solid propellant rockets of high thrust and short burning time. Accuracy of placing the 6,600 lb. warhead on target was to be 1% of the range and azimuth.



• **Design operational**—It is believed that the design studies were frozen around 1950-1952. By this time the Germans had terminated their work and the Soviets were completely on their own. This gave the Reds some five years to build and begin testing.

By 1957, the T-2 IRBM had become operational and the *Sputnik* launchings were ready.

However, at the time of design freeze, warhead weights were large (viz., the 3 metric ton payload weight of the R-14 Project). It now means that the Russians can fire large hydrogen weapons over most of Europe. More significantly, the R-14 project has given us a closer "guesstimate" of what the T-3 ICBM or the *Sputnik* vehicles were like.

It is quite probable that the T-3 ICBM uses the T-2 as the upper stage, and that at least a two stage vehicle is involved. The T-3 would more probably look like the Martin *Titan* than the single stage Convair *Atlas,* and would be a multi-purpose weapon from the standpoint of production.

• **Future estimates**—Since the T-2 engine is rated at about 220,000 lb. thrust, the conservative estimates are that the T-3 would have to put out 3 to 5 times the thrust. Whether this is being done with a single large engine (at near 1 million pounds of thrust), or whether a bank of T-2 engines are being used is problematical.

First stage thrust for *Sputniks* I and II have been estimated at about 466,400 lb. by rocket experts Engel and Boedewadt. One may speculate whether the first two Russian satellites were launched by a souped-up T-2 IRBM or a modified T-3 ICBM.

missile business

by Seabrook Hull

Several new philosophies in missile system planning and procurement are becoming evident. They will have a material impact on "who" gets "how much business" and how that business will be conducted. Watch these trends. They will help you in planning your sales campaigns.

Boeing Airplane Company has been given the *Dyna-Soar* program. There is very strong indication that this is true, and that the Martin-Bell team is in solely to "keep them (Boeing) moving and on their toes." This could mean that the Air Force is using the competitive study contract system primarily as a psychological prod. This may be all well and good from the point of view of getting top "running scared" performance out of the selectee, but this kind of predetermination can cause those companies on the team "that never had a chance anyhow" to waste a lot of time, money and manpower. We will follow this situation closely.

Efforts are being made to rationalize missile families, so as to eliminate duplication of and to fill gaps in capabilities. For example, the official Army view is that *Sergeant* is the replacement for both *Corporal* and *Redstone,* and that *Pershing* extends the Army's missile range. This makes *Sergeant* an over-200-mile bird; *Pershing,* over 500. It also emphasizes a problem with the smaller solid propellant missiles, namely, that they have a limited flexibility of range. In this connection, Army is designing and developing a missile with a range between *Little John* and *Honest John,* and another to fill the gap between *Honest John* and *Lacrosse.*

Foreign missiles for U.S. forces under the Mutual Weapons Development Program is another trend that may be about to pick up steam. Pending delivery of the *Dart,* U.S. Seventh Army is already using the French *SS-10* anti-tank missile for training and evaluation. Army is now known to be considering a British missile for use with U.S. forces. And, there are unconfirmable reports of possible closer cooperation between the U.S. and Britain in the design, development and production of IRBM-type missiles.

These foreign reports emphasize the business importance of keeping close tabs on European developments in the whole field of rocket and missile technology. If possible, a full-time technical scout should be maintained abroad, or at least, the retaining of a part-time service.

Another massive merger appears to be under way which could have a major effect on the missile business. The Dutch-owned international giant, Philips Lamp, is reported to be about to merge its more-or-less-controlled subsidiaries: Philips Electronics, Consolidated Electronics Industries and Central Public Utilities into a single corporation. This corporation could be so devised as to start out life with $100-million worth of liquid assets.

contract awards

NAVY

By Purchasing Office:

Epsco, Inc. received $121,320 for data handling system.

Elgin National Watch Co., West Coast Micronics Div., received $57,051 for safety arming devices.

Detroit Controls, Div. of American-Standard, received $25,591 for controls.

General Electric Co. received $1,477,820 for components of MA-1 compass systems.

Goodyear Aircraft Corp. received $62,934 for study for anti-submarine defense.

By Bureau of Ordnance:

Coates Electric Mfg. Co. received $75,230 for 14 missile altitude and velocity simulators; 13 pneumatic missile test sets.

Convair, a div. of General Dynamics Corp., received $107,104 for *Terrier* guided missile test equipment.

By Office of Naval Research:

Leland Stanford Jr. University received $35,000 for research in electron microspectroscopy of macromolecules.

University of California received $50,000 for research in the nature and location of corrosion fatigue attack, and $60,000 for research on the effects of high pressure and temperature on transformations and constructions of metal and inorganic solid systems.

General Mills, Inc. received $34,182 for research on thermoelectric properties of semiconducting compounds.

Boston University received $29,860 for research in the effects of changes in communication patterns.

Manufacturing Laboratories Inc. received $60,000 for research on lattice stability of metallic phases.

Colorado School of Mines, Research Foundation, Inc., received $52,200 for research on the properties of dislocations in body-centered cubic metals.

Mass. Institute of Technology received $75,000 for research on the structure of liquid metals and alloys.

University of California received $368,285 for research on the radio-frequency spectrum of galactic and extra-galactic sources.

Manson Laboratories Inc. received $74,955 for research on the development and fabrication of two prototype alkali vapor resonance magnetrometers.

General Electric Co. received $34,085 for research on low temperature brittleness of refractory metals, and $30,794 for research on the nuclear magnetic resonance study of metals and alloys.

Sylvania Electric Products, Inc. received $35,147 for research on intergranular fracture of metals at elevated temperatures.

Stanford Research Institute received $38,854 for research on preparation and properties of oxide single crystals.

Armour Research Foundation of Illinois Institute of Technology received $30,000 for research on mechanism of stress-corrosion embrittlement.

Franklin Institute of the University of Pa. received $61,530 for research on solid solution hardening.

Rias Inc. received $30,840 for investigation of bulk and surface defects in cold-worked metals.

Leland Stanford Jr. University received $27,986 for research on the formation of intermediate alloy phases by diffusion processes.

Westinghouse Electric Corp. received $110,000 for research on collision processes relating to the ionosphere.

Mass. Institute of Technology received $100,000 for studies leading to the growing of single crystals, and $95,000 for investigation of the thermoelectric and other physical properties of a wide variety of binary and other compounds.

Duke University received $25,000 for research on nuclear magnetic resonance at low temperatures.

University of Cincinnati received $36,830 for research on Me-ZR-Ti-O phase diagrams.

Winzen Research Inc. received $32,315 for research on Project Skyhook.

Blinding Speed:

Speed so great that existing control systems were incapable of directing its flight path . . . so great that newer, more compact, more accurate, virtually automatic control systems were developed to guide the B-58, America's first and only bomber capable of sustained supersonic flight.

Today, this is an outstanding fact of the B-58 . . . sustained supersonic flight, rivaled only by its *growth potential.* This means that tomorrow, it will go even further.

Growth potential in the airplane results from growth potential for the individual engineer. This, and the strong challenge to his creative ability, are integral parts of the new concept in engineering organization at Convair-Fort Worth that has produced such a world challenging weapon.

If your ambitions call for a position that provides such growth potential for you, send a confidential resume of your training and experience for consideration by engineers in the area most suited to your qualifications. For personalized handling, address your inquiry to Box *748M.*

CONVAIR FORT WORTH

FORT WORTH, TEXAS

CONVAIR IS A DIVISION OF GENERAL DYNAMICS CORPORATION

Kingfisher Target Missile Delivered to Army

First of a series of Q-5 *Kingfisher* recoverable ramjet target missiles has been turned over to the Army under a $7.5-million contract to Lockheed Aircraft Corp.'s Missile Systems division. The *Kingfisher* is the latest development in the Q-5 missile program. It was previously under an Air Force contract with Army participation. The Q-5 family is a development of the Lockheed X-7 ramjet test vehicle.

The *Kingfisher* is equipped with a firing-error indicator electronic scoreboard which records and transmits firing accuracy information on hits and misses.

The 38-foot bird weighs in at about 8,000 pounds when ready for flight, and has a wing span of 10 feet, with a 20 inch diameter. Launched from an Air Force B-50, it is propelled to speed by underwing rocket boosters until its Marquardt ramjet takes over. The Army will use it to test anti-aircraft missiles at White Sands.

$65 Million Contract Granted for *Snarks*

Three contracts totaling over $65 million have been awarded to Northrop Aircraft by the Air Materiel Command.

The contracts involve the *Snark* long-range intercontinental air-breathing missile, and break down as follows: $37.9 million for 16 *Snarks;* $18.7 million for *Snark* development tests; $8.7 million for ground support equipment.

Chemical Firm Develops New Plastic for Missiles

A new plastic for missile and rocket parts, said to be able to withstand up to 4,500°F, has been developed by Reichold Chemicals, Inc.

Reinforced with glass cloth or asbestos, the resin can be used for nose cone sections, skin strengtheners, internal hoops, electronic equipment mountings and other parts, the company reports.

Laminated parts made from the new phenolic resin (Plyophen 5900) can take heat of 500°F for 100 hours and longer, and will successfully withstand the maximum 4,500° for short periods.

Other properties claimed by the company are: exceptionally high strength at extreme temperatures; low moisture absorption; good insulation properties and good resistance to organic solvents, weak inorganic acids, hydraulic aircraft oil, de-icing fluids and hot gas erosion.

. . . contracts

AIR FORCE

By AFFTC, ARDC, Edwards AFB:

C. A. Sheldon Electric Co. received $50,615 for space time system for timing use of sled on experimental track.

Allied Chemical & Dye Corp., General Chemical Div., received $28,000 for engineering study of reaction of fluorine and metals.

By Cambridge Research Center, ARDC:

Ball Brothers Research Corp. received money for design and construction of a rocket borne monochromatic camera.

Research Technology Associates, Inc. received $38,783 for study of electron and ion beams under outer space conditions.

General Mills, Inc. received $63,749 for research on balloon barrier materials and balloon structural members.

Ohio State University Research Foundation received $25,000 for study of parametric amplification.

Hughes Aircraft Co. received $89,099 for study of control of electromagnetic radiation from aircraft and space vehicles.

Sylvania Electric Products, Inc. received $74,447 for investigation of factors affecting microwave electrical breakdown and transmission near missile antennas.

Melpar, Inc. received $44,771 for air electromechanically trough-guide scannable antenna.

Radiation, Inc. received $40,000 for research directed toward the accomplishment of absolute low-level beta analysis of samples for strontium 90 and lead 210.

By HQ AFMTC, ARDC, Patrick AFB:

Hallamore Electronics Co. received $118,780 for racks, discriminator.

Nems-Clarke Co. received $46,634 for polarization Diversity combiner.

Dynatronics, Inc. received $111,300 for cotar remote positioning modification kit and polarization diversity modification kits for TLM-18 antennae.

Cubic Corp. received $175,679 for increase in funds.

Radiation, Inc. received $48,000 for increase of funds.

Cubic Corp. received $158,808 for laboratory study and narrow band correlation detection unit for Cotar.

Dynatronics Corp. received $44,151 for airborne telemetry test and calibration racks.

Lenkurt Electric Co., Inc. received $136,446 for real time data transmission system.

By HQ AFOSR, ARDC:

University of Chicago received $247,946 for research on nuclear interactions in cosmic rays.

University of Washington received $30,000 for "boron and silicon chemistry."

University of Illinois received $25,000 for continuation of research on diffusion in metals.

University of Texas received $74,502 for continuation of research on "gas-phase and surface reactions of hydrocarbons at moderately high temperatures."

Mass. Institute of Technology received $48,550 for "aerothermoelasticity."

University of Rochester received $245,060 for research on optical and electrical properties of solids.

Polytechnic Institute of Brooklyn received $100,000 for continuation of research on "electromagnetic theory and information processes."

Harvard College received $78,144 for research on combustion aerodynamics.

Aeronutronic Systems, Inc. received $135,549 for a study of hypervelocity particle effects.

Sunstrand Turbo, a div. of Sunstrand Machine Tool Co., received $41,969 for research program on rational scaling procedures for liquid fuel rocket engines.

AVCO Mfg. Corp., AVCO Research Laboratory Div., received $151,011 for research on "basic studies in magnetohydrodynamics."

University of Southern California received $26,300 for research on "thin liquid films."

Mass. Institute of Technology received $107,350 for research on "heat transfer characteristics of diffusion boundary layers."

Princeton University received $87,598 for research on the ignition of solid propellants.

University of Maryland received $37,700 for research on reports concerning "intermittent and non-linear processes in turbulent flows."

Princeton University received $242,550 for research on combustion processes in liquid propellant rocket engines.

University of Illinois received $91,858 for a study of the crystallography and morphology of martensites, and of the properties and dislocations in crystals.

ARMY

By Engineer District, Pittsburgh, Corps of Engineers:

Drost-Sanford Construction Co. received $253,375 for construction of *Nike* support facilities for Cleveland defense area.

By Engineer Div., New England, Corps of Engineers:

Emerson & Cuming, Inc. received $31,260 for conducting research and investigations directed toward the development and evaluation of an inorganic ultra high temperature dielectric material.

Jansky & Bailey, Inc., received $121,492 for conducting interference control studies, and obtaining data for electronic systems.

Grinnell Co., Inc. received $35,947 for nozzle and detector head assembly.

General Electric Co. received $540,000 for two development models of range height indicator.

By Purchasing and Contracting Division, White Sands:

Dorsett Labs. Inc. received $97,550 for telemetry system.

By Ordnance Missile Command, Redstone Arsenal:

Atlantic Design Co. received $71,968 for 20,800 manhours of maintenance for ballistic missile systems and equipment.

Consolidated Avionics Corp. received $30,504 for developing criteria and reduction in checking out missile systems, and utilizing the criteria developed for making final designs of such equipment.

By Signal Supply Agency:

University of Michigan received $65,000 for research studies directed toward development of "an algebra for automata."

Purdue Research Foundation received $97,245 for research work to be employed in a silicon crystal-perfection study.

General Electronics Labs., Inc. received $44,387 for research and development work leading to the design and fabrication of experimental model duplex rhombic antenna.

Westinghouse Electric Corp. received $89,983 for research work leading to the development of a high temperature match box receiving tube.

University of Akron received $78,000 for studies of condensation polymers such as nylon, mylar and the siliconer.

Sperry Gyroscope Co., Div. of Sperry Rand Corp., received $5,201,744 for equipment plan, missile impact locators.

University of Pa. received $45,806 for experimental and research work for microwave crystal deterioration study.

Battelle Memorial Institute received $299,770 for additional studies, investigations, tests and materials covering standardization of electronic component parts and materials.

Arthur E. Magher Co., Inc. received $208,927 for rehabilitation of environmental chambers.

North American Philips Co., Inc. received $82,470 for engineering test models of hexagonal magnetic materials.

University of Wisconsin received $80,000 for research study of micrometeorology to determine experiments, means, and concepts to increase basic knowledge of aerodynamic processes in the lower atmosphere.

By Engineer District, Jacksonville, Corps of Engineers:

Maurice H. Conneli & Associates, Inc. received $85,000 for design of complex 30 (Pershing) facilities, ABMA.

By Electronic Proving Ground Proc. Office:

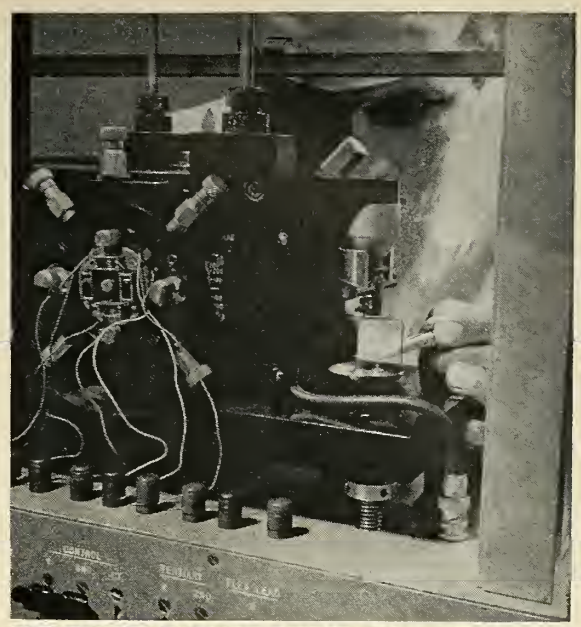
Motorola Inc. received $4,186,840 for prototype electronic warfare system.

By New York Ordnance District:

Belock Instrument Corp. received $59,997 for design, engineering and fabrication for a guidance and control system.

Union Carbide Development Co., Div. of Union Carbide Corp., received $68,377 for a research program of evaluation of performance of structural metals.

MATERIAL LABORATORY is scene for testing gas solubility of flotation fluid for new type liquid-floated gyroscope.



M-H TORQUE BALANCE DEVICE used to calibrate microsyns. It measures torques as low as one eight-billionth of a lb.

Minneapolis-Honeywell:

How A Manufacturer Banks on Research

by Raymond M. Nolan

Not many companies today look to the poorhouse as the key to their future—but Minneapolis Honeywell is banking on just such a thing. Its Honeywell Research Center is located in a former county poorhouse on ten acres of land in Hopkins, Minnesota, just outside Minneapolis.

Here, scientists—most certainly not working under poorhouse conditions—carry on basic research with only one limiting rule—the research must be directed towards improvements in the field of automatic control.

Basic research is carried on for all divisions of the corporation by the staff of more than 150, supplemented by applied research within each of the product divisions. Some of the basic areas which touch on the missile field are high-power transistors, small barium titanate transducers, infrared detection cells and basic advances in solid state physics and metallurgy.

The center works on such diverse projects as growing what are purported to be the largest tellerium crystals in existence, "promising" new methods of compounding cermets, and testing infrared cells on targets located at the end of the Center's long research halls.

When any research appears to have promise for the company, it is transferred to, and continued by, the applied research units in each of the divisions. Much of the present research now in progress in the Aero Division, largest unit of the Military Products group of Minneapolis Honeywell, has to do with gyroscopes and stabilized platforms for inertial guidance, including the gimbal-less platform and the still-secret electrostatic gyroscope.

NO FLYWEIGHT is world's smallest electrical switch. It weighs 1/28th ounce.

• **Research means health**—This heavy emphasis on research—company-financed for the most part—is probably the best reason for the current size and healthy condition of the Military Products Group (MPG). Its yearly gross of around $110 million now amounts to roughly one-third of the total company gross, and this $110 million is well spread through the three services and various other government agencies.

More than 9,000 people work for the MPG with the lion's share, 6,000, in the Aero division. The Ordnance division leads the rest in size, with 2,000 employees. The various other divisions, located in Los Angeles, Boston, St. Petersburg, and Seattle make up the balance of the company's facilities and personnel.

Most of the missile activity within the Aero division today is concerned

with inertial guidance, although M-H is a prime contractor on such systems as the *Asroc* and the still-classified *Wagtail.*

• **Gimbal-less gyros?**—One of the more interesting projects still in the research stage at Aero is the gimbal-less gyro reference system.

M-H won a design competition sponsored by Wright Air Development Center and is currently attempting to construct the system.

Some of the still-untried features now under study are digital pick-offs and torquers for the gyros, and a computing arrangement that would allow frame-fixed reference gyros in a missile. However, there are some stiff problems, so development of this system is probably some time off.

With the pick-offs and torquers, one problem is repeatability of pulse strength. With the frame-fixed reference system, a computer which will continually compute the proper orientation signals to the measuring accelerometers is, at present, the toughest nut to crack.

M-H has dubbed its system "GAINS" (Gimbal-less Analytical Inertial Navigational System.)

For more immediate applications, M-H has developed what is probably the smallest stabilized platform system now in existence (see m/r July 14), and an extremely rugged (up to 80 g's) gyro for use in smaller solid-propelled missiles.

• **Clean area**—During plant shutdown this month, the company is completing a move to consolidate all floated gyro, accelerometer and stable platform assembly in a new "white" (super-clean) area. Total clean area now is 30,000 sq. ft., but the new super-clean area will give 3,000 sq. ft. (supported by 4,600 sq. ft. for support and cleaning operations). The new area will provide for production operations that require the ultimate in extreme testing and development control.

Some of the innovations are: a Cambridge Absolute Air Filter air-conditioning system similar to those used by the Atomic Energy Commission; shoe cleaners for all personnel working in the area; walls and ceilings of non-porous vinyl; and overall ceiling lighting to avoid overhead clutter. Freon is piped into the room and is used as the cleaning agent during all parts of assembly.

·Steady expenditures for new products and new techniques such as these keep M-H in a strong competitive position for the defense dollar. Since many R&D projects are company-financed, the company is in a position to undertake fixed-price rather than cost-plus-fixed-fee contracts in many business situations.

Stephen F. Keating, vice-president in charge of the Military Products group and manager of the Aero division says, "We feel that the same business philosophy should be applied to our military business as has been applied to our commercial business. Thus, if using company money for military products research enhances our position, we have no hesitation in spending."

He continued, "Of course, some projects by their nature must be handled on a government contract basis. But we try not to let those overweigh the company—initiated jobs."

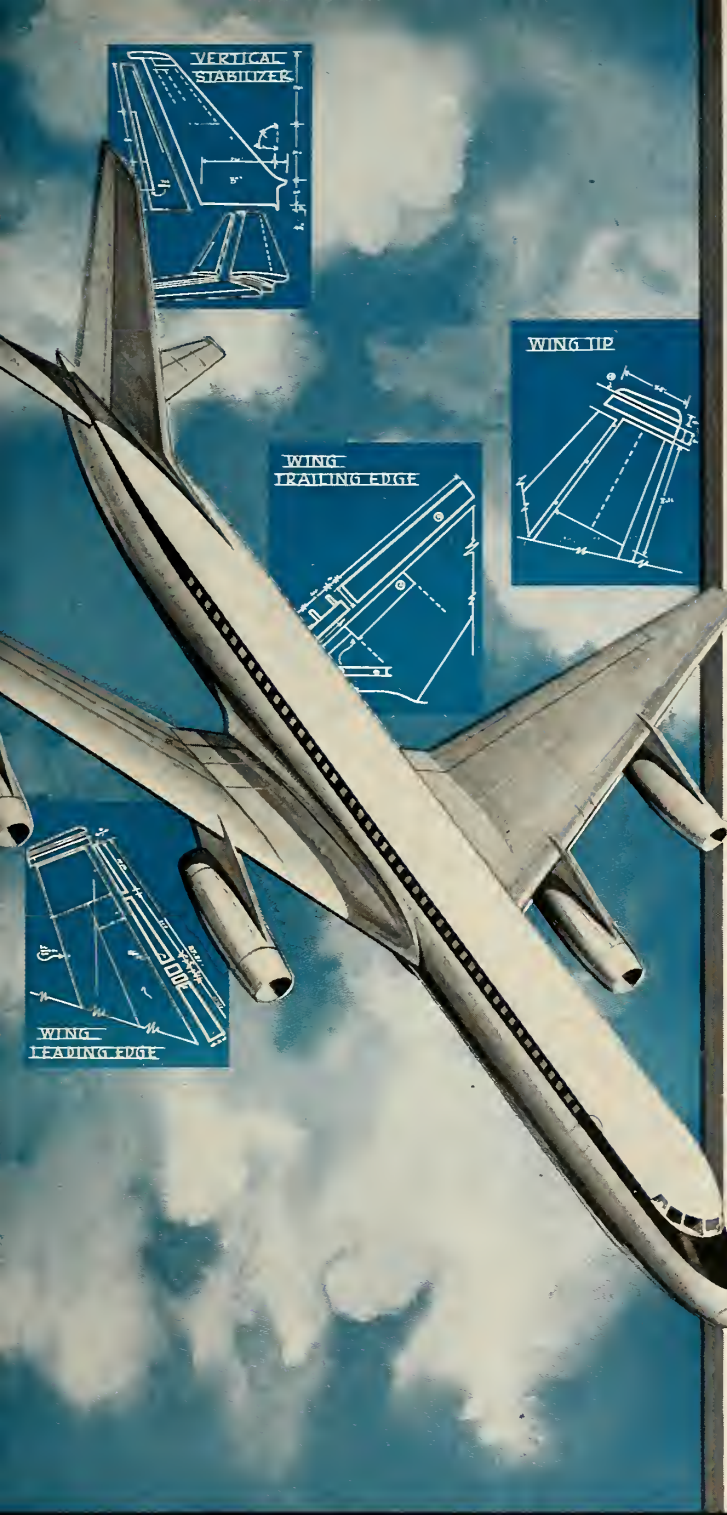
• **Space flight**—The subject of space flight and M-H participation in future programs has also been given considerable attention. Company planners see something around $22 million ($13 million production and $9 million R&D) by 1962.

A significant item is that the $9 million is estimated at 36% of total engineering effort in 1962. Some of the projected areas are human and equipment environmental controls; improved navigational, guidance, and flight control systems; and display and instrumentation in the data processing field.

The recent announcement that M-H is participating in the Dyna-Soar project indicates that some of the plans are already turning into reality.

At present, the Basic Studies Group of the research unit in the Aero Division is at work determining the immediate areas for attention. No name has been picked yet for the space efforts, but wags around the Aero plant are already calling personnel working in that particular area the "Honey-mooners."

VIBRATION EQUIPMENT is mounted on lead mass for testing a gyroscope. An M-H test engineer views the completed setup through a thick-glass, triple-pane window.



Crosley helps CONVAIR JET 880 to keep a date

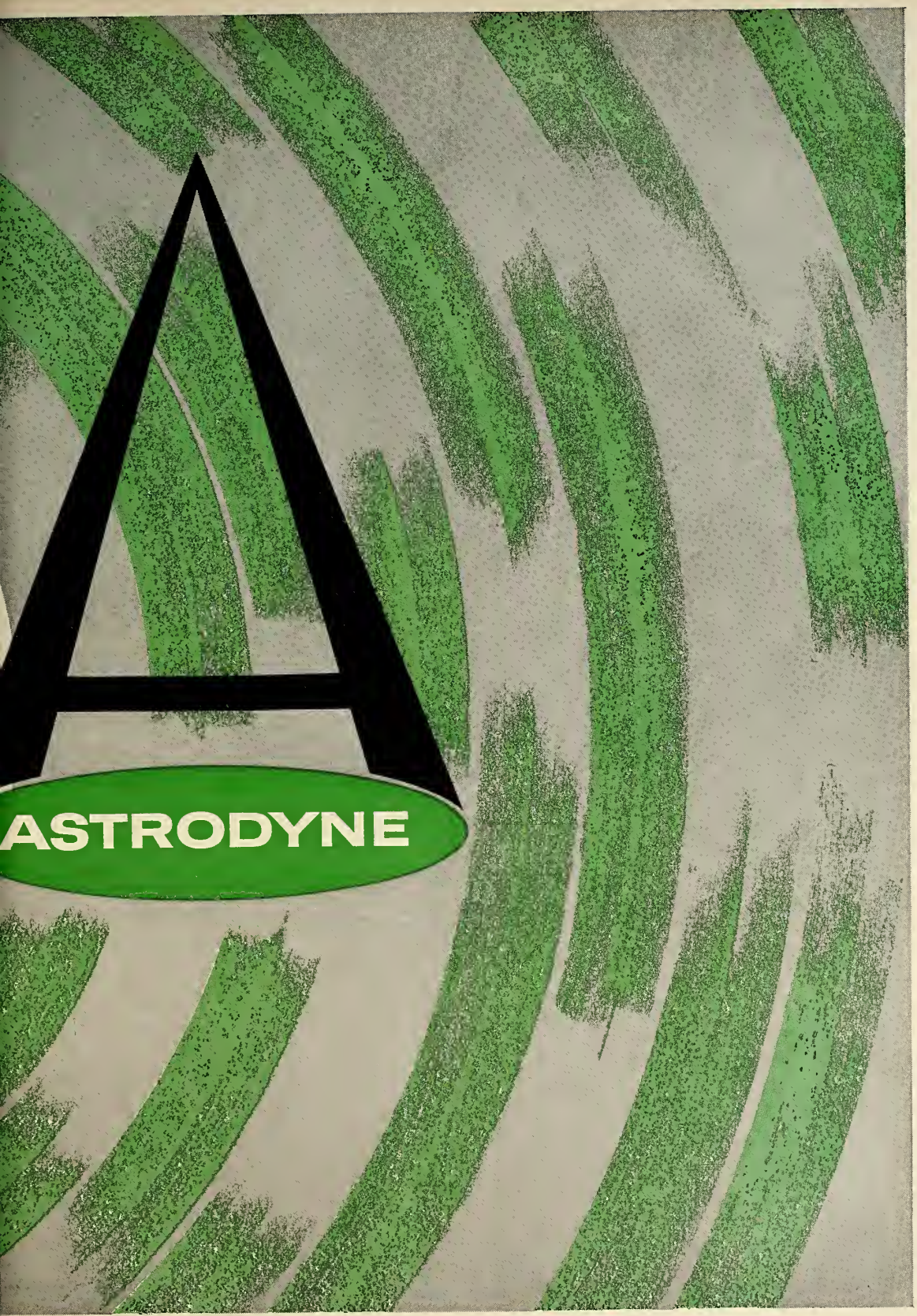
Soon the Convair Jet 880 will take to the skies as one of the world's fastest jetliners. Sleek, smooth and strong—the luxurious jet will race the sun at 615 miles per hour!

Convair has chosen Crosley to design and produce many of the 880's components. And while actual construction progresses, a Crosley team of engineers is "on site" at the plant to help insure speedy transition from design to production to maiden flight date.

Crosley's contributions to airframe construction include all of the conventional types of assembly in addition to the newer methods of honeycomb, metal bond, and chem-milling. Equally important are Crosley's contributions to safety in flight, represented by such developments as Volscan—the electronic air traffic control system, or airborne navigation and communications equipment, embodying advanced concepts of electronic application.

For further information on Crosley's airframe and other capabilities write to the Vice President—Customer Relations, Avco Manufacturing Corporation, Crosley Division, 1329 Arlington Street, Cincinnati 25, Ohio.

Avco // Crosley


ASTRODYNE

Company Officers

Anthony Hass has been elected president of the Dryomatic Corp. Hass has served as vice president and sales manager of the company since 1950. Previously, he was employed as division manager of Atlantic Research Corp., and as general manager of Kilgore Chemicals, Inc., located in Washington, D.C.

Henry Arnhold has been elected chairman of the board and **John Bouwmeester** president of General Ceramics Corp., Keasbery, N.J. **Hans Arnhold** is retiring after 30 years as board chairman. He will retain his position as chairman of the executive committee and member of the board.

Brig. Gen. Edwin M. Day, USAF (ret.), was elected president of Fairchild Aerial Surveys, Inc. Former president **Leon T. Eliel** has been elected chairman of the board.

Vice Admiral Charles B. Momsen, USN (Ret.), has been elected to the board of directors and named as consultant to CREI Atomics, Inc. He is also consultant to General Dynamics Corp., U.S. Rubber, Raytheon Manufacturing Co. and the Coleman Engineering Co.

Ira G. Ross, formerly executive vice president and director of Cornell Aeronautical Laboratory, Inc., Buffalo, N.Y., has been elected president. Ross succeeds **Dr. Theodore P. Wright,** vice president for research at Cornell University. Dr. Wright, who has served as president and chairman of the board of the Laboratory since 1948, continues as chairman of the board of directors.

Paul P. Huffard, a director of the Union Carbide Corp., has been elected to the board of directors of Greer Hydraulics, Inc. Huffard joined the Union Carbide organization in 1909 and has served as vice president, president, and director of a number of Union Carbide's divisions and affiliates. He has been a director of the corporation since 1944.

William H. Moore, chairman of the board of Bankers Trust Co., New York, and **Bruce Bromley,** a partner in the New York law firm of Cravath, Swaine, and Moore, have been elected to International Business Machine Corp. board of directors to fill existing vacancies. Moore is also director and member of the executive committee of the Republic Aviation Corp., and a director of the M. A. Hanna Co. Bromley, admitted to the New York Bar in 1920, was formerly a justice of the New York Court of Appeals.

Honors

L. Eugene Root, Lockheed vice president and Missile Systems division general manager, was honored by his alma mater, College of the Pacific, with the honorary degree of Doctor of Science.

John W. Lazur has been elected director of the New York Section of the American Astronautical Society. Lazur is military operations manager at Allen B. DuMont Laboratories, Inc.

Engineering

Hans Meyer has joined the engineering staff of Richard D. Brew and Co., Inc. Formerly with Epsco, Inc., Meyer worked on design and development of delay lines and special components.

Thomas Courtney, Jr., design research specialist, has been named chief project engineer for Temco Aircraft Corp. Formerly with McDonnell Aircraft Corp., St. Louis, Courtney had major design responsibilities in development of jet fighters, and worked on the *Talos* and *Green Quail* missile projects weapon system. He also was a member of the composite design research panel for the *Bumblebee* missile.

Dr. Phillip W. Lett has been named chief engineer, and **Walter C. Beyer** assistant chief engineer of Defense Engineering at Chrysler Corp.

Graham Tyson has been appointed senior applications engineer for data handling systems at Telemeter Magnetics, Inc. Tyson was formerly with the electronic data processing division. He also was associated with Northrop Aircraft Corp., where he was group leader for research and development of data processing systems.

William H. Foulds has been named chief development engineer for Monitor Products Co., South Pasadena, Calif. Foulds was formerly with the British Admiralty Signal & Radar establishment in charge of communications.

Industry

Joseph J. Vasicek has been appointed secretary of Servomechanisms, Inc. Vasicek, who has a background in finance and accounting, joined Servomechanisms six years ago as chief auditor and assistant to the treasurer of the company.

Dr. Raymond L. Bisplinghoff and **Dr. Wayne B. Nottingham,** both senior professors at Massachusetts Institute of Technology, have been appointed to top consultant positions with National Research Corp.

James R. Jones has been appointed manager of Army contracts at Ford Instrument Co., division of Sperry Rand Corp. He will be responsible for customer relations and sales with the Army.

Dr. Carroll Barrack will head the new Electronics department of Miller Research Laboratories, Baltimore.

Dr. Allen M. Peterson heads the Communications and Radio Propagation group at Stanford Research Institute. This group is a new combination of two radio systems laboratory research groups at the Institute. Peterson's assistants are **Ray L. Leadabrand** and **Wilbur R. Vincent,** who direct research in propagation and communication systems, respectively.

L. E. Rasmussen, former plant manager, has been appointed general manager of the Cincinnati division of Bendix Aviation Corp. He was formerly with the Atomic Energy Commission as chief of the radiation instruments branch in the production division, Washington, D.C. and Oak Ridge, Tenn.

Murray S. Gelber was recently appointed treasurer of Hughes Aircraft Co. Previous to joining Hughes, Gelber was vice-president and manager of AiResearch Co., a division of the Garrett Corp. With Garrett since 1939, Gelber had served as chief accountant assistant controller, assistant to the president and vice-president of manufacturing.

ATTENTION

all aircraft development and maintenance engineers

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The Weatherhead Company has on file many case histories verifying the dependability, low cost installation and maintenance advantages of our famous Ermeto MS flareless hydraulic and pneumatic tube fitting. Perhaps no other fitting has contributed so much to the advancement of aircraft piping technology or has attained wider recognition and usage in critical applications.

We know, however, that there are many types of aircraft installations on which we do not have full technical data. Here's your chance to help us compile a broader range of application information — and maybe win a big cash prize for yourself as well.

This is a national contest open to all design, planning and maintenance men with a story to tell on either the Weatherhead Ermeto tube fitting in industrial applications, or the MS flareless fitting in aircraft.

1st Prize . . . $1500.00
2nd Prize . . . $1000.00
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175 Other Cash Prizes

act now . . . contest closes Sept. 30, 1958

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Study Contract Awarded For New Space Ship

General Dynamics Corp. has been granted a $1-million contract by the Department of Defense, to determine the feasibility of an air and space ship which would be powered by controlled nuclear explosions.

DOD's Advanced Research Projects Agency authorized the contract, which calls for expenditure of the $1 million over a year, beginning July 1. The Pentagon said the contract would be continued if results show promise. General Dynamics' General Atomic Division, San Diego, will handle the project.

The propulsion system was proposed by GD. No further details were given beyond the fact that the system is unlike other nuclear propulsion systems proposed or under development at the present time.

General Bronze Moves Into Electronics Manufacturing

General Bronze Corp. has formed the GB Electronics Corporation, and leased 160,000 square feet of manufacturing space for the facility at Valley Stream, Long Island.

GB Electronics will occupy the site early in September, and plans to employ several hundred persons. The company is developing airborne antenna and infra-red devices for reconnaissance.

The Valley Stream plant will house complete experimental facilities. Officers of the company are A. S. Saphier, president; Peter J. Keulemans, executive vice-president; Ira Kamen, vice-president; Warren J. Freeman, vice-president and treasurer; Phineas S. Schey, vice-president; and Milton S. Salmon, secretary.

Rapid Tax Writeoffs Granted Missile Firms

The Office of Defense Mobilization has granted rapid tax writeoffs to four firms engaged in missile R&D or component manufacture. Beneficiary of the largest amount was Callery Chemical Co., Douglas County, Kans., with a $3.8 writeoff at 65%.

Others were Aerojet-General Corp., Azusa, Calif., $964,917 at 60%; Lockheed Aircraft, MSD, Van Nuys, Calif., two contracts totaling $636,167 at 65%; Lockheed Aircraft Corp., MSD., Palo Alto, Calif., two contracts totaling $483,322; Olin Mathieson Chemical Corp., explosives div., Carterville, Ill., $790,000 at 50%; Olin-Mathieson Chemical Corp., explosives div., $118,000 at 60%.

world astronautics

by Frederick C. Durant III

Exciting possibilities for the use of 90-100% strength hydrogen peroxide for manned satellites have been uncovered in the recent flurry of design studies. As a multi-purpose fluid, H_2O_2 has significant potential. Not only is catalyst-decomposed peroxide a source of thrust for satellite attitude control, but also for turbo-generated electric power. Furthermore, the products of decomposition, water, and oxygen might be used for human consumption.

The decomposition of H_2O_2 produces heat which can power refrigeration systems and regenerate certain carbon dioxide absorbents. For further information, write American Food Machinery's Special Projects Division, Buffalo, N.Y.

The British "school tie" is an ancient tradition. A modern counterpart is the British Interplanetary Society tie. Dark blue, heavy silk, with a discreet rocket and stars motif, it is available to members of the BIS for only $2.10. Address Secretary, BIS, 12 Bessborough Gardens, London, S.W.I.

The concept that "astronautics is just an extension of aeronautics" was blasted recently by ex-ARS President Capt. R. C. Truax, USN. Truax, a naval aviator, has preached rocketry and space flight for more than 20 years. He holds that it is no more reasonable to wed astronautics to aviation because a space vehicle spends a fraction of its time within the atmosphere, than to marry aviation to automotive transportation because an airplane spends a short time rolling along a runway on rubber tires!

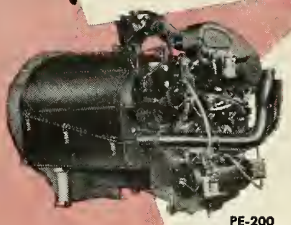
For the teenage craftsman, (and his Dad), Model Missiles, Inc., Denver, Colo. markets a complete model system kit, Rock-A-Chute. Powered by a safe, solid propellant rocket charge, a 15 in. Aerobee-Hi scale model will climb to 500 ft. A nylon parachute is automatically ejected, returning the rocket gently to earth. After capture, the parachute can be refolded, the rocket charge replaced and countdown procedure started again.

Model Missiles, Inc. is headed by rocket engineer Harry G. Stine. A Model Missile Association has been formed which publishes THE MODEL ROCKETEER monthly.

There is still speculation as to the size and configuration of the U.S.S.R. *Sputnik* launching vehicles. Some calculations were made recently by Univ. of Md. Prof. S. Fred Singer, based upon the intensity of brightness of the *Sputnik* I rocket body and the rate of deceleration caused by atmospheric drag (see p. 11 for more information).

The indications are that the rocket body may have been at least 50 ft. long, and 12 to 16 ft. in diameter. The satellite launcher was probably not a 3-staged vehicle as has been suggested, but perhaps a 1½-staged affair or a clustered rocket. All engines are believed to have been ignited at takeoff, and therefore there was no coasting period or problems associated with high altitude starts.

You Hitch Your Ground Support Equipment to a STAR



PE-200
8-cyl. 250 hp.

When You Build Around PACKETTE POWER

You go far toward clinching complete satisfaction with your product when you design that product around Packette power. For the Military Standard engines known as Packettes (Mil. E6449-A)—Continental-designed, Continental-built, with the time-proved Continental air-cooled aircraft engines as their basis—tap a reservoir of internal combustion experience dating from 1902.

The five Packettes—30 to 250 horsepower—are built for global operation—in the desert, in steaming equatorial jungle, at the pole. They are light and compact, and easy to service in the field. Upkeep is eased by a high degree of parts interchangeability both with other Packette models and with engines of the basic Continental aircraft line, whose service and parts facilities encircle the world.

Packettes are power plants in being—approved for all branches of the Armed Forces,—and in steadily-widening use in ground support equipment of all kinds. If YOUR product's requirement lies within the Packette limits, you too will be ahead with dependable Packette power.

WRITE FOR COMPLETE INFORMATION

Continental Motors Corporation

AIRCRAFT ENGINE DIVISION

MUSKEGON, MICHIGAN

Convair

Small Engines For Big Job

Powerful Verniers That Control *Atlas, Thor* Thrust Variations Reach Operational Production Status

by Norman L. Baker

The vernier engine thrust control system for the *Atlas* and *Thor* missiles has reached an operational production status. Production and testing of this unique auxiliary missile control system is currently underway at Rocketdyne Neosho.

Rocketdyne reports that the low thrust engine system is achieving an extremely high degree of reliability in test firings. The near ultimate in simplicity of fabrication and assembly gives it a mass production capability.

The system was designed and developed specifically for directional and thrust stability of the *Atlas* missile system. Later the engines were designed into the *Thor* IRBM. Both *Atlas* and *Thor* are equipped with two of the small auxiliary power units.

The verniers provide adjustment for any thrust variations in the parallel booster engines of the *Atlas,* in addition to maintaining roll control and directional stability. On the *Thor,* with its single sustainer engine, two of the verniers mounted at the base of the rocket 180 degrees apart provide roll control and precise adjustment in pitch control.

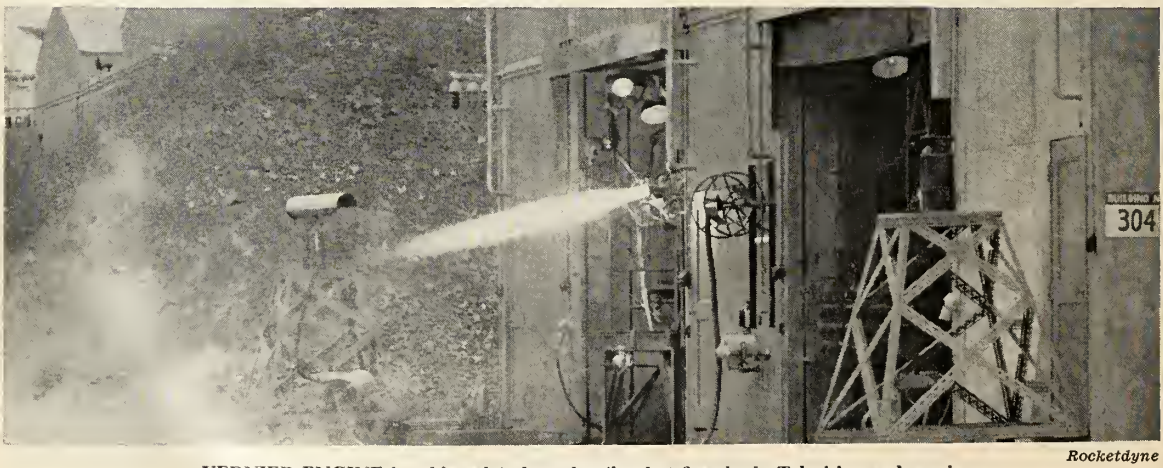
The vernier engine roll control for the *Atlas* and *Thor* reaches a high degree of sophistication when compared with the *Jupiter* system. The exhaust of the gas generator of the *Jupiter,* located at the base of the missile, can be swiveled through an 180 degree arc for supplying thrust about the vertical axis.

Gimbaling freedom of the vernier engines provides approximately 120 degrees in the roll axis and 60 degrees in the pitch axis.

The vernier engines are ignited shortly before missile takeoff. Initial thrust is reduced approximately 20% for the first few seconds of flight, when the verniers are required to provide only roll control. Thrust is provided for several seconds after sustainer engine cutoff to insure attainment of programmed missile attitude in azimuth and elevation.

The verniers operate on the missile's propellants of liquid oxygen and RP-1, a higher grade of kerosene fuel than that used in turbo-jet engines. An efficient regenerative cooling system is employed to drop the 5,000 degrees Fahrenheit combustion temperature to a safe level for sustained burning. Engines are cool to the touch after several minutes firing duration.

Rocketdyne Neosho, in addition to production testing, is engaged in a continuing development program. Hot firing tests include long duration fixed firings in order to check reliability, and thrust variation tests combined with continuous gimbaling operations.

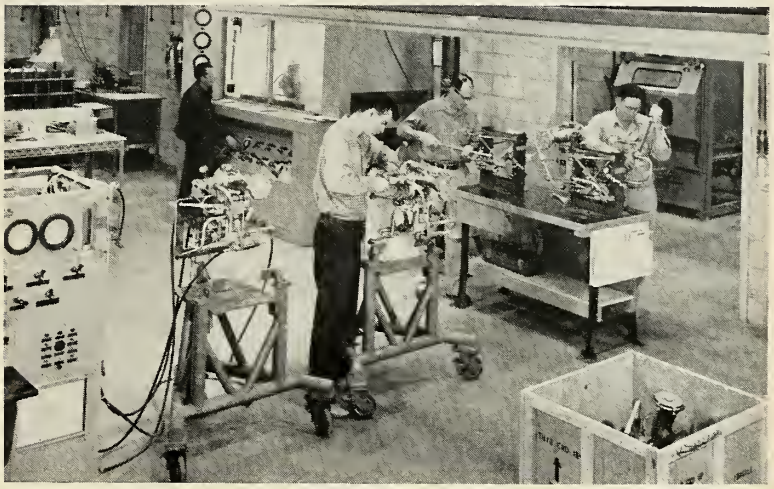


Rocketdyne

VERNIER ENGINE is subjected to long duration hot fire check. Television and movie cameras film the operation. Additional component test cell areas are in background.

Rocketdyne

WORKMEN AT ROCKETDYNE Neosho's production plant assemble complete vernier engine systems. Engines are given a routine production check before packaging. Sample hot firings of this production power package are made regularly.

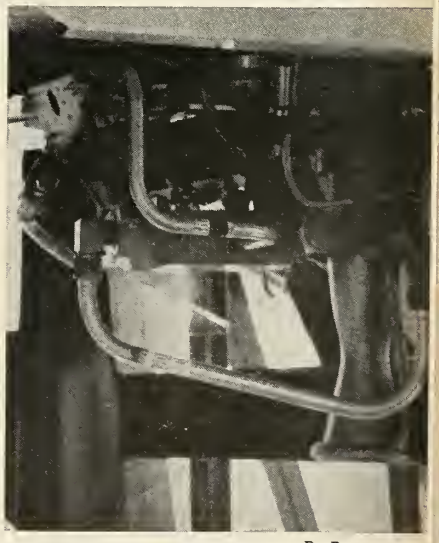


Rocketdyne

THE ENGINES are attached to moveable jigs in bench clamps before packaging for shipment to the prime systems contractor, where the engines will be installed on the missiles. Fabrication of the units requires a minimum of plant operating area.

Rocketdyne

WATCHING THE STATIC FIRING of a vernier engine: Gene Andrews, test engineer; T. S. Dowe, industrial engineer; E. E. Thiessen, test foreman; Norman L. Baker, m/r editor; E. A. Wright, factory manager; and Bill Van Dyke, public relations.



D. Perry

VERNIER ENGINE mounted on *Thor* IRBM. Another unit is mounted underneath on opposite side of the sustainer.

HIGH ALTITUDE PHOTO ABOVE EGLIN AIR FORCE BASE

FIREBEE: "ENEMY" JET OVER AMERICA

The most realistic "enemy" in the skies over America today is the Ryan Firebee. This jet-fast, elusive target drone is being used to sharpen the sights of the men who man the nation's air defense system and to evaluate the missiles upon which they rely.

The Firebee flies at the high speeds and altitudes required to test the performance of the newest, most deadly air-to-air and ground-to-air missiles. It possesses the maneuverability and extended duration needed to realistically simulate "enemy" intercept problems.

Developed by Ryan for the Air Force (Q-2A), Navy (KDA-1) and Army (XM21), the Firebee is in volume production and operational use. It is being fitted with special radar and infra-red reflective devices for simulating varied target characteristics and providing broader missile-target compatability. The Firebee can be equipped with wing pods to carry added fuel... a warhead... photo or television reconnaissance gear.

The Firebee is an example of Ryan's skill in blending advanced aerodynamic, jet propulsion and electronics knowledge to produce a highly successful solution to a complex aviation problem... meet a vital military need. Other examples are the Air Force-Ryan X-13 Vertijet and Navy-Ryan AN/APN-67 automatic navigator for global jet flight.

RYAN BUILDS BETTER

AIRCRAFT · POWER PLANTS · AVIONICS

Ryan Aeronautical Company, San Diego, Calif.

propulsion engineering

by Alfred J. Zaehringer

Ion rocket engine of ½ lb. thrust is being built by NACA. Electric field will accelerate cesium ions to speeds of 300,000 miles/hr. NACA has reached exhaust velocities on the order of 400,000 miles/hr. in other experiments.

Erosive burning of colloidal propellants is receiving considerable research attention in France. Present theory is based on existence of a turbulent layer near the burning surface, resulting in a thermal and diffusion effect. The diffusion effect is more pronounced at low pressures prevailing in rockets.

New low cost nitric acid process placed in operation by Hercules Powder should interest rocket people. A magnesium nitrate process produces sulfate-free, concentrated (99+%) acid—almost chemically pure at technical grade price. The 50 ton per day unit at Parlin, N.J. could go to 150 tons per day.

Nitrogen tetroxide is being studied as a replacement for LOX at Redstone Arsenal. N_2O_4 is a liquid at normal temperatures (boiling point is 70°F) and gives a density times I_{sp} of 330 sec with hydrazine, as compared to 290 with LOX. Biggest headache with the oxidant is high freezing point (12°F), however this may be solved by warming or by the use of freezing point depressants.

Easy-to-handle ethylenimine is hypergolic with concentrated nitric acid, the Chemirad Corp. reports. The fuel can also be mixed with gasoline, alcohol, furfural, or other fuels for rocket use.

Polycyclic aldehydes make hypergolic rocket fuels. Phillips Petroleum has patented substituted tetrahydrofurfural and homologs as new bipropellant fuels.

Acetylene dissolved in ammonia or anamine makes a high energy fuel when burned with limited amounts of oxygen. Aerojet finds that the low combustion temperature (2600°K) produces much hydrogen. One mole of acetylene and 2 moles of ammonia with 1½ moles of oxygen gives an I_{sp} of 260 sec.

Ban on nitromethane: Tank car shipments of this monopropellant have been halted after two million dollar explosions. One was at Mount Pulaski, Ill., and the other at Buffalo, N.Y. Cause is not known.

Zirconium powder has a combustion temperature of 4,930°K in oxygen at 1 atm pressure. Temple University researchers believe that hafnium, lanthanum, thorium, or zirconium have the highest combustion temperatures of all metals. These metals, however, do not have the highest heats of combustion.

Cosmic dust as a rocket propellant? Despite low densities of galactic dusts and the necessary high vehicle speeds, several schools of thought believe that a high I_{sp} intermittent detonation engine might work on such dusts.

Materials Research Program Advocated by ARDC General

Maj. Gen. Marvin C. Demler, deputy commander of the Air Research and Development Command, has called on industry to participate in a voluntary nationwide R&D program to meet the materials requirements of "the space age challenge."

Gen. Demler made the appeal in a keynote address opening a two-day ARDC-sponsored Materials Technical Symposium in Dallas, which drew an audience of 1,000 military and civilian scientists and engineers.

"The materials research and development problems created by advance aeronautics have been compounded by space flight," he told the delegates. He added that improvement in the performance of new weapons called for improvement of the basic materials of which their component parts are built.

Liquid Rocket Powerplant Completed Ahead of Time

Reaction Motors Division of Thiokol Chemical Corp. has completed a development contract on a packaged liquid rocket powerplant some two-and-one-half months ahead of the Bureau of Aeronautics contract schedule.

The packaged liquid powerplant includes propellant tanks and thrust chambers, all shipped complete with factory-load propellants.

Most probably, "liquid packaging" will be used initially on small missiles carried by Navy aircraft. *Sidewinder* and *Bullpup* are under consideration at the present time.

Radar Aids Safety Officer At Cape Canaveral

Residents in the vicinity of the Air Force Missile Test Center at Cape Canaveral will probably welcome the news that destruction of an off-course missile is not dependent solely on the decision of a human being. The button is pushed by the Range Safety Officer, who is aided in his decision by an elaborate arrangement of radar and computing devices.

Because of the speed of a missile and the relatively short time in which a decision must be made, eight ground radar antennas, part of the AZUZA tracking system, follow the missiles upward flight after launch. Data is fed into an IBM 704 computer, which computes the exact landing point every ten seconds in case of engine failure.

The computer output is displayed graphically in the central operation room, where two lines on a map indicate the safety limits of the firing range.

Army C. of E. Gets Go-Ahead on Missile Sites

A final go-ahead for construction of a *Titan* launching pad at the new Pacific Missile Test Range has been given the Army's Corps of Engineers, according to Maj. Gen. Walter K. Wilson, Jr., deputy chief of engineers for construction.

At a press conference in Los Angeles, Gen. Wilson said that other facilities for the *Thor, Atlas* and *Titan* will be built at the new range, but he declined to say how many, or when completion could be expected for these missile facilities.

A test facility for the Army Ordnance Missile Command will be constructed at Camp Irwin, near Barstow, Calif., in the southern desert. With a probable cost of over $30 million, the desert site will be an extension of the Army program being conducted by Jet Propulsion Laboratory. No missiles will be fired from the Camp Irwin area; operations will be confined to static tests for fuel development and power plant studies.

Gen. Wilson said that the joint Army-Air Force construction program during the past fiscal year totaled more than $1 billion—10 to 15% of which was for missile sites. He said this percentage for missile site construction is expected to jump to between 25 and 30% of the total expenditures for the current fiscal year.

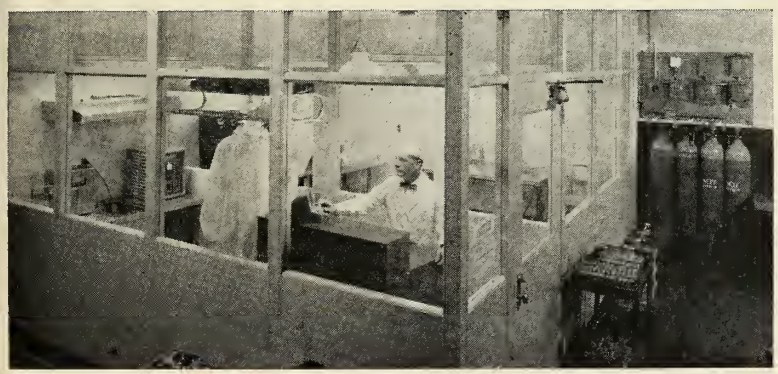
Some facilities constructed for the *Nike-Zeus* program at White Sands Proving Ground are expected to be ready for occupancy this month. However, Gen. Wilson pointed out that the *Nike-Zeus* program is in its "infancy," and the decision to fund for an all-out program has not been made at present.

Asked if the present *Nike-Ajax* sites could be used when the *Nike-Hercules* is phased into operation, the general said that the "tailored" nature of missile development precludes even a second generation of the same missile family from using the same facilities. It was noted, however, that there are some *Nike-Ajax* sites, built as what he termed the "second series," that could be adapted for *Nike-Hercules* operations.

Nike-Hercules units will probably not be put into operation in the southern California area this "calendar year," Gen. Wilson said, but will probably be ready sometime in "the current fiscal year."

Asked if the Los Angeles area would be a high priority district for the *Hawk* anti-aircraft missile, the Army officer said that it probably would not be designated as such. The region is not considered a primary target for such attacks.

Impurity-Free Chamber for Parts Processing



"Clean room"—working areas with controlled, dust-free atmospheres—aren't limited to the guidance manufacturers. The Superior Valve and Fittings Co. of Pittsburgh recently placed in operation a 16 x 16 ft. room for processing precision valves and parts for missiles.

In the glass-enclosed chamber, manual control valves are ultra-sonically cleaned, tested, assembled and packaged in heat-sealed polyethylene bags. Present units being manufactured are automatic fuel control valves for Douglas Aircraft Co.

Other factors in the "clean room" besides the elimination of dust are the control of temperature, moisture, atmospheric pressure, vibration, illumination, ventilation and noise.

In the room, all valve parts are cleaned in an ultrasonic trichlorethylene bath, which removes 96% of all particles down to one micron in size. Stainless steel or polyethylene containers are used throughout, and all parts are inspected under ultraviolet light for any remaining traces of hydrocarbons. When testing is finished, completed valves are capped and plugged with ultrasonically cleaned plastic caps, and then sealed in polyethylene bags.

Advanced Camera Tube "Sees" the Unknown

An advanced type of camera tube, based on televison principles, has been developed by RCA. The tube may help disclose unseen details of the planets and distant nebulae.

Known as the Intensifier Orthicon, it is reportedly 100 times more sensitive than the fastest film for the same exposure time, at low light levels.

The tube was developed by Dr. George A. Morton and Dr. John E. Ruedy at RCA's David Sarnoff Research Center, Princeton, N.J. The research program was sponsored by the Aeronautical Research Laboratory at the Wright Air Development Center.

Operating on principles employed in the Image Orthicon used in present television pickup functions, the tube can "see" in surroundings which appear completely dark to the human eye.

Missiles Almost Half Of Army Hardware Plans

Of the $1.6 billion the Army plans to spend on hardware in fiscal 1959, almost half is earmarked for missiles. *Redstone* heads the missile money list with $109 million.

The Army estimates that surface-to-surface missiles, like *Nike-Hercules, Nike-Zeus* and *Hawk*, will take another $503 million.

The request submitted to the Senate Appropriations Subcommittee also included: *Sergeant*—$44 million; *Lacrosse*—$36 million; *Honest John* and a successor to *Little John*—$35 million.

Nike Mobile Trainer Ready for Use

International Telephone and Telegraph Corp. is producing a mobile trainer for use at *Nike* missile centers.

Housed in a 20-foot trailer, the trainer can inject six synthetic aircraft targets into control radars, with each of the simulated targets having the characteristics of extremely fast, maneuverable planes.

Creation of the trainer, according to ITT, eliminates the necessity of using aircraft for training operations. The device can simulate target speeds of up to 2,300 mph, with a maximum target range of more than 100 miles. It can also simulate target altitudes up to 80,000 feet; maneuvers, including climb rates, up to 40,000 feet a minute; and dive rates up to 80,000 feet a minute.

Here's How "*Gaslight*" Looked to Observers

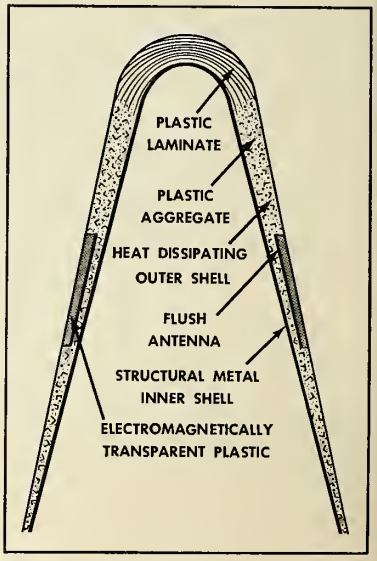
10 SEC.—First to appear was booster, closely followed by smaller instrument package.

13 SEC.—As components descended, nose cone was visible, leading trio to earth.

19 SEC.—Instrument package burned out, booster, slowed by friction, lags behind nose.

Army and industry observers gained significant new re-entry and anti-missile data from the photographic, spectrographic and radiometric studies of the May 18 firing of a *Jupiter* nose cone that was recovered (m/r July 14, p. 14).

Spectral and radiometric measurements were made by special meteor type spectral cameras and radiometers designed by Barnes Engineering Co., Stamford, Conn. Other members of the *Gaslight* team included scientists from AVCO Research Laboratory, Aerojet General, AF Cambridge Research Center and ABMA. "Gaslight" was carried out under the direction of David D. Woodridge and Ray V. Hembree of ABMA.



Plastic Covers Cone

Developed under a contract of less than $2-million by Cincinnati Testing and Research Laboratories, Inc., the protective coating for the *Jupiter* IRBM nose cone is a striking example of the contribution to missilry that small companies can make. Designed to ablate and utilize a CTL proprietary phenolic resin as the basic material, *Jupiter* employs a modified asbestos "down-wind" laminate for the thickest section, graduating to an asbestos-phenolic aggregate for the back part of the cone. Indications are that about 16 laminations are used, and that the thickest part of the coating is on the order of four inches. A pattern of flush antennae are arranged around the cone. The structural inner shell is reported to be aluminum. The cone is being investigated for possible application to *Atlas, Titan, Polaris* and *Minuteman*.

USSR Re-entry Solution Duplicates U.S. Method

Russia's answer to the heat problem in IRBM and ICBM reentry nose cones concurs with U.S. technology. U.S.S.R. engineer, Colonel K. Malyutin, writing in SOVETSKIY FLOT (Soviet Fleet), reports that "to combat aerodynamic heating, rockets are given a highly finished streamlined form and the head portion is made of high-temperature alloys or . . . special compounds of phenol resins with ground asbestos. Sometimes the shell is made of laminated plastics, the layers of which successively burn away during severe areodynamic heating." This translation of SOVETSKIY FLOT was reported by Commerce Department's Office of Technical Services.

Laminated phenolic resins combined with a phenolic-asbestos aggregate provide the basic solution to *Jupiter* nose-cone re-entry. This coincides very closely with what Russia says she is doing. In addition, the Russian article suggests the use of transpiration cooling, where fuel is forced through minute openings in the missile shell with resultant cooling due to evaporation.

This same article, without indicating specifically that the vehicle mentioned is of Soviet design, describes the ballistic rocket as a three-stage, cigar-shaped wingless object with a pointed nose housing the payload. The first stage employs aerodynamic stabilizers and rudders which control the rocket's course up to 18-to-24 miles altitude. In space, control is effected by means of exhaust gas vanes (jetarators) made of high temperature alloys, or, depending on the specific design, gimbaled motors.

Industry to Obtain Space Bill "Rights"

Strong industry objections to the civilian space agency bill provision giving the government all patent rights on inventions which would result from the program has helped bring about a Congressional change-of-heart.

The conference committee which met last week to iron out differences in the House and Senate version of the bill issued instructions that an amendment was to be written which would grant the government non-revokable royalty-free license, while industry would keep the commercial rights. (see p. 33)

Navy Gets 84-ton Heater to Speed Missile Work

The Naval Ordnance Laboratory in Silver Spring, Md. is installing an 84-ton heater to supply extremely hot air at enormous pressures for use in a new hypersonic wind tunnel under construction. The heater system is part of the Navy's multi-million dollar program to step up ballistic missile development by expansion of the laboratory's aero-ballistic plant.

OPTICAL MEASUREMENTS of the incandescent nose cone and rocket body of the *Jupiter* IRBM during re-entry over the Atlantic Ocean (opposite page) were obtained by Avco Research Laboratories in participation with an inter-service team organized by the Army.

Avco recorded three kinds of optical data: (1) radiation intensity, (2) spectral distribution of emitted light, and (3) color motion pictures of the incandescent re-entering bodies. To detect and record radiation intensity at eight significant wave lengths, Avco developed an eight-channel, portable, photo-electric device, known as the Mark II Radiation Recording System.

Radiometer Developed For High-Speed Missile Measure

One of the instruments used for tracking purposes during the recent successful *Jupiter* re-entry experiments was the Wide-Field Radiometer Model R-4K1. Designed and manufactured by Barnes Engineering Co. of Stamford, Conn., specially for "Operation *Gaslight*" (see m/r July 14, page 14), this instrument weighs 13 pounds and is constructed to be held and pointed like a shotgun.

It consists of an optical head and an electronics unit, connected by a single cable. The optical head is equipped with a gunstock and pistol grip for ease of handling and rapid acquisition and tracking of the target.

A major feature in target acquisition and tracking is the wide—up to 4° —circular field of view.

The detector and amplifier are combined in an easily interchangeable package for measuring targets at widely different temperatures. Available for use are lead sulfide, infrared photomultiplier, and germanium immersed thermistor bolometer detectors, all packaged with matching preamplifiers.

The Model R-4K1 has provisions to optimize its function for day or night operation. Total radiation chopping is used for night measurements, while space filter chopping is used during the day to suppress uniform background signals by several orders of magnitude.

An illuminated-recticle type telescope sight is used to permit easy target acquisition and tracking.

The optical head can be removed from the gunstock and mounted on a high-speed pedestal, radar antenna, infrared tracker mount, or optical tracker mount, for simultaneous use with other instrumentation.

First Infrared Detection of Re-entry Achieved

The first successful infrared detection of an approaching ballistic missile has been achieved. The announcement by the U.S. Army and Aerojet-General Corp. revealed that in the experiment, conducted aboard missile tracking ships off the Lesser Antilles Island Group in the Atlantic, a *Jupiter* test vehicle was followed by a portable radiometer as it re-entered the earth's atmosphere until it plunged into the ocean.

The equipment was developed by Aerojet-General and consists primarily of a radiometer telescope with field calibration source, a 16mm. motion picture camera, automatic recorder and batteries. Resulting data included measured intensity of infrared radiation and photographs of the re-entry.

Army Unhappy on *Nike-Zeus* Cut

Strong elements in the Army are miffed at Defense Secretary Neil H. McElroy for deciding against committing *Nike-Zeus* to production.

Here is the issue:

Defense Department has lopped off some $507 million the Army requested for the anti-missile missile. Many Army leaders feel this could delay production and deployment of defense against the ICBM for almost a year.

Basically, the Army feels that its *Nike-Zeus* is worth buying now, while McElroy, upon the advice of his scientific advisers, favors postponing a decision to buy until the missile is further developed and its capabilities more fully proven. The DOD secretary has ordered maximum speed in the research and development phase of ballistic missile defense, instead of obligating millions for *Nike-Zeus*.

His advisors, principally in Advanced Research Projects Agency, feel that *Zeus* has not advanced far enough to become the best defense against the ICBM, and that it would be wasteful to spend money for tooling and new facilities, ahead of knowledge.

• **Army views with alarm**—Army, on the other hand, after study of many types of anti-missile systems, firmly believes that the one with the highest hope of success is *Nike-Zeus* and that it can provide—at an early date—a reasonable ICBM defense.

As one Army ordnance general puts it: "The risk of not going ahead is worse than the risk of going ahead." The Ordnance Command feels that it is more important now to attain some degree of readiness instead of waiting until research provides a better system. At present, *Nike-Zeus* is the only anti-missile under development. DOD does not intend to fund *Talos* as an AICBM.

Present funds will allow Army to produce only prototypes of *Nike-Zeus*, and Army contends that additional funds in the present fiscal year budget would provide ready weapons during the prototype period. These could be deployed, providing at least a partial defense on an area, rather than a point defense basis. At the same time, research could go ahead on second and third generations of the *Zeus*.

Many Army leaders, including General Maxwell Taylor, have estimated that the Army will need $6 billion over a period of years in order to provide adequate defense against the ICBM.

• **ARPA view**—ARPA scientists, however, have advised McElroy that there are a great many unknowns in the problem of intercepting an ICBM. ARPA, which has a budget of $157 million for ICBM defense, of which $57 million will be turned over to the Army for further research on *Nike-Zeus*, is not convinced *Zeus* is the best system.

Chief scientist Herbert York wants to investigate the various phenomena that occur on re-entry. It is known that when a warhead enters the atmosphere—about 60 miles up at speeds on the order of Mach 22—it produces a very large acoustical shock. This ionizes the air and could provide a means for determining parameters that are needed in order to shoot it down.

York estimates that if the warhead is detected 300 miles out—which presumably would be a good figure for the range of *Nike-Zeus*—there would be only a 60 second reaction time. If research uncovers some phenomena that detects an ICBM on its way up, reaction time for an AICBM would be on the order of 25-30 minutes.

Army feels that if it gets the $507 million for additional procurement in the fiscal year 1959 budget which Congress has yet to approve, that 35% of it could be obligated in the first quarter, and the rest would be distributed over the remainder of the fiscal year.

Even a supplemental appropriation next January would still cut eight months from the operational capability of the missile, Army says. If funds are made available, Army plans a *Nike-Zeus* production program in late 1959.

Congress still hasn't made up its mind on *Nike-Zeus*. It could restore some of the money Army says it needs, but restoration probably would be less than half of the one-half billion.

There are about 40 subcontractors involved in the program. Western Electric is prime contractor, and Bell Telephone Laboratories has the prime research and development responsibility. Douglas Aircraft will make the missile, and RCA the transmitters. The overall system includes acquisition radar, tracking radar, missile trackers and the defending missile and launcher complexes.

McElroy has assigned Army the responsibility for developing the missile and launch systems. Air Force has responsibility for developing the early warning system, called BMEWS, of which the Wizard program is part of the detection program.

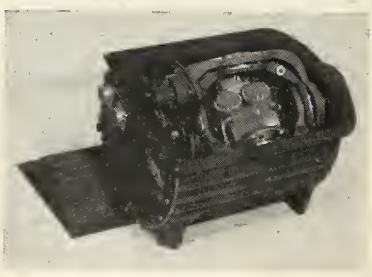
DOD Standardizes Format For Tech Data on Parts

The Department of Defense has prescribed a standardized format for technical information which contractors must submit to the military, in order to estimate requirements for initial spare parts.

Up to now, data concerning life expectancy and functioning of parts or components has been submitted by contractors in varying forms and degrees of detail.

The new procedure will be implemented within 90 days, and be effective, regarding contracts, within 180 days.

Miniaturized Stable Platform Revealed



The Area division of the Minneapolis-Honeywell Company recently revealed details of a miniaturized stable platform designed for use in missiles where size and weight are prime considerations.

The new unit uses MIG (miniature integrating gyro) and accelerometers, and is completely encased in an aluminum housing with external power connections brought in through AN-type connectors. Dimensions are 11″ long x 9.5″ in diameter.

The MIG units, in use in other applications for more than a year, measure 2.5″ long x 1.75″ long and weigh about one-half pound each. Angular momentum is $10^5 gm/cm^2/sec$, and drift rate is less than 0.5 degrees/hour.

Under trim with each warmup, the random drift rate will be in the order of 0.15 degrees/hour. Drifts due to ainsoelasticity in gimbal and motor structures are 0.02 degrees/hour/G^2 at the maximum.

A design feature in the MIG is the combining of the signal and torque generators into a single dual-microsyn called the Dualsyn. The Dualsyn uses 16 poles and 4 sets of 0.0045 wire windings (twice the thickness of a human hair) to become an AC pickoff and either an AC or a DC torquer. With the Dualsyn at one end of the MIG case, the gimbal is in the other.

The new platform was developed as a company-financed project. M-H officials were unable to predict future applications, but indicated that negotiations were in progress with "at least one of the services."

Support Reorganization Bill

Adm. Radford Calls Existing Act Refuge For "Roles and Missions" Prerogatives: House Okays $1.72 billion construction

by Frank G. McGuire

The very law that tried to insure a unified defense establishment has been blamed as part of the underlying cause of poor co-operation in the Defense Department.

Admiral Arthur W. Radford, USN (Ret.), former chairman of the Joint Chiefs of Staff, told the Senate Armed Services Committee that the existing law is often used as a shield behind which individual services hid in order to prevent elimination of their functions or missions.

According to Radford, when duplication of functions or missions forces the Secretary of Defense to consider eliminating the overlapping area the affected services cite the law prohibiting him from doing so. It is often claimed that the particular function involved is a "Basic Pillar" of that service's roles and missions, and removing this "pillar" from the defense setup is illegal in view of the roles and missions assignments guaranteed with the establishment of the Defense Department. Radford stated that the possibility of the Secretary of Defense being called before Congress to explain his "illegal" actions causes a delay of weeks or months in a decision on the matter.

Radford told the committee that he was greatly disappointed in the amount of co-operation given the Secretary of Defense by the military departments. He strongly urged support of the House reorganization bill (HR 12541) with the amendments recommended by the President.

Asked where he thought the government could save money through the proposed reorganization, Radford stated that he didn't think defense expenditures would actually go down anytime in the near future. He said, however, that he believes the existence of so many types of weapons is a waste that might be eliminated under reorganization.

Admiral Radford was supported in many of his statements by Sen. Stuart Symington (D-Mo.), former secretary of the Air Force. Symington and Radford obviously saw eye-to-eye on many of the alleged faults of the present system.

• **Other Activity** elsewhere on Capitol Hill:

The Navy assured the House Armed Service Investigating Subcommittee that it is not following a policy of awarding contracts for propellants to private firms while its own facilities "die on the vine." A flurry of reports that the Indian Head, Md., powder factory was laying off 2,000 employees, while Aerojet-General received a $10 million contract for *Polaris* propellant caused congressmen to react with an investigation.

The investigation is not expected to be limited to the Indian Head matter, but will probe broad aspects of government investment in private weapons facilities. About five such cases are believed to be on the agenda for the subcommittee.

RAdm. Paul D. Stroop, chief, Bureau of Ordnance, told the subcommittee that the Navy had made a $23-million management-control arrangement with Aerojet.

As far as the contract for *Polaris* propellant is concerned, Stroop said, Aerojet was, at the time of the decision, one of only two firms capable of making the propellant needed. Thiokol was the other firm considered.

"Aerojet had extensive Navy-owned facilities at Sacramento which were being used for limited JATO production, and these facilities were available for work on *Polaris* with suitable modifications," he said.

Later, Aerojet president Dan A. Kimball told House investigators he could see "no logical basis" for the controversy. Kimball told the congressmen that it should "never have arisen, because we are in an entirely different kind of business. We cooperate with, but we are no sense a competitor with, Indian Head. Our purposes and processes are entirely different from theirs, and our positions in the missile field, while related, are not parallel."

Other action in the House saw a $1.72-billion military construction authorization bill for FY 59 passed and sent to the Senate. A large portion of the total is earmarked for missile-related construction and other uses. Over 50% of the Army authorization is slated for construction programs in the SAM category, research and development, and training.

Of the total amount, $288 million was authorized for Army; $319 for Navy; $957 for Air Force; $39.9 for the Reserves; and $50 million for ARPA; plus about $64.5 million for deficiency authorization.

Conferees Approve Space Agency Bill

Senate and House conferees have unanimously approved a bill to create a new civilian space agency and to back the President with a nine-man council to advise him on space problems.

The compromise bill was praised by both Senate Democratic Leader Lyndon Johnson (Tex.) and Rep. John McCormack (D-Mass.), who agreed that it improved on versions passed by both the House and Senate. Both expressed hopes that the Congress would act quickly on the measure and send the completed bill to the President for his signature.

President Eisenhower had asked the legislature to create a civilian space agency, using NACA as a nucleus. Johnson said the bill is "in conformity" with the administration's views.

The Conferees also approved provisions in the bill which would create a National Aeronautics and Space Council. Previously, the Senate had approved a seven-member space policy board with broad policy-making powers, and the House had approved a 17-member advisory panel for the director of the new agency.

Under the approved version, the President would be the chairman of the nine-member council and therefore responsible for final action. The advisory council would have comparable status with the National Security Council, and would be composed of the Secretary of State, Secretary of Defense, the head of NASA, the chairman of the Atomic Energy Commission and four others to be selected by the president.

Missile Test Trucks Pass Road Tests

First two of an undisclosed number of tactical mobile missile test stations built by Convair under U.S. Marine contract, have successfully completed road testing.

The battery missile test trucks to be used for *Terrier* missile checkout under tactical conditions are constructed on government furnished four-wheel drive, three-quarter ton, M-37 cargo trucks.

In addition, the contract calls for a number of missile repair vans which will be equipped to repair missile components rejected during checkout.

Typewriter Manufacturer Enters Missile Business

The Underwood Corporation has entered the missile business field through the purchase of the Canoga Corporation of California.

"The Canoga Corp., which has plants at Van Nuys, Calif., and Ft. Walton Beach, Fla., has been engaged in the development of missile range instrumentation, radar systems, ground support equipment, and telemetering systems, and will remain in those fields. The division is expected to more than double its personnel within a year.

"The Underwood Corp., which grossed more than $77 million last year, expects to increase that amount substantially. Underwood will acquire other organizations in the missile field, with the full intention of moving into the business on a large scale."

Mr. Paul H. Ryckoff, president of the Canoga Corporation, will head the new Canoga division of Underwood.

Convair Gets $314 Million *Atlas* Design, Development

A letter contract has been issued by the Air Force to Convair (Astronautics) Division of General Dynamics Corp. for $314.3-million for past and present research, development and design of the *Atlas* intercontinental ballistic missile and supporting equipment.

The contract announcement was made by Major Gen. Ben I. Funk, ballistic missiles manager for the Air Materiel Command, at the dedication of the new $40-million Convair-Astronautics plant at San Diego. Cost of the plant and its equipment has been shared equally by the Air Force and General Dynamics Corp.

The new contract is in the form of a supplemental agreement to the basic *Atlas* contract, Gen. Funk said. It puts into formal form a previous letter contract, and "represents a substantial effort on the part of Convair in the prosecution of the *Atlas* ICBM program."

This was the second *Atlas* contract announcement made by the Air Force. In January 1957, an initial allocation of $145-million to cover part of the design, fabrication and testing costs of the 6,325-mile *Atlas* was disclosed.

Man-In-Space Panel Named by ARPA

The Advanced Research Projects Agency has named a panel to study the problem of Man-In-Space. Two classes of members make up the panel: voting and non-voting. Voting members include: Dr. Samuel B. Batdorf, chairman; Capt. Robert C. Truax, USN; Richard B. Canright; R. S. Cesaro; C. R. Irvine; Dr. Arthur J. Stosick, and Robertson Youngquist.

Additional non-voting members of the Man-In-Space panel attend primarily in a monitoring capacity.

Dr. Batdorf is technical director of Lockheed's Missile Systems Division and a specialist in materials engineering. Capt. Truax, past president of the American Rocket Society, has been assigned to the WS117L project. (Project SNAP, see p. 7) with the Air Force's Ballistic Missile Division, and joined ARPA three months ago.

Canright is a member of the NACA subcommittee on rocket engines and chief of the missiles powerplant group at Douglas Aircraft. Dr. Stosick is chief of the rockets and materials division at JPL, and is a specialist in physical chemistry, propellants and metallurgy.

ARPA's staff is less than 50 scientists and management experts, who are responsible for such projects as the Man-In-Space program. The proposed ARPA budget listed $46.2 million to finance the program.

Stanford to Maintain Document Depository

The Atomic Energy Commission has contracted with Stanford Research Institute to maintain a classified documents depository to serve the Western part of the country. The depository includes about 7,000 reports dealing with various aspects of nuclear energy research.

The AEC maintains similar depositories in other parts of the country for the use of firms holding AEC access permits. About 140 such firms are in California. Arrangements for use of the SRI depository may be made through AEC's San Francisco operations office.

Lockheed Space Lab To Expand Double Its Size

The Space Communications Laboratory at Lockheed Missile Systems Division, Sunnyvale, Calif. will be almost twice its size in mid-August when an 8,000 square foot addition is scheduled for completion.

Work on the $115,000 addition, which will be used mainly for offices, has been started. The new unit will also permit expansion of laboratories in the present 10,000-square-foot building. Lockheed's satellite tracking station will also be expanded.

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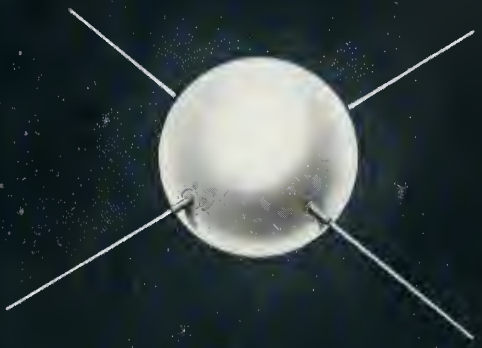

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Grand Central Rocket Co. congratulates the U. S. National Academy of Sciences, National Science Foundation, U. S. Naval Research Laboratory, The Martin Company, and all associated contractors and individuals who were affiliated with this outstanding contribution to the IGY program.

Because of demonstrated performance and reliability, one of Grand Central's solid propellant rocket engines was selected for the third stage of the VANGUARD vehicle, and was given the assignment of placing the satellite in orbit at a velocity of 18,000 mph. Grand Central Rocket Co. is honored to have played this prominent role in the VANGUARD project.

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