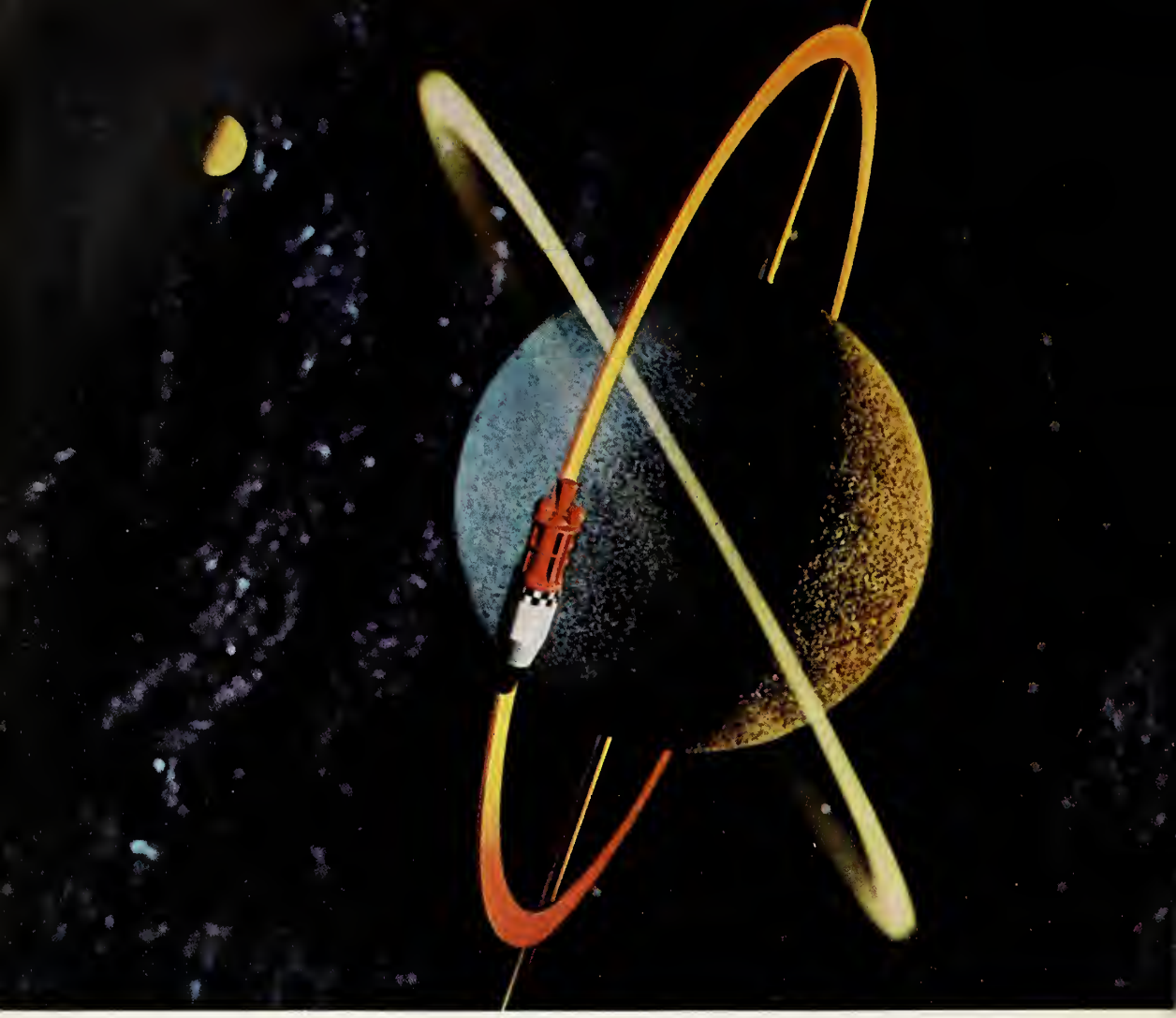
May 2, 1960

missiles and rockets

THE MISSILE/SPACE WEEKLY

Navy Telescope Locates New Radio Sources

AN AMERICAN AVIATION PUBLICATION



Bell-powered Agena satellites in orbit — symbolized.

THE ENGINE WITH THE FUTURE

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Vast sums of money and vital scientific data ride on these built-in attributes of Bell Aircraft's rocket engine for Lockheed's Agena satellite, second stage of the Air Force Discoverer series.

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Agena's engine is typical of the exciting projects in Bell's rocket propulsion center. It is part of the dynamic new approach of a company that's forging ahead in rocketry, avionics and space techniques. These skills serve all government agencies. Engineers and scientists anxious for a new kind of personal challenge can find it at Bell.

Niagara Frontier Division

BELL AIRCRAFT CORPORATION

BUFFALO 5, NEW YORK

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NASA announces . . .

THE TRANSFER OF THE DEVELOPMENT OPERATIONS DIVISION OF THE ARMY BALLISTIC MISSILE AGENCY TO THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Dr. Wernher von Braun, director of the new NASA Marshall Space Flight Center in Huntsville, Ala., pictured with NASA's Mercury Astronauts

Dr. Wernher von Braun and his space team join NASA

The National Aeronautics and Space Administration leads the nation's efforts to find, interpret and understand the secrets of nature as they are revealed in the laboratory of space.

This vigorous effort requires boosters for space vehicles which greatly exceed the thrust of any boosters currently available. For this reason, the $100 million Huntsville plant, together with its famous space team, are being transferred to NASA. The new NASA facility in Huntsville will be known as the George C. Marshall Space Flight Center.

NASA is now the largest civilian research organization in the United States. For details about outstanding professional opportunities, address your inquiry to the Personnel Director of any of these NASA centers:

NASA Goddard Space Flight Center
Washington 25, D. C.

NASA Flight Research Center
Edwards, California

NASA George C. Marshall Space Flight Center
Huntsville, Alabama

NASA National Aeronautics and Space Administration

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Engineers and scientists interested in a wide range of activities will appreciate the advanced nature of research and development projects under way at JPL. These projects include research, basic and applied, in Electronics, Solid State Physics, Propulsion, Aerodynamics, Structures and Materials and the design, development and analysis of space probes and satellites. Individually responsible engineers and scientists work together as a thoroughly integrated team in accomplishing the complete objective.

Programs involve guidance, telemetering, data recording and reduction, instrumentation, structures, propulsion, materials, solid state physics, components, heat transfer problems and systems analysis and are constantly influenced by continuing JPL space exploration research providing individuals with challenging assignments in almost every phase of engineering and science. Staff progress in diverse fields of activity is constantly being made.

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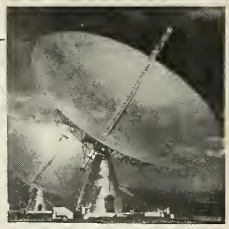
THE MISSILE / SPACE WEEKLY

missiles and rockets

May 2, 1960 Volume 6 No. 18



THE COVER

Navy's new twin radio telescope built and operated by CalTech has already located nine radio sources from outside our galaxy. Its two 90-ft. antennas are mounted on rails.

Published each Monday with the exception of the last Monday in December by American Aviation Publications, Inc., 1001 Vermont Ave., N.W., Washington 5, D.C.

Wayne W. Parrish
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MAY 2 HEADLINES

ELECTRONICS

SPECIAL SECTION

ADVANCED MATERIALS

GROUND SUPPORT EQUIPMENT

PROPULSION ENGINEERING

ASW ENGINEERING

INTERNATIONAL

DEPARTMENTS

30,988 copies this issue

ASW Department Welcomed

To the Editor:

The ASW write-up in your April 11 issue is the most factual I have seen. It presents the subject in excellent perspective. Budgetary facts, which you have presented well, are of basic interest to industry. The description of the ASW problem and of systems and equipment is accurate and interesting. I also note with pleasure the touch of humor under "Strippers."

Harry Sanders
Director, ASW Engineering
Chance Vought Aircraft, Inc.
Dallas

To the Editor:

I was very pleased with what your April 11 issue contained, since the establishment of the new Anti-Submarine Warfare Department will mean increased coverage in the field dear to my heart.

Your coverage of the Navy Capability and needs in the article "Tools the Navy Needs in ASW" was excellent. It was particularly worthwhile to see the ASW budget breakdown and FY comparison.

I feel that you have made an excellent start and with your intended purpose in mind, I expect to be a continued avid reader of your publication.

Earle A. Williams
Manager, Advanced Systems Projects
Defense Electronic Products
Radio Corp. of America
Camden, N. J.

To the Editor:

It was a pleasure to see that you have inaugurated a new ASW department in M/R.

ASW, like every other "anti," is difficult to define. It is neither a weapon nor a system, but is so general that it is difficult to come to grips with it. When the subject is broken down into its parts we have detection, tracking, localization, classification and the kill. However, during the cold war the parts that become of most importance are detection, classification and tracking. Perhaps there is another very important facet to the cold war situation which might be called policy. That is, the attitude that a country will assume if the problems of detection, classification and tracking are solved—then what?

In other words, at what point would the situation of enemy submarines lying close to our shores and pointing nuclear-armed missiles at us become intolerable? Then what would we do about it? I would think that we would come to this eventually, or that USSR would, if the presence of our *Polaris* submarines became an unbearable threat to them.

These are just random thoughts.

With best of luck,

C. B. Momsen
Vice Admiral, USN (Ret.)
Arlington, Va.

To the Editor:

I noted the establishment of a new section in M/R covering ASW Engineering. My only comment is that this is a fine initial start and something that has been required for some time.

As you are aware, advancement in the technology of underseas environment has been extremely limited. On the other hand, the importance of conquering the seas is at least equal to, if not greater than, the importance of conquering space. I would therefore suggest that articles be included which would excite scientists in pursuing studies in underseas phenomena for military and peaceful application of the knowledge and resources of the world's seas.

G. F. Blunda
Assistant to the Vice President and General Manager for Development Planning Radioplane Division of Northrop Corp., Van Nuys, Calif.

To the Editor:

I think your April 11 edition was a very excellent initial coverage of ASW, and I think it was an excellent decision on your part to start this department. One can hardly comment on how you could improve the department after one issue, but I have read many ASW articles by various magazines and I do have a comment as to how you could improve over the general approach.

Namely, it has been my impression that most ASW articles try to cover entirely too much in each issue. I think it would be a better approach to have a special coverage of one important phase of undersea warfare in each issue. Then, perhaps, in order to keep abreast of other phases, you might have a single page or half page written in the *Newsweek* "periscope" style.

I think the idea of having a guest editorial by Vice Admiral Hayward was very good and would suggest such an ASW editorial weekly if possible, but at least monthly.

F. G. Selby, Rear Adm. USN (Ret.)
USW Staff Coordinator
Goodyear Aircraft Corp.
Akron, Ohio

...All aspects of ASW Engineering will be explored in forthcoming articles which will be geared to giving engineering management a more basic understanding of the problems of the field.—Ed.

Saturn Fabrication

To the Editor:

I saw the April 18 M/R yesterday, and

Mr. Maus' article (on *Saturn* fabrication) certainly looks good. You gave it very fine treatment.

Joseph M. Jones
Headquarters, Army Ordnance
Missile Command
Redstone Arsenal, Ala.

IRC's *Tiros* Solar Cells

To the Editor:

The April 11 issue of M/R carried a complete report on Project *Tiros* ("*Tiros* Presages Long-Range Forecasts").

May we call your readers' attention to one correction. The 9200 solar cells on the *Tiros* satellite were supplied by the International Rectifier Corporation, not Hoffman Electronics Corporation as reported in your article. The performance of *Tiros* is indicative of the fine cooperation RCA has received from IRC on the solar power subsystem in the satellite.

M. G. Staton
Administrator, Planning
Radio Corporation of America
Astro-Electronic Products Division
Princeton, N.J.

To the Editor:

Congratulations to M/R, and particularly to Paul Means, for the very fine and timely article on the *Tiros* weather satellite which appeared in your April 11 issue.

You undoubtedly have been contacted by RCA, pointing out that you credited the 9200 solar cells used in the project to Hoffman Electronics Corporation, when in fact the cells were manufactured and supplied to RCA by International Rectifier Corporation. We received a wire from RCA on April 11, advising us that M/R had made this error in the article, and that they would be happy to verify the fact that we supplied all of the cells used on the *Tiros*.

Within the next few days an RCA spokesman called and stated that he had conferred with NASA on the problem and that they felt it was RCA's responsibility to correct this erroneous impression. I assume this has been done.

You will be interested to know that your publication is well read by members of the financial and investment community as well as by scientists, as indicated by the number of letters we have received calling our attention to this misstatement. It is a testimonial to the excellence of your reporting in this dynamic industry, and to the presentation of your editorial material. Again—congratulations.

William E. Wilson,
Director of Public Relations
International Rectifier Corp.,
El Segundo, Calif.

Get Thee Behind Me, *Saturn*

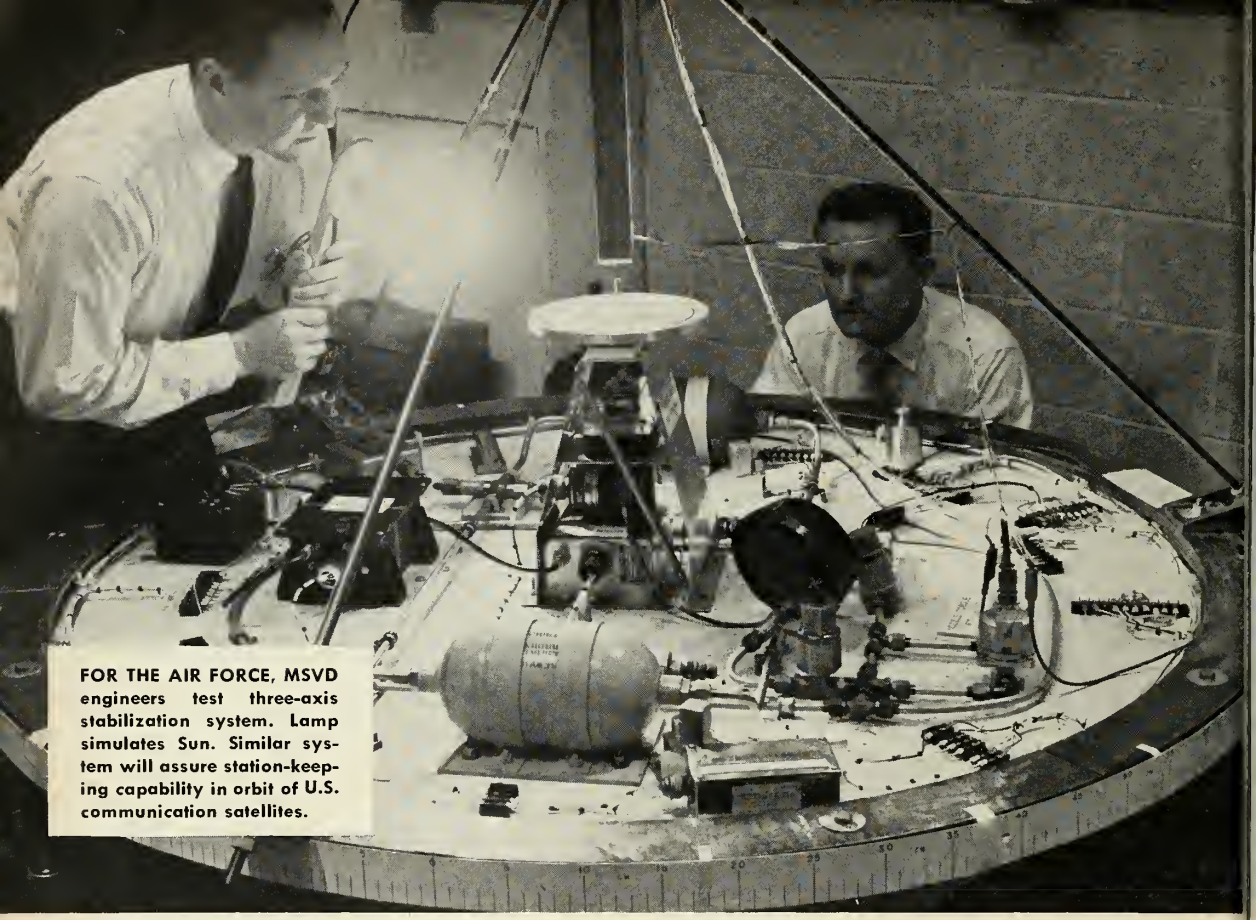
To the Editor:

Re your cover picture of April 18.

How did you resist the temptation to use the caption, "Rings of *Saturn*"?

Robert L. Mahin, Staff Engineer
Sigma Corporation,
Pacific Palisades, Calif.

It wasn't easy.—Ed.



FOR THE AIR FORCE, MSVD engineers test three-axis stabilization system. Lamp simulates Sun. Similar system will assure station-keeping capability in orbit of U.S. communication satellites.

MISSILE AND SPACE VEHICLE DEPARTMENT

...center for missile and space technology research and development at General Electric

Progress in space vehicle navigation

As space vehicles probe further and further away from the Earth, and as their missions become more and more complex, the need for accurate, high-precision space navigation and control becomes increasingly vital.

General Electric Missile and Space Vehicle Department engineers are now developing and testing space vehicle control equipment for the 24-hour-orbit communication satellite program. They have already designed and flight-tested on space vehicles a three-axis stabilization system as well as orbit computation and correction techniques. Using the Earth and Sun as reference points, this MSVD three-axis system successfully controlled the attitude in space of U.S.A.F. *Atlas* and *Thor* re-entry vehicles during a major portion of their ballistic flights. The control accuracy attained on these flights could be duplicated on flights further into space, using other planets and stars as check-points.

For more information about MSVD's space navigation and control work for the Air Force and its other contributions to U.S. space technology progress, write to Section 160–73, General Electric Missile and Space Vehicle Department, Philadelphia 4, Pennsylvania.

GENERAL ELECTRIC

MISSILE AND SPACE VEHICLE DEPARTMENT

A Department of the Defense Electronics Division

Scientists and Engineers interested in career opportunities in Space Technology, contact Mr. T. H. Sebring, MSVD

The Countdown

WASHINGTON

No Strategic Unification

Navy officials are resisting strong pressure to bring *Polaris* missiles under a single strategic command. Their argument: communications. They contend it is both impractical and unwise to try and control submarines at sea from a land-based headquarters which might be destroyed in an initial nuclear attack. Similarly, they feel it would be wrong to put complete retaliatory command control aboard a sub which also might be destroyed. Hence, the AF's ICBM's and *Polaris* are expected to remain under dual commands

Europeans Need Range

The United States may be asked next to finance a European missile range for the training and re-training of *Thor* and *Jupiter* crews. One of the big problems is finding a suitable location. Africa appears out because of political instability. Best bet: a launching complex in Portugal to fire into the Atlantic.

To be Opened New Year's

Look for a revival of the B-70 program next year. DOD officials privately expect funding of the Mach 3 missile-launching bomber will be increased "considerably" with the change in administration and plans for a step-up already have been packaged.

Switch to Tactical Missiles Coming

With the end of the strategic missile build-up in sight in the mid-60's, top DOD planners already see a switch in funding emphasis to tactical weapons for limited war. Market for small missiles to be used by infantry and tanks is expected to increase perceptibly in FY '62.

Far-out Nuclear Testing

The United States now possesses a capability of launching a one-megaton atomic warhead one million miles into space, according to Dr. Reuben F. Metler, executive vice president of Space Technology Laboratories. He said it could be triggered at that distance for test purposes.

INDUSTRY

Space without Bankruptcy

New cost analysis study by the Rand Corp. shows the United States could support a $5-billion to $10-billion annual space expenditure. If build-up is gradual and geared to expansion of the nation's economy, there would be no need for either wage-price controls or reduction in military spending.

Chemical Warfare Contracting Up

Army spelled out its requirements in chemical, biological and radiological warfare for 500 industry representatives at a three-day briefing this past week. Several companies will submit bids on their own proposals—where the Army provides classified information and the company pays for the work.

Full *Saturn* Static Firing Due

All eight engines of the *Saturn* space booster will be static-fired simultaneously for the first time this week at Huntsville. Thrust will be at a level of 1,320,000 lbs., each engine operating at 165,000 lbs. In later tests, the total thrust will rise to 1.5 million lbs.

Titan Storable Fuel Plant Started

Olin Mathieson Chemical Corp. will build a $10-million to $50-million plant for the production of anhydrous hydrazine at Saltville, Va. The top priority program, COUNTDOWN has been told, will furnish high-energy storable fuel for the later model *Titan* ICBM's.

Centaur Moves West for Tests

Pratt & Whitney will ship the LOX-hydrogen *Centaur* engine from West Palm Beach, Fla., to Sycamore Canyon, near San Diego, in a few weeks. A final checkout stand is being completed and static firing could start next month.

INTERNATIONAL

Germany Gets Space Mission

West Germans have taken a NASA offer to participate in the U.S. space program on a rather large scale. The country will help make satellite instrumentation and may build equipment for space capsules.

French Form Materials Company

Seven French concerns, including C. F. Thomas-Houston and Sud Aviation, have joined in the formation of a new corporation—SERMIAT (Societé d'Etude et de Realisations de Materiels et d'Installations Aeroterrestres.) The group will research and manufacture new materials for space vehicle use.

NATO Squabbles over IRBM

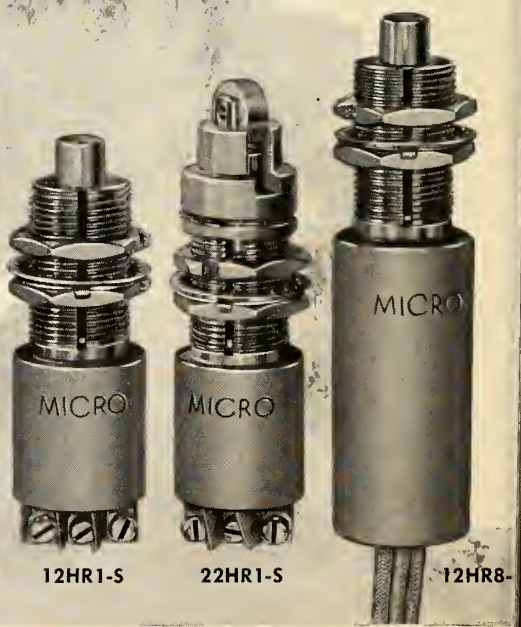
One of the major objections to the purchase of *Polaris* by NATO is being raised by France. The French want an IRBM they can base in North Africa which would require a 2500-mile minimum range. *Polaris'* present range is 1200 miles and it is expected to be two years or more before it is increased to 2500 miles.

For Technical Countdown, See Page 21

Sealed and Shock-Resistant ...precision

Hermetically Sealed "HR" Switches

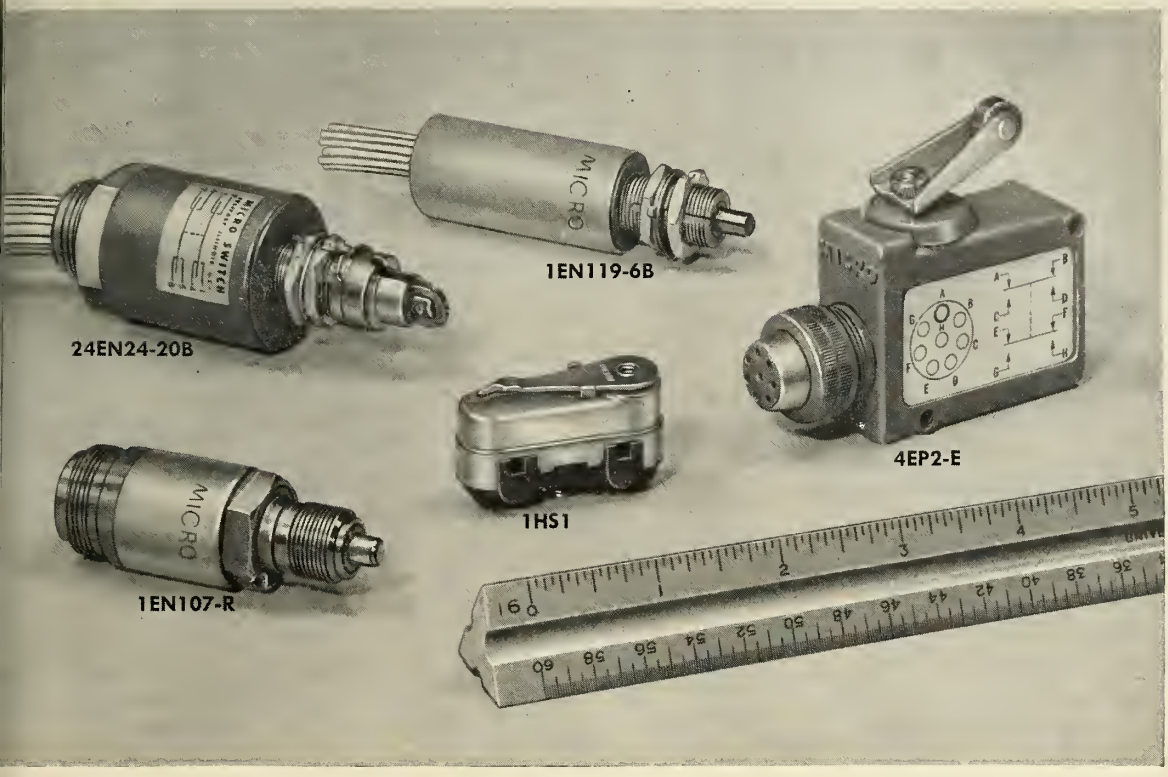
Explosive shock or high temperatures from missile exhausts present no problem to MICRO SWITCH "HR" switches. They are hermetically sealed to maintain constant operating characteristics regardless of changes in atmospheric or environmental conditions. "HR" switches operate dependably in a temperature range of −65° to +600°F. All exposed parts are corrosion resistant. To qualify as a true hermetically sealed switch, the chamber containing the switching element is evacuated and filled with inert gas; the conductor sealing is glass-to-metal and metal-to-metal, and the contained switching unit is actuated through a sealed metal diaphragm. An ice scraper ring on the actuator shaft removes ice or mud which might cause jamming or binding. Write for Catalog 77 which describes "HR" and other MICRO SWITCH enclosed switches for airborne equipment.



12HR1-S and **22HR1-S**—Both contain two single-pole double-throw snap-action switching units. 5 amp. (resistive), 28 vdc.

12HR8-6—Has high-temperature lead-wire extending from internally threaded conduit hub. 5 amp. (resistive), 28 vdc.

12HR1-S **22HR1-S** **12HR8-**



switches for missile launchers

The most complete test laboratory in the precision switch industry makes it possible for MICRO SWITCH to test switches under severe conditions of shock, vibration, temperature or altitude. This has made possible a complete line for missile, aircraft, rocket, launcher, marine and ordnance applications. Here are just a few of the switches specially designed for missile launching:

1EN107-R Meets BUORD requirements, can withstand 1,000 pounds of sea water pressure per square inch. Has two high-shock basic switches. Write for Data Sheet 176.

4EP2-E Sturdy housing, exceeds shock and vibration resistance tests MIL-S-6743 and MIL-S-6744. Also meets immersion tests for MIL-E-5272A. Conduit hub houses sealed solder terminals and elastomer seal gland. Write for Catalog 77.

1HS1 Single-pole double-throw contact arrangement, conductors sealed in glass. Metal housing is evacuated and filled with dry inert gas under pressure, a true hermetic seal. Write for Catalog 78.

1EN119-6B and **24EN24-20B** Both are used on missile test stands. Environment-proof seals with ice scraper rings on actuator shafts to remove ice or mud which might cause jamming or binding. Write for Data Sheet 176.

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Major new space role?

Navy Bids for Space Launching

Memorandum says HYDRA concept would save billions of dollars over Air Force type of land launchings

POINT MUGU, CALIF.—The Navy is advancing a plan for launching giant rocket boosters from the ocean's surface which would give it a major new space role. The Navy says the proposal will save the nation's space effort billions of dollars over the next 15 years.

Floating of multimillion-pound-thrust space boosters vertically in the ocean for launch would eliminate the need for expensive land-based ground support equipment, the Navy says.

Test firings of small solid-propellant rockets have been made successfully at Pacific Missile Range to prove the feasibility of the system. To support its proposal, the Navy released a lengthy technical memorandum on the concept here last week and at the same time opened a test firing to the press.

The Navy plans additional tests, not only of solid-propellant rocket vehicles but also of vehicles with storable liquid motors and other types of rocket boosters.

The technical memorandum was illustrated with a drawing of a typical Air Force-type launch pad and gantry which the authors said could be eliminated under the new proposal.

Details of the Navy concept, named HYDRA, came from scientists at the Naval Missile Center here. The plan calls for building of large space vehicles in drydock, casting propellant at dockside, towing the vehicles to a launch area by tugboat, and firing them while they float vertically.

"The proposed system for water launch of solid-propellant booster vehicles will represent a significant advance for scientific as well as military exploitation of space," the Navy technical memorandum asserts.

Although the Navy says the concept is not applicable to any present weapon system, it is expected to provide significant advantages to large boosters using either solid propellants or nuclear powerplants. Non-storable liquid propellants are not compatible with a sea launch, the memorandum states.

The Navy says the concept is being put forward as a means of advancing the national space effort and is accordingly oriented to non-military applications. It says development could begin almost immediately by modifying existing solid-propellant hardware such as *Scout* and then proceeding to larger solid-propellant booster vehicles, either single-chamber or clustered, with almost no upper limit on vehicle size.

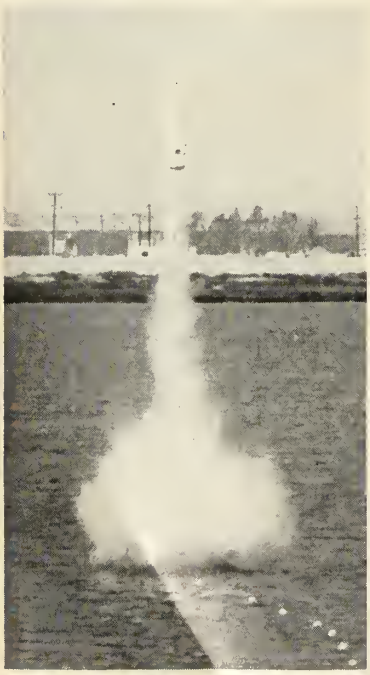
The technical memorandum suggests that all of the rendezvous problems anticipated in constructing space stations might be eliminated by using water launch of extremely large solid booster clusters with the entire space station as the payload.

Although the Navy emphasized the non-military aspects of the HYDRA concept and specifically denied any attempt to adapt *Polaris* to the technique, it is apparent the system has military applications. Using the HYDRA concept, large numbers of ballistic missiles could be launched without use of special *Polaris*-type submarines, although probably at some sacrifice in accuracy. A standard World War II fleet submarine could tow the missiles to chosen sites and launch them with little difficulty (M/R, February, 1957).

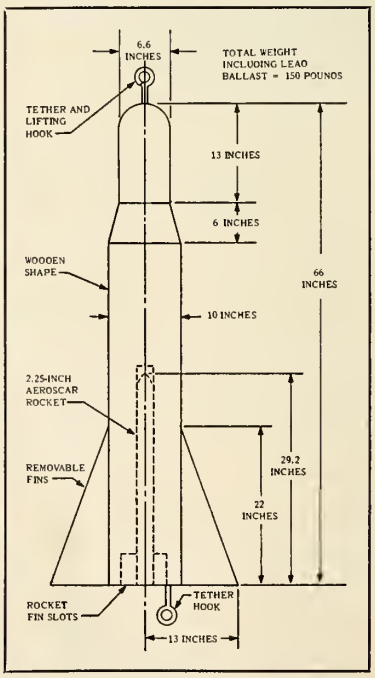
The HYDRA technique, developed by the Missile and Astronautics Directorate of the Naval Missile Center, is said to be economically feasible only in the case of boosters somewhat larger than *Atlas*.

The Navy's technical memorandum says the greatest single advantage of the proposed water launch for the national space program is the relative ease with which logistics and handling problems of large space boosters are met.

It notes that land-based launch complexes require quite extensive facilities to support liquid-propellant rocket firings, including fuel and oxidizer storage, cryogenics systems, concrete launch pads with water-cooling systems, large steel gantries, and armored blockhouses. It points out that frequently support equipment is three to five times as expensive as the vehicles themselves. Much of this equipment also is needed for land-based solid propellant boosters, it is pointed out.



HYDRA 1 test vehicle shown in flight.



SKETCH of vehicle's design details.

rom Sea

By contrast, the ocean offers a "no-cost, self-healing, water-cooled launch pad," the Navy asserts.

"Even more important than the savings effected in the handling, logistics and launch phases, is the extreme mobility gained by such a water-launch system," the proposal states. "Immediately, 70 per cent of the earth's surface becomes a potential launch site. A simple, practical means of obtaining equatorial orbits without diplomatic haggling or tribute paid to foreign powers is within our grasp."

The proposal envisions a fleet of launch and telemetry ships which could be recalled to base after a launch and then used in other areas as desired.

Navy officials here emphasized that no major modifications would be required to adapt standard vehicle designs to sea-launching. They cite the example of using an air-to-air rocket in the demonstration vehicle with little change. Even the ignition of the propellant while underwater has proven quite simple, the Navy says.

The sea-launch test vehicle HYDRA I, was a 150-lb. missile with a wooden shaped body and removable fins. Overall length was 70 in. and maximum diameter, 10 in. The rocket motor was a 2.25-in. Aeroscar, modified for the sea-launch test and delivering 890 lb. thrust for 0.45 sec.

The Navy's technical memorandum says no major technological breakthroughs are necessary to overcome the expected problem areas of corrosion, watertight integrity, guidance, air/sea interface effects during launch and payload checkout techniques.

Contrary to appearances, the prospect of rough water is expected to disturb a floating vehicle very little. Navy calculations and tests show that a rough sea would cause a disturbance in the vehicle's longitudinal axis of five degrees or less.

The technical memorandum says that in order to effectively cope with the motion of the booster vehicle while floating in the upright position, some form of inertial platform will be a prime requirement. It says the form of the guidance platform probably will be a local vertical system, since a system mounted within the vehicle's upper stage can be erected to the local vertical by self-contained means.

"Similarly, alignment can be also accomplished inertially, using advanced gyrocompassing techniques," the memorandum states, adding that miniaturization and advanced digital techniques would be extensively employed.

A suggested alternate form for platform orientation is the use of star-trackers coupled with an inertial platform, while the upper stage is floating out of water. Immediately prior to launch, the star-tracking equipment would be removed and the burden of accurate guidance placed on the low drift rate gyros.

Many of the facilities to implement the HYDRA technique are now in existence: drydocks for fabrication and checkout; LSD (landing ship, dock) vessels to transport the vehicle to a launch site (if towing were not used) and support craft to service it before launch.

A catamaran-type vessel to straddle the protruding nose of the vessel could attach payloads, check guidance, and act as a floating gantry to the booster. The only thing left behind the booster after launch would be the firing lead wiring.

The advantages of the HYDRA system increase as the size of the vehicle increase, according to the Navy.

When nuclear boosters become operational, a concept such as HYDRA will be ideal from a number of standpoints, the studies show. Safety, an overriding consideration in the nuclear rocket program, would be maximum during a launch on the high seas. Security would also be at a maximum level during such an operation, as attested by the undetected nuclear launches of the *Argus* program from the USS Norton Sound in the South Atlantic.

On the problem of corrosion and marine growth at sea, proper design is held to be the answer. One such solution would involve a plastic envelope surrounding the booster. The envelope would be stripped off the vehicle automatically at launch.

Structural design of the wet-launch booster would not differ from present standards, it is noted, since stresses applied during flight will always exceed those loads applied during handling by seaborne equipment.

In a test at Point Mugu for benefit of the press, Navy officials successfully demonstrated underwater ignition of a rocket designed for aerial ignition; stability of underwater launching techniques; no water instability resulting from rocket exhaust; no choking of the supersonic exhaust by water inertia effects, and the pop-out phase.

For most efficient operation, a solid propellant rocket should have a specific gravity of about .9. This would leave appoximately 10% of a vehicle protruding from the water before launch. Most present solid rockets are in the specific gravity range of 1.02 to 1.40 (with regard to sea water), and some additional buoyancy is required.

Air Force Releases Funds For Glider-shaped *Dyna-Soar*

The Air Force this last week finally released funds for the first phase of the huge *Dyna-Soar* space bomber program.

The action followed years of haggling and frustration ended by a final lengthy review aimed at determining whether the vehicle should have a ballistic shape or be a glider as originally planned. The glider won.

The Air Force announced on April 27 that it had released $29.7 million for "design and ground testing necessary to build a boost-glide aerospace test vehicle." The money was released to the *Dyna-Soar* industry team led by Boeing, developers of the vehicle, and Martin, developers of the booster, which will be a modified *Titan* at least in the first stages of the program.

The funds were all the Air Force had planned to spend on *Dyna-Soar* from past appropriations. However, the FY 1961 budget includes $58 million for the program.

Official estimates put the cost of the program by 1966 at more than $800 million.

• **Step-by-step**—Under Phase 1 of the program as announced so far, Boeing will build 11 space gliders—three for ground tests, four for unmanned flights and four for manned flights. The first manned flights will be sub-orbital. They will be launched from Cape Canaveral.

The first glider flights are expected to be unpowered air drops from a B-52 jet bomber. The first manned powered flight is expected to come in the mid-1960's under the presently planned rate of spending.

Later phases of the program—if approved—would give the United States an operational space bomber—the first military space craft.

Power Says *Minuteman* Will Cost Far Less Than *Polaris*

The coming Air Force-Navy struggle over strategic weapons rumbled through Congress this past week.

Gen. Thomas Power in newly-released testimony told the House Military Appropriations Subcommittee that the *Minuteman* system would be eight times cheaper than *Polaris*.

"I am not saying that to take a crack at *Polaris*," he said. "I am saying we should be cost-conscious regarding the system we are going into.

"The mobile *Minuteman* is a relatively cheap system and has a very high survivability factor. I think there is a great challenge to use existing rolling stock wherever you can, a great challenge to put austerity in this program, a great challenge to use existing railroad personnel to run the trains and put the specialists there to fire the missiles."

Only a few days before the Power testimony was released, a *Polaris* test missile soared more than 1150 statute miles down the Atlantic Missile Range. The missile—launched the night of April 25—was the first in the *Polaris* series to exceed 1000 miles.

• **Double challenge**—Power said his figures on the comparative cost of the *Polaris* and *Minuteman* systems "may be subject to question." But he said his "people have worked them up carefully."

"I think the great challenge is to have the weapon systems that are not only effective from a military point of view but also competitive from a cost point of view. This is what we have addressed ourselves to and why we in SAC like the *Minuteman*. It is a cheap system, relatively. It is cheap in manpower and cheap in initial cost."

The Power testimony came as the overall national defense debate continued across the country:

• Secretary of Defense Thomas S. Gates told Associated Press editors at a luncheon in New York that the United States was going to Geneva backed by military forces that are strong and ready for all-out or limited war. He reiterated past denials that any "deterrent gap" exists.

• Gen. Maxwell Taylor, retired Army Chief of Staff, predicted at the 1960 National-Military Industrial Conference in Chicago that if present trends continue there will be a "dangerous imbalance" of military strength in favor of Russia within the next four or five years.

• Gen. Thomas White, Air Force Chief of Staff, denied charges that the United States is risking disaster by pursuing a philosophy of "overkill" in building strategic striking power. The charge was made by Maj. Gen. John B. Medaris, retired chief of the Army Ordnance Missile Command. White said at a luncheon in New York that he was "not sure what overkill is in a war for your survival."

• Gen. Laurence Kuter, North American Air Defense Commander, told the Senate Armed Services Committee in Washington that he was "deeply concerned" over cutbacks in the *Bomarc B* program and cancellation of the program to build the F-108 Mach 3 interceptor.

ASTIA Speeds Work with Automation

ARLINGTON HALL STATION, VA.—Automated operation of the Armed Services Technical Information Agency (ASTIA) has begun with the completion of the first phase of a complete mechanization of its technical information retrieval and distribution services.

The DOD scientific information center, operated by ARDC, has stepped up its efficiency an estimated 30% with new electronic computer equipment. The second phase of the mechanization program, scheduled for completion by July, will up this efficiency gain to 40%, according to ASTIA officials. A third phase will allow the agency to greatly expand its services to the military and DOD contractors.

The new electronic data processing system—centered around a Univac 90-column solid-state computer—cost $105,000 and an estimated 25 man-years of personnel time. The end result of the modernization will be much faster and better service to ASTIA's "customers" as well as significant savings in operating costs.

• **Major job**—The prime function of ASTIA is to provide scientists and engineers in military research and development with reports on work and findings on previous projects. Such information allows research personnel to keep abreast of scientific progress and apply the findings to current work.

Scientific reports in the ASTIA collection now number more than 750,000. New titles are catalogued at a rate of 30,000 per year. Approximately half a million copies of reports are furnished to requesters each year. The agency serves nearly 3000 qualified industrial users, 1400 military agencies and units, and 17 NATO and SEATO countries.

Practically all military R&D contracts require the contractor to furnish copies of reports on their work to ASTIA. These reports are screened, categorized, assigned reference numbers, and catalogued. Titles and abstracts of these reports are listed in a Technical Abstract Bulletin issued twice monthly and distributed to all qualified users. Copies of these reports may then be requested and furnished to those with an established need-to-know and military certification.

All reports are microfilmed and this film used for reference and to produce copies of the reports for distribution. An additional print of the microfilm is stored in vaults outside so-called "war-hazard" areas.

• **Big speed-up**—The addition of the electronic processing equipment has greatly simplified and speeded up the retrieval and distribution process. Titles are recorded on punched cards according to a just-completed "Thesaurus of ASTIA Descriptors" which categorizes the subject matter of the reports. Other punched cards contain information on all qualified users including pertinent contract numbers, need-to-know, and areas of interest.

Requests for copies are also entered on punched cards and these are fed into the computer along with the catalog and organization cards. The computer determines the validity of the request and prints out security classification information, inventory control data, reproduction instructions, and shipping labels. Copies of the requested report, if not in stock, are made from the microfilm by continuous process using either photoreproduction or the Xerox method. Shipment is usually made within three days from receipt of request.

In addition to copies of reports, ASTIA will also furnish bibliographies on specific subjects. These are furnished in the form of reproductions of catalog cards containing titles and abstracts of all available information on that particular subject. Printed bibliographies on major fields of science and technology in which there is wide interest are also made up periodically and distributed.

All contractors and subcontractors of the military services with a legitimate need for R&D scientific and technical information are eligible for ASTIA services. Eligibility is established through cognizant military project offices.

NASA Spurs Lunar Impact Program

The National Aeronautics and Space Administration set into motion two contracts last week which should culminate in the rough landing of a 300-pound instrument package on the moon in the spring of 1961.

In two separate releases NASA announced that:

• Aeronutronic Division of Ford Motor Co. has been selected to prepare a $3.5-million advanced capsule design study for a 300-pound package to be impacted on the moon by the *Atlas-Agena-B.*

• NASA will buy 16 *Agena-B* launching vehicles from Lockheed during the next three years at a cost of about $50 million.

The early launching date for the lunar impact vehicle, given by NASA officials in testimony before Congress, was somewhat of a surprise because the program had been injured by the cancellation of *Vega.* (See M/R, Dec. 21.) Besides not having the thrust of *Vega,* the *Agena-B* also lacks the midcourse guidance necessary for lunar probe shots. NASA officials think they can correct this deficiency during the next year.

The package which Aeronutronic will design is scheduled to contain a seismometer and a temperature-recording device, and the body of the space craft will carry a television camera system for photographing the moon.

At a distance of about 20 to 25 miles from the moon, the mushroom-shaped package will be detached and a retro-rocket will slow its speed to impact at less than 300 miles an hour.

The parent craft containing the television camera and weighing about 500 pounds will be destroyed as it impacts the moon at a speed of more than 5000 miles an hour. It is being constructed at the Jet Propulsion Laboratory.

Protecting the payload during rough-landing will be a honeycomb crushable material designed to absorb severe impact. The instruments are designed to radio back information to earth for a month or longer.

NASA lost time on its lunar impact program with the cancellation of *Vega.* The present schedule indicates that all of this time will be made up.

• **Background**—The conflict between *Vega* and *Agena-B* arose out of the President's national launch vehicle program, set up in 1959. Under this program, NASA was given the go-ahead on *Vega,* and any new launch vehicle system proposed by a service was to be cleared through the White House. *Agena-B* was not, and the President is said to have reacted with criticism of the Air Force.

But since the Air Force's *Agena-B* program was a fait accompli, either the *Vega* or *Agena-B* had to go. Decision was in favor of the *Agena-B.* NASA sources say the decision was political, based on the fact that Congessional criticism would be greater when an Air Force program is cancelled than it would be if a NASA program is cancelled.

• **Comparison**—The *Vega* engine, developed by General Electric, would have produced 35,000 pounds of thrust, had a start-restart capability, which, with its midcourse guidance system, gave it the capability of performing nearly circular orbits and placing payloads on the moon with great accuracy.

Vega would have been ready by the Spring of 1961.

Agena-B, which will not be ready for NASA use with *Atlases* until *Vega* would have been, develops only a little over 15,000 pounds of thrust from its Bell Aircraft nitric acid and UDMH engine. Though it has a start and restart capability, this is mated with an IR horizon scanner guidance system which is good for only roughly circular orbits.

The *Atlas-Agena-B* will have, however, the capability of placing the proposed 800-pound spacecraft on deep space missions, and will be able to rough-land 300 pounds of the craft on the moon.

The NASA announcement of the spring of '61 launch indicates its confidence that the mid-course guidance system can be introduced to the system by this time.

Douglas Aircraft Corp. has been selected from 34 other bidders to negotiate with NASA for fabrication of Saturn's *second stage. Estimated cost of development and production of nine second stages, including two spares, will be more than $65 million.*

Douglas's job will be to fabricate a frame for four 20K Pratt & Whitney LOX-liquid hydrogen engines. The stage, designated S-4, will be the second stage of the original Saturn *configuration, and the fourth stage of the final configuration.*

Dogulas will build the stage at its Santa Monica, Calif., Div., from where the stages will be barged through the Panama Canal up the Mississippi River into the Ohio River and into the Tennessee River to Huntsville for checkout and mating to the eight-engine Saturn *first stage. Then it must retrace its steps down the Mississippi River into the Gulf of Mexico through the Florida canal system into the Banana River to Cape Canaveral.*

This adds up to more than 10,000 miles of barge travel for the 50-foot-high, 18-foot-diameter stage from manufacturer to launch.

—news briefs—

NASA-NEGOTIATED CONTRACTS—National Aeronautics and Space Administration would have to submit complete data to Congress on all its negotiated contracts under a provision tentatively adopted this last week by the House Space Committee. Details required would include price, number of bidders and their proposals. The amendment to HR 9675 was an outgrowth of NASA's refusal to supply information on the Rocketdyne F-1 rocket engine award to General Accounting Office and the Space Committee.

ASW SUB LAUNCHED—First Nuclear-powered ASW killer submarine, the Tullibee, was launched last week at the Electric Boat Yard of General Dynamics Corp. Vice Adm. Edmund B. Taylor, commander of the Atlantic Fleet Anti-submersible Defense Force, called it America's most advanced weapon against the Soviet undersea fleet.

ATLAS **FROM COFFIN**—Air Force said last week its new coffin launching complex for the *Atlas* at Vandenberg Air Force Base is operational. First shot from the coffin launcher on April 22 impacted 4300 miles west, near Wake Island. Missiles are stored horizontally in the coffin launchers, then erected for firing.

DOD is Killing Proposed Gag on Ads

As M/R went to press this week a proposed Department of Defense directive which would give DOD the power of censorship over all defense industry advertising, speeches and press releases appeared to be dead and awaiting burial.

A Defense Department spokesman quoted Murray Snyder, assistant DOD Secretary for Public Affairs, as saying he was "going to recall the damned thing." Credit for its recall was given to the publicity which followed a news leak on the story. This was followed by a blast from Congressman John E. Moss, chairman of the House Government Information Committee, and a defensive statement by Snyder.

The Defense spokesman said that the proposed directive, which would virtually have placed all statements and advertising by military contractors under Snyder for "policy" control, was not prepared by Snyder's office. It was put together, with Snyder's concurrence, he said, in the office of Perkins Mcguire, Assistant DOD Secretary for Supply and Logistics, and in its original form was actually much more stringent than in the version which leaked.

All three military services protested the proposed directive when it was sent to them for coordination. Defense contractors when they learned of the proposed censorship also protested violently.

"Under the circumstances," said the spokesman, "it would be impossible to get the directive out now."

• **Advertising "czar"**—Moss protested that the directive would have given Snyder "the powers of an advertising czar." If the plan went into effect, he said, "I fear it would do a great deal to prevent intelligent discussion of defense policies which may mean life or death to the United States."

The directive was viewed as interfering with freedom of speech under provisions (see Section VIII below) automatically disapproving the release of any material by contractors which could be interpreted "as intended to influence the adoption, revision or cancellation of plans, programs or policies of the government, including legislation."

Mcguire defended the directive as the only way he knew of stopping "objectionable" advertising. But critics said it went far beyond suggestions of the Hébert Committee to stop questionable ads.

Text of Snyder Ad Censorship Directive

I. **Purpose**

The purpose of this Directive is to set forth guidelines and procedures for the security review and clearance for public release by defense contractors (including subcontractors) of advertising material and other public information concerning products and services purchased by the Department of Defense.

II. **Cancellations**

DOD Directive 5230.3, dated 18 January 1952, and DOD Directive 5230.5, dated 24 September 1953 are hereby cancelled.

III. **Policy**

Persons and firms furnishing products and services to the Department of Defense, (including non-profit organizations and educational institutions) and officers, employees, representatives and agents of such persons and firms, shall not release, for public dissemination, information regarding products or services except as authorized in this Directive or approved in advance by the Secretary of Defense or his designee.

IV. **Delegation of Approval Authority**

The Assistant Secretary of Defense (Public Affairs) is hereby named as designee of the Secretary of Defense for the purpose of approving or disapproving requests for clearance of information coming within the scope of this Directive, this clearance to be exercised through the Office of Security Review. In appropriate cases decisions shall be made in coordination with the General Counsel and The Assistant Secretary of Defense (Supply and Logistics).

V. **Authorized Issuances**

A. Contractors shall be authorized to release to the public, without advance approval, the following information pertaining to unclassified or classified contracts for products and services purchased by or furnished to the Department of Defense:

1. Statements that a contract has been awarded.

2. The type of product or services involved, in general terms (such as aircraft of standard types, tanks, trucks, ammunition, clothing, construction; or study of a new electronics system or a high altitude research study, etc.), provided the designation of the product or services is not itself classified.

3. With respect to unclassified contracts only, releases may include the name of the Department of Defense contracting office, a brief description of the product or service involved, the quantity of products to be furnished, and the dollar amount.

4. Help-wanted and recruiting information, which does not divulge classified material.

5. A general statement of the kinds and numbers of additional employees which will be required by the facility involved.

6. Announcement of subcontracting opportunities for unclassified subcontracts, providing no classified material is made public concerning the prime contract or higher tier subcontracts.

7. With respect to research and development work performed by nonprofit organizations and educational institutions, unclassified information of public or professional interest pertinent to accomplishments under a con-

ract, provided the release of such information is not limited by terms of he contract. The release of unclassified information derived from research nd development contracts is encouraged, as the dissemination of such nformation will accrue to the general enefit of the United States.

8. The specific information, in the pecific format previously approved ursuant to VII below.

B. In order that manufacturers olding classified Department of Defense contracts may make state of usiness reports to stockholders, stock exchanges, etc., the total company-wide dollar value of backlog may be released provided:

1. That only the Department of Defense total is used and not broken down by individual military service or tem.

2. That the release does not reveal the quantity or volume of individual orders.

3. That the report is not made for period of less than three months.

C. In case of doubt as to the releasability of information pursuant to this paragraph, contractors should follow the procedures of VII below.

VI. Issuances Requiring Prior Approval

Contractors shall not be authorized to release information other than that set forth in V above without prior aproval of the Office of Security Review, Office of the Assistant Secretary of Defense (Public Affairs). Paragraph VIII below sets forth those types of releases which will not be approved, and therefore should neither be released nor submitted for approval. Examples of information which may not be released without such approval are:

1. Production schedules, future planning on production schedules, or rates of delivery.

2. Information on sources of supply, quantities and qualities of strategic or critical supplies and movements, assembly or storage of supplies or material.

3. Information on sabotage attempts or plant security measures.

4. Information any research and/or development projects, except as provided in V. A. 7, above.

5. Information on any missiles, nuclear devices or weapons; "BW-CW" agents, materials or weapons; and other new weapons or weapon systems.

6. Information, including any photograph, sketch or plan concerning first models of weapons or equipment, outstanding production achievements, or performance of weapons or equipment.

7. Information on material for shipment to allied governments under MDAP, NATO, etc.

8. Movement of military aircraft or naval vessels. (This restriction is applicable to all cases, including those where actual movement order is unclassified.)

VII. Approval Procedures

A. Persons and firms (including non-profit organizations and educational institutions) desiring approval to release information other than of the type set forth in V. above, shall forward requests for approval in writing to:

Office of Security Review
The Assistant Secretary of Defense (Public Affairs)
Washington 25, D.C.

The military departments are authorized to provide in contracts that requests for approval shall be submitted through designated departmental officials or offices. Subcontractors shall forward requests through prime contractors, who shall be responsible for initial screening of submitted material.

B. The information proposed for release shall be attached to the request, precisely in the format and substance desired to be released, including any photographs, sketches, plans, blueprints, models (if practicable), charts, etc., or other art work which are proposed for release.

C. Approvals are restricted to the specific release submitted for approval. Any change whatsoever in format, art work, or substance requires a new approval.

VIII. Issuances Which Shall Not Be Approved

Proposed releases containing the following types of information shall not be approved:

1. Inaccurate, incomplete, or misleading material. (E.g., inappropriate claims of operational availability or operational capability of products under research or development or furnished to the Department of Defense).

2. Appraisal of the military effectiveness or ineffectiveness of weapons and weapon systems of the United States or other countries, or discussion of the economic impact of award or cancellation of specific defense contracts, or continuance or discontinuance of specific procurement programs or the military strategy and tactics upon which such programs are based, where, in either case because of timing, content, magnitude or a combination of any of these elements, release of information could reasonably be interpreted as intended to influence the adoption, revision or cancellation of plans, programs or policies of the Government, including legislation.

3. Discussion of the relative merits of conflicting military strategies and tactics, which may affect the purchase or development of products or services by or for the Defense Department.

4. Classified information, or information pertaining to research, methods, or end products that develop a security classification in an otherwise unclassified contract.

5. Statements concerning movements of military aircraft and naval vessels, unless screened by the responsible commander.

6. Statements concerning qualifications, acceptance or approval of products or services furnished to the Department of Defense; that a contractor is the sole supplier of a product or services or, the percentage of prime contractor's requirements provided by a subcontractor, in terms of quantity or dollar value.

IX. Implementation

A. The following contract clause shall be inserted in all contracts involving research, development and experimental work, classified contracts, and all other contracts for more than $100,000:

"The Contractor shall not release for public dissemination information regarding products or services purchased by the Department of Defense except as authorized or approved in advance by the Secretary of Defense, or his designee. Procedures for securing approval shall be as set forth in Appendix F, Armed Services Procurement Regulation, entitled "Manual for Release of Information By Contractors," issued [date], as said Manual may from time to time be amended, which is hereby incorporated by reference with the same force and effect as though fully set forth. The substance of this clause shall be inserted in all subcontracts involving research, development and experimental work, classified subcontracts, and all other subcontracts for more than $100,000. Authorization or approval for release under this clause shall not be construed to authorize or approve payment for the cost of releasing information."

B. The substance of this Directive shall be published in a "Manual for Release of Information by Contractors" and inserted as an Appendix to the Armed Services Procurement Regulation.

C. Violations of this Directive shall be brought to the immediate attention of the Office of Security Review and, as required, the Assistant Secretary of Defense (Public Affairs) will consult with the General Counsel and the Assistant Secretary of Defense (Supply and Logistics) concerning appropriate action.

Temco Consolidating with Ling-Altec

Temco Aircraft and Ling-Altec Electronics last week disclosed plans to merge into Ling-Temco Electronics, a combination expected to both diversify and strengthen the two companies in missiles and electronics.

The proposal is to be acted upon shortly by stockholders and directors of the companies, both headquartered in Dallas.

Temco, prime for the Navy's *Corvus* air-to-surface missile, suffered a setback in sales during 1959 and earnings slipped from $1.50 a share in 1958 to 68 cents last year. The company had a backlog of about $83 million on March 31, 45% in missile and electronic work.

Temco recently picked Clyde Skeen, former vice president of weapons system program management of Boeing's aerospace division, to be its general manager. He is to become president of the new company.

A major component supplier, Ling-Altec is an integrated company with considerable electronic research and development facilities. It had sales of about $48 million last year compared to $100 million for Temco. Combined asscts of the two companies total about $69 million.

The merger announcement said management and key operational employes of both companies would remain much as they are now. Slate of officers of Ling-Temco would have Robert McCulloch, Temco's president, as board chairman and chief executive officer; Ling-Altec chairman James J. Lang would be vice chairman and chairman of the executive committee. Lee D. Webster of Ling-Altec would be executive vice president.

mergers and expansions

AERONUTRONIC DIVISION—Ford Motor Co. has dedicated its partially completed 200-acre Engineering and Research Center at Newport Beach, Calif. Aeronutronic expects to employ approximately 3700 persons at the facility by 1962.

UNITED CONTROL CORP. is planning a 136,000 sq. ft. combined engineering and production facility on a 30-acre site in Overlake Industrial Park, east of Seattle. Employment will be 1000 persons by completion in Feb. 1961.

TELECOMPUTING CORP. of Los Angeles has purchased the previously unacquired 13% of its Frank R. Cook Co. subsidiary to make it wholly-owned . . . Materials Products Corp. (Melcor) is planning an 80,000 sq. ft. expansion adjoining its present site in Trenton, N.J. The less than year-old firm manufactures thermoelectric modules for cooling applications.

SCINTILLA DIVISION of Bendix Aviation Corp. has broken ground for a 30,000 sq. ft. engineering and production plant for Bendix cabling operations at Santa Ana, Calif.

ASTRONAUTICS, INC., is the name of a new engineering, manufacturing and technical firm establishing in Eau Gallie, Florida. Three former RCA managers of the AFMTC are part of the executive committee; George W. Soderquist of Eau Gallie, Herbert Kilberg and Robert E. Wilkinson. More members will be added to the board of directors.

SYLVANIA ELECTRIC PRODUCTS INC. is planning another expansion. A 180-acre, campus type electronic data processing center will be built in Newton, Mass. with some 200,000 square feet for development of data processing techniques and equipment.

BELL & HOWELL company and its subsidiary, Consolidated Electrodynamics Corp. have combined research activities and will add 30% more personnel than the two previous departments.

ELECTRONIC ENERGY CONVERSION CORP. has acquired 82% of the common stock of Behlman Engineering Co. of Los Angeles, and its subsidiary Custom Magnetics, Inc. No changes in personnel or policies are contemplated, according to the company.

NORDEN DIVISION of United Aircraft has purchased a 35-acre tract in Costa Mesa, to build a 50,000 square-foot engineering, research, and manufacturing facility for its Data Systems department. Operations now being conducted in leased plants in Gardena and Santa Ana, Calif. will be moved to Costa Mesa.

JACK & HEINTZ, INC. has bought the business assets and manufacturing rights of Roto-Lock Couplings; Inc., South Gate, Calif. Roto-Lock's inventory and tooling will be moved to Cleveland.

CONTINENTAL ELECTRON CO. stockholders have voted to change the corporate name to Cetron Electronic Corp., under which many of its products are already sold.

IMC MAGNETICS CORP. of Westbury and Los Angeles has acquired 80% of shares of the Arrow Valve Corp of Phoenix, Arizona producers of high precision jet atomizers, valves and filters. Arrow will work closely with the PSP Engineering Division of IMC, Maywood, Calif.

LAMBDA ELECTRONICS CORP. has broken ground on a 76,000 square foot electronics plant at Huntington, L.I., N.Y. to which it will move from College Point.

financial news

Thiokol Chemical Corp.—An explosion at the Longhorn facilities caused a 35% reduction in Chemical Division sales during the first quarter of this year. Sales in the Rocket Division were up 27%, but much of these sales represented reimbursement for costs in excess of original estimates under cost-plus-fixed-fee type contracts so did not contribute to profits. Net earnings for the three months ending March 31 were $817,820, a decrease of 37% from the corresponding period of 1959.

Martin Co.—Both sales and earnings increased in the first 1960 quarter over the last year's first quarter total. Net sales and other income rose to $140 million, 14.9% over 1959's $122 million. Net income rose 14.8% to $3.5 million from $3 million.

Douglas Aircraft Co.—Sales of $251 million for the first quarter of FY 1960 ending Feb. 29 compared favorably with quarter sales of $227 million a year ago. Douglas suffered a loss in income of $6.9 million this quarter compared to a loss of $8.1 million in 1959. Backlog as of Feb. 29 was $1.4 billion, of which $746.2 million or 52.8% was in military orders. This total is some $79 million less than total backlog at the end of the first 1959 quarter.

At 00h00m01s GMT, May 1, 1960, Martin logged its 523,692,000th mile of space flight

To keep the lonely vigil . . . *Martin PM-1 air-portable nuclear reactor, to supply electricity and heat at remote Air Force stations, is now being developed and produced for the AEC.*

MARTIN

You're on the inside of the entire $45 Billion Military Market when you advertise in Armed Forces Management—reaching 17,000 top military and civilian personnel in the Department of Defense. Over 4,000 copies go to the Pentagon alone! It reports with authority on military policies, politics, plans . . . editorial material of interest, value and importance to all the military services.

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Technical Countdown

ELECTRONICS

Solid-State Breakthrough Due

Watch for announcement of a major breakthrough in solid-state devices in the next few months. The work is in progress at a university research laboratory.

IR Detects Long Distance Launchings

Highly successful infrared photographs of missile performance over long distances have been obtained by Perkin-Elmer Corp. under an Air Force contract—results that will have obvious implication for the *Midas* early-warning satellite program. Meanwhile, another *Midas* launching is reported to be very imminent.

Missile Path Detection Studied

Melpar's Applied Science Division is studying the feasibility of recognizing missiles and space vehicles by the paths they leave in space or the atmosphere, under an ARDC contract.

AMR Develops Automated Central Computer

An automated centralized computer center, to be operational by July 1, 1963, is under development at Atlantic Missile Range. Design objectives include computation and display of real-time trajectory and telemetry data, completely reduced data six hours after test, and a final data report containing complete test information.

E-OS Improves Solar Concentrators

Solar concentrators with efficiencies approaching 90% and weighing less than 1/3 lb./sq. ft. have been developed by Electro-Optical Systems. Future units of 5-10 ft. diameters will provide 1200-1500° F temperatures.

Paper Will Bury Us

Chrysler Corp. publications chiefs say a continued "information explosion" will demand an increase of 66,000 technical writers in industry and government by 1970. Tech publications industry now employs 35,000; grosses $4 billion a year.

GROUND SUPPORT EQUIPMENT

LOX Trailer Totals Revealed

Air Products Inc. has built 127 LOX semi-trailers for missile/space use in the last two years, all of 4000-gallon capacity. Company has been awarded a $1,801,632 Army contract to produce *Jupiter* trailers.

Com System Weight Cut

Paraballoon antenna will be used to reduce weight and size on a mobile troposcatter communications system Westinghouse is developing under a $2.6 million Air Force contract.

PROPULSION

Plumbing Worst Headache—Schriever

The biggest problem in developing long-range missiles has been plumbing, says Lt. Gen. Bernard A. Schriever. There are a lot of valves and regulators that must operate under extreme conditions, the ARDC commander said.

Kiwi-A Prime Checks Begin

Cold-flow checks began last week on a mockup of *Kiwi-A Prime,* a device that will be fired this summer as the second test in the Project *Rover* nuclear rocket program. Mockup at Los Alamos Scientific Laboratory is similar to the rocket to be fired at Jackass Flats, Nev., except that it contains no radioactive material.

France Builds Bigger Solids

A solid-propellant grain weighing 2645 lbs. is under development by the Service des Poudres, France's in-house rocket agency, in the nation's IRBM program. During the 1961 budget year, grains will be scaled up to 8-10,000 lbs. and later to 50,000 lbs.

Booster Recovery Design Study Set

Boeing Airplane Co. will prepare a preliminary design for a recoverable booster system under a nine-month contract awarded by ARDC. Although no application was mentioned, a recoverable booster would have obvious *Dyna-Soar* application.

H-power Answer Due in 5 Years

Researchers will know in five years whether magnetically controlled thermonuclear power is feasible, says Dr. Richard F. Post of Lawrence Radiation Laboratory, Post believes the answer will be yes, he told the American Physical Society.

ADVANCED MATERIALS

Lockheed Takes Up Hot Question

A series of 50 re-entry models for Mach 18 manned orbital and interplanetary flight will be studied by Lockheed under an Air Force contract.

Super Insulation Use Licensed

A super insulation developed by National Research Corp. will be used in manufacture of long-term storage vessels for liquid helium, hydrogen and fluorine. Standard Pressed Steel Corp. has obtained NRC license.

Gear Production Automated

A computer will be used to plan production or gear production tools at National Broach and Machine Co. A Bendix Alpha-Numeric computer has been installed.

ASW ENGINEERING

Marine Communication Technique?

The fish and animals of the sea may teach the Navy how to combat submarines. Adm. Arleigh A. Burke, chief of Navy Operations, says a study of sea-animals' communications may provide an answer to the under-sea detection dilemma.

SPACE MEDICINE

Zero-Gravity Plane Planned

Boeing plans to fit a KC-135 tanker-transport to test human reactions at zero gravity. By flying into a ballistic trajectory at 25,000 ft., the plane will be able to simulate weightlessness up to 40 seconds.

Personnel Problem?

Getting people to man space stations, once the romance has worn off, will be as tough as finding lighthouse keepers, concludes North American Aviation engineer Fred Payne. Boredom will be the killer.

Digital Decommutator Is Big Advance

EMR system can be used with any pulse-type telemetry—early model slated for use at Fort Huachuca

by Charles D. LaFond

Electro-Mechanical Research, Inc. of Sarasota, Fla., has developed for the first time a digital decommutator that can be used with any pulse-type telemetry system. Now in production, the system is a significant advance in missile and space vehicle data handling.

With solid-state modular construction throughout, the extremely compact equipment can perform all types of data reduction and decommutation in addition to providing a variety of digital or analog outputs.

EMR, which developed the system at a cost of over $1 million and 2½ years of work, believes there is no equivalent on the market.

Costing roughly $30,000 each (depending on the functional configuration), both the military and many missile primes have contracted for systems now in production. An early version of the system will be installed by Beckman Instrument at the Army's Fort Huachuca test facility in Arizona.

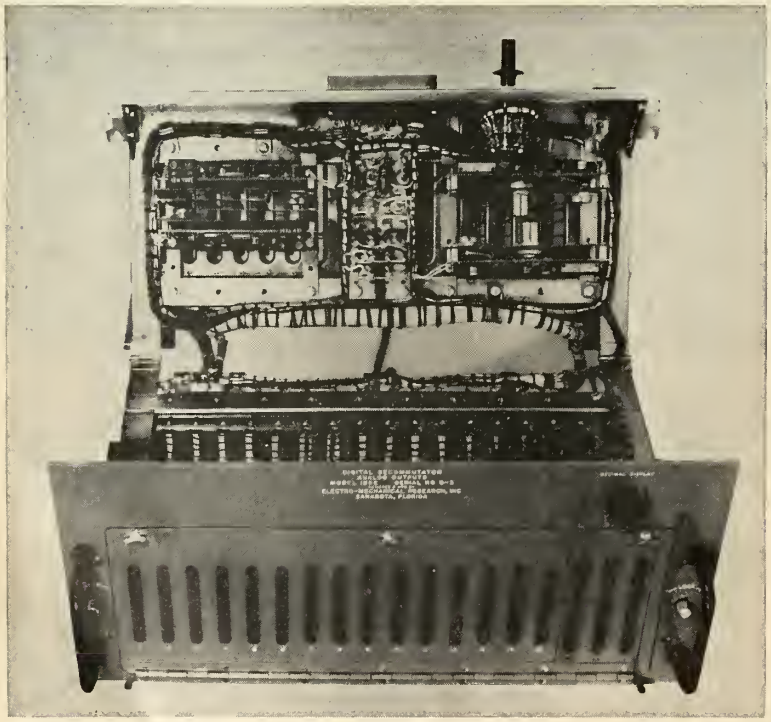
• **Adaptability**—Flexible in its functional configurations, the Model 185 digital decommutator can be adapted by the use of several different subsystems to accept any pulse type telemetry signal input (PAM, PDM, PCM, etc.) over a wide range combination of possible sampling rates and number of channels in a frame, its developers say.

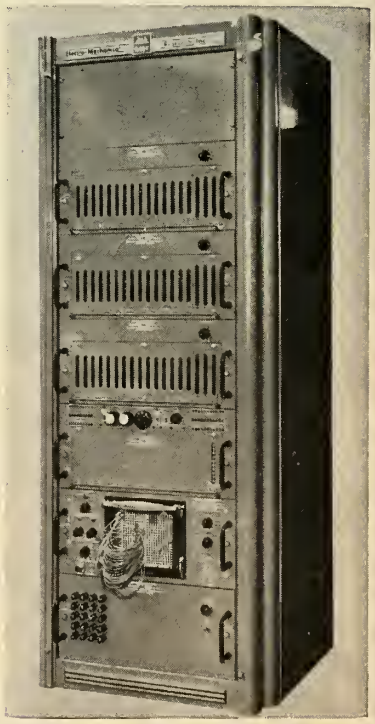
Pure binary and binary-coded-decimal outputs can be provided in multiplexed form for tape recording or decommutated for digital computers and printer readout. If desired, an analog output in decommutated form can be produced with an 8-bit binary display and a 3 x 4 binary coded decimal display. Almost all other forms of standard readout also are available.

Because digital techniques and circuitry are used from input to output, an unusually high degree of stability, freedom from noise and jitter, indifference to missing channels, and overall synchronization are attained.

• **Operation**—The EMR Model 185 will accept PAM (pulse amplitude modulation) or direct and taped PDM (pulse duration modulation, a form of pulse time mod.) signals at any sampling or playback rate from 28 to 4600 pps. From 10 to 128 channels/frame can be processed.

For PCM (pulse code modulation) operation, rates are 128 words/frame and 4600 words/sec. max, with either 28 words/sec. min, or 16 words/sec. min., depending on subsystem configuration.





LEFT: TYPICAL ANALOG output drawer of the EMR Model 185. Top half of the inner chassis swings up exposing vital circuitry for easy maintenance and accessibility. Logic circuitry on modular cards is accessible at the front-panel. RIGHT: EMR MODEL 185 digital decommutator, because of its solid state modular construction, packs a 48-channel decommutator in less than a single rack. The three upper panels each contain a 16-output analog drawer. An 8-bit binary front-panel display is associated with each analog channel and any channel can be selected for front-panel decimal display.

Word and frame synchronization logic for the PCM circuitry is such that a transmission fadeout or change in data bit rate causing momentary loss of sync will not result in an output error. If the proper sync word is not recognized by the synchronization logic within 5% of expected arrival time, all data transfer is inhibited.

Other safety features are built in to give correct recognition and prevent false transfer of data. Transmission mode conversion—PCM to PNM (pulse number modulation) and back to PCM—cannot cause data degradation or increase error rate.

Synchronizing and programing logic is completely digital. Integrations are performed numerically; filtering is handled digitally or in the time domain to achieve flexibility and to provide perfect holding and fast response.

The PCM storage reads out straight parallel binary multiplexed outputs for tape recording at various rates: 10 bits at sampling rates up to 1150 pps—an 11th bit indicates overflow; 8 bits at higher sampling rates. A binary coded decimal storage reads out a multiplexed BCD output (12 bits for 3 digits, 8421 code). A 17-in. oscilloscopic bar chart display also can be provided.

For decommutated outputs, PCM channel data is directed to an output memory by plug-in patchboard. Memories are digital units, capable of indefinite storage without decay, which drive binary-to-analog converters. The converters have similar hold characteristics. A variety of converters can be used for driving the standard types of pen or film recorders.

Decommutated digital outputs also can be provided in straight binary, BCD, or straight decimal form for driving standard printers or type recorders.

• **Characteristics**—In the present system, 10 to 128 channels are available. (Standard 19-inch rack chassis are used.)

Sample rates are variable continuously between 28 and 4600 pps, and nine coarse ranges can be selected by switch.

A 20% pulse rate variation can be obtained beyond the edge frequencies determined by range setting. A 12-cps pulse-rate modulation of ±20% peak amplitude at 900 samples/sec. can be followed without loss of sync.

Synchronization can be held with up to ±12% jitter of the channel-sync pulses. Jitter frequency can be greater than 500 cps, the company says.

Nor will sync be lost with up to 20 consecutive missing pulses, at any sampling rate. In describing the system, a company spokesman said the system locks on the fifth pulse if four consecutive pulses are lost. (This would be at an average sampling rate of 900 cps, modulated at 6 cps to peak sampling-rate drifts of ±20%.) The system also locks on the frame-sync signal after 20 consecutive missing pulses under the same conditions, he said.

From 28 to 1150 pps, resolution depends on number of bits: 0.1% at 10 bits; 0.4% at 8 bits. Resolution is fixed at 0.4% for over 1150 pps.

Linearity is ±0.04% from the best straight line.

Without employing automatic compensation, sensitivity will drift less than 0.5% over a 6-hr. period. With compensation, drift can be held to within 0.1% of full scale with the 10-bit output or to less than 0.4% of full scale for the 8-bit output.

EMR Model 185 Electrical Specification

Type Input	Duty Cycle (%)	Sample Rate (pps)	Bit Rate-Serial (bps)	Word Rate-Serial or Parallel (wps)	Word Length Max. (bits)	Frame Length (words)	Input Impedence (ohms)	Input Level (volts)*
PAM	40–90	28–4600	.....	.....	..	.....	40K	2–100
PDM	(Ref. IRIG Document # 103–56.) Proportional over 900 pps	900–4600	.....	.....	..	.....	40K	0.5–100
PCM	.....	.....	120–60,000	16–4600	16	10–128	40K	0.5–100

* Peak to peak, single- or double-ended, either polarity.

Special Handling Demands Are Basic to Launch Success

PHILADELPHIA—Prelaunch time element and even success of a missile launch depends to a large degree on the unglamorous general handling phases of the missile and its components. Some electrical equipment and materials, said Robert Moyer at the A.I.E.E. Materials Handling Conference here recently, demand special care and attention.

So necessary are these for the internal missile subsystems that improper handling techniques can limit performance and prevent mission accomplishment.

Complex handling problems occur not only with the missile itself but with the ground support equipment too. Missile mission dictates the kinds of problems encountered, says Moyer.

Typical extremes, he said, would be the fixed-installation *Atlas* or *Titan* launch as compared with the highly mobile *Lacrosse,* completely self-contained and carried on an Army 2½-ton truck.

Moyer, electrical lead engineer in Martin's *Titan* firing group at Cape Canaveral, described the following missile and GSE electrical areas offering the greatest need for special handling techniques:

MISSILE SUBSYSTEMS

• **Primary batteries**—Silver-zinc automatically activated batteries are used in many different missiles ranging from the short range artillery types to ICBM's. Special attention is required from the standpoint of temperature control prior to activation and of electrolyte overflow disposal. (The electrolytes are caustic and corrosive—usually a 30% solution of potassium hydroxide.)

For extended periods of exposure (over 2 hours) prior to activation in temperature environments beyond the range of 40°F to 125°F, a temperature control device must be employed to obtain rated energy output.

Low-temperature problems are solved easily by a heater, powered from external support equipment. Although not so frequently encountered as the lower temperatures, temperatures above 125°F require use of air conditioning devices during pre-launch operations.

For ICBM's this is not too difficult since the equipment and power source do not create an unwieldy requirement.

For short-range mobile missiles, the employment of an air conditioning device is more of a problem. To avoid the bulk of a complex air conditioning system powered from an external source, fans may be directed on the batteries. Also, the battery could be installed just prior to launching time, but for operational missiles it is expedient that a missile have a minimum of ready time.

Disposal of electrolyte overflow after battery activation can be readily taken care of by connecting a stainless steel or plastic tube from the battery

vent to an overboard drain. Disposal inside a missile could cause serious electrical short circuits or even damage other components or missile structure.

Activation time of a primary battery must be at the latest possible time prior to launch. This precludes the need for battery replacement if other launch delays occur. Batteries are good for about two hours under no-load conditions, but if a launch delay occurs after the missile loads have been applied, battery replacement is mandatory.

Automatically activated silver-zinc batteries require practically no attention during the unactivated shelf-life period.

• **Secondary batteries**—Rechargeable secondary silver-zinc and nickel-cadmium batteries still have missile-program applications. Larger and heavier than the primary batteries, they require charging within 4 days prior to use. To maintain instantaneous readiness for an operational missile, batteries must be removed every four days for discharging and recharging. This is a cumbersome task.

Charging sometimes involves a tedious process in eliminating internal battery shorts due to electrolyte spillage. Disassembly may be necessary to remove completely the electrolyte spillage. However, during operation no electrolyte overflow drain is necessary.

• **Thermal batteries**—Relatively free from special handling techniques, thermal batteries have application only in those missiles having low electrical power requirements and short operating time (under one minute).

• **Hot-gas APU's**—Gas turbines such as the monopropellant (ethelene oxide) and bipropellant (LOX and RF_1) are much less extensively used at the present time than are batteries as auxiliary power units. So far, the problem of storing and handling of propellants has precluded extensive use of the gas turbine.

When gas turbines are used, provision must be made to protect other components in its proximity from the high temperatures and exhaust gases. Usually in bipropellant systems combustion of exhaust gases takes place when coming in contact with oxygen from the atmosphere.

A distinct advantage of the gas turbine is its relative freedom from the effects of high and low ambient temperatures.

• **Other power equipment**—Inverters, converters, and transformer rectifiers usually present handling problems only when exposed to extreme ambient temperatures. Extreme temperatures can severely affect windings of motor and generator fields, carbon and wire-wound resistors, and transistors.

High temperatures encountered during pre-launch operations result primarily from heat dissipation of electrical and electronic units. Also, missile compartment temperatures have been elevated up to 145°F just from solar radiation.

An external air conditioning system using an external power supply can solve the problem during pre-launch operations. Cooling capability is usually only that which is available from heat sink of the equipment itself. In most cases this amounts to an operating time of only slightly more than that required for flight operating time.

Ambient temperatures can be expected to be as low as −65°F due to geographic location. With proper design, compensation for these low temperatures can be achieved with little weight increase. In liquid-propelled missiles where liquid oxygen is used, compartment temperatures can be expected to go much lower than −65°F; compartment temperature is a function of the time cryogenic propellants are required to be in the tanks prior to launch. This problem exists primarily in the longer range missiles where it has been solved by an external air conditioning device.

• **Connectors and cables**—Missile electrical connectors and cabling present very few problems during the process of operational handling. Missiles located in areas exposed to high relative humidity and salt spray present the greatest problems.

A continual maintenance program is necessary to keep any electrical termination from being exposed to these environments. When necessary to remove individual wires or disconnect electrical connectors, care must be taken to protect against corrosion. The entire connector or exposed termination should be covered with a moisture-proofing compound of silicone-rubber and activator.

Particular care must be taken at all times to prevent wire insulation from being punctured.

Great care must be taken with electrical cables in the proximity of the missile engine. Cable is available now which can be exposed to ambient temperatures up to 1000°F. Additional protection is sometimes added by wrapping a cable with asbestos and aluminum tape.

In liquid-propelled missiles there is the possibility of small fires in the engine compartment due to propellant leakage. If cables are sufficiently wrapped with protective tape they can tolerate small fires without causing electrical system failure.

SUPPORT EQUIPMENT

• **Cables and umbilical connectors**—For pre-launch operations a number of circuits usually are provided to the missile for external power, operation of missile relays and valves, and telemetry. To achieve successful missile operation, disconnect of these umbilicals must be made at a specified time.

Umbilical release is performed electrically, mechanically, pneumatically, and simply by pull-away (or any combination of these methods). Design trend has been toward the pull-away release for improved reliability.

Great care must be taken when installing umbilical connectors to prevent damage or misalignment. Umbilical connectors which contain large power pins sometimes require pin lubrication to assure release. A coating of Dow Corning No. 4 has been used successfully for this purpose.

For pre-launch operations, protection must be provided against moisture and salt spray between the umbilical connector and the missile connector. An application of silicone rubber compound sealing the umbilical connector to the missile provides good protection against corrosion.

At missile launch, umbilical cables are sometimes exposed to very high temperatures from the missile engines. Protection can be accomplished by wrapping the exposed cables with a layer each of asbestos and aluminum tape.

• **Power equipment**—Power requirements for a missile operation vary from a few hundred watts to as much as 1000 kw. For ICBM's the power problem just becomes one of designing an electrical power system large enough to meet the load requirements. For mobile-launched and air-launched missiles, missile-component design is critical from the standpoint of a minimum requirement for external electrical power.

Sufficient power for air launched missiles usually can be derived from generators mounted on the accessory pad of the aircraft's engines.

Missiles operating from mobile launchers, in various environments, sometimes have power requirements greater than that available from the prime mover. When this occurs an auxiliary power unit is required. The attendant operational problems are that of providing a fuel supply and maintaining a battery power source including battery heater for operations in low temperatures for starting purposes.

Missiles and Rockets

ASTROLOG

A status report on U.S. missiles and rockets and all space vehicles presently in orbit

★ *Indicates change since March 7 edition*

PROJECT	CONTRACTORS	DESCRIPTION	STATUS
SPACE VEHICLES			
★ADVENT (ARPA-Air Force)	GE-Bendix prime for polar-orbiting phase	New overall name for advanced communications satellites STEER, TACKLE and 24-hour instantaneous repeater called DECREE	R&D
AGENA (Air Force)	Lockheed, prime; Bell, propulsion	1700-pound satellite after burnout	Used in DISCOVERER program; larger model to be used with ATLAS and THOR under development; NASA also will use to take place of cancelled VEGA
★ATLAS-ABLE (NASA)	STL, prime; GE/Burroughs, Arma, guidance; Rocketdyne, Aerojet-General, ABL, propulsion	Orbit 200-lb. vehicle around moon or send into deep space	Two lunar orbit attempts beginning this summer
CENTAUR (NASA)	Convair, prime; Pratt & Whitney/-JPL, propulsion	Soft-land 730-lb. on moon; first liquid hydrogen engine; 30,000-lbs. of thrust	First test flight in spring, 1961
COURIER (ARPA-Army)	Army Signal Corps, prime	Delayed repeater communications satellite	R&D; satellite in advanced stage; first to be launched in spring
★DISCOVERER (Air Force)	Lockheed, prime; GE, re-entry vehicle	THOR-AGENA launchings of early stabilized satellites	Of first 11 launched, 6 stabilized in orbit; ejected capsules not recovered
★DYNA-SOAR I (Air Force)	Boeing, space craft and systems integrator; Martin, propulsion	Boost-glide orbital space craft; first space bomber; TITAN booster	R&D; first glider flights from Edwards AFB by 1962; intensive material studies underway
★ECHO (NASA)	Langley Research Center, prime	Puts 100 ft. inflatable sphere in 1000 mile orbit; passive communication satellite	First launch due this month
JUNO II (NASA)	ABMA/Chrysler, prime; Ford Instrument, guid.; Rocketdyne/JPL, prop.	Early deep space booster; small payload	Five more shots planned
★MERCURY (NASA)	NASA, prime; McDonnell, capsule	First manned satellite	Capsule tests on ATLAS to begin; manned capsule launching by REDSTONE down Atlantic this summer; first manned flight scheduled in 1961; first abort capsule test set for May
★MIDAS (Air Force)	Lockheed, prime	Early-warning satellite; detect ICBM launchings by infrared before birds leave pad; R&D models weigh 2 tons; operational system to have 12-15 satellites	R&D; early launchings from Cape; later from Pacific Missile Range's Point Arguello; transferred from ARPA to Air Force; first R&D launching Feb. 26 failed because of apparent trouble in second stage; second launching imminent
★NIMBUS (NASA)	Contract to be let shortly	Follow on to TIROS weather satellite	Study
★NOVA (NASA)	No prime announced; Rocketdyne, propulsion	Clustered 6-9 million lb. booster plus upper stages	Early R&D on 1.5 million lb. F-1 engines
★ORION (ARPA-Air Force)	General Atomic	Space station launched by series of atomic explosions	Advanced engineering studies under way; tests may be attempted; program shifted to Air Force alone

PROJECT	CONTRACTORS	DESCRIPTION	STATUS
★PROJECT 3059	No contracts announced	Solid motor in 1 million to 2 million lb. thrust class	Research determining feasibility; study contract expected soon
SAMOS (Air Force)	Lockheed, prime	Reconnaissance satellite; formerly SENTRY	R&D; stabilization already achieved in DISCOVERER series; first test launching scheduled this spring; transferred from ARPA to Air Force
★SATURN (NASA)	NASA Huntsville Facility, prime; Rocketdyne, Pratt & Whitney, propulsion; others not announced	Five-stage vehicle with 1.5-million-lb. clustered booster. Second stage to be cluster of four 200,000-lb. liquid hydrogen engines; third, two 200-K engines; fourth, four 20-K's; fifth, two 20-K's	New timetable; first static firing of two engines a success; full test late spring; first flight late 1961; first operational flight 1963 with 4th and 5th stages on booster; NASA plans to build 30 during 1960's
★SCOUT (NASA-Air Force)	Chance Vought, prime; Minneapolis-Honeywell, guidance; Aerojet-General/Allegany/Thiokol, propulsion	Solid four-stage satellite launcher; 200-300 lb. payload in orbit	Air Force and probably Navy also to use for research; first test in April partially successful; AF test expected soon
★THOR-ABLE (Air Force-NASA)	STL, prime; Rocketdyne/Aerojet-General/ABL, propulsion	Early deep space booster; new Air Force upper stage called ABLE-STAR has start-stop capability	Sun orbit shot in Spring—nine months behind schedule. Only two shots left in program
THOR-DELTA (NASA)	STL, prime; IT&T, guidance; Rocketdyne/Aerojet-General/Allegany,prop.	Put 65-lb. satellite in orbit around moon	R&D; first flight early this year; to be used in ECHO and TIROS program
★TIROS (NASA-AF-Army-Navy-Wea. Bu.)	RCA-Army Signal Corps, prime	Meteorological satellite; TV pictures of cloud cover	R&D; three launchings this spring; first launching in April a success; two more this spring scheduled
★TRANSIT (ARPA-Navy)	Johns Hopkins Laboratory, prime	Navigational satellite; R&D model weighs more than 250 lbs.; operational model about 50 lbs.	TRANSIT 1B R&D satellite put in orbit April 13
TRIBE (ARPA)		Family of space launching vehicles	Planning
YO YO (Navy)	No contract announced	Tactical sea-launched one-pass reconnaissance satelloid	Studies
★X-15 (NASA-AF-Navy)	North American, prime; Thiokol, propulsion	Rocket plane; 3600 mph; flight at edge of space; on AF model each XLR-11 rocket engines develop 16,000 lbs. of thrust; later XLR-99 engines to develop 50,000 lbs.	Five powered flights; one plane damaged in landing; second plane hit Mach 2 and more than 80,000 ft. Feb. 11; first X-15 has been accepted by the Air Force, turned over to NASA for testing at Edwards AFB
MISSILES & ROCKETS			
★ALFA (Navy)	Avco, prime	ASW surface-to-underwater; 500 lb. solid; conventional; formerly called ABLE	Deployed on destroyer escorts
ASROC (Navy)	Minneapolis-Honeywell, prime	Surface-to-underwater; solid rocket torpedo; nuclear	R&D; operational Jan. 1961
ASTER (Navy)	Ford Instrument, prime	Anti-submarine rocket launched from surface ships; 30-35 mile range; marriage of TERRIER and SUBROC	R&D
ASTOR (Navy)	Westinghouse, prime	ASW underwater to underwater; rocket torpedo; nuclear	R&D
★ATLAS (Air Force)	Convair, prime; GE/Burroughs, Arma, guidance; Rocketdyne, propulsion; GE, re-entry vehicle	ICBM; more than 5500-mile range; liquid; nuclear	44 military launchings: 27 successes, 8 partial, 9 failures; 5 scientific launchings: 4 successes; 1 failure. Two operational at Vandenburg; 11 of 13 sites named
ARM (Air Force)	No contract announced	Anti-radar missile	R&D
BOMARC-A (Air Force)	Boeing, prime; Westinghouse, guidance; Marquardt, propulsion	Ramjet surface-to-air interceptor; liquid booster; 200 m. range; Mach 2.7; nuclear	First squadron operational at McGuire AFB, N.J.
★BOMARC-B (Air Force)	Boeing, prime; Westinghouse, guidance; Thiokol, propulsion	Ramjet, surface-to-air; solid booster; Mach 2.7; more than 500 m. range; nuclear	Eight launchings: 1 success, 7 failures; first successful flight April 14. Production program sharply cut back by Air Force.
BULLPUP (Navy-Air Force)	Martin, prime; Martin, guidance; Thiokol (Reaction motors), propulsion	Air-to-surface; 4-8 mile range; conventional 250-lb. bomb; new model has pre-packaged liquid; nuclear-tipped model under development	Deployed with Atlantic and Pacific Fleets; bigger model under R&D; Air Force buying modified version
COBRA (Navy)	No contract announced	Anti-ship radar missile	Early R&D
★COBRA (Marines)	Boelkow Entwicklungen, West Germany, prime; Daystrom, U.S. distributor	24.6-pound anti-tank missile; 1 mile range; 191 mph speed; solid propellant	Marines planning to purchase; Army considering them; already operational with West German troops

PROJECT	CONTRACTORS	DESCRIPTION	STATUS
CORPORAL (Army)	Firestone, prime; Gilfillan, guidance; Ryan, propulsion	Surface-to-surface; 75-mile range; liquid; nuclear	Deployed with U.S. & NATO troops in Europe
CORVUS (Navy)	Temco, prime; W. L. Maxson guidance; Reaction Motors, propulsion	Air-to-surface; pre-packaged liquid; radar homing; about 100-miles range	First successful test July 18, 1959
CLAYMORE (Army)	No contract announced	Anti-personnel missile	R&D
CROW (Navy)	No contract announced	Air-to-air missile	R&D; has been flight tested
★DAVY CROCKETT (Army)	In-house project at Rock Island, Ill., arsenal	Surface-to-surface; solid; bazooka launched; sub-kiloton nuclear warhead; two launchers of different size for various ranges	R&D; operational in FY '61
EAGLE (Navy)	Bendix, prime; Sanders, guidance; Aerojet propulsion	Air-to-air; 100-mile range; nuclear; for launching from relatively-slow aircraft	Early R&D
★FALCON (Air Force)	Hughes, prime; Hughes, guidance; Thiokol, propulsion	Air-to-air; 5-mile range; Mach 2; solid; conventional; GAR-11 has nuclear warhead	GAR-1D & GAR-2A & GAR-3 operational; GAR-4 & GAR-9 under R&D; GAR-9 work slowed; GAR-11 contract let
GENIE (Air Force)	Douglas, prime; Aerojet-General, propulsion	Air-to-air; unguided; 1.5-mile range; nuclear	Operational
GIMLET (Navy)	No contract announced	Air-to-surface; unguided; considered highly accurate	R&D
HAWK (Army)	Raytheon, prime; Raytheon, guidance; Aerojet-General, propulsion	Surface-to-air; 20-mile range; solid; conventional; designed to hit low-flying planes	Operational; units training for early deployment to Europe and Far East; advanced Hawk under development; Jan. 29 successfully intercepted Honest John, first known intercept of one tactical missile by another
HONEST JOHN (Army)	Douglas, prime; Hercules, propulsion	Surface-to-surface; unguided; 16.5-mile range; nuclear	Operational; deployed in Europe
★HOUND DOG (Air Force)	North American, prime; Autonetics, guidance; Pratt and Whitney, propulsion	Air-breathing air-to-surface; 500-mile range; Mach 1.7; turbojet; nuclear	Operational; to be launched from B-52G intercontinental bombers; stockpile expected to exceed 400; training fully underway; B-52 launched one in April after non-stop flight with it to North Pole from Florida
JUPITER (Army)	Chrysler, prime; Ford Instrument, guidance; Rocketdyne, propulsion; Goodyear, re-entry vehicle	IRBM; liquid; nuclear	To be deployed with Italian troops in Italy and used as AICBM target drone; 29 military launchings: 22 successes; 5 partials; 2 failures. One 15-bird squadron to be deployed in Turkey. Last R&D test shot launched Feb. 4
★LACROSSE (Army)	Martin, prime; Federal Telecommunications Laboratories, guidance; Thiokol, propulsion	Surface-to-surface; highly mobile; 20-mile range; solid; nuclear	Operational; 4 units being trained; 3 more planned for 1960; to be deployed in Europe and Far East; advanced LACROSSE R&D program dropped at least temporarily
LITTLE JOHN (Army)	Emerson Electric, prime; ABL, propulsion	Surface-to-surface; unguided; 10-mile range; solid; nuclear	Operational this year; units training with it
★LOBBER (Army)	No contract announced	Surface-to-surface; cargo carrier; 10-15 mile range; also can drop napalm; LOBBER with warhead called BALLISTA	Studies
LULU (Navy)	No contract announced	Surface-to-surface; nuclear	R&D
MACE (Air Force)	Martin, prime; AC Spark Plug, guidance; Allison, propulsion	Air-breathing surface-to-surface; more than 650-mile range; turbojet & solid; nuclear; B model has 1000-m. range	Being deployed with U.S. troops in West Germany; now all mobile but hard-base version in R&D
MATADOR (Air Force)	Martin, prime; Thiokol/Allison, propulsion	Air-breathing surface-to-surface; 650-mile range	Being turned over to West Germans; also deployed in Far East
★MAULER (Army)	Convair, prime	Surface-to-air; IR guidance; highly mobile antiaircraft and antimissile missile for field use; to be on trucked vehicle	R&D
★MINUTEMAN (Air Force)	Boeing, major contractor; Autonetics, guidance; Thiokol, propulsion first stage; Aerojet, propulsion second stage; Avco, re-entry vehicle; AMF, rail launcher	2nd generation ICBM; solid; mobile; nuclear; 3 stages	R&D. Expected to be operational by late 1962 and deployed in 1963; to be installed in hardened sites and made mobile on trains, possibly trucks; tethered full-scale test models successfully fired from silos; guidance systems successfully tested on rocket sleds at Holloman AFB, N.M. First base site named: Malmstrom AFB

PROJECT	CONTRACTORS	DESCRIPTION	STATUS
MISSILE A (Army)	ARGMA to act as prime; six R&D contracts for components scheduled to be let soon	Surface-to-surface; 65-70 mile range; solid	Design studies
NIKE-AJAX (Army)	Western Electric, prime; Western Electric, guidance; Hercules Powder, propulsion	Surface-to-air; 25-mile range; Mach 2.5; solid & liquid; conventional	Deployed in U.S., Europe & Far East
NIKE-HERCULES (Army)	Western Electric, prime; Western Electric, guidence; Hercules & Thiokol, propulsion	Surface-to-air; 80-mile range; Mach 3+; nuclear; claimed effective against air-launched air-breathing missiles	Rapidly replacing NIKE-AJAX
★NIKE-ZEUS (Army)	Western Electric, prime; Bell Telephone, guidance; Thiokol and Grand Central, propulsion	Anti-missile; 3-stage; 200-mile range; solid; nuclear	R&D test launchings at White Sands at the rate of about one a month beginning Aug. 26. Five launchings: 3 successful, 2 partial. Test shots in the Pacific against drone missiles planned in mid-1961. Administration has refused to okay Army recommendation to begin production.
★PERSHING (Army)	Martin, prime; Bendix, guidance; Thiokol, propulsion	Surfece-to-surface; solid; under 700-mile range; nuclear	R&D; to replace REDSTONE; first R&D launching Feb. 25 from Cape a success; 35 miles as programmed; second April 20, a success
★POLARIS (Navy)	Lockheed, prime; GE, guidance and fire control; Aerojet-General, propulsion; Lockheed, re-entry vehicle	Underwater and surface-to-surface; solid; 1200-mile range can hit more than 90% all targets in Russia; nuclear	58 launchings of test vehicle; 40 successes; 16 partial; 2 failures; launched from surface ship Aug. 27, 1959; expected operational late in 1960; 1100-mile plus range vehicles under test at Cape Canaveral; all major milestones except launching from sub passed
RAVEN (Navy)	No contract announced	Air-to-surface; about 500-mile range	Study
REDEYE (Army)	Convair, prime; Atlantic Research, propulsion	Surface-to-air; 20-lb. bazooka-type; IR guidance; solid; conventional	R&D
REDSTONE (Army)	Chrysler, prime; Ford Instrument, guidance; Rocketdyne, propulsion	Surface-to-surface; liquid; 200-mile range; nuclear	Deployed with U.S. troops in Europe
REGULUS II (Navy)	Chance Vought, prime; Stevid, guidance; Aerojet-General, propulsion	Surface-to-surface; turbojet & solid; 500-mile range; nuclear	Deployed aboard U.S. submarines; used as target drone
SERGEANT (Army)	JPL/Sperry, prime; Sperry, guidance; Thiokol, propulsion	Surface-to-surface; solid; more than 75-mile range; nuclear	Production. To replace CORPORAL this year
SHILLELAGH (Army)	Aeronutronics, prime	Surface-to-surface; lightweight; can be vehicle-mounted	R&D; expected to be operational mid-1960's
SIDEWINDER (Navy)	GE-Philco, prime; Avion, guidance; Naval Powder Plant, propulsion	Air-to-air; IR guidance; 6-7-mile range; conventional; new 1-C models to have switchable IR and radar-guided warheads	Deployed with Navy and Air Force; all-weather type under development
★SKY BOLT (Air Force)	Douglas, prime; Nortronics, guidance; Aerojet, propulsion	Air launched ballistic missile; more than 1000-mile range; solid; nuclear	R&D; to be purchased by British also
SLAM (Air Force)	No contract announced	Surface-to-surface; low-altitude; supersonic; nuclear-powered ramjet; nuclear	Study-R&D
SNARK (Air Force)	Norair, prime; Northrop, guidance; Aerojet-General, propulsion	Surface-to-surface; 5500-mile range; solid and turbojet; Mach .9; nuclear	Deployed at Presque Isle, Maine
SPARROW III (Navy)	Raytheon, prime; Raytheon, guidance; Aerojet-General, Thiokol, propulsion	Air-to-air; 5-8 mile range; Mach 2.5-3; solid and pre-packaged liquid; conventional	Operational with carrier aircraft; earlier SPARROW I obsolete; new contract aimed at extending range and altitude
SUBROC (Navy)	Goodyear, prime; Kearfott, guidance; Thiokol, propulsion	Underwater or surface-to-underwater; 25-50 mile range; solid; nuclear	R&D
SS-10 (Army)	Nord Aviation, prime	Surface-to-surface; primarily anti-tank; 1600-yards range; 33 lbs. solid; wire guided; conventional	Operational with U.S., French and other NATO and Western units; battle-tested in North Africa
SS-11 (Army)	Nord Aviation, prime	Surface-to-surface; also helicopter-to-surface; 3800-yard range; 63 lbs.; wire guided; conventional	Operational. Under evaluation by Army.
★T-238 (Army)	No contract announced	Four-inch diameter, small, short-range poison gas rocket; to be fired from 45-tube launchers	Operational
TALOS (Navy)	Bendix, prime; Farnsworth/Sperry, guidance; Bendix/McDonnell, propulsion	Surface-to-surface; 65-mile range; solid & ramjet; Mach 2.5; nuclear	Operational aboard cruiser Galveston

PROJECT	CONTRACTORS	DESCRIPTION	STATUS
TARTAR (Navy)	Convair, prime; Raytheon, guidance; Aerojet-General, propulsion	Surface-to-air; 10-mile range; Mach 2; 15 feet long & 1 foot in diameter; solid dual-thrust motor; conventional	Many test firings in Pacific; expected deployment 1960 as primary armament of guided missile destroyers; production
TERRIER (Navy)	Convair, prime; Reeves/FTL, Sperry, guidance; ABL, propulsion	Surface-to-air; 10-mile range; Mach 2.5; 27 feet long; solid; conventional	Operational with fleet
TERRIER-ADVANCED (Navy)	Convair, prime; Reeves/FTL, Sperry, guidance; ABL, propulsion	About 100% performance improvement over TERRIER	Operational Advanced TERRIERS to be deployed about mid-1960
★THOR (Air Force)	Douglas, prime; AC Spark Plug, guidance; Rocketdyne, propulsion; GE, re-entry vehicle	Surface-to-surface IRBM; 1500-mile range; liquid; nuclear	Operational; 4 bases set up in England. 62 military launchings: 43 successes; 12 partial; 7 failures; 24 scientific launchings; 23 successful, 2 partial; 3 failures; R&D and "hot rod" advanced tests completed Feb. 29.
★TITAN (Air Force)	Martin, prime; Bell, Remington Rand, guidance; Aerojet-General, propulsion; Avco, re-entry vehicle	Surface-to-surface ICBM; 5500-mile range; liquid; 90 feet long; nuclear	13 launchings test vehicles: 9 successes; 1 partial; 3 failures. Five sites for 7 squadrons named; 14 squadrons planned
★TYPHON (Navy)	Applied Physics Lab, prime	Medium and long range seagoing anti-missile missiles; formerly called SUPER TARTAR and SUPER TALOS; solid booster and ramjet sustainer; conventional; supersonic	Early R&D
WAGTAIL (Air Force)	Minneapolis-Honeywell, prime	Air-to-ground; low-level; solid; designed to climb over hills and trees	R&D
★WILLOW (Army)	Chrysler, prime	Highly-classified missile	R&D
ZUNI (Navy)	Naval Ordnance Test Station, prime	Air-to-air, air-to-surface; solid; unguided rocket; 5-mile range; conventional	Operational

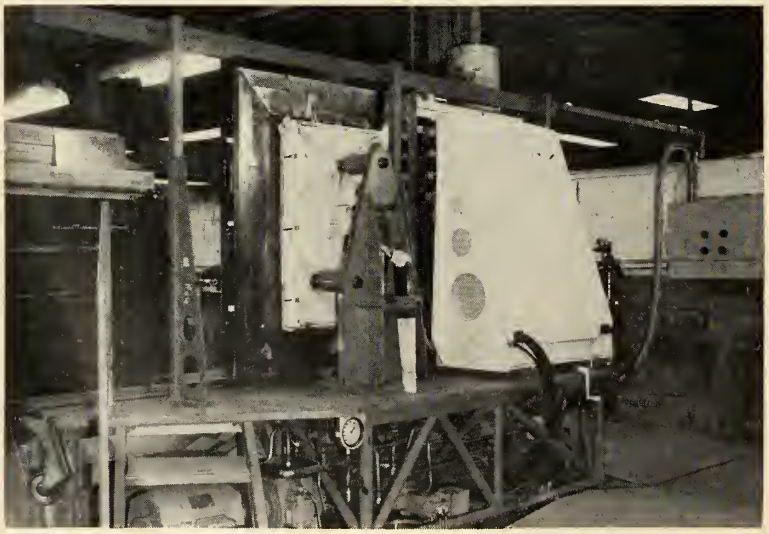
SATELLITES

SATELLITE	COUNTRY	STATUS
EXPLORER I (30.8 lbs.)	U.S.	Launched 1/31/58, est. life 3-5 years. Orbits earth, perigee: 224 m., apogee: 1573 m., period 114.8 min. (Discovered Van Allen Belt)
VANGUARD I (3.25 lbs.)	U.S.	Launched 3/17/58, est. life 200-1000 years. Orbits earth, perigee: 409 m., apogee: 2453 m.
LUNIK I "MECHTA" (3245 lbs.)	Russia	Launched 1/2/59. Believed to be in orbit around sun on 15 mo. cycle.
VANGUARD II (20.7 lbs.)	U.S.	Launched 2/17/59, est. life 10 years +. Orbits earth but is "wobbling," perigee: 347 m., apogee: 2064, period: 125.85 min., inclination to equator: 32.88°.
PIONEER IV (13.40 lbs.)	U.S.	Launched 3/3/59. Orbits sun, and achieved primary mission, an Earth-Moon trajectory.
EXPLORER VI "PADDLE-WHEEL" (142 lbs.)	U.S.	Launched 8/7/59, est. life: to Aug. 1961. Orbits earth, perigee: 156 m., apogee: 26,357 m., period: 12½ hours, speed: at perigee 23,031, at apogee: 3126 mph., inclination to equator: 46.9°.
VANGUARD III (about 100 lbs.)	U.S.	Launched 9/18/59, est. life 30-40 years. Orbits earth, perigee: 319 m., apogee: 2329 m.
LUNIK III (about 614 lbs.)	Russia	Launched 10/4/59, est. long life, orbits earth-moon; took first picture far side of moon; est. perigee: 30,000 m., apogee: 291,000 m.
EXPLORER VII (91.5 lbs.)	U.S.	Launched 10/13/59, est. life 20 years, orbits earth, perigee: 341, apogee: 679.
DISCOVERER V CAPSULE (less than 300 lbs.)	U.S.	Launched 8/13/59. Satellite burned up in atmosphere Sept. 28. Capsule also thought to have been destroyed, but it was later rediscovered and first thought to be an unidentified Soviet satellite. Est. life several months. perigee: 134, apogee: 1074.
★PIONEER V (94.8 lbs.)	U.S.	Launched 3/11/60, est. life: forever orbits sun, interplanetary radio communication satellite, passed 6 million miles 12:08 EST April 24.
★TIROS I (270 lbs.)	U.S.	Launched 1/4/60, est. useful life: 3 mos. perigee: 435 m; apogee: 468. Picture-taking weather satellite.
★TRANSIT 1B (265 lbs.)	U.S.	Launched 1/13/60, est. life: 16 mos. minimum; perigee: 233; apogee: 479. First R&D navigation satellite.
★DISCOVERER XI (1700 lbs.)	U.S.	Launched 1/15/60, est. life: brief; perigee: 109; apogee: 380; Air Force advanced satellite R&D vehicle.

Norair Method Slashes Brazing Time

Radiant honeycomb method to be used for making advanced missile panels; working time cut from 3-12 hours to 5-15 minutes

THERMOCOUPLES ATTACHED to the outer skin of a brazing envelope containing a stainless steel honeycomb sense temperature variations and instantly apply precise heat corrections during the brazing cycle.



ENVELOPE BEING chilled has just moved from between the banks of radiant brazing lamps at right. Movement from position to position takes 1.25 seconds.

by John F. Judge

Radiant honeycomb brazing, a process developed by Northrop Corp.'s Norair Division, will be the production method used under a new $956,447 Air Force contract for manufacture of stainless steel honeycomb panels for advanced aircraft and missiles.

The process, Nortobraze, reduces brazing time from three to 12 hours down to a range of 5 to 15 minutes depending on the complexity of the part involved. The essence of the Northrop method lies in banks of radiant quartz lamps capable of temperatures up to 6000°F in the brazing of panels in a varity of shapes, sizes and thicknesses.

The workpiece is enclosed in a gas tight envelope of soft auto body steel. Initially, two such steel sheets are stamped to fit the honeycomb configuration. The outer skin of the workpiece is placed on one of these sheets. A brazing alloy sheet is laid on next, followed by the honeycomb core and any solid inclusions. Another brazing alloy sheet, the second skin and edge members, if any, are applied in order. The closing auto body steel sheet is laid on the pile, vacuum and argon lines attached and the envelope is roll seam welded around the edges.

Air is purged from the envelope and argon gas admitted to a pressure of 500 mm Hg. The envelope is tested for leaks and a coating of heat-asborbent paint is applied. The entire piece is then positioned in the vertical brazing rack and the lamp banks moved into place on either side.

The workpiece is brought to a temperature plateau of 1725°F and held there for a period of time determined by the configuration, inclusioned solids and brazing mixture.

• **Uniform heating**—The temperature throughout the brazing cycle is rigidly controlled through a console containing six power control channels, each having a preprogramed function generator. The temperature cycle is plotted beforehand on graph paper and scanning devices within the function selectors follow the graph lines, actuating sections of the lamp banks. Thermocouples located in the envelope provide feedback to complete the loop.

These couples provide localized temperature control at all times during the cycle—maintaining uniform heating despite varying core thicknesses and solid metal inclusions.

When the heating cycle is complete, the envelope is moved to the chill dies and cooling begins in a matter of seconds. The dies, using either water or chemical refrigerants, bring the workpiece down to a temperature where it is dimensionally stable. Then the entire envelope, still filled with argon, moves through a heat treating process. After heat treating the envelope is cut open and the completely brazed panel is removed.

The framework holding the panels during the brazing cycle also shields the thermocouple terminals. A coating of highly reflective ceramic gold maintains near-room temperatures about these terminals—even though the quartz lamps are but inches away.

The current Nortobraze machine can accommodate panel sizes up to 2 x 3 ft. Thickness can vary from 0 to 6 in. The next machine being built will handle panels up to 4 x 5 ft. There is no real upper limit to the size of a Nortobraze process.

Besides the stainless steel family of metals, Nortobraze has been applied to titanium alloys and is adaptable to the niobium and molybdenum groups.

The specific contract just awarded is a production-type agreement, but the parts involved are more likely to be prototypes for some of the advanced concepts of the Air Force. The contract will be administered by the Manufacturing Methods Division of the Aeronautical Systems Division at Wright-Patterson Air Force Base.

Hoffman Hits New High In Solar Cell Efficiency

Silicon solar cells with a guaranteed 13% minimum efficiency are rolling off the production lines at Hoffman Electronics Corp., Los Angeles.

According to Hoffman, this is the first time such cells have been available on a regular basis. Furthermore, none of the currently orbiting satellites have solar power converters with efficiencies greater than 9%.

The increase in efficiency is the result of a production advance involving the addition of nickel-plated, solder-dipped positive contact strips to the surface of the cells. This innovation reduces the series resistance of the "P" layer of the cells, increasing the relative efficiency of each unit by about 15%.

As a direct result of this development, cells with 10% efficiency are being reduced 30% in price. The reduction is felt all down the line.

Biggest Hand-forged Aluminum Piece Made by Alcoa for Douglas Tunnel

The world's largest hand-forged aluminum mandrels are shaping the nickel nozzle liners for the new hypersonic wind tunnel at Douglas Aircraft Co.

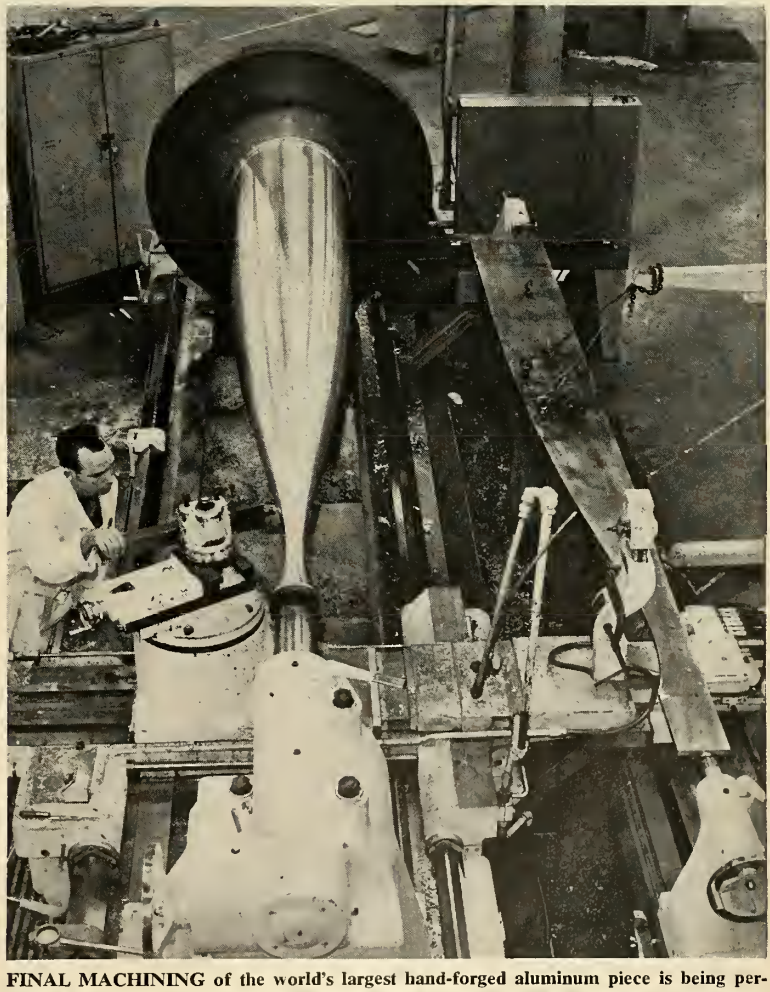
The first forging, produced by the Cleveland Works of the Aluminum Company of America, roughly resembled its final bottle-like shape and weighed 8230 lbs. After an initial machining operation by Hillcrest Crankshaft and Machine Corp., Titusville, Pa., Alcoa heat-treated and artificially aged the mandrel to achieve its best physical properties.

The 12-foot forging was finish-machined by Douglas to exacting diameter tolerances. The piece tapers from 24 in. at one end to 3 in. at the other with 0.001 in. tolerance attained at 1440 measuring stations.

A special electroforming tank at Bone Engineering Corp., Glendale, Calif., deposited nickel on the mandrel to a depth exceeding ⅝ in. The entire assembly was brought to sub-zero temperatures and—since aluminum shrinks more than nickel at the same low temperature—the mandrel separated from the coating.

The perfectly formed nickel liner remaining after withdrawal of the mandrel is ready for immediate installation in the Douglas Mach 6 nozzle.

Two larger mandrels from Alcoa will be required for the Mach 8 and Mach 10 nozzles. A 9650-lb. forging will be needed for the Mach 8 nozzle and an 11,900 lb. piece for the Mach 10 nozzle. All of the mandrels can be re-used.



FINAL MACHINING of the world's largest hand-forged aluminum piece is being performed by Douglas Aircraft Co. Produced by Alcoa, the forging served as a mandrel in the shaping of a nickel nozzle liner for the new hypersonic wind tunnel at Douglas.

Saturn Booster Bulkheads Pose Fabrication Problems

by Frank G. McGuire

MANHATTAN BEACH, CALIF.—Two methods of fabrication are being used by U.S. Chemical Milling Corp. to produce high-strength, lightweight bulkheads for the *Saturn* space booster.

The booster, developed by the Army Ballistic Missile Agency and now under sponsorship of the National Aeronautics and Space Administration, uses both 70 in. diameter and 105 in. diameter tanks.

Basic material for the bulkheads is Reynolds #5086 aluminum alloy. The components and their fabrication present problems not previously encountered by industry because of the size and close tolerances involved. These considerations prevented use of existing techniques for machining the parts.

The tankheads, being basically hemispherical, are ideal shapes for spinning, and this method expedited production while cutting tooling costs. A spun shape, however, has inherent departures from the optimum.

• **Special lathe**—The spinning process creates external surface waviness and thickness variations both radially and longitudinally. It was to overcome these disadvantages that U.S. Chemical Milling Corp. designed and built a special lathe specifically to machine the tankheads being produced for *Saturn*.

The lathe machines the entire outside surface relative to inside surface through a hydraulically actuated tracer valve and enclosed slave system. Thickness tolerances of ±0.005 in. are obtained in production through use of this method.

Physical properties are attained through work hardening. By controlling the process and breakdowns used and by effecting a considerable stretch on the final spinning operation, good ultimate and yield strengths are obtained.

For the 70 in. diamcter tanks (which will form a cluster about a central 105 in. diameter tank in the finished vehicle), USCM begins with a workpiece of 100 in. x 100 in. #5086 aluminum alloy measuring 0.300 in. thick.

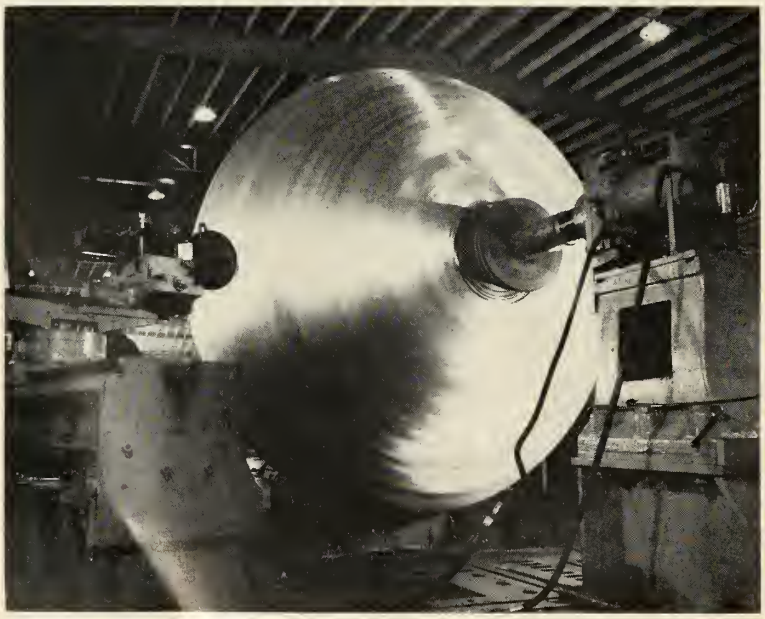
These tankheads are machined on the lathes at the firm's Manhattan Beach facilities, while other parts lend themselves better to pre-machining, then a subsequent overall removal through chemical milling to the final dimensions.

In the 70 in. diameter tankheads, the minimum thickness is 0.142 in. In a variable-thickness tankhead, chemical milling is especially effective because the thickness of the finished part is thinner than is practical to machine.

• **Reduction**—With this type of tankhead the circumferential band remains at 0.125 in. and the principal dome area is reduced to a minimum thickness of 0.020 in. These parts were first machined to a uniform thickness, then chemically milled.

The 105 in. diameter tankhead begins as a blank of material 135 in. x 135 in. and measuring 0.375 in. thick. The aft bulkhead of this central tank is eventually reduced to 0.230 in. overall, while the forward bulkhead is a variable-thickness component measuring a minimum of 0.156 in. near the center, tapering to a minimum of 0.230 in. in a circumferential band about two inches wide around the edges.

The use of this method is expandable so that required tapers in material thickness or the incorporation of radial bands of lighter or heavier gauge material can be accomplished.



FINAL TRIMMING operation on the 105 in. *Saturn* tankbead. Because of the size and tolerances involved, U.S. Chemical Milling Corp. built a special lathe to machine these tankheads.

Lockheed Weightlessness Simulator Being Built

The first insight into how a man will behave under the conditions of long periods of weightlessness in outer space will be gained through experiments with Lockheed's null gravity simulator.

The firm's Human Factors Research Laboratory at Marietta, Ga., has designed and is building the device that will permit close observation of subjects working and sleeping under the effects of weightlessness.

The simulator is actually a large cylindrical tank of water. The subject, equipped with breathing apparatus, will be entirely submerged. The entire simulator will revolve, creating a condition of weightlessness in the water that will closely resemble that of outer space. The spinning will eliminate the subject's sense of direction by confusing the otholith organs of the inner ear. The distribution of pressure by the water will remove the unidirectional pressure so characteristic of gravity.

While in this environment, the subject will perform a series of tests and operations similar to those which would have to be done in a spacecraft. Observers will be able to measure the subject's actions and reactions through instruments.

F. A. Cleveland, Lockheed Georgia Division's chief design engineer says that some of the more serious effects of weightlessness may not appear until after an extended time of exposure. Short time tests cannot achieve such results.

The simulator is also expected to find use as a training means to familiarize astronauts with null gravity conditions.

IT&T Group Plays Heavy Role at PMR

by Richard van Osten

A group of 150 civilian technicians is shouldering heavy responsibilities in the nation's polar-orbiting satellite programs and ballistic missile launches from the Navy's Pacific Missile Range.

They are employes of Federal Electric Corp. charged with operation and maintenance of electronic facilities at PMR's Naval Missile Facility, Point Arguello, Calif. (NMFPA).

Range support task was awarded to FEC, the service organization of International Telephone and Telegraph Corp., with a $1.4-million Navy contract in April, 1959.

• **Assignments**—The initial contract covers Phase I of FEC operations at NMFPA. This includes maintenance and operation of ground-to-missile telemetry; communications, including automatic and manual telephone equipment and four types of radio equipment—HF, VHF, UHF and microwave data link.

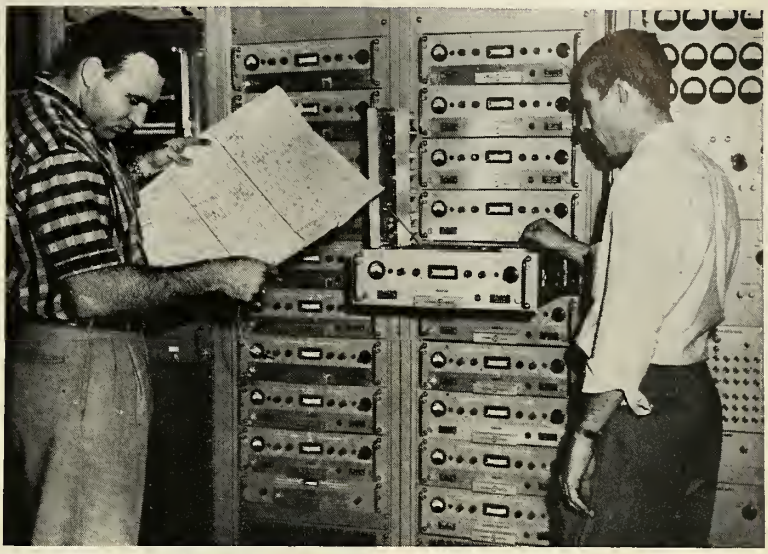
FEC is charged also with the critical job of monitoring daily all radio frequencies within the NMFPA area. Frequency interference control (FIC) detects and locates sources of radio frequency interference before, during and after a launch; assists PMR headquarters at Pt. Mugu in monitoring responsibilities assigned by the Federal Communications Commission; and provides needed information on satellite orbits as an additional monitoring function.

Instrumentation and range safety radar is operated and maintained by FEC personnel for missile tracking and impact prediction; air and surface surveillance and height finding of objects which might interfere with or be endangered by a launch operation.

For range safety, FEC functions include the post of range safety coordinator who must monitor all radar and range safety systems and select the best of available data for display to the missile flight safety officer. The latter uses the information to determine whether or not a destruct is required.

FEC personnel are responsible also for photo-optical equipment—fixed, calibrated-position cinetheodolites, mobile optical tracking units and related types.

Still another critical function charged to FEC is maintenance and operation of display equipment—radar indicators, manual and automatic plotting boards and status boards.



BIG GSE JOB is performed by employes of Federal Electric Corp., which has responsibility for maintenance and operation of electronic facilities at PMR's Naval Missile Facility, Point Arguello. Here two technicians check out telemetry equipment.

• **Three-ring circus**—First step in FEC action for a launch is receipt of instrumentation plans from PMR headquarters designating types and quantities required. Various FEC groups responsible for equipment to be used check it out and put it in the "ready" category.

FEC then receives an operation schedule and countdown procedure. When operations reach the countdown phase, three things happen. Or, as a FEC representative puts it: "All hell breaks loose in three ways at one time!"

The three functions line up as follows: range areas are cleared by surveillance radar and with Navy ships, aircraft and helicopters; the range user checks out the missile or vehicle and FEC's telemetry group reports to the user on the status of the signal; and all instrumentation is rechecked according to a prescribed countdown procedure.

When the missile or vehicle is fired, FEC personnel are about as busy as the proverbial paper hanger.

Telemetry groups record signals from the missile. Photo optics men track and photograph the launch and flight. Instrumentation radar crews track and record missile position. The range safety coordinator monitors and selects data to assist the missile flight safety officer. Operations and display personnel man radar indicators, plotting and status boards.

After the launch, crews collect data from each section, identify it, and transmit it to the Navy's data reduction center at Pt. Mugu.

• **Navy's chores**—What, then, does the Navy do? The answer is "Plenty!" as far as PMR is concerned.

As operators of PMR, the Navy retains overall responsibility for all missile operations over the range whether they be fired from nearby Vandenberg AFB or NMFPA. This includes range safety, impact prediction and tracking. On certain Vandenberg shots, however, "destruct" decisions may rest in the hands of an Air Force officer.

Navy personnel hold supervisory positions such as Range Operations Supervisor (ROS) who is assigned on a program or project basis in overall charge (less in-flight range safety) of operational phases of range support; Range Facilities Control Officer (RFCO) who is assigned to coordinate and report to all concerned on readiness of all facilities required for an operation; Missile Flight Safety Officer (MFSO) who represents the Range Safety Officer (RSO) and is responsible for execution of the "Range Safety Operational Plan" for a particular op-

eration; Surveillance Officer (SO) with functional responsibility in a particular geographic area of the range for a specific period of time or individual operation to exercise control of assigned aircraft, boats, air and surface radars display equipment and communications facilities.

Other positions with overall Navy responsibility include: Ground Safety Officer (GSO) who is charged with controlling the hazard areas during operations, including pad safety, movement of personnel and traffic evacuation of nonessential personnel from the ground hazard area, and surveillance of the Southern Pacific Railroad's right-of-way which extends the length of both Vandenberg and NMFPA; Pad Safety Officer (PSO) who monitors missile or vehicle preparation work involving use of hazardous materials or systems; Launch Control Officer (LSO) with responsibility for supervising accomplishment of all functions necessary in the preparation and countdown; and the Operations Conductor (OC) who represents the range user and is responsible for informing the RFCO and ROS of his time schedule and countdown progress, hold, cancellings, or incompleting the operation if objectives of the range user cannot be satisfied.

• **Expansion due**—FEC is heavily involved in all NMFPA projects other than tracking of *Thor, Discoverer* and *Atlas* launchings from Vandenberg. Among the more exotic support areas are the Atomic Energy Commission's HAS (High Altitude Sampler), *Sunflare,* a Naval Research Laboratory project to study solar flare phenomena; *Tumbleweed,* an AEC/Sandia Corp. project; *Tepee,* Office of Naval Research study of an aircraft and missile detection system. Future support operations will include *Titan, Samos, Midas* and Project *Mercury,* man-in-space.

FEC expects to add about 25% more personnel within the next few months as operations step up at PMR, and as FEC moves into Phase II of its NMFPA responsibilities.

The second phase will get under way in about 90 days. This will place all toxic fuel handling, ordnance handling and ground clearance facilities in the lap of FEC.

The ITT service organization does not fit in the same organizational spot as Pan American Airways in the Atlantic Missile Range. It might be described as a "little further down the line."

On the record, Navy Capt. William J. Sarcipno, commander of NMFPA, has praised FEC as a "fine example of military/industry teamwork." Off-the-record conversations with responsible Navy personnel at the facility also produced high praise for FEC's operations.

RCA Calls Transistorized EDP System 'World's Fastest'

Los Angeles—An electronic data processing system billed as "the world's fastest" has been introduced by the Radio Corporation of America. Dubbed RCA 601, the transistorized system is applicable to either business or scientific uses.

Unveiled simultaneously with the company's smaller EDP system, Model 301, the unit is designed to augment the year-old Model 501. RCA feels it has thus made available "the first total concept of computer service." All three are fully transistorized and modularly constructed.

Expected to cost more than $20,000 monthly on a rental basis, the new 601 system incorporates a high-speed memory unit with a character capacity of 262,000 numbers, letters or symbols.

Up to 64 tape stations can be linked to the 601 for memory storage, each tape station having a capacity of 20 million data characters and a memory cycle of 1.5 millionths of a second. Tape speed is 120,000 characters/sec., and decisions can be made at the rate of 666,667/sec.

The "open-end" system design enables the user to expand capacity, increase functions or speed.

Its multi-programing provision has been designed to permit the automatic running of any number of independently written programs simultaneously, limited only by the system's total memory. In parallel processing or control operations, the system will operate on a job priority basis, as well as handling changeable priorities.

• **'Little brother'**—The "little brother" of the 601 is a computer designated model 301 and intended primarily for business applications. This unit rents for up to $9000/-month and can serve either as a com-

MAGNETIC MEMORY discs of the RCA 301 data processing system are examined by two RCA vice presidents, T. A. Smith, Industrial Electronic Products Div., and D. H. Kunsman, Electronic Data Processing Div. This is the first data processing system to use magnetic discs—similar to 45-rpm records—for its memory "storehouse"; it also can use magnetic tape on reels.

plete system or as an auxiliary to one of the larger models.

The basic processor of the 301 incorporates two sizes of core memory—either 10,000 or 20,000 individually addressable alpha-numeric characters—the program control, and a simplified control panel.

Other modules available for use with the basic system include card punch control, paper tape control, reader control, printer control, and simultaniety control. The last of these enables the computer to perform other functions while a memory search is being conducted.

The memory unit of the 301 contains 128 discs with magnetic recordings on both sides having a storage capacity of 4½ million data characters. As many as five of these can be utilized with the 301; discs can be interchanged rapidly or erased for re-recording.

Twelve magnetic tape memory units can be included in the 301 complex, each of which has a storage capacity of 4 million data characters. The unit can read tapes either forward or backward with equal speed.

The printer used with the 301 reads out data at the rate of 72,000 characters/minute. Variations in format and existing capabilities are under control of the stored program.

M-H Computer Within Price Range of Small Businesses

LOS ANGELES—A "new generation" computer billed as the most powerful available in the moderate-price field has been unveiled by the Datamatic Division of Minneapolis-Honeywell. The Honeywell 400 is expected to make high-speed electronic data processing feasible for most of the 10,000 top firms in the country.

Designed as a business computer rather than a scientific tool, the 400 performs up to 6000 operations per second, a rate as much as tenfold that of other computers in the same price range. Expected to rent for $8660 per month, the 400 is well below the $10,000-monthly rental figure generally considered to be the upper limit for small businesses, or subsidiary operations of large businesses.

The basic unit consists of a central processor, four high-speed magnetic tape units, a high-speed printer, and a card reader. Two additional tape units and a card punch can also be added as optional equipment.

• **High compatibility**—The new system, available for delivery in mid-1961, will be compatible with the larger data processing system, the Honeywell 800, enabling a firm to use it in conjunction with the 800 or to graduate from the 400 to the 800 with maximum ease and minimum disruption of processing.

High performance in the fields of storage and high-speed manipulation of large volumes of data make the 400 most efficient at sorting and maintaining files.

The 400 and 800 models use identical tape systems, printers and card readers. Information compatibility of the two models will also be complete, so that each system can read the data obtained and recorded by the other.

Core memory capacity of the 400 will be 1024 words of 48 bits each; this may be doubled, however, at customer option. Reading and writing operations may be performed simultaneously, and high-speed printing may be performed simultaneously with any other operation.

• **No 'baby'**—Transfer rate of information to or from the tape will be 64,000 characters or 96,000 decimal digits per second. Orthotronic control, a feature used on Honeywell's data processing systems, will detect and correct any errors in, or damage to, information recorded on the tapes.

The printer operates at 900 lines per minute, and the card reader handles 650 cards per minute.

The company emphasized that the 400 is not a "baby" machine. "Although not as powerful as the 800, this later system is nevertheless a complete and powerful system," according to Samuel D. Harper, Director of Sales Engineering for the Datamatic Division.

Minitrack Calibration Will Use Star Reference

Accuracy of Minitrack—worldwide satellite tracking network—will be checked by a new calibration technique using the stars as reference. The work is being done by Bendix Radio under a just-announced contract with NASA.

Calibration of the satellite tracker uses an aircraft in flight on a starlit night. A blinker light on the aircraft—actuated by a timed radio signal from the Minitrack station under test—is tracked by a precision camera on the ground. The aircraft's position in space is determined by its photograph against the background stars.

Simultaneously, a 108 mc radio signal is transmitted from the aircraft and recorded by the Minitrack station. The position of the plane as fixed by the radio signal received is compared against the starlit photographs and any errors of calibration are exposed.

Each Minitrack site is calibrated three times a year.

900 LINES a minute is the speed of the printer included in the Minneapolis-Honeywell Regulator Co. 400 high-speed electronic data processing system.

Super-Accurate

NBS Uses Cesium Clock To Measure Frequency

Transmission of the world's most accurate radio frequency standard began last week at the National Bureau of Standards. Using the Bureau's new cesium atomic clock, the VLF (20 kc) broadcasts originate at Sunset Canyon, 20 miles west of Boulder, Colo.

Signals from the Sunset Canyon station—WWVL—may reach as far as Hawaii or even to New Zealand, but are not strong enough to provide good coverage over the entire globe. The Sunset station will serve as the pilot for eventual establishment of worldwide transmissions. The original signal will be used for research necessary before such service can be established.

The low-frequency waves from Sunset Canyon will follow the curvature of the earth with the ionosphere and the ground acting as upper and lower limits of a gigantic duct to guide the signals over the globe. Since the ionosphere will thus serve only as a boundary and not a direct reflector, it will have almost no effect on the speed of the waves. For this reason, the 20 kc frequency will provide a much more stable transmission than the presently used high frequencies of WWV and WWVH. Accuracies will be on the order of 100 times better.

Such ultra-precise standards, unknown a short time ago, are becoming increasingly necessary in the missile/-space age. Some uses: time coordination of missile and satellites tracking station recording; measurement of minute quantities of electrical and radio energy in basic research; as vital aid to progress in electronics.

The International Consultative Radio Committee (CCIR) adopted the proposed 20 kc frequency band in April 1959. Last December, the frequency was adopted by the International Radio Conference in Geneva for the International Telecommunications Union.

Guardite Co. Unveils New Space Simulation Chamber

LOS ANGELES—A hyper-environmental space simulation test chamber was unveiled at the recent Institute of Environmental Sciences conference here by the Guardite Co., a division of American-Marietta Co.

The spherical test facility permits simulation of altitudes up to 1.5 million ft. It is intended to test materials and components under space extremes of altitude, temperature and radiation.

Thiokol Presses On-Site Loading

Lack of reliability and scale-up capacity make segmented solid rockets a 'dead end,' Wilhite maintains

by Jay Holmes

Reliability and scale-up capability are overwhelming considerations in favor of loading very large solid-propellant rockets at the launch site, a Thiokol Chemical Corp. official declared last week.

Bryce Wilhite, technical director at Thiokol's Utah Rocket Operations Center, maintained in an interview that logistic considerations would limit the growth of segmented rockets—making the concept a technological "dead end."

Wilhite did not specifically mention the current Air Force competition on a contract to study the feasibility of building a solid booster with 100-million-lb.-seconds total impulse. But his remarks had obvious bearing on the competition.

The six solid-propellant companies bidding are divided on how to fabricate and cast so large a rocket. Everyone agrees it is impractical to manufacture a whole rocket and transport it to a distant launch site. The reason is that the motor is simply too large for transportation by air, rail or truck. Although no one has given exact dimensions, it is generally assumed that the motor would be about 12 ft. in outside diameter and about 60 ft. long.

Thiokol and Rocketdyne Division of North American Aviation have proposed on-site mixing and loading. Aerojet-General Corp., Grand Central Rocket Co. and United Technology Corp., a recently formed subsidiary of United Aircraft, prefer building rocket segments at their plants and putting the segments together at the launch site. It is not known which approach is favored by the sixth competitor, Hercules Powder Co.

• **Reliability hurt?**—Wilhite contended that segmented construction automatically reduces system reliability by increasing the number of components. For instance, he said, if a rocket is made of six segments, each with a 95% reliability, the system reliability is the 6th power of 0.95—about 74%.

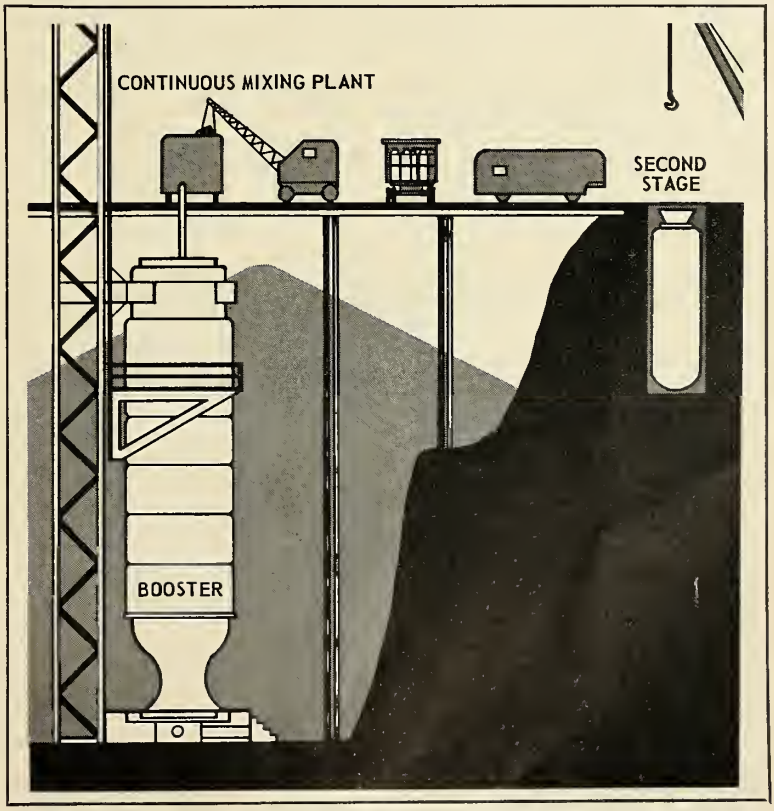
Further, he argued, reliability is reduced further by the impossibility of hydrotesting the rocket case. The propellant segment is cast into the cylindrical case segment at the plant and the segments are bolted or screwed together at the launch site. There obviously is no way to hydrotest the case with propellant in it.

The Thiokol official asserted that there are only two reasons for considering segmented rockets: ease of fabrication and logistics. So far as logistics is concerned, he said, the segmented approach is a technological dead end. It may be possible to transport segments and put together a motor one generation larger than those that can be transported by rail or truck, he said. But for the scale-up after this one, he asserted, it will be necessary to switch of on-site loading.

"The segmented rocket has absolutely no growth potential," Wilhite declared.

• **Experience**—Wilhite said Thiokol's Huntsville, Ala., division first worked on segmented rockets in 1952, when it was working on the *Loki* missile, which had a rocket 3 in. in diameter and 5 ft. long. The *Loki* motor had two segments, a cylindrical portion and a forward head. The head, filled with propellant, was fitted inside the cylinder.

In 1956, Wilhite continued, Thiokol built and fired a segmented motor 6 ft. in diameter. The rocket, called



BIG BOOSTER is loaded as it stands in firing position in this artist's conception, while the second stage waits in the pit to the right. Thiokol's continuous mixing plant was described in detail in the April 18 M/R (p. 28).

NASA to Be in Solid Booster Project

The Air Force will coordinate its Project 3059 big solid booster with the National Aeronautics and Space Administration, it was learned on high authority this last week.

Because of NASA's prime responsibility for developing big boosters, there has been considerable internal Air Force discussion about the appropriateness of sponsoring the development. The decision was positive—that there is a legitimate military requirement for supporting this advance in rocket technology and that the Air Force can take the first step without obtaining approval at the Department of Defense level or higher.

If a large solid rocket is proved feasible under the one-year study planned, the Air Force will go to higher authority before authorizing the next phase—a full-scale development program. During the first year, the Air Force will ask a NASA propulsion official to serve on a committee supervising the project.

Although no decision will be made until after the feasibility study, Air Force officials consider Dyna-Soar *a likely application. A solid booster has the usual advantage of rapid reaction and simplicity—important in any military weapon system.*

the "Big B," consisted of a head section, a main segment 4½ ft. long and a nozzle section.

It makes sense to fabricate the rocket case in segments and put the pieces together at the launch site, he said. Thiokol is convinced that the case should be built up from cylindrical segments, he added. This is because cylindrical weld seams introduce only half as much weakness as longitudinal seams.

Wilhite said he does not consider propellant physical properties a serious problem in design. He said he sees no need for internally reinforcing the grain, particularly when the booster is cast in a vertical, ready-to-launch position.

"The worst condition occurs when a rocket is lying on its side and cold flow of the plastic propellant puts the bond in tension. We ran slump with rocket engines 31 in. in diameter lying on their side for five or six years without ill effects," he said.

• **Loading**—On-site loading is best accomplished with the use of a mobile continuous mixing and loading plant. Wilhite noted that Thiokol has developed a pilot facility for a continuous mixing process at the Army's Longhorn Ordnance Works at Marshall, Tex.

Premixed fractions of the propellant would be delivered to the site in self-discharging transfer containers. The fractions would be in the form of pastes or slurries with very long shelf life, since oxidizer and fuel elements would be kept separate.

The mixing machine would feed directly into the rocket case. Wilhite said it might be wise to launch from near a steep hill or cliff, so as to simplify the layout as shown in the accompanying artist's conception.

He made no estimate of the cost of such an installation. But he said the expense for the continuous mixing and loading plant would be small in comparison with the overall cost of the launching facility.

• **Curing**—After loading, the propellant can be cured by piping hot air through or by wrapping the case with electric blankets. Thiokol studies indicate that the most practical method of curing is a controlled-zone approach —under which the mass would be cured in relatively small sections. If such a large mass were cured at once, it would develop excessive stresses and strains during contraction on cooling, which would probably produce propellant faults.

After curing, the core and casting fixtures are removed and the grain is trimmed to the desired size. Since propellant is poured from the forward end, the head must be attached after curing. This attachment will have to be made with bolts or screws, since it is obviously impossible to weld.

For materials handling, the principal items required are self-discharging transfer containers to feed the propellant ingredients to the mixing equipment. Thiokol said several types of pressure feed tanks on the market can be modified for this purpose.

Special mobile cranes or elevators and miscellaneous feeding and transfer equipment will also be needed for propellant handling. The operation can be made mobile and self-sufficient by installing everything on tractor-trailers, lowboys, refrigerated vans or trucks.

Some additional minor pieces of equipment will be required, Thiokol said, but it cannot be described until after completion of a detailed design project.

Secrecy, Fierce Competition Mark Rocket Case Making

Solid propellant rocket cases, a market that may approach a billion dollars in the next half-decade, make up one of the most fiercely competitive and secretive areas in the missile-space business.

The competition is wide open because there are thousands of companies in the metal and metal-parts trade who are qualified or who think they are qualified. And, with the recent interest in plastic rockets, hundreds of plastics manufacturers are potential new competitors.

These are the findings of a special M/R survey of companies in the field.

The rocket-case business is secretive for many reasons. Military security plays a prime role, of course. The desire to protect companies' proprietary secrets is another factor. A third is the reluctance of propulsion contractors to identify their suppliers.

The rocket-case business is lucrative because, in the missile age, it is a piece of hardware that still can be manufactured by mass production methods. If you can meet the tolerances and deliver in quantity, you can earn a nice piece of change.

However, there is a great deal more to the "ifs" than meets the eye. A few large companies suffered very bloody noses in the early stages of the rocket-case business. Some smaller ones lost their shirts.

• **Confinement**—The engineering problem—steering between the Scylla of too much dead weight and the Charybdis of too little strength—leaves little room for maneuver.

For in the solid rocket, the rocket itself is the combustion chamber. The entire case—not just the throat area as in a liquid rocket—must withstand the tremendous pressures of the expanding gases. Thus, the solid rocket has more dead weight than the liquid engine.

As solid rockets have grown bigger, the problems have gotten worse. Currently, the most headaches—and consequently the most money—are in the cases for the Air Force *Minuteman* ICBM, the Navy's *Polaris* fleet ballistic missile and the Army's *Pershing*.

Polaris cases have been in production for several months. The Navy plans to bring the submarine-launched weapon to operational status by the

end of this year. Next in line will be the Army's *Pershing*, which may go into production before the end of the year. *Minuteman* still has at least another year to go.

A fourth big solid missile, whose status is still unclear, is the Army's antimissile *Nike-Zeus*. It will be at least a year before the *Zeus* goes into production.

• **Those involved**—Five companies are involved with the production of *Polaris* cases. They are Aerojet-General Corp., Norris-Thermador Corp., Kaiser Metal Products Inc., A. O. Smith Corp. and Excelco Developments Inc.

Excelco—together with its companion company, Newbrook Machine Corp.—manufactured most of the cases while *Polaris* was in the development stage. Shortly before the missile went into production last year, Aerojet-General, the propulsion system contractor, acquired the Rheem Manufacturing Co. of Downey, Calif.

Aerojet centered its case manufacturing in the Downey plant. However, to meet the Navy's requirements, Norris-Thermador, Kaiser and Smith, which had been making development cases, were given production contracts.

The amount of money involved and the production rate are classified. The Navy declines even to disclose just how much of the current year's $876 million *Polaris* budget is going for cases.

Pershing cases are being made by Pratt & Whitney Division, United Aircraft, and Young Development Division of Hercules Powder Co. Douglas Aircraft Co. makes *Nike-Zeus* cases.

The *Minuteman* situation is complicated by the competition for propulsion contracts. Thiokol Chemical Corp., sole source on the big first stage, has at least four sources for cases: Allison Division of General Motors, Solar Aircraft Division of International Harvester, Pratt & Whitney, and Curtiss-Wright.

On the second stage, Aerojet has been chosen as primary source and Thiokol is providing a limited technical backup. Aerojet's Downey Division and Lycoming Division, Avco Corp., are providing Aerojet's cases. Thiokol obtains cases from Allison and the Rocket Engine Section of the General Electric Co. It is understood that Allison plans a proposal to Aerojet on the second stage too.

Aerojet and Hercules Powder Co. are in competition for the third-stage contract. Both are making their own cases. Aerojet is also obtaining development cases from Lycoming, Pratt & Whitney, General Electric, Allison, Solar and Curtiss-Wright.

• **Techniques**—Manufacturing techniques will probably vary widely on the large missiles, depending on the time the production run begins and the urgency of the program. The earliest method was "roll and weld" as in the production of aircraft bodies. It was a natural method to be adopted, since many rocket contracts have been awarded to aircraft manufacturers.

Some development companies achieved outstanding results with this method. Industry spokesmen often express amazement at Excelco's success.

According to metallurgical theory, the roll and weld method introduces a weakness in the longitudinal weld seam. The theory is that the crystal structure of the metal is disturbed by the welding, which heats the metal unequally.

Spokesmen for Excelco dispute the theory vigorously. A. J. Newman, Excelco vice president, shows visitors welded cases hydrostatically tested to failure. In every case, the burst is away from the seam. It is a question of getting welders who know their business, Newman says.

To avoid the problem of the longitudinal seam, manufacturers are experimenting with several processes involving seamless cylinders. Some are starting from forged rings and spinning or flow-turning the rings into cylindrical shape. The head is welded on. This does not introduce as much weakness because there is only half as much strain across a circular weld as across a longitudinal weld. *Pershing* cases will probably be made without a longitudinal seam.

But the use of forged rings and spinning equipment is expensive, parthe *Minuteman* first stage. Thiokol is investigating many approaches in an effort to find a manufacturing method that will provide cases of the necessary strength at minimum cost.

• **Downhold**—Keeping costs down is especially important in the *Minuteman* program because the low cost of solid rockets was one of the main factors involved in the Air Force decision to develop a third ICBM.

In *Polaris* manufacture, a longitudinal seam is used but it is reinforced. The case, 54 in. in diameter, is .220 in. thick. Across the weld, this is reinforced to a thickness of .280 in. to insure complete reliability.

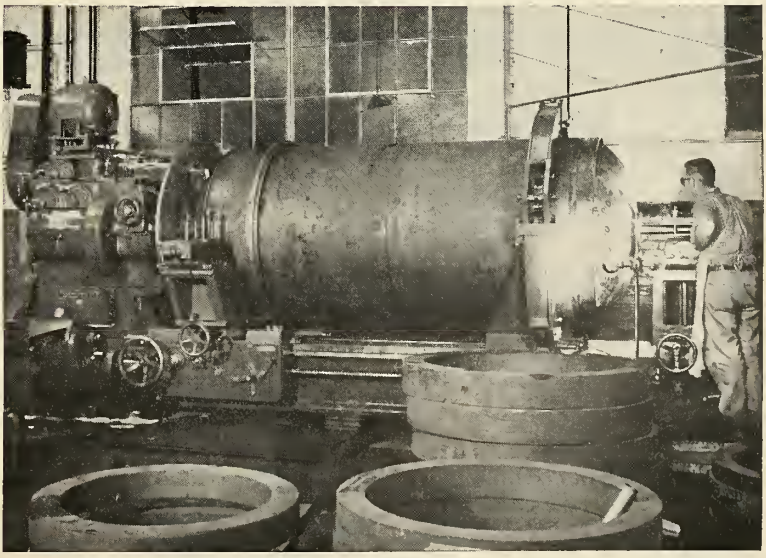
A. O. Smith Corp. reports it has manufactured more than 80 first-stage *Polaris* cases with only one hydrostatic test failure on the longitudinal seam. The failure, in a case without weld reinforcement, was attributed to a human error in reading a radiograph.

In manned aircraft, welding design normally calls for a 15% decrease in strength across a weld. The reinforcement adds enough metal to increase strength by about 25%.

• **Conservatism**—The steel used for *Polaris* cases is a slight modification of AMS 6434, designated by Aerojet as M255. It is heat-treated to a 0.2% offset yield strength of 190,000 psi.

This is a very conservative design, since AMS 6434 steels are considered capable of heat-treating up to 210,000 or 220,000 psi yield. The cases are tested at 1150 psi proof pressure, which imposes a stress of 145,000 psi.

The *Polaris* chamber pressure is classified. However, it can be assumed it is lower than the 1150 psi proof



POLARIS **CASE is shown in production at the Vernon, Calif., plant of Norris-Thermador Corp. A horizontal lathe is machining the outer surface.**

pressure. This adds another level to the conservative design: The chamber pressure is lower then the proof pressure; the proof pressure stress is lower than the heat-treated strength of the metal; the heat-treated strength is less than the maximum.

The production methods at Norris-Thermador are typical of the methods used for making *Polaris* cases. At its Vernon, Calif., plant, Norris-Thermador uses rolled sheet, plate and rough forgings in producing first and second stage cases. Welding is performed with the use of a tungsten inert gas head to protect the steel from oxidation.

Case heads are formed on a 6000-ton Lake Erie hydraulic press, welded to the sub-assembly and machined to final critical dimensions. The units are delivered to Aerojet separately, but with closures attached.

The case is heat-treated after the head and closure are welded to the body sub-assembly. This is done in a gantry-type furnace featuring a vertical, drop-bottom construction and an oil-quench pit. At A. O. Smith's Milwaukee plant, the heat-treat quench is in molten salt.

Another machining follows the heat-treat. Then the case is hydrotested. Complete final machining and final inspection wind up the production.

The *Polaris* specification calls for machining welds before and after reinforcement. Some engineers have questioned this requirement on the ground that the machining introduces weakness into the weld area. As far as is known, *Polaris* is the only major missile program that requires machined welds. The reason is classified.

Chutes, Solid Rockets To Help Recover *Saturn*

A combination of parachutes and solid-propellant retro rockets will be used to recover the *Saturn* booster, Dr. Wernher von Braun says.

After a 200-mile trajectory from Cape Canaveral, the booster will enter the atmosphere at about Mach 5, Von Braun has told the House Appropriations Subcommittee.

The recovery equipment and the operation for recovering one booster will cost about $250,000, Von Braun said, and the value of engines and other hardware recovered will be much greater.

The booster will go through a cluster of parachutes to bring it down to the water at low speed, he explained. At the end of a 100-ft. line will be a fuze that will be ignited on contact with the water. The fuze then fires eight rockets to counteract the remaining downward velocity and the booster eases into the ocean.

Ocean Research to Get $60 Million

Government plans to build ships and laboratories, develop research tools and recruit scientists

by William Beller

For the past two weeks the problems of oceanography have been gone over in congressional hearings relative to bills pending in both the Senate and the House. What these hearings mean is that the government is thinking of spending about $60 million a year for oceanographic research.

Late last month the Senate's Committee on Interstate and Foreign Commerce held hearings on the bill, the "Marine Sciences and Research Act of 1959," which drew heavily for recommendations from a report by the National Academy of Sciences-National Research Council's Committee on Oceanography. The Senate committee seemed favorably disposed towards the bill and there is a chance that it will be brought to the floor during the present session of Congress.

On the House side, an oceanographic bill identical with the Senate's is resting in the Merchant Marine and Fisheries' Subcommittee on Oceanography. There is little chance that this one will see the floor of the House this session. There were also oceanographic hearings last week before the House Space Committee, which were pegged to an Overton Brooks bill, but few people believe that this particular work has any significance.

• **What's important**—Whether or not legislative action is taken on any of the oceanographic bills during this session of Congress is not believed to be too important. What is important, according to a member of the Subcommittee on Oceanography, is that congress realize the importance of oceanography, that soon the body will be appropriating money for the work, and that meanwhile various government agencies already have the power to increase the tempo of their oceanographic studies and will be doing so as fast as they can.

The purposes of the identical Senate and House bill is "to advance the marine sciences; to establish a comprehensive ten-year program of oceanographic research and surveys; to promote commerce and navigation; to secure the national defense; to expand ocean resources; to authorize the construction of research and survey ships and facilities; to assure systematic studies of effects of radioactive materials in marine environments; to enhance the general welfare; and for other purposes."

The organizations listed in the bill to help in this work and to receive appropriations for their help are the National Science Foundation, Division of Marine Sciences; various activities in the Department of Commerce; the Department of Health, Education, and Welfare—Office of Education; the

Summary of Recommended Budget for New Oceanographic Activity by Agency

(Report of Nat. Acad. of Sc.-Nat. Res. Council)

(millions of 1958 dollars)

ar	Navy	Coast and Geodetic Survey	Bureau of Commercial Fisheries	Maritime Administration	Nat. Sc. Foundation	Office of Education	Atomic Energy Comm.	Bureau of Mines	Total
60	28.78	5.83	7.97	5.45	6.40	0.50	3.08	0.35	58.36
61	28.83	6.09	13.86	3.80	8.35	0.50	2.95	0.25	64.63
62	30.40	9.75	12.83	1.65	12.65	0.50	4.35	0.25	72.38
63	33.80	8.70	12.42	....	11.60	0.50	2.95	0.25	70.62
64	35.22	9.30	11.75	....	11.98	0.50	2.95	0.25	71.95
65	32.68	9.20	15.03	....	13.32	0.50	2.95	0.25	73.93
66	27.45	9.88	12.38	....	14.08	0.50	4.35	0.25	68.89
67	20.36	6.43	12.20	....	14.22	0.50	2.95	0.25	56.91
68	20.36	6.43	12.37	....	14.22	0.50	2.95	0.25	57.08
69	20.36	6.43	12.35	....	14.22	0.50	2.95	0.25	57.06
tal	278.24	78.04	123.16	10.90	121.04	5.00	32.43	2.60	651.41

Summary of Recommended Budgets for New Oceanographic Activity

(Report of Nat. Acad. of Sc.-Nat. Res. Council)

(millions of 1958 dollars)

ar	Education and Manpower	Ships	Shore Facilities (Research)	Shore Facilities (Surveys)	New Devices	Radioactivity in Oceans	Resources	Total
60	0.80	39.80	1.50	0.76	7.40	3.08	5.02	58.36
61	0.80	40.45	2.70	1.52	9.50	2.95	6.71	64.63
62	0.80	45.30	3.90	3.00	9.60	4.35	5.43	72.38
63	0.80	35.95	6.60	4.50	10.90	2.95	8.52	70.22
64	0.80	33.65	10.50	6.00	10.50	2.95	7.55	71.95
65	0.80	29.00	12.60	7.50	10.50	2.95	10.58	73.93
66	0.80	20.55	13.50	8.26	10.50	4.39	10.93	68.89
67	0.80	10.45	13.20	8.26	10.50	2.95	10.75	56.91
68	0.80	10.45	13.20	8.26	10.50	2.95	10.92	57.08
69	0.80	10.45	13.20	8.26	10.50	2.95	10.90	57.06
tal	8.00	276.05	90.90	56.32	100.40	32.43	87.31	651.41

Atomic Energy Commission; and the Navy.

The bill asks for a coordinated, long-range program of oceanographic research similar to that recommended as a minimal program by the Committee on Oceanography of the National Academy of Sciences-National Research Council. This program lists the following needs:

• Building modern, oceangoing ships for scientific research, surveys, fisheries exploration and marine development.

• Building laboratory and shore facilities adequate to service and supplement the research and survey fleets.

• Developing new and improved research tools, instruments, and techniques including bathyscaphs and other manned submersibles, manned and unmanned deep ocean buoys, modified icebreakers, acoustical equipment and telemetering devices, current meters, direct density, turbulence and radioactivity measuring devices, biological sampling instruments, precision salinometers and echo sounders, magnetometers, and deep sea underwater cameras.

• Recruiting prospective oceanographers from among undergraduate students of science, and facilitating their advanced education through a fellowship program.

• Getting more knowledge about the habits and use of marine life.

Establishing a national oceanographic records center to disseminate oceanographic and related data.

• Developing international cooperation in the marine sciences.

• **Ships & planes**—The engineering needs for ocean exploration were brought out in the National Academy of Sciences-National Research Council's "Oceanography 1960 to 1970," as well as by witnesses at the Senate hearings. Such needs were in large part based on ASW requirements.

More oceanographic research ships were asked for, ones uniquely designed for their missions. It was said that those that the country does have are makeshift, obsolete and uneconomical to operate.

A vigorous program aimed at developing manned submersibles was asked for. These craft should be able to get down to the bottom of most of the ocean and make whatever measurements and studies are needed there.

There is need for open-ocean manned research platforms which are stable and can remain in place so that time studies can be made.

A major program is needed to develop anchored and drifting buoys for getting space and time coverage of ocean characteristics.

The Academy says that it seems likely that aircraft can be used effectively for some research and surveys on the open ocean, particularly for studies involving the joint problems of oceanography and meteorology. Nearly all laboratories will need single-engine planes; several will need twin-engined amphibians; some will need four-engined commercial-type aircraft.

• **Further suggestions**—Here are other recommendations made:

Instruments should be developed for survey work, which are more accurate, effective and trouble-free than those now in use. Specialized devices such as Loran C, inertial navigation equipment, gravity meters and stable platforms should be made available for research as well as surveys as soon as possible.

A major program aimed at developing new high-seas engineering techniques should be started. Restricting our work are our limited abilities to handle heavy equipment at sea and to conduct operations such as drilling and bottom sampling of the ocean floor.

Machine aids to computation and data storage have much to offer and should be looked into for oceanographic applications.

High-pressure facilities to permit controlled physical and biological experiments in the laboratory are needed.

Efforts should be made to secure the active participation of private industry in the development and manufacture of new devices and instruments for oceanographic research and surveying.

Navy's Morris Dam Spotlights Undersea Guidance, Control

Underwater antics of missiles and torpedoes are under close Navy study.

Special facilities at Morris Dam near Azusa, Calif., may provide solutions to difficult problems of guidance and control of missile after water impact and entry. The research and development program is looking also for improved torpedo vehicles and techniques.

The site is equipped with a one-of-a-kind variable angle launcher (VAL) to simulate almost every possible water entry angle. Missile nose cones and system components are fired into the 160-ft.-deep lake by a compressed air system through 300-ft.-long tubes. Small subsystems and components are usually mounted in Mark 25 torpedos left over from World War II.

Principal use of the VAL system is to determine what happens when a missile hits the water's surface. If the test involves components only, effects of g forces during water entry are evaluated. Considerable time is devoted to studies of the minimum angle at which a missile can hit the water and follow through on its mission without "skipping" across the surface like a flat rock.

A second area of investigation involves research in water entry velocity. This approach varies considerably between test missiles, but prime purpose is to achieve configurations with optimum velocity and without danger of structural damage.

Third main study area at Morris Dam is verification of model-based computations as to underwater trajectory and the relationship of the trajectory to structural demonstrations.

Data are recorded by high-speed motion picture cameras and hydrophones. Evaluation of test results is made at the Naval Ordnance Test Station, Pasadena Annex, with optical, audio and computer equipment. The Pasadena Annex, like Morris Dam, is an adjunct of the Naval Ordnance Test Station at China Lake, Calif.

Test vehicles may be designed to float after launch. This provides ease of recovery. If the vehicle sinks, however, electronic "queening" search gear is used to locate the test object. Ten Navy divers are on hand to aid recovery which can take days if the vehicle sinks into the deep silt of this typical foothill lake.

Other test facilities include a nose cone water entry device. This unit, using huge shock cords as propulsion, operates exactly like a giant slingshot—slamming the nose cones into the water from about 200 ft. over the surface.

The Morris Dam site also has a propulsion research area for static firings of both solid and liquid propellants.

About 50 scientists and technicians, in addition to the divers, are assigned to the site on a permanent basis.

Hydrofoils Entice Navy, Maritime Administration

Succumbing to the lure of 100-knot surface skimming, the Navy has sent out requests for bids on an operational 115-ton hydrofoil boat and the Maritime Administration has awarded a contract for a 60-knot, 80-ton craft to Dynamics Developments Inc., an affiliate of the Grumman Aircraft Engineering Corp.

IRE-ARS Conference Has Good Panels, Poor Exhibits

CINCINNATI—Graced by the presence of some of America's top scientists, the 14th Annual Joint IRE and ARS Spring Technical Conference on electronic data processing and space technology drew an undeservedly small attendance here.

Although its dull and unimaginative exhibit hall warranted (and received) slight attention, the panels drew interested and active audiences during the two-day meeting.

Chaired by such stalwarts as Avco-Crosley's Dr. George Bruck and J. C. Elms (vice president and general manager), IBM's R. G. Connihan, University of California's Dr. Joseph Kaplan, M.I.T.'s Dr. Charles S. Draper, Sperry Rand's T. H. Bonn and Maj. Gen. M. C. Demler and Col. J. Paul Stapp of the Air Force, the eight panel sessions were informative and well directed.

Rocketdyne Uses Dry Ice To Cool Propellant Mix

Dry ice is being used to cool and speed the processing of solid propellant, Rocketdyne Division of North American Aviation reports.

At Rocketdyne's Solid Propulsion Operations in McGregor, Tex., the company disclosed recently, process engineers found that dumping dry ice into the propellant mix reduces mixing time by at least 30% and makes it possible to cut reject rates by as much as 20%.

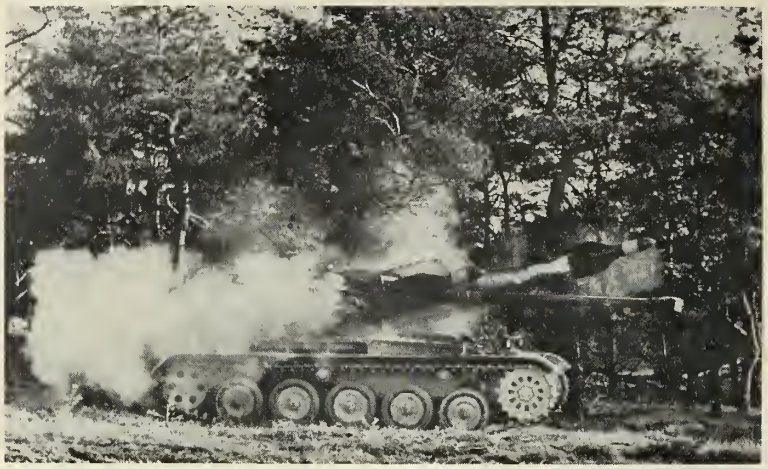
Here is why: Propellants with a high burning rate must be mixed very slowly because heat buildup in the mix necessitates periodic stops for cooling. Previously, water was circulated through the mixer jacket at a temperature of 40°F. Despite this, the mix temperature would climb above 155°F.

By dumping 50-lb. batches of crushed dry ice directly into the mix, Rocketdyne engineers reduced the temperature of a 450-lb. mix to about 80° each time. A total of 200 lbs. of dry ice was used with each batch.

There was no contamination of the propellant—the dry ice all bubbled away harmlessly as carbon dioxide gas.

Stauffer Produces New High-Energy Oxidizers

Stauffer Chemical Co. has begun pilot-plant production of two new high-energy oxidizers, nitrogen trifluoride and tetrafluoro-hydrazine. The compounds are useful by themselves or as building blocks for more complex compounds, Stauffer said.



GE May Get License for Nord's *SS-11B*

General Electric Co. is expected to be awarded a license shortly to manufacture the Nord *SS-11B* antitank missile.

Details of the licensing arrangement were still being worked out last week, M/R was informed. The *SS-11B*, which closely resembles the *SS-11* shown being fired from a tank above, is aimed by remote control and eliminates the wire guidance of the *SS-11*.

In a development Nord calls "human sense control," the missile operator employs a pair of binoculars containing infrared cells sensitive to the heat impulses emitted by the exhaust of a jet tracer in the missile. Trajectory is automatically calculated in a transistorized fire control box worn on the operator's belt and fed to the missile's guidance. The flight path duplicates the line of sight course in the cross hairs of the binoculars.

The *SS-11B* has a minimum range of 100 yards compared to 550 yards for the *SS-11*. Effective maximum range is 2.2 miles for both versions of the missile.

If the license agreement goes through, it will be the third Nord missile to be produced under license in the United States. The French company recently licensed Bell Aircraft to produce *CT-20* and *CT-41* drones.

British Report On R&D Funding Trend

The British Government's Department of Scientific and Industrial Research estimates that of the $830.7 million spent during 1958 on research and development by British manufacturing industry, $280 million was spent by the missile and aircraft industry. In fact, about 80% of the defense contracts for research and development were awarded to the missile, aircraft and electrical engineering industries.

The Department lists the "cost per qualified worker in research and development" in various industries. The missile and aircraft industry worker heads the list at $86,136, with the automobile industry second, a good way behind, at $55,378.

An interesting table compiled by the Department of Scientific and Industrial Research is one showing "research and development expenditure compared with net output" (defined as "the value added to materials by the process of production, including the gross margin of any merchanted or factored goods sold"). The missile and aircraft industry's net output is given as $783.7 million: the research and development expenditure, $280 million, represents 35.7% of this figure. The next industry on the list, electrical engineering, shows a percentage of 11.9.

• **R&D doubles**—The Department of Scientific and Industrial Research states in its report: "In 1955 it was estimated that nearly two-thirds of expenditure on research and development in manufacturing industry's own establishments was provided out of defense contracts. In 1958, the proportion was less than half, so that expenditure on civil research and development has approximately doubled between 1955 and 1958."

The British budget for 1960-6 provides for an increase in the amoun of money allocated to the Ministry o Aviation for research and developmen during 1960-61 of $23.8 million, o about 4%. Of the total ($566,020,000) "research and development work b industry" will account for $434,170, 800, an increase of $14 million, o 3½%. Most of the balance is mad up by allotments to British Govern ment research establishments, payment to Australia in respect of the Woomer range and "assistance to the develop ment and proving of transport aircraft.

More French Vessels To Be Armed With Missile

The last of eighteen 2700-to escorters launched for the French Navy will be equipped with *Malafon* an 11-mile range anti-submarine mis sile, instead of the antiaircraft missile previously indicated by the French.

Spokesmen for the French Nav have announced that it will reques in the Defense program law now be ing prepared, the construction of fou or five missile cruisers (5-ton) an of the prototype of new escorters whicl also will be armed with missiles.

RAF Medical Research Has 100,000-ft. Ceiling

LONDON—Although Great Britai is putting a great deal of money int new equipment and expansion at th RAF Institute of Aviation Medicin research facilities for space medicin are not included in the program, c even contemplated.

Equipment at the Institute is d signed for experiments in human ascer up to altitudes of 100,000 feet—b not beyond. Present facilities include human centrifuge with two rotor arm each outfitted with gondola and axi observer station; large climatic chan bers and several high-altitude chan bers.

Among sections in the Institute a Acceleration, Flight Selection and Ps chology, Applied Physiology, Climat Testing, Comparative Physiology, Hi Altitude Physiology, Training, Bi metry, Biophysics, Biochemistry, Tec nical and Equipment.

Problems peculiar to Naval avi tion are included in the experiment program. Cmdr. F. Burgess, MS USN, is stationed at the Institute und an exchange arrangement with t U.S. Navy.

Polaris-Subroc?

Joint Fire Control Is Proposed by Librascope

The Librascope Division of General Precision Equipment Corp. is proposing development of a combined fire control system for *Polaris* and *Subroc* missiles for use aboard *Polaris*-launching submarines.

J. J. Murray, General Precision chairman, says Librascope is "currently negotiating" the proposal.

Librascope developed the fire control system for the *Subroc* antisubmarine missiles soon to be operational in nuclear-powered fleet submarines. General Electric developed the fire control system for *Polaris*.

General Precision also has announced its entry into the transistor field. Murray said. A new company, The Kearfott Semiconductor Corp. with facilities in West Newton, Mass., has been formed for development and production of transistors and other advanced semiconductor devices.

The new company will operate under the Kearfott division of General Precision. Robert N. Brown, VP and general manager of the Kearfott division is chairman of the new company, and Stephen Cudlitz, formerly of the Instrumentation Laboratory of MIT, has been elected president. Robert S. Henderson, also formerly of MIT, has been named executive VP.

Tiros I Pictures Give New View of World Cloud Forms

U.S. Weather Bureau meteorologists reported last week that *Tiros I's* pictures have revealed an unexpected large degree of organization in the earth's cloud systems.

By the end of last week the weather satellite had completed some 300 orbits around the earth and had taken over 7000 pictures.

The most striking revelation, according to Dr. F. W. Reichelderfer, Chief of the U.S. Weather Bureau, came in pictures taken of the spiral cloud formations associated with large storms. Some of these spiral formations viewed by *Tiros I's* cameras were more than 1500 miles in diameter.

The cameras gave meteorologists, according to the Weather Bureau's Director of Meteorological Research Dr. Harry Wexler, "the first definite proof that a large percentage of such storms (spiral) . . . have a banded structure."

Radar during World War II, Dr. Wexler related, observed that tropical storms consisted of bands of clouds spiraling around a center rather than "a solid cloud mass rotating around the center." *Tiros* proved for the first time that clouds outside of the tropics have the same type of structure.

Weather satellites, according to Dr. Reichelderfer, will not replace current operations in predicting weather one or two days in advance, but will greatly increase the meteorologists' capability to make long-range forecasts by showing them the comprehensive world cloud picture.

Pioneer V 'Repaired' from Over 5,000,000 Miles Away

Pioneer V was "repaired" last week from a distance of over 5 million miles.

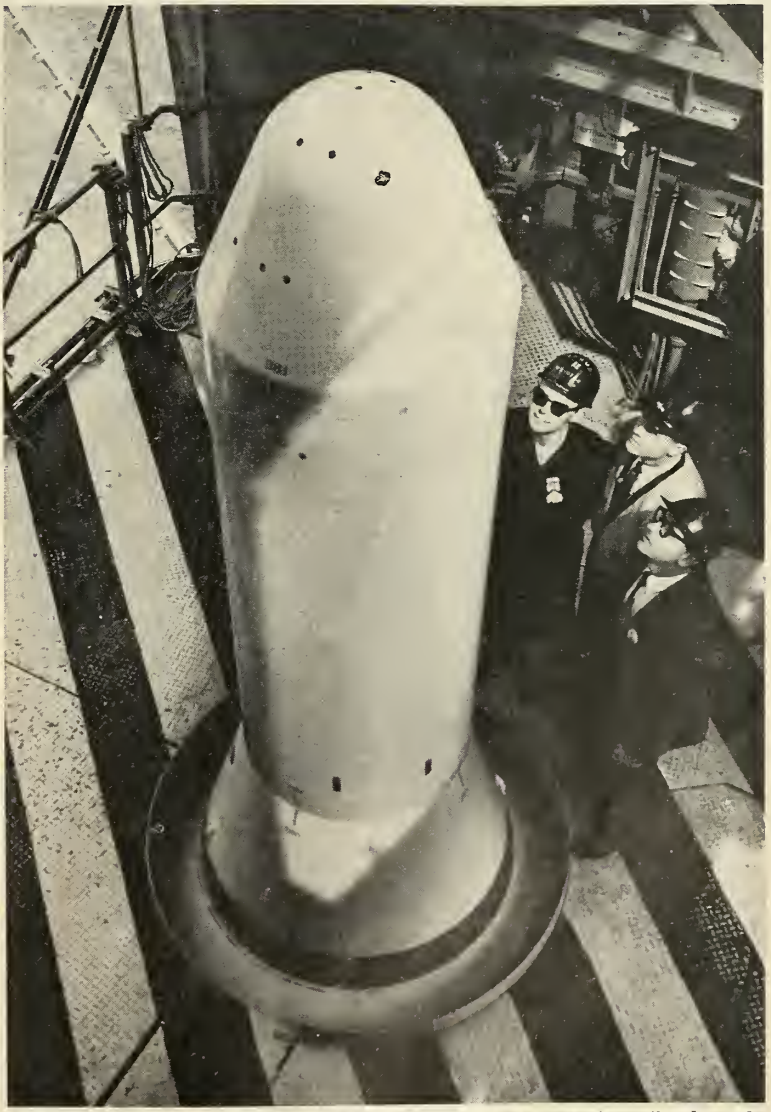
The source of trouble was the sun satellite's "telebit" unit which collects data before it is transmitted to earth.

Robert Gottfried of Space Technology Laboratories, Inc., who was instrumental in the design of the "telebit" unit, traced the trouble to a diode the size of a pinhead. He then worked out a new translation code for the channel taking the bad diode into account.

Gottfried's feat was extremely difficult, considering that the 10 lb. "telebit" unit contains some 450 transistors, 1500 diodes, 1600 resistors, 1000 capacitors, and several thousand soldered connections.

Before the "repair," values coming from the telebit channel which handles battery voltage levels, battery temperature readings and solar-cell paddle temperatures were obviously wrong.

Just One More Look



LAST INSPECTION is made of Avco nose cone before it soared 5000 miles down the Atlantic Missile Range aboard successfully fired Martin *Titan* on April 21.

Direct Reading Goniometer

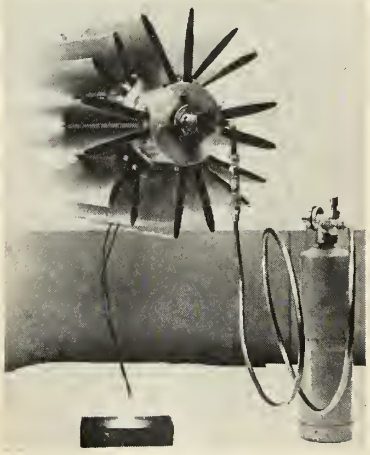
Calibration of divided circles, polygons and angle gages with direct reading to 0.1 second of arc is possible with the new Microptic Precision Goniometer developed by the Engis Equipment Co.

The bearing for the worktable carries a glass-divided circle, and the auto-collimating telescope unit also contains an optical system for determining the mean value of the opposite-side circle readings. Thus the measurement of the auto-collimator rotation and the measurement of the table rotation may be obtained separately with equal precision. The table may also be rotated relative to the divided circle about an auxiliary center by means of a micrometer spindle engaging a wormwheel. A second auto-collimating telescope is mounted on a column carried by the base casting.

Circle No. 225 on Subscriber Service Card.

Thermoelectric Generator

The General Instrument Corp. has produced a small (one-foot-high), lightweight (10 pounds) automatic thermoelectric generator than can produce electricity for a year on $10 worth of ordinary propane gas and will keep running as long as the fuel supply lasts.



Believed by the company to be "the first practical thermoelectric generator actually to be made commercially available in the United States," the unit is designed as an "ultrareliable and unmanned source of power" for radio communications, sea and air navigational aids, and industrial and scientific instrumentation in remote areas where other sources of electricity are not available or have a short life span and must be replaced or recharged.

The generator is expected to be priced at $500 or less in large-scale production quantities. Single "evaluation samples" are avalaible at a price of approximately $5000.

The generator, which employs "thermopiles" semiconductor elements to convert the heat of the burning propane into electricity, produces five watts of power, for as long as the fuel supply lasts. It has been designed to run for approximately a year on a 200-lb. tank (50 gallons) of propane gas, which sells commercially for about five cents a pound. By storing 1000 pounds of propane gas with the generator, it could run unattended for five years, according to the company.

Circle No. 226 on Subscriber Service Card.

Position Transducer

Small angular measurements can now be taken while maintaining all of the advantages of a precision potentiometer, with a new angular position transducer produced by Bourns, Inc.

Sensitive to a rotation of 0.012° and with a range of ±3° to ±5°, the instrument is currently being used on the gimbals of a rocket motor to provide a telemetering signal proportional to its angular movement. The magnified input of a small angular movement actuates a wiper which moves across a precision potentiometer producing a high-level DC output that can be used without amplification. Completely sealed against environmental conditions, the unit is oil-filled to further increase its life, eliminate noise and damp all resonant frequencies.

Flat frequency response to 30 cps has been observed without discontinuities or excessive wear. Life expectancy of the model is over 100,000 cycles.

Circle No. 227 on Subscriber Service Card.

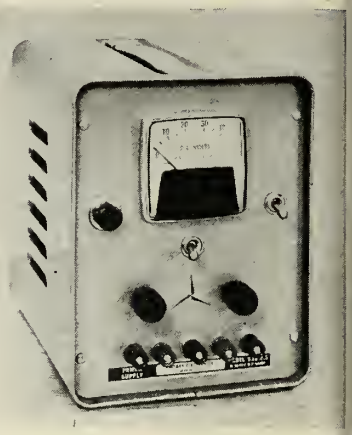
Transistor Power Supply

Trygon Electronics has introduced the new Trylab series of transistorized power supplies designed specifically for laboratory applications.

The units furnish 0-36 Volts DC at 0-600 ma and 0-18 Volts DC at O-1 Amp, with 0.05% line and load regulation and less than lmv. ripple. Automatic short circuit protection is provided with variable current limiting provisions to enable the user to draw only the required amount of power, thus protecting the load from overcurrent conditions. Turn-on and turn-off transients have been eliminated even for light loads, protecting the load from overvoltage conditions.

Remote sensing circuits have been incorporated in the units to maintain the required regulation at the load; remote programing over the entire voltage range is available as an optional feature.

The series regulator network, featuring a by-pass resistor technique, allows the power transistors to operate



at a lower temperature by dissipating the excess electrical energy in power resistors. Since the junction temperature of the transistors is thus reduced, a longer operating life results for these solid-state components.

Circle No. 228 on Subscriber Service Card.

Component Coating

A silicone base varnish, water thin and transparent, is being marketed by Melpar Inc., for the protective coating of electronic components.

The varnish, Melvar A-100, has a low curing temperature, a high operating temperature (400°F), and satisfactory fungicidal properties under tests specified in MIL-V-173A. The coating protects against electrical leakage caused by contaminants and breakdowns at high altitudes, and reduces moisture absorption.

The varnish can be applied by dipping, brushing, spraying or vacuum-impregnating without obliterating component markings.

Circle No. 229 on Subscriber Service Card.

'Blind' Welder Announced

An electronic seam weld-tracing device has been placed on the market by Welsma Co. The instrument automatically causes the electrode of the torch to follow the seam regardless of any mismatch in the workpiece.

When the electrode deviates from the seam an error signal is produced.

Amplification of this signal causes a servo motor to move the torch in a direction that nullifies the signal—in effect, guiding the torch back to the seam.

The instrument permits blind welding. The torch can be initially placed some distance from the seam, but as soon as a small arc is struck, the torch will move toward the seam and stay with it until the welding cycle is complete. Sample tests have shown that the deviation of the torch from the seam does not exceed 0.003 in. regardless of any mismatch and is negligible when passing over a small tack.

Circle No. 230 on Subscriber Service Card.

Alloy Junction Material

Indium precision spheres, for forming alloy junctions in germanium transistors with purity up to 99.9995% are available from Accurate Specialties Co., Inc. This ultrapure indium sphere assures reproducible results in forming the junction to the germanium crystal, according to the firm.

The spheres can be had in diameters ranging from 0.001 in. to 0.250 in. with the diameters held down to plus or minus 0.0001 in. precision and sphericity to plus or minus 0.0001 in.

In addition to pure indium, a number of alloys are available in spheres using the 99.9995% pure element. These include indium-gallium, indium-zinc, indium-gallium-gold, indium-gallium-zinc, indium-gallium-aluminum, indium-germanium and indium-germanium-gallium.

Production sphere lots of 1,000,000 pieces or more can be delivered within 10 days of receipt of order.

Circle No. 231 on Subscriber Service Card.

Read-out Oscilloscope

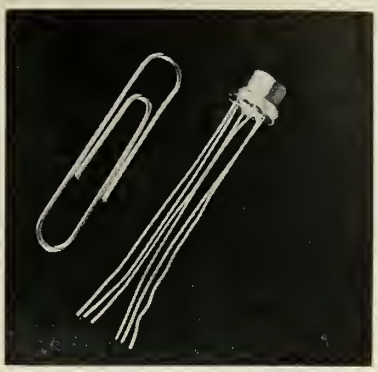
The indeterminate patterns of wave forms on an oscilloscope have been related to direct numerical reading and these readings have been automatically transferred to key punch machines for permanent record and statistical analysis in the DuMont Laboratories' new 425 Oscilloscope.

This direct tie-in of an oscilloscope with key punch equipment brings automatic tabulation of statistical test data to the laboratory or plant floor. The 425 scope can feed its data directly into analog and digital computers. If a variety of tests are contemplated, information from a battery of scopes can be printed on a single card.

Circle No. 232 on Subscriber Service Card.

Multiheaded Transistors

The Electronic Transistors Corp. has developed and is currently manufacturing multiheaded transistors to effect a further subminiaturization in transistorized circuits to a much greater degree than is now in use.



The multiheaded transistor is a combination of any type or types of transistors presently in use. These combinations, for example, may include PNP, NPN, Audio Frequency, Amplifier, Computer, Converter, General Purpose, High Frequency, Low Frequency, Intermediate Frequency, Low Noise, Matched Pair, Medium Frequency, Mixer, Oscillator, Radio Frequency, Subminiature and Switching. These applications may be combined in every variation and combination desired as each multiheaded transistor contains the individual transistor as per specifications in the multiheaded package.

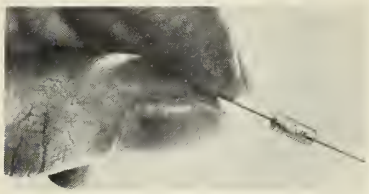
The combination of these individual transistors within the multiheaded package creates no interference and has absolutely no contact with any other transistor within the package inasmuch as they remain individual as if they were not in the same package.

Circle No. 233 on Subscriber Service Card.

Germanium Tunnel Diodes

Sperry Semiconductor has announced immediate availability of germanium tunnel diodes covering the widest range of typical peak currents being offered to the industry. Sample quantities of types T101-T105, with peak currents ranging from 0.8 ma to 20.0 ma are available through all Sperry sales offices for engineering investigation and application.

Peak to valley current ratios on all types are in excess of 5.0 to 1, typically 8.0 to 1. Offering many inherent design advantages, including small size, reliability, radiation-resistance, wide temperature range and high cutoff frequency, they have a typical peak point voltage of 50 millivolts and typical valley point voltage of 250 millivolts. Op-



erating and storage temperature range is from —55 to +100°C. The units have a 100 milliwatt dissipation rating at 25°C.

Preliminary specifications have been established on five types for use. Typical peak currents for the five types now in production are as follows: T101—0.8 ma; T102—1.5 ma; T103—3.5 ma; T104—7.0 ma; T105—15.0 ma.

Circle No. 234 on Subscriber Service Card.

Hi-Speed Torque Meter

B & F Instruments has added to its line of products a new high-speed torque meter, Model F2C2A, capable of accurate transmission of torque signals through 50,000 RPM.

The model is being manufactured in ranges from 0 to 100 in./lb. full-scale through 0 to 1000 in./lb. full-scale with 0.6pd male spline shaft ends.

Larger versions of this model with 0.8pd male spline shaft ends will transmit torque through 2500 in./lb. full-scale; a still larger version with 1.2pd splines will cover ranges up to 10,000 in./lb. full-scale.

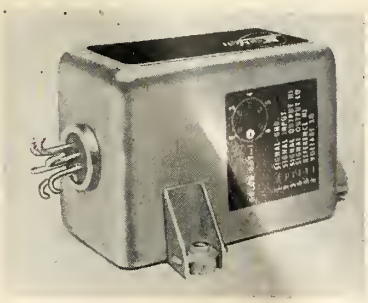
The instrument is usually furnished with coupling halves on the shaft assembly.

Circle No. 235 on Subscriber Service Card.

Rejection Circuit

Kearfott Division of General Precision Inc., has announced availability of the D4816-01 quadrature rejection circuit designed to operate from a preamplifier or gain controlled amplifier into a transistor servo amplifier.

Small and lightweight, this device



rejects the component of the input wave which is 90° from the reference input. The component of the input sine wave which is in-phase with the reference will produce a square wave whose magnitude is proportional to the load and the magnitude of the in-phase signal.

The unit is designed to operate in an ambient temperature range of −55°C to +115°C at altitude from 0 to 100,000 feet.

Circle No. 236 on Subscriber Service Card.

Flush Circuit Laminate

A copper-clad industrial laminate for flush-printed circuits has been developed by General Electric. Designated Textolite 11585, the glass-reinforced epoxy laminate is designed to make printed circuits that take 30 minutes in boiling trichloroethylene, over 30 minutes in gold cyanide solution, or 2 minutes in a 500°F solder bath without blistering or bond failure.

The new grade has high insulation resistance, low water absorption, stability in humidity and superior bonding strength, according to G.E. Engineers.

Textolite 11585 is available in sheets measuring 36 x 48 in. as well as in the standard sheet sizes of 36 x 36 and 36 x 72 in.

Circle No. 237 on Subscriber Service Card.

new literature

ENCODERS. A 12-page brochure, "Shaft Position Digital Encoders With Magnetic Readout," is available from the ASCOP Division of Electro-Mechanical Research, Inc. The literature gives complete specifications for the company's 13-bit, 8-bit, and incremental encoders. In addition, operating principle of the new type of magnetic readout is described in detail with illustrations. Recommended simplified transistor circuitry is given for interrogation playback, detection, and amplification of the new magnetic encoders. A conversion table is included for conversion from binary code to decimal or Gray codes.

Circle No. 200 on Subscriber Service Card.

HIGH TEMPERATURE APPLICATIONS—Bulletin #120, the first in a series of high-temperature applications bulletins offering industry detailed information on the use of ceramic tooling materials at elevated temperatures, is now available at no charge to production engineers faced with high temperature processing problems. Bulletin 120 shows the typical application of a Duramic 2000°F material in an RF soldering application, where the material offers unique characteristics required in this type of high temperature process: high heat resistance, low thermal expansion rate, and non-wettability by molten solder alloys. A photo depicts a fixture arrangement for soldering a magnet assembly giving details on RF coil design, fastening and locating methods used.

Circle No. 201 on Subscriber Service Card.

FLIGHT LABORATORY SERVICES. A 16-page illustrated color brochure describing full services for testing airborne equipment quantitatively and qualitatively in flight is available from the RCA Flight Laboratory, Radio Corporation of America. Services include flight-test instrumentation, data reduction and analysis, and aircraft installation, maintenance and modification.

Circle No. 202 on Subscriber Service Card.

ALUMINUM JOINING—A complete survey of aluminum welding, brazing and soldering is included in a comprehensive, practical, 40 page illustrated manual by All-State Welding Alloys Company, Inc. Among subjects covered are welding aluminum and its alloys by inert gas shielded metal arc with a consumable electrode, inert gas shielded metal arc with a tungsten electrode and the latest arc and gas welding processes. Chapters are also devoted to aluminum brazing with an introduction and detailed description of aluminum brazing alloys, brazing by torch, cleaning and finishing after brazing and charts of brazeable aluminum alloys. The soldering section includes melt and flow charts, how to solder aluminum to other metals and instructions on aluminum soldering with torch or iron—with or without flux.

Circle No. 203 on Subscriber Service Card.

MINIATURE CHOPPERS. An 8-page general instrument catalog which gives a complete set of technical definitions and specifications on new miniature chopper models as well as "standard" instrument chopper models is now available without cost from James Electronics Inc.

Circle No. 204 on Subscriber Service Card.

COOLING CRYOGENIC ELECTRONICS. A variety of miniature and compact refrigeration systems for cooling electronic devices to temperatures ranging from 3.5°K. to 200°K. is described in a new brochure published by Air Products, Inc.

Circle No. 205 on Subscriber Service Card.

contracts

NASA

$37,812—Kaiser Fleetwings, Inc., Bristol, Pa., for services and materials 6-100 foot inflatable satellite container assemblies. (Erroneously listed under Air Force in our April 18 issue)

MISCELLANEOUS

$2,600,000—Westinghouse Electric Corp., for tactical scatter communication equipment.

$50,500—Hanley Industries, Inc., St. Louis, for loading of propellant-actuated, gas generating cartridges for *GAM-72* missiles. Subcontract from Essex Manufacturing Co.

NAVY

$21,000,000—Bendix Aviation Corp., Detroit, for continued development and evaluation of the *Eagle* missile system.

$12,384,000—Westinghouse Electric Corp., Pittsburgh, for design, development and production of nuclear propulsion components for three submarines.

$1,600,000—Yardney Electric Corp., New York City, for manufacture of silvercell silverzinc batteries to power propulsion and homing devices in the Mark 37 torpedo.

$800,000—Cook Technological Center, Cook Electric Co., Chicago, for classified work.

$750,000—Pacific Car and Foundry Co., Renton, Wash., for job orders in connection with the overhaul and modification of government furnished truck guided missile transporting—*Terrier*.

$600,000—Packard Bell Electronic Corp., for classified airborne recorder-computer equipment to be used in antisubmarine warfare.

$124,970—Camin Laboratories, Inc., Brooklyn, N.Y., for conducting a production improvement study of electro-formed rocket nozzles.

$32,000—General Electric Co., Utica, N.Y., for providing field services of engineers in connection with installation, repair, modification and/or servicing of *Sidewinder* missiles, their components and/or associated equipments.

AIR FORCE

The Perkin-Elmer Corp., Norwalk, Conn., for developing an electronic-optical system for the *Titan*. Subcontract from AC Spark Plug Div., General Motors Corp. Amount not disclosed.

Melpar, Inc., Falls Church, Va., for design and construction of an antenna assembly for the 609A ballistic missile. Amount not disclosed.

$2,640,000—Westinghouse Electric Corp., for six mobile radio sets for use in support of the air weapons control system.

$175,000—J. C. Carter Co., Costa Mesa, Calif., for supplying all fuel and cryogenic pumps for the *Titan* missile sites. (Three contracts).

$140,000—Avien, Inc., Woodside, N.Y., for production of a reference junction compensator for use on the *Minuteman*.

$38,940—General Electric Co., Scranton, Pa., for electron tubes.

$33,114—Wiancko Engineering Co., Pasadena, for digital instrumentation system.

$29,260—Bendix Aviation Corp., Eatontown, N.J., for electron tubes.

$27,779—Leeds and Northrup Co., Atlanta, for recorders and indicators.

ARMY

Horkey-Moore Associates, Torrance, Calif., for production of ten ammonia servicing trailers used in connection with GAM-77 *Hound Dog*. Amount not disclosed.

$5,500,000—General Dynamics Corp., Convair Div., Pomona, for development of the *Mauler* guided missile system.

$1,962,900—Western Electric Co., New York City, for development of local communication and range instrumentation plant at Kwajalein Island test site in support of *Nike-Zeus*.

$595,194—Raytheon Co., Andover, Mass., for modification kits, *Hawk* launcher and concurrent repair parts and line items. (Three contracts).

$272,931—Western Electric Co., New York City, for *Nike* spare parts and components. (Two contracts).

$268,582—Firestone Tire and Rubber Co., Los Angeles, for decontamination kits and shop sets, engineering services and repair parts for the *Corporal* missile. (Three contracts).

$248,346—General Dynamics Corp., Convair Div., San Diego, for engineering services and the supplies required for proto-proofing installation and flight test of *GAR-11* missile capabilities in F-102A type aircraft.

$110,129—Douglas Aircraft Co., Santa Monica, for repair parts for the *Nike* system. (Three contracts).

$83,715—Bendix Aviation Corp., Computer Div., Los Angeles, for dimensional flight simulator and auxiliary equipment.

$83,559—Garrett Corp., AiResearch Mfg. Co., Los Angeles, for *Nike* repair parts.

$75,000—California Institute of Technology, Pasadena, for research on hypersonic wind tunnel program.

$55,000—The Martin Co., Orlando, for plastic frame shields and jet vane assemblies for the *Pershing*.

$46,790—RCA, Electron Tube Div., Harrison, N.J., for electron tubes.

$43,933—Southwest Research Institute, San Antonio, Tex., for investigation of current state-of-the-art technology relating to tracking mechanisms and couplings and the construction of scale engineering model.

$32,334—R. E. Clarson, Inc., St. Petersburg, Fla., for additions and changes complex 30 and missile assembly building D, Cape Canaveral.

reviews

POTENTIAL NONNUCLEAR USES FOR DEPLETED URANIUM, published by the Atomic Energy Commission. Order TID 8203 from OTS, U.S. Dept. of Commerce, Washington 25, D.C. $.75.

The report discusses: past industrial uses and markets for uranium and its products; physical and chemical properties of depleted uranium and its principal compounds; potential industrial uses of depleted uranium and its compounds; health and safety hazards involved in industrial usage of depleted uranium; and a summary of comments relating to potential markets.

when and where

MAY

American Physical Society, Conference on Reactions Between Complex Nuclei, Gatlinburg, Tenn., May 2-3.

Instrument Society of America, Symposium on Electrical Safety Instrumentation, DuPont Country Club, Wilmington, Del., May 2-3.

American Institute of Electrical Engineers, National Aeronantical Electronics Conference, Dayton, Ohio, May 2-4.

Instrument Society of America, National Flight Test Symposium, San Diego, May 2-5.

Society of Aerospace Materials and Process Engineers, (SAMPE) Eastern Division, Spring Meeting, Massachusetts Institute of Technology, Cambridge, May 3.

Western Joint Computer Conference, Jack Tar Hotel, San Francisco, May 3-5.

National Association of Relay Manufacturers, Eighth Annual Conference on Electromagnetic Relays, Oklahoma State University, Stillwater, May 3-5.

Materials Handling Exhibition and Convention, "Mechanical Handling" sponsored by Associated Iliffe Press, Dorset House, London, May 3-13.

Properties and Application of Materials in Aerospace Vehicle Design, sponsored by Martin Co.-Denver, Park Lane Hotel, Denver, May 4-6.

National Machine Tool Builders Association, 58th Spring Meeting, The Roosevelt Hotel, New York City, May 5-6.

Radiation Research Society, Annual Meeting, San Francisco, May 8-12.

Aerospace Medical Association, 31st Annual Scientific Meeting, Americana Hotel, Miami Beach, May 9-11.

1960 Symposium of the Institute of Radio Engineers' Professional Group on Microwave Theory and Techniques, Hotel del Coronado, San Diego, May 9-11.

Instrument Society of America, National Power Instrumentation Symposium, Drake Hotel, San Francisco, May 9-11.

National Rocket Society, Semiannual Meeting and Astronautical Exposition, Ambassador Hotel, Los Angeles, May 9-12.

Second Southwestern Metal Congress and Exposition, American Society for Metals, Sheraton Dallas Hotel, and State Fair Park, Dallas, May 9-13.

1960 Electronic Components Conference, sponsored by IRE Professional Group on Component Parts; AIEE, EIA, and Western Electronic Manufacturers Association, Hotel Washington, Washington, D.C., May 10-12.

American Institute of Chemists, Annual Meeting, Radisson Hotel, Minneapolis, May 11-13.

New York University Conference, "The Critical Million—How to Talk to the Nation's Scientists and Engineers . . ." New York City, May 17.

ASME Production Engineering Conference, Shroeder Hotel, Milwaukee, May 17-19.

names in the news

W. O. Chamberlin, Jr.: Appointed to the newly created post of director of Advanced Planning for Cook Electric Co.'s Technological Center. Previous posts: Dayton representative for Hughes Tool Co.; assistant manager, missile contracts department, Hughes Aircraft Corp., and staff assistant to the vice president of Ryan Aeronautical Co.


CHAMBERLIN

Michael A. Moscarello: Appointed chief engineer for the Ford Instrument Co., division of Sperry Rand. Was formerly assistant chief engineer.

Dr. Emil Onaca: Who joined Leach Corp. in 1958, named marketing analyst for the firm.

Richard M. Hultberg: Elected director of Radiation, Inc.'s Systems Development Division-Melbourne. Was previously with International Telephone & Telegraph Corp.

John Pink: Named products marketing manager for The CompuDyne Corp. Was formerly senior sales enginecr at Southwestern Industrial Electronics Co.

Robert M. DeHaven: Former associate director named manager of the flight test division of Hughes Aircraft Co., replacing **Clarence A. Shoop,** who will devote his efforts entirely to Hughes International.

Robert E. Kinter: Replaces **Roy E. Campbell,** retiring, as director of advertising and sales promotion for Joy Manufacturing Co.

Robert G. Butterwick: Appointed advertising and sales promotion manager of Minneapolis-Honeywell Regulator Co.'s Industrial Systems Division, formerly known as Davies Laboratories.

Gordon A. McAlpine: Named market manager, Industrial and Automation Products, Radio Corporation of America. Prior to joining the firm was for 13 years associated with the Industrial Sales Division of Ex-Cell-O Corp.


McALPINE

Douglas T. Egbert and **Wilbur A. Taylor:** Appointed director of astronautics and research marketing and director of missile marketing, respectively, at Northrop's Norair Division. Prior to joining the firm in 1951, Egbert was head of structural dynamics with the U.S. Navy's Bureau of Aeronautics and dynamics engineer with North American Aviation, Inc. Taylor joined the firm in 1955, serving successively as an engineering specialist and supervisor of air defense systems in weapon systems analysis.

Herman E. Goodman: Resigns as vice president and director of advertising and public relations at Textron, Inc.

Frederick A. Henry (USAF-ret.): Appointed manager of long-range planning for Summers Gyroscope Co. Previous posts: Director of planning, Associated Missile Products Corp.; Assistant to the vice president and general manager of A. O. Smith Corp., and executive contract officer for Fletcher Aviation Corp.

E. Floyd Sherman: Named director of program development for the Systems Laboratories Division of Electronic Specialty Co.

Jack H. Kent: Formerly with Landau Metal Products, Inc., appointed general manager of Telemetal Products, Inc., a subsidiary of Polarad Electronics Corp. He will be responsible for the overall operation of the organization.


KENT

Ray D. Gardner: Named chief engineer of Horkey-Moore Associates, wholly-owned subsidiary of Houston Fearless Corp., replacing **John N. Kerr,** vice president engineering. Previous posts: System project engineer with Northrop Corp.; Vultee Aircraft Co.; Douglas Aircraft Co. and Andrew Higgins Aircraft Co.


GARDNER

C. L. Hewitt: Manager of Republic Aviation Corp.'s customer relations department, named manager of sales in the Missile Systems Division.

Stanley M. Smolensky: Appointed executive director of marketing at Thiokol Chemical Corp.'s Reaction Motors Division.

Orval W. Rahn: Former associate design engineer, appointed vice-president-design and engineering for Luminator, Inc.

Walter R. Lamb: Former supervisory physicist at the U.S. Naval Radiological Defense Laboratory, joins Rheem Semiconductor Corp., where he will work on development of new types of transistors.

Peter L. Lindley: Former manager of special products section at Electro-Data Corp., appointed manager of technical services at Endevco Corp.

David I. Shapiro: Joins the customer relations staff of the Fruehauf Missile Products Division of Fruehauf Trailer Co. Was formerly Western representative for Vertol Aircraft Corp. and Allied Associates.


SHAPIRO

Logan J. Hines: Named head of The National Cash Register Co. Electronics Dept.'s newly formed military engineering department. **Everett A. Emerson,** formerly in charge of preliminary design, will direct the department's systems engineering activities.

Richard T. Barrett and **John Agnitch:** Join the Newport Beach, Calif., Aeronutronic division of Ford Motor Co. Barrett, formerly advanced systems sales manager for Lockheed Electronics Co. will be manager of systems marketing, Range Systems Operations. Agnitch, previously in charge of military space systems marketing in the advanced program development department of Hughes Aircraft Co., will be on the markcting staff of Space Technology Operations.

Dr. Thomas T. Omori: Chief project manager of Aerojet-General's Space Technology Division since last September, appointed European manager of the NATO-Aerojet Propulsion Program for production of motors for the *Hawk* with headquarters in Paris.

B. A. Kvist: Former assistant director of contracts, named director of contracts at Aerojet.

Dr. Richard B. Nelson: Formerly manager of Klystron Development, elected manager of Tube Division Research and Development at Varian Associates. Prior to joining the firm in 1951 was associated with Litton Industries, General Electric Co., the National Research Council of Canada and RCA.

Dr. Howard S. Seifert: Former special assistant for professional development at Space Technology Laboratories, joins the technical staff of United Technology Corp.

John R. O'Brien: Promoted to vice president-government relations in the military products division of Hoffman Electronics Corp. Was manager of the firm's Washington, D.C., office and will continue to make his headquarters there.

ADVERTISERS' INDEX

EMPLOYMENT

M/R BUSINESS OFFICES

Washington 5, D.C.—1001 Vermont Avenue, NW; STerling 3-5400
Walton E. Brown, Advertising Sales Manager

New York 17, N.Y.—20 East 46 Street; YUkon 6-3900
Paul B. Kinney, Eastern Advertising Manager
Paul N. Anderson
Raymond G. Quirk

Los Angeles, California—8929 Wilshire Blvd.; OLeander 5-9161
James W. Claar, Western Advertising Manager
Charles R. Martz, Jr.

Detroit 2, Michigan—201 Stephenson Building; TRinity 5-2555
Kenneth J. Wells

Chicago 2, Illinois—139 N. Clark St.; CEntral 6-5804
George E. Yonan

Miami, Florida—208 Almeria Ave., Coral Gables
Richard C. Hager

London, W.I, England—28 Bruton Street; Grosvenor 8356
Norall and Hart

Geneva, Switzerland—10 Rue Grenus; Geneva 321044

Paris, France—11 Rue Condorcet; TRU 15-39

'Q' Awards for Quality and Quantity

Addressing the employees of Packard Bell Electronics, President Robert S. Bell declared:

"Today our ability to grow through profit is threatened by inflation and by foreign competition. We are individually and collectively at war. It is a war against foreign ideology and technology—and against our own complacency. Aside from preparedness, it is not a war of missiles and nuclear weapons but one of philosophy and production. It is economic and psychological war covering almost every area of our lives."

President Bell noted that the United States today stands almost at the bottom of the list of major nations in terms of annual rate of economic growth—while the Soviet industrial growth persists at 8 or 9 per cent a year; that the gap between our two economies will be dangerously narrowed by 1970 unless our own industrial growth is increased.

Bell has a device for at least helping to solve the problem—a device which might well be adopted by every manufacturer of any size.

It is the "Q" award—"Q" for quality and for quantity. It is a monthly recognition of the employee, section, department or division at Packard Bell for improvement in production quality or quantity "beyond the expected."

President Bell says: "Only through quantity can we fight inflation and compete in foreign markets; only through quality can we prevail in any market."

For details write Packard Bell.

Snyder Tries to Muzzle Manufacturers

On the wall back of the desk occupied by Murray Snyder in the Pentagon are two large framed photographs. A visitor sitting facing the Assistant Secretary of Defense for Public Affairs can hardly fail to be impressed by this aspect of Mr. Eisenhower looking over Murray's right shoulder and Mr. Nixon over his left.

This indeed is the impression which the former White House assistant press officer has tried to create; that while he may be occupying a Defense Department position, he really represents the White House and takes his direction from there.

It may be true. During Murray's tenure he has done more to gag the normal commonsense flow of information from the military than any predecessor. He has permitted himself to be surrounded in his immediate office with some of the rankest incompetents Pentagon newsmen have ever tried to work with. With their help he has withheld news on whimsical orders, muzzled high-ranking officers and civilians, devised the "not classified but not releasable" security regulation. Most present-day Pentagon news comes not from releases but from leaks.

His latest dictatorial move—and possibly his greatest—has just come to light. It was a move to place all defense contractor advertising under the regulation of his office for policy clearance.

Rep. John E. Moss (D-Calif.), chairman of the House Government Information Subcommittee, calls the proposed directive an attempt to make Snyder an "advertising czar"; to give him the power to censor advertising, speeches and press releases by manufacturers. The three services are opposing the directive.

The very manner in which this story has come to light—by surreptitious leak—demonstrates the flaws in Snyder's gag rule system and in his own sincerity. If there is a need to checkrein the advertising and speeches of defense contractors, there are a dozen methods whereby the matter could be taken up with those primarily concerned —and not imposed by a secretly contrived order which violates every American concept of free press and free speech.

Clarke Newlon

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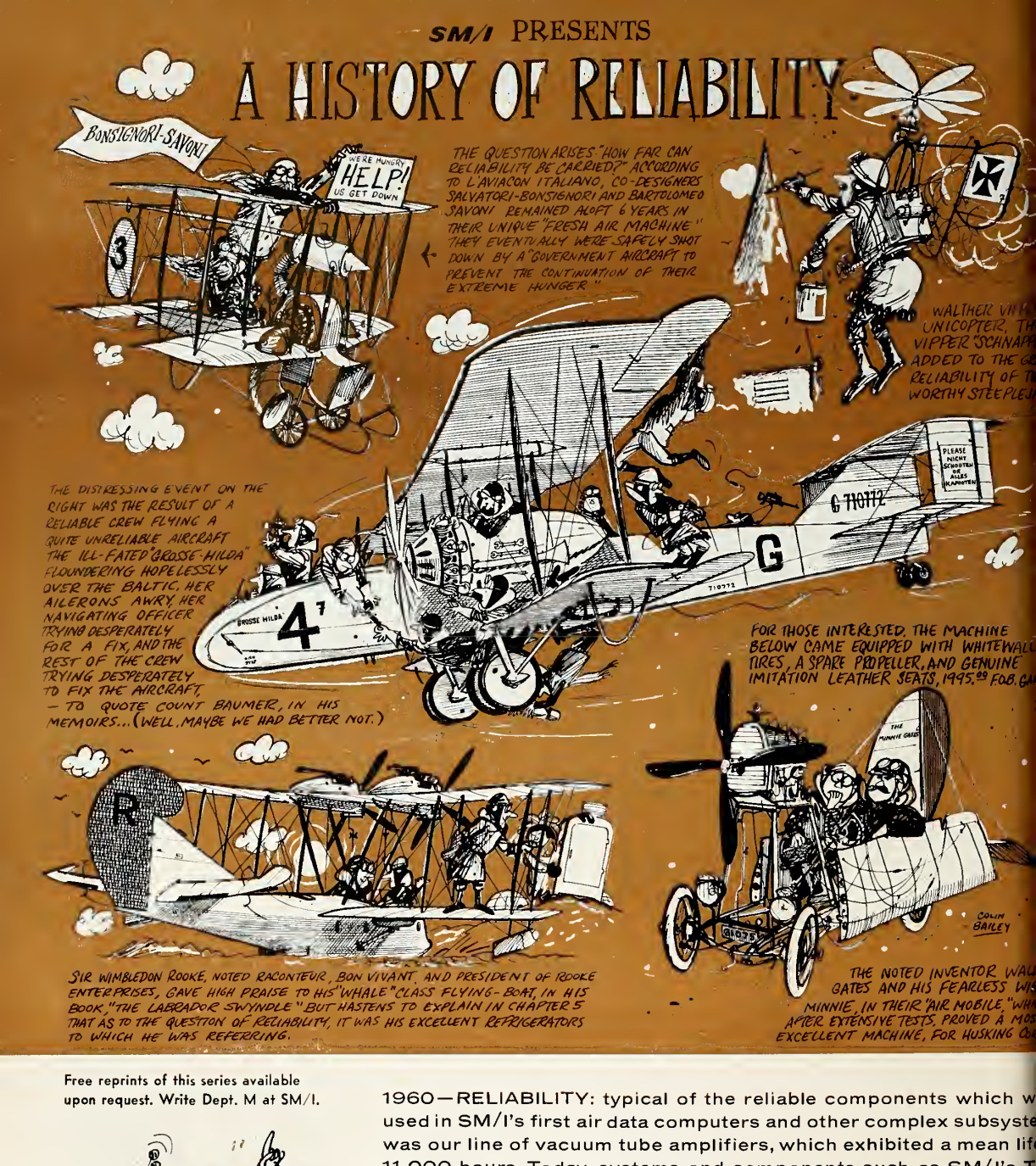

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