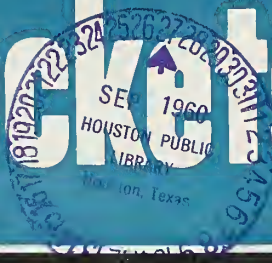


missiles and rockets

THE MISSILE SPACE WEEKLY



Making Nose Guard for Polaris

Close-up of Thiokol's Space Engine . . .

Astronauts, Mercury Heads Hit Critics . . .

Exclusive: Polaris' Nose Fairing . . .



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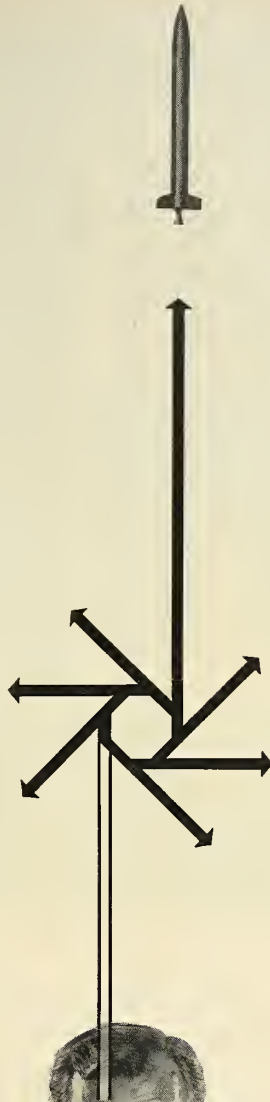
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missiles and rockets

September 26, 1960 Volume 7, No. 13



THE COVER

Worker at Dumont Manufacturing Corp. heat-tacks a layer of glass cloth forming part of the inner shell of the nose fairing for Polaris. See story on p. 20.

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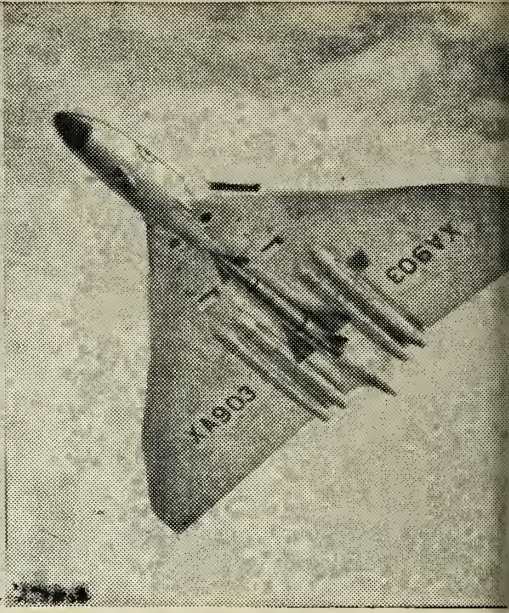
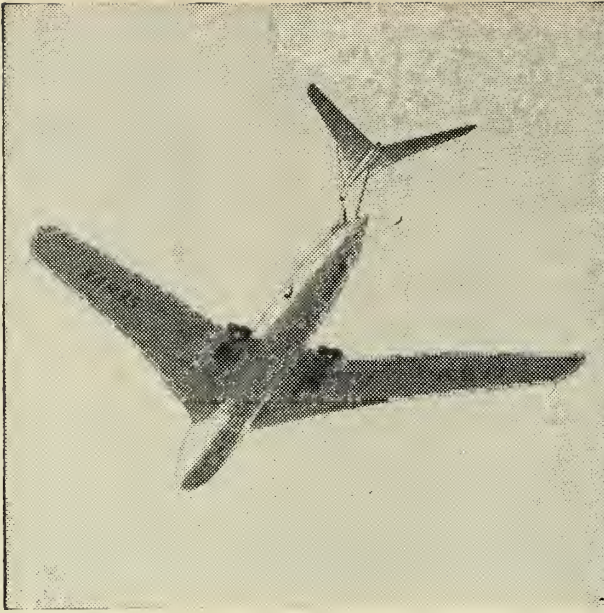
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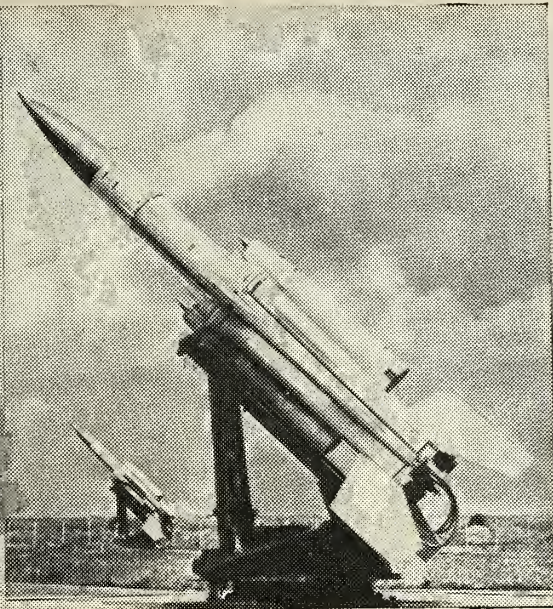
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WASHINGTON

Navy Moves on AUTECH

Construction of an ASW missile test range is moving into the study stage. The Navy is holding a bidders conference Oct. 4 for contracts on overall system analysis. No specs are available. The proposal for the range—called AUTECH (Atlantic Underwater Test and Evaluation Center)—was revealed by M/R (Aug. 1 p. 8). It may be located in the Bahama Islands and is expected to cost about \$70 million.

Writing to the Dead

Budget cogitations in the Pentagon these days have a futile air—much like writing letters to the dead. A great deal of the paperwork going on is expected to be meaningless after the November presidential elections, no matter who wins.

\$1 Billion Watermark

NASA budgeters are working in a cheerier climate. They apparently feel that the FY '62 spending program can go over the \$1 billion mark—an increase of 10% over the current fiscal year. NASA Administrator T. Keith Glennan is predicting that the agency's annual appropriations will pass the \$1.5 billion milestone in the mid-'60's and level off near \$2 billion.

Revival?

Word is being spread that the Tactical Air Command's proposal for a tactical ballistic missile, the *TBM*, isn't dead yet. Budgetary plans are being pushed to start development of such a 1200-1500-mile missile in FY '62—although, significantly, DOD approval is still lacking. COUNTDOWN was told (M/R, Sept. 5) that an identical proposal had been turned down by the Air Force top command. Even if brought back into budget consideration at this stage, the *TBM* is given small chance to survive another shakeout.

Zeus Tests in '62

Complete system tests of the *Nike-Zeus* against *Atlases* fired into the Pacific are now scheduled for 1962. Identical tests had been planned for next year, using *Jupiters* as targets. But this program was scratched because of the budget squeeze.

Wild Blue Wonder

In a move that yields little to clarity, the Air Force is rechristening its *609A*—the modified *NASA Scout*—*Blue Scout*. The Air Force will call all four-stage model *Scouts Scout*. It will call a three-stage version *Blue Scout I*; a *Scout* with fourth-stage guidance, *Blue Scout II*; still another version, sometimes called the *2356*, *Blue Scout Jr.* Next year it plans to fly 15 *Blue Scout Jr.*'s and 15 *Blue Scout II*'s.

INDUSTRY

Sounding Rocket Splurge

The Weather Bureau's '62 budget is expected to show major emphasis on satellites and sounding rockets. The bureau will try again for \$5 million to fund communications systems and R&D for weather satellites. It is also looking for money to set up a network of sounding rockets. They would be spotted at 500-to-1000-mile intervals across the U.S.; there would be firings at least once a day in winter and twice a week in summer.

Navy Astronautics Increase

A sizeable increase in its astronautics program is contemplated in the Navy's '62 budget request. One major item is expected to be for a seagoing satellite launcher—a converted seaplane tender.

Execs Wanted

At least one personnel consultant is finding the demand for electronics executives, managers and senior scientists running at an all-time high. For those in the \$15,000-and-up bracket there are reportedly more openings than at any time in the past decade.

Sparrow 6-B Competition Gets Hotter

Latest report is that the battle for the propulsion contract on the Navy's new longer-range *Sparrow 6-B* will be narrowed to three competitors next month. Three one-year contracts will be awarded about Oct. 1, and a sole source will be chosen late in 1961. Aerojet is expected to get two of the contracts (solid and pre-packaged liquid) and Rocketdyne the third—for a competitive solid motor.

INTERNATIONAL

French Seek Polaris

The French Government under the whip of President de Gaulle appears to be pushing hard for construction of its own nuclear-powered *Polaris* submarines. France wants to buy *Polaris* missiles from the U.S. and equip them with its own nuclear warheads. So far, no agreement has been reached with the U.S. Meantime, de Gaulle's government is seeking Parliament's approval of four ballistic missile subs. At a recent launching, de Gaulle promised they would be forthcoming, adding: "It is I who tell you this."

Overseas Pipeline

Anxiety over Communist Chinese border violations is expected to make India put more money into defense and rocket research . . . France's missile test ship "Ile d'Oleron" will be completely refurbished next year with telemetry equipment suitable for checking advanced missiles . . . Dai Nihon Celluloid Co. is building Japan's version of the *SS-10* antitank missile. Buttons replace the joystick control in the Nord system.



The Polaris will locate and destroy its target some 1200 miles away with the help of Raytheon Weld-Pak circuit modules. These Weld-Pak units, based on an M.I.T. Instrumentation Laboratory packaging concept, are vital elements of the Polaris guidance system. Polaris is one of 22 U.S. Missiles that rely on Raytheon components and equipment.

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Thiokol's 'Man-rated' Engine

Due for first test on X-15 this week, the XLR99 may be the first powerplant enabling man to maneuver in space

by John F. Judge

XLR99-RM-1 DATA

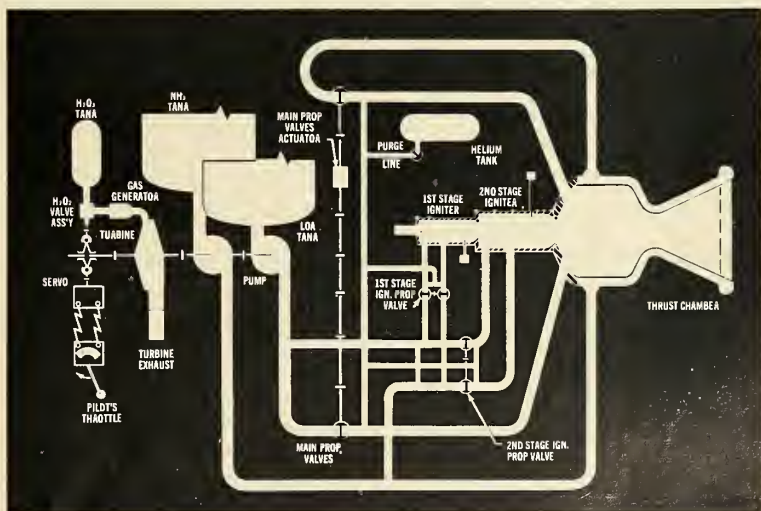
Dry Weight	900 lbs.
Wet Weight	1,000 lbs.
Envelope	41 in. x 72 in.
Overhaul	1 hour
Turbine Speed	12,700 rpm
Nozzle Expansion Ratio	9.8
Flow Rate (O ₂ /NH ₃)	197.9 lb./sec.
Overall Thrust (Vacuum)	58,500 lbs.
Specific Impulse (Vacuum)	284 sec.
Throttling (Current)	25,000 to 50,000 lbs.
Throttling (Possible)	11,700 to 50,000 lbs.

propellants the engine could develop almost 100,000 lbs. thrust without any major design changes. This would not involve a reduction in its man-rated characteristics.

One of the main advantages of the '99 in manned space applications is that 85% of its operational functions are accomplished before the vehicle is committed.

Engineer Robert Cramer of Reaction outlined the possible uses of the XLR99 in manned space programs. In each case, Cramer is referring to the currently available engine.

•**B-70-boosted**—A 200,000-lb. package consisting of the *Dyna-Soar* glider, propellant and a cluster of three XLR99 engines could be air-launched by the B-70. Using a LOX-NH₃ combination, this package would have the



The mere moving of a throttle starts the cycle by actuating a governor controlled metering valve, permitting a controlled amount of H₂O₂ to flow into the gas generator. The peroxide is decomposed into steam and free oxygen which in turn drive the turbo pump. Liquid ammonia and oxygen are delivered to their respective main propellant valves by the turbopump. The ammonia is circulated through the engine chamber walls for cooling during operation.

The propellant combination enters the first-stage ignition chambers and is ignited by an electric spark. Combustion in this chamber signals the opening of the sec-

ond igniter chamber valves. Operation of the second-stage igniter opens the main propellant valves. The '99 is now in full operation and can be throttled by the pilot from 25,000 lbs. to over 50,000 lbs. thrust.

With a flick of his wrist, the pilot can close the main propellant valves, automatically purging the injector and combustion elements with helium to remove residual propellants.

The combustion of the igniters continues, burning off the remaining propellants. Then these are helium-purged. The engine is completely shut down and can be restarted at will.

A ROCKET ENGINE that might well open a shortcut to maneuverable manned space flight is about to be flown for the first time.

It is Thiokol's XLR99-RM-1—the rocket engine designed to hurl the X-15 through the upper limits of the atmosphere at 4000 miles an hour.

This engine has been installed in the X-15 No. 2 plane and the first powered flight is expected this week. The flight will consist of a series of stop-start operations. The engine will not reach its minimum continuous thrust level—a thrust sufficient to break all existing aircraft speed records.

The designers of the '99 regard its space applications as a logical extension of the X-15 program.

The trust category of the XLR99 is such that:

—With a B-70-boosted launch, XLR99's could orbit *Dyna-Soar* and provide maneuverability in space.

—With a Saturn-boosted launch, XLR99's could accomplish the same thing or orbit a maneuverable second-generation *Dyna Soar* type vehicle.

—With the *Nova* booster concept, XLR99's could soft-land men on the moon and bring them back.

According to its builder, Reaction Motors Division of Thiokol Chemical Corp., the '99 is the only man-rated engine of its kind in existence.

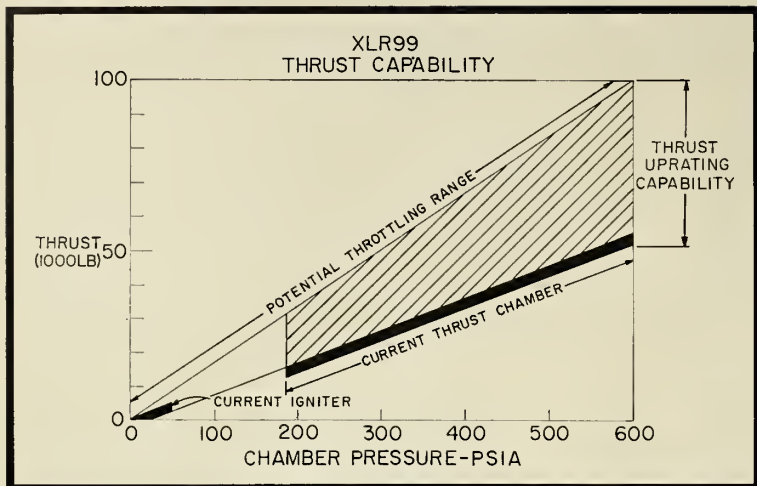
By "man-rated", Reaction means that the powerplant has been designed from the beginning for pilot control. With 1200 operations totaling 11 hours running time in ground firings, the '99 is almost foolproof.

The engine has performed in temperatures ranging from -65° to 165°F., and also at 300°F. Capability of functioning under all acceleration vector conditions, including negative, has been demonstrated.

For the X-15, the LOX/NH₃ powered engine is throttleable from 25,000 to 50,000 lbs. thrust (sea level). But throttling could start at 11,700 lbs. thrust, say Reaction's engineers.

With currently available high-energy

safety plus reliability . . .



thrust capability to orbit the glider with dry fuel tanks.

If the fuel combination was upgraded (higher density propellants) using currently available liquids, the 200,000-lb. package could orbit the glider with propulsive capacity to spare. The XLR99's restart ability could be utilized in space.

In addition, with stepped-up fuels, the cluster might be reduced to just two engines.

The B-70 concept could be broadened to include a lighter package, involving high-energy fuels and two engines to attain orbit.

• **Ground launch**—A 70,000-lb. package consisting of an XLR99 interim booster and the *Dyna-Soar* glider could be easily lifted by the *Saturn*. In this case, the XLR99 would kick the glider into orbital conditions and fall back to earth.

An even more ambitious project would follow the same general lines but add an XLR99 to the glider itself for orbital maneuvering. This would involve a second-generation *Dyna-Soar*, capable of carrying more than one man.

The XLR99 of 1960 is capable of landing a man on the moon and bring-

ing him back. Such a project is undoubtedly in the *Nova* class as far as booster stages are concerned, the XLR99 being the final propulsor means.

• **How safe is safe?**—It goes without saying that the presence of a man in a space vehicle demands a "safe" propulsion system. This powerplant must also be reliable. The two concepts are not complementary.

In order to gain maximum safety a series of elements must be incorporated into the engine design. These elements complicate the reliability, simply because of their existence. There is a shift away from simplicity.

According to Reaction Motors, the XLR99 is safe and of proven reliability.

On the safety side, for instance there was the problem of a critical accumulated amount of propellant in the firing chamber. This amount is defined as the minimum quantity needed to rupture the chamber under deflagration conditions.

In operation, the '99 can reach this amount in 1/200 second or about a pint out of a flow of 28 gallons per second. At the time two systems were available—a race between start or shutdown of the engine or to detect the occurrence of the condition and correct. Neither seemed to be applicable.

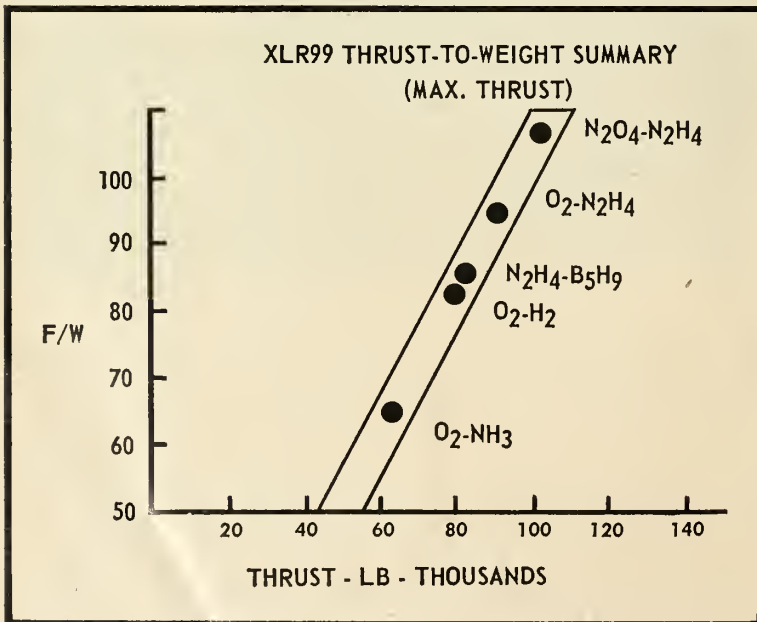
Instead, Reaction Motors engineers designed the problem out of the '99 by staging the igniter subsystem in two sections. This method allowed an increase in the critical amount by using a smaller chamber and a changed state of the propellant (gaseous oxygen).

Thus enough energy is provided to assure combustion of the propellant mixture or, if the mix is outside the flammable range, to evaporate it.

Reliability of the '99 is high—better than 98% in the test program. The re-use feature of the engine allows the designers to shake out the bugs that caused the early failures. Another factor enhancing reliability is that the majority of malfunctions are not continuing affairs. Shutting down the engine may cure the disorder.

An example of this is that only one malfunction occurred in a stretch of 68 engine operations. This was temporary in that shutting down and restarting the engine solved the problem.

Reaction Motors has a long history in the use of rocket propulsion for manned flight. From 1943 to the present a conservative total of 798 rocket-powered flights have been made in a variety of vehicles. Reaction's engineers point out that the fuel substitution characteristics of the '99 make available a wide range of performance capability from one basic, fully developed engine



Astronauts, Mercury Bosses Hit Back

STG program directors argue that delays must be expected; astronauts criticize general public's impatience

by Jay Holmes

HAMPTON, VA.—Astronauts and the managers of Project *Mercury* are talking back to critics of the delays in getting an American into space.

Everyone at Space Task Group, the National Aeronautics and Space Administration agency responsible, insists that *Mercury* is moving at the top speed possible. Delays are natural in a research and development program, they maintain.

No one from Director Robert R. Gilruth to the seven astronauts has any serious doubt that the Russians will put a man or two in orbit ahead of America and possibly very soon.

And no one at Langley Research Center is denying that *Mercury* has fallen behind schedule as charged by critics in Congress and elsewhere. NASA and STG officials decline to give details on the original schedule, however, on the ground that it was an informal, internal matter—not a promise made to anyone.

For the record, Gilruth will say only that it is still expected that a manned capsule will be launched on a ballistic trajectory aboard a *Redstone* sometime around the end of 1960, and that man in orbit will be accomplished some time in the latter part of 1961.

• **Must set dates**—Navy Lt. Cmdr. Malcolm S. Carpenter puts it this way:

"You never really know how long it will take when you try something new. When starting a new kind of repair on my car, I may tell my wife it will be done in an hour. When she comes back two hours later—"

"He tells her to shut up," said another astronaut, Navy Lt. Cmdr. Walter M. Schirra Jr.

Referring to planning dates, Carpenter declared, "It's unrealistic for anyone to expect us to meet such a schedule."

Maxime A. Faget, chief of the STG Flight Systems Division, commented, "We've got to have dates for planning, to set delivery deadlines for subcontractors. Not only do we pick the earliest date possible, but often one a

month or two in advance, which may be impossible."

The plan to fire a manned McDonnell capsule atop a *Redstone* booster by the end of 1960 was an example of this type of scheduling, Gilruth said. (The manned shot will probably be the third in the *Mercury Redstone* series, due to begin in a few weeks.)

"If there are no unforeseen problems, the first three *Mercury Redstone* shots can still come before the end of the year," he added. "But we don't like to give glib dates. Too many things depend on what goes before."

• **Unfair comparisons**—Gilruth said the only promise on timing that he ever

made was in the summer of 1958 before the old House Select Committee on Aeronautics and Space Exploration, in which he said manned flights were "a couple of years off at least."

The *Mercury* boss said it is unfair to compare rate of progress with an estimate by Wernher von Braun that a man could be sent into space in a *Redstone* capsule "a year after the word go."

"*Mercury* is an entirely different program from Von Braun's Project *Adam*," Gilruth declared.

The *Mercury* capsule is much more complex than that for Project *Adam*, he explained, because it is designed for an orbital mission. The environmental control system, for example, is designed to sustain a man up to 18½ hours—2 hours on the launch pad, 4½ hours in flight and 12 hours afterward while waiting for recovery.

"Although we were supposed to use state-of-the-art components throughout the capsule, this wasn't possible," said Richard Johnston, deputy chief of the STG Life Systems Branch. "Of course, we could have done it if we had a Russian rocket available as a booster."

• **Weight handicap**—The sticky point was the orbital capacity of the *Atlas* booster. The whole capsule and the man inside could not weigh a total of more than one ton. Current Russian rockets can orbit 4½ to 5 tons.

Maximum weight of 90 to 100 lbs. was assigned to the environmental control system, Johnston declared. "If we had used existing aircraft equipment, the weight would have been 350 lbs. With their payload capacity, I'm sure the Russians could have used existing equipment."

The *Mercury* environmental control system developed by STG and AiResearch Division of Garrett Corp. weighs 89 lbs. One of its features is a 7500-psi oxygen storage bottle, which was beyond the state of the art two years ago. "The standard oxygen cylinder then weighed 22 lbs. and carried about 2½ lbs. of oxygen. Now we are building bottles that weigh 4 lbs. and carry

A Question of Control

Should the military or a civilian agency be in control of space exploration? Mercury astronauts aren't eager to take sides on this issue.

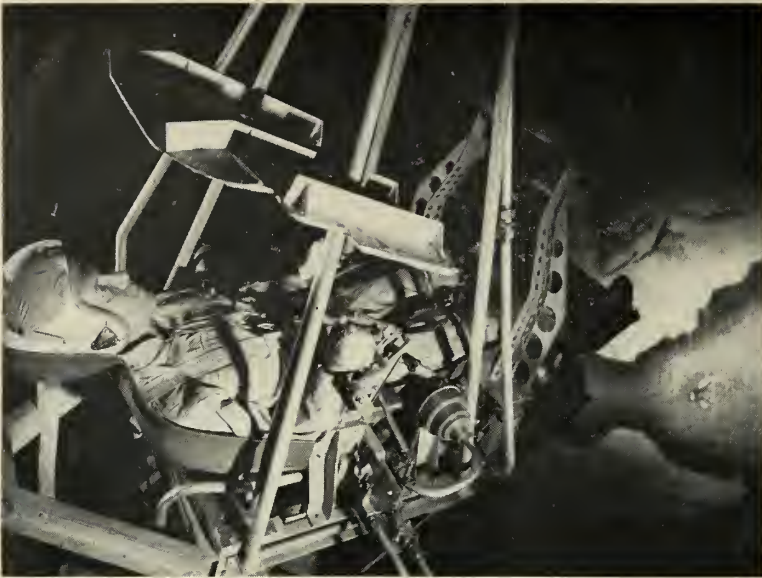
Their own self-control was evident when they were reminded that Lt. Gen. Bernard A. Schriever, ARDC commander, had said that military men in American history have played the major role in exploring unknown regions.

"That's an unfair question to ask us," said Air Force Capt. Leroy G. Cooper Jr. "He's a general and we are in the military. How can you expect us to comment on what he says?"

"We couldn't possibly have a purely civilian effort," interposed another astronaut, Navy Lt. Cmdr. Walter M. Schirra Jr. "Let's call it a U.S. effort."

"I don't see the necessity to draw a distinction, the capsule just has the words 'United States' on its side," said Navy Lt. Cmdr. Malcolm S. Carpenter.

Added Air Force Maj. Donald K. Slayton: "In another 50 years, the effort won't be just national, but international."



MERCURY ASTRONAUT Navy Lt. Cmdr. Walter M. Schirra Jr., shown here on an air-bearing simulator, expressed some skepticism over Soviet man-in-space ability.

4 lbs. of oxygen," Johnston said.

Under present plans, the complete environmental control system will be flight-tested on MR-2, the second *Mercury Redstone* shot, which is to carry a monkey on a ballistic trajectory, probably late this fall.

Johnston said cabin pressurization was proved out on the first *Mercury Atlas* shot in July, even though the *Atlas* exploded 65 seconds after liftoff.

• **Time factor**—Gilruth and Faget denied also that they had ever sold *Mercury* with the argument that it is a cheaper way to get a man into space.

"We said it would take less time," Faget remarked. "We proposed to take the *Atlas* booster and base design on present state of the art—to keep reliability at a maximum and avoid blind alleys in R&D."

The argument between a *Mercury*-type ballistic shape and an aerodynamic re-entry body like *Dyna-Soar* had to be settled in favor of the *Mercury* shape with emphasis on present state of the art, Faget said. Developing a *Dyna-Soar* would have taken more time.

The STG officials denied that *Dyna-*



SPACE TASK GROUP engineer Charles Olasky at the control panel of a procedures trainer. STG officials say delays are natural in an R&D program like *Mercury*.

Soar delays are due to administrative indecision. "Many technical problems have held up progress," Faget asserted.

• **Public's impatience**—Four of the seven astronauts who happened to be present at Langley Research Center earlier this month denied they are "blue" about the progress of the program.

"Everyone from Dr. Glennan to the way down would like to see us go tomorrow," said Air Force Maj. Donald K. Slayton. "Who wouldn't?"

"No matter how fast it were to go we wouldn't be completely satisfied," added Air Force Capt. Leroy G. Cooper Jr.

"Impatience is peculiar to the general public," said Carpenter, "not to those associated with Project *Mercury*."

"There's been too damned much conjecture about the whole thing," Schirra remarked. "Reading history, I didn't detect any anxiety on the part of the public about when the Wright Brothers would get their plane airborne."

"The whole thing depends on your idea of what our mission is," interjected Slayton. "If it's purely a political maneuver for international prestige then you can't help but be disappointed that we're behind the Russians."

"But there are two philosophies," Carpenter declared. "The people at STG believe this is a research program to follow without knocking heads together. But the general public always wants to be first and best."

"It's just like the Olympics," remarked Schirra. "I'm pretty disgusted about the hue and cry over John Thomas, a great high-jumper, just because he missed one jump in the finals."

• **Waiting for boosters**—The only doubt heard on this point was expressed by Schirra, who said, "It would be very interesting to go back through the last three years and read all the learned predictions that a Russia would be in space imminently. I'll believe it when I see it."

"Nevertheless, I'd like to borrow on our boosters," remarked Cooper.

Everyone agreed that boost power is the key to speeding America's man-in-space efforts. The *Mercury* capsule is tied to the *Atlas* booster. *Dyna-Soar*, the Air Force program for a glider-type space vehicle, depends on *Titan*.

Project *Apollo*, the NASA three-man space ship, must await development of the *Saturn* booster.

"Of course, *Apollo* is nowhere near maximum effort," Faget remarked. NASA will spend \$1 million in the current fiscal year on industry studies of design of the space ship. A prime contract is to be let in FY 1962.

How could *Apollo* be speeded? "Build *Saturn* faster," Faget replied.

Usefulness of Transit Questioned

Speakers hit accuracy of navigational satellite, cite lag in space biomedicine; exhibits feature PCM telemetry and many improvements

by Hal Gettings

THE *TRANSIT* navigational satellite may not be as useful as some of its proponents claim, according to one server.

Speaking at last week's IRE Symposium on Space Electronics and Telemetry, in Washington, D.C., Dr. Conrad C. Wan, of Hughes Aircraft, said that development of a system such as *Transit* for commercial applications appears needlessly redundant and unnecessary.

He pointed out that commercial mapping does not require now—or for the immediate future—better accuracy than is provided by present methods. Airline requirements are even less stringent in this regard.

Dr. Wan did not touch on the possible use of *Transit* in nuclear submarines to periodically check their inertial guidance systems. The navigational satellite is most often touted as a global aid for ships and aircraft—seldom mentioned is this more vital Navy requirement.

Both technical and non-technical problems involved in the development of an operational *Transit* system were outlined by Dr. Wan. He cited the need for greatly increased accuracy, the reliability problem, and requirements for new and more accurate maps to effectively use the proposed new technique.

On the non-technical side, he took a grim view of prospects for the necessary international acceptance by all marine and air fleets and the crews themselves. And he said that the cost factors involved would be of considerable interest in a working system, "technical elegance notwithstanding."

• **Space biomedical research lacking**—Lack of U.S. emphasis on space biomedical research was attacked by Brig. Gen. Donald Flickinger, Air Force Assistant for Bioastronautics (ARDC). He said that too little is known about the effects of weightlessness and space radiation to allow putting a man into space with safety and maximum efficiency.

Gen. Flickinger pointed out that although the U.S. was a pioneer in space

biology and medicine, since 1952 work in this field has dropped well below what is necessary to allow it to keep up with advances in space flight equipment and techniques.

To bolster our effort, Flickinger advocated two courses of action:

1) A comprehensive integrated program of space biological investigation with broad approach and ground and space facilities to do the job. ("Biomedical investigations on a space-available piggyback basis will not suffice," he said, "and it is time all of us in the space business face up to the realistic and hard facts of the matter.")

2) A plan and mechanism to collect, collate, and disseminate—on a truly international basis—pertinent space biomedical data.

• **PCM predominant**—In spite of the planned emphasis on space electronics in the Symposium program, most of the 40-odd exhibits were concerned with telemetry and largely ignored guidance and other areas of electronics. PCM (pulse code modulation) telemetering equipment was predominant, emphasizing the growing trend toward digital systems. In addition, some compatible—combination of digital and FM—equipment was in evidence.

Judging by the exhibits, many leading telemetering equipment manufacturers feel that PCM is the coming thing, even though FM-FM will be with us for a long time and will still have many applications with no competition from digital systems.

Epsco and Radiation, Inc.—both old timers in the PCM business—heavily emphasized digital equipment. CEC's Datalab Division showed its version of a "standard" system using circuit-stack construction of primary units which can be put together to fit a wide variety of applications.

Tele-Dynamics introduced a high-speed Dataplexer as the first unit in a proposed complete PCM system. A new analog-digital converter is scheduled to appear in March. Bendix-Pacific announced plans for a complete solid-state system, to be ready by the first of next year.

General Devices, Inc. showed units

of its PCM equipment, including high/low-level modular Multicoders which operate with its PDM multiplex systems. United ElectroDynamics exhibited the gold-plated CT-19 system built to operate at temperatures near 800°F.

• **FM/FM improved**—Several companies are taking the middle road in telemetry development with "compatible" systems that offer some of the advantages of digital techniques but still operate with existing FM/FM ground equipment—a major economic factor in future telemetry development.

Vector Mfg. introduced its version of a completely solid-state modular PCM/FM-FM system with high/low-multiplexer. The Hiloplexer portion of the system can be used by itself to generate a PAM output or, with an analog-digital converter and processor, to produce a digital output to the transmitter.

Hoover Electronics reported considerable success during the past year with its Vernitel equipment. These units quantize voltages into one of 16 discrete levels and a vernier voltage—each controlling a standard FM sub-carrier oscillator—to provide FM/FM signals with accuracies reported to be comparable with PCM.

• **Other improvements shown**—Many companies are showing progress in improving the accuracy and optimum performance of FM/FM systems. Data-Control Systems, among others, is doing much in the miniaturization of both airborne and ground components and in human-engineering operating equipment.

Transmitters, too, showed evidence of improvements in ruggedness, small size, and solid-state construction. Telechrome exhibited an extremely small, well-built 5-watt transmitter. Vector showed what is claimed to be the only solid-state transmitter and power amplifier for telemetering frequencies.

Several firms have gone ahead in developing 2200 mc receivers, although this frequency band is not slated for general use until 1965-70. Both Nems-Clarke and General Electronics Labs had new models on display. ❧

Defense/Space Issue Hangs Fire in Election Campaign

First test flight last week of *Blue Scout Junior*—Air Force version of the NASA *Scout Rocket*—was marred by a telemetry failure shortly after launch. All four stages performed normally, however, and the Air Force called the 17,000-mile-high shot a success.

This was the first of 15 firings scheduled in the HETS (Hy-per-Environmental Test System) 609A program aimed at experiments in support of military space and weapon systems development. The HETS vehicles use existing solid-propellant engines and can be assembled in a variety of configurations tailored to specific experiments. Building-block technique provides a series of economical, versatile, and reliable vehicles for a wide range of space missions.

Six different solid motors will be used in various 609A configurations:

1) Aerojet Senior (30 KS 120,000)—Conventional motor with steel case and nozzle and polyurethane propellant.

2) Thiokol XM-33—Conventional motor using polybutadiene-acrylic acid fuel.

3) ABL X-254 (Hercules Powder)—Motor case is of filament-wound fiberglass impregnated with epoxy resin and using a cast double-base propellant.

4) ABL X-248—Same construction and fuel as X-254.

5) Aerojet 30 KS 8000—Motor case is steel-tape wound bonded with epoxy resin. Motor has phenolic-fiberglass nozzle exit cone and uses polyurethane propellant.

6) NOTS (Naval Ordnance Test Station) spherical motor—Two stainless steel hemispheres welded together. Has phenolic-lined internal nozzle. Polyurethane propellant used as fuel.

A standard data recovery vehicle has been developed for use with all 609A configurations. The recovery vehicle is a spherically capped cone weighing about 90 pounds. It consists of three basic assemblies: heat shield, structure, and data capsule. No attempt was made to recover this first shot.

All Stages Fire in First Air Force Blue Scout Shot

With the election only six weeks away, a thorough-going debate over the state of the nation's defense and space programs remained largely in the wings of the presidential campaign.

Overshadowed as it was by the U.N. "rump summit," there was a question whether Candidates Kennedy and Nixon ever could get down to specifics on this issue.

Nixon appeared bent last week on remaining aloof—calling for a truce on all talk that would portray the nation as weak. Kennedy continued to hammer away at a theme of strengthening the world position of the United States by promptly building up its defense posture and launching an attack on poverty at home and abroad.

Steering clear of detailed proposals, Kennedy said that if he were elected president he would immediately ask Congress for the "funds and authority necessary to give us a nuclear retaliatory

power second to none, making it vulnerable to surprise attack, and a conventional forces so mobile a modern that they can stamp out a brush-fire before it spreads."

Nixon made his "unity" plea saying "we have a responsibility avoiding resort to statements which tend to divide America" and indicating weakness which would encourage Khrushchev.

• **Brush-off**—Earlier, Nixon brushed off the space race, contending:

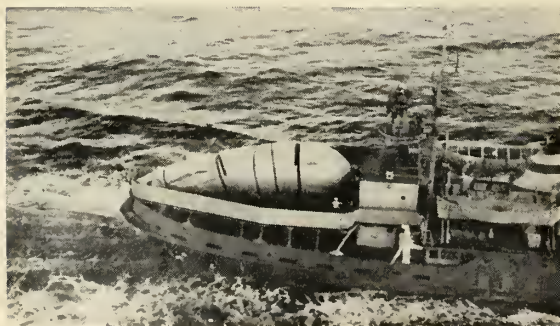
"Our program is coming along splendidly. If the Russians move ahead of us they won't stay there for long."

Apparently with this remark in mind, and the possibility that a Russian manned space shot or deep space probe was imminent, Kennedy declared that he was unsatisfied to be "second to the moon." He added, "I have heard all the excuses—but I believe, not in America that is first but an America that is first—period." However, offered no approach to achieve this end.

Meantime, Khrushchev prepared to offer a new disarmament plan stripping the U.N. of all police power, and the U.S. Navy was keeping a watchful eye on two antenna-bedecked Soviet ships off the coast of Newfoundland. Although there was conjecture that they could be range ships, informed sources said the blimp-carrying tug and heavily laden tanker more likely were spy ships. (See below.)

The two vessels also were believed to be supplying the Soviet Atlantic trawler fleet.

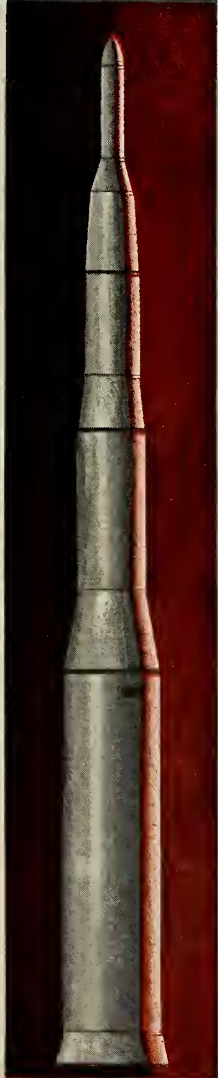
Mission of the trawler fleet was outlined to the House Committee on Un-American Activities by Capt. Nikolai Artamonov, defected Soviet naval officer, who also said Russian leaders had ordered their military forces in 1959 to start preparing for a possible nuclear surprise attack on the U.S.



Soviet Ships Operate off Grand Banks

TWO RUSSIAN SHIPS, both heavily instrumented, pursued a mysterious mission 350 miles off the Newfoundland coast last week—ignoring U.S. Navy patrol planes keeping them under surveillance. The tug *Fedotov* (left) carried a small blimp on its stern and flew it almost daily at varying heights. The heavily loaded tanker *Kokand* had a small helicopter aft. When a new

Soviet space shot failed to materialize on Sept. 19 to coincide with Premier Khrushchev's arrival at the U.N., speculation shifted to the possibility that the ships were on a trawler submarine fueling expedition rather than deployed for range purposes. It was also possible that their antennas were trying to spy on U.S. communications and submarines.



SEALED IN A SECRET SILO

Somewhere in a wasteland, the Air Force Minuteman will keep its lonely vigil all through a thousand nights. Buried and untended, it must be ready to spring to life if the button is ever pushed.

Minuteman poses a real challenge to the New Reliability—reliability which must guarantee successful firing at any moment in the far future. Each of the missile's systems, each of its thousands of electronic components, must function perfectly at that given moment. For once the missile is lowered into its silo, no human hands again need touch it.

The Minuteman's critical guidance and control system has been entrusted to Autonetics. We are proud to be a member of this United States Air Force missile team.

Once again America's defense force reaps the harvest of Autonetics' pioneering. A decade of experience with major projects has given Autonetics a unique capability in systems management—and in meshing its work with that of other companies in building modern weapon systems.

Guidance Systems by Autonetics



DOWNEY, CALIFORNIA

A DIVISION OF NORTH AMERICAN AVIATION, INC. REGIONAL OFFICES: WASHINGTON, D.C. AND DAYTON, OHIO

INERTIAL NAVIGATION / ARMAMENT AND FLIGHT CONTROL / COMPUTERS AND DATA SYSTEMS



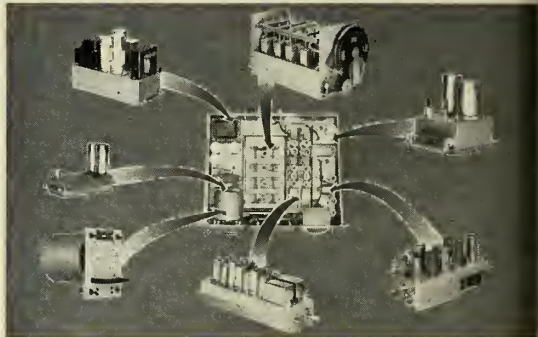
For more than a quarter century, Hallicrafters has worked in close partnership with our armed forces on fast solutions to critical military electronics problems. Out of this priceless experience are emerging startling new ideas and hard-hitting, fast-moving techniques to keep our country one jump ahead in electronic warfare . . .



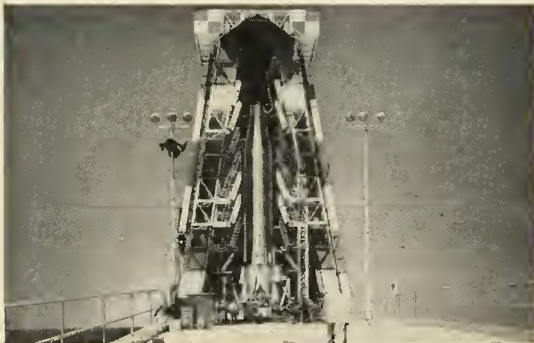
B-52 and other military aircraft will be protected by the most potent Electronic Countermeasures equipments yet devised. These equipments were developed in close teamwork with the Air Force under Hallicrafters' QRC (Quick Reaction Capability) program. Now qualified to meet full environmental specifications, they are in quantity production.



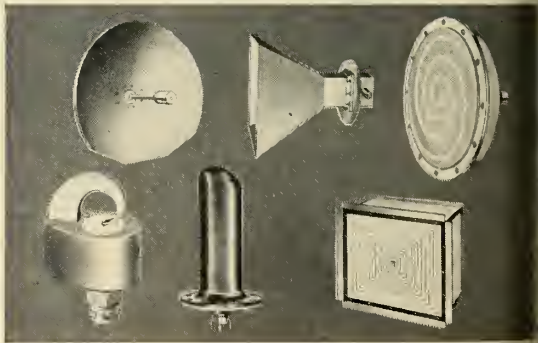
New levels of speed and efficiency are being reached in equipment modernization, retrofit and technical support programs with Hallicrafters' radical new "Blue Streak" project. Specially-trained Maintenance and Technical Support Teams, close-knit and flexible, can be tactically deployed to accomplish maintenance, installation and testing of electronics weapons systems anywhere in the world.



Hallicrafters communications leadership is exemplified by new high frequency Single Sideband receiver, (model no. SX-116). 100% modular design permits simple modification for compatability with existing and future communications systems. Stability, with proper available plug-ins, is better than one part in 10,000,000 per month. Hallicrafters also offers an existing capability in receiving and transmitting techniques up to frequencies of 50,000 megacycles.



Hallicrafters participation in the Atlas missile project helped to develop capability for many areas of the complex missile field, including code translator data systems; ground support equipment; ECM testing and antenna systems. Current explorations involve latest Infra Red techniques.



Airborne antennas and micro-wave components with power capability in excess of 1,000 watts, can be made available to solve tomorrow's very high power handling requirements. Testing of microwave components is possible with special high power generators, designed and built by Hallicrafters.

Looking for a challenging new opportunity? We are interested in qualified engineers at all levels. For full details in confidence, contact William F. Frankart, Director of Engineering.

For further information on Hallicrafters facilities and experience in military electronics research, development and production, please write to:

hallicrafters  company

Military Electronics Division,
Chicago 24, Illinois

Technical Countdown

MATERIALS

Titanium Cases Likely for Minuteman

Possible replacement of the high-strength steel cases with titanium in the first two stages of *Minuteman* is a likely result of a series of Air Force tests. BMD's Col. J. I. McCoy says that the tests are "showing great promise."

Project Firefly Rolling

ARPA is spending \$1 million in learning how known quantities of possible missile trail components interact or react in the upper atmosphere. One goal, of interest to the Air Force, is the elimination of such tattle-tale trails. Above 60 miles these gases may occupy an area 10 miles in diameter and several hundred miles in length. They are detectable by radio energy reflected from free electrons and metal particles.

Lockheed Strengthens High-Strength Steels

A cadmium-plating process refinement developed by Lockheed chemists utilizes additives to eliminate the effects of strength-stealing hydrogen gas usually released in plating. The hydrogen is assimilated by a nitrate added to the bath.

Formed Moly, the Easy Way

Based upon the success of using tungsten hexafluoride to form relatively thick and intricate pieces of tungsten through vapor deposition (M/R, Sept. 12, p. 23), an Allied Chemical Corp. chemist foresees molybdenum hexafluoride being used soon in a similar process to form molybdenum pieces.

Fiberglass-Plastics Boom

Everybody is getting into the fiberglass-plastic case business. Current gossip is that all three stages of *Minuteman*, both stages of *Polaris* and both stages of *Sky Bolt* will go to the lightweight material in advanced versions. (See p. 31.)

Alloy Selection Made Easier

A device using a master diagram and any three of the four main design variables (stress, temperature, material, creep time or rupture rate) immediately determines the fourth variable. Studies at Union Carbide Metals Co. on the creep-rupture behavior of alloys near their melting points established the method, among other things.

Porous Metal Process Evolved

Mott Metallurgical Corp. has come up with a new process to obtain controlled porosity in stainless steel, iron-nickel alloys and other high-temperature alloys. Typical product—a porous stainless steel wind tunnel model permitting flow through the nose at a rate six times faster than the flow through the base.

PROPULSION

ALB3M Static Tests OK

Aerojet has had two successful static tests of the first stage of the *Sky Bolt* ALB3M. Douglas makes the steel case of the two-stage missile, which is a little smaller than the Army's *Pershing*.

Comanches and Delawares are Coming

Two new high-performance sounding rockets, using the *Cajun-Apache* case, are under development at Thiokol's Elkton, Md., plant: The *Comanche* will employ the polyurethane propellant used in *Subroc*; the *Delaware* will use *Minuteman* PBAA propellant.

ELECTRONICS

Floating Telescopes Next

A recoverable balloon-borne telescope with an appropriate telemetry link to ground comprises a satellite detection system being developed by Electro-Optical Systems for the Air Force. Immune to countermeasures, says EOS, the system will use a 20-in. Bouwers telescope suspended 300 ft. below a 200-ft.-dia. balloon to pick up satellite-reflected light over several hundred miles range. Coverage includes 360° azimuth, 15° to 75° elevation.

And More Telescopes Proposed

A new instrument was proposed for stellar measurement by General Mills' Mechanical Division before the IAF in Stockholm recently. Called a Stellar Aberrascoper, it could be used to measure changes in positions of two nearly diametrically opposite stars with vastly improved accuracy. The electro-optical system would use two rotating rigidly mounted telescopes, facing in opposite directions. The company is currently developing a "self-contained guidance" package using such an instrument.

Saturn Checkout Bids Due Soon

NASA's Marshall Space Flight Center, Huntsville, Ala., is asking for bids by October 1 on an automatic checkout system for the *Saturn* booster. The contract will call for study, design, system fabrication, and complete testing—all to be completed within 16 months.

New TV Program Scheduled

Lockheed Electronics' tiny 2-lb. TV camera will permit a revolutionary advance in missile flight performance testing, its developers say. Coupled with its new FM/FM telemetry transmitter, the battery-operated system is designed for use inside or outside a space vehicle. Chief advantage in system is real-time readout at ground stations. (See story on p. 26.)

Device Upgrades Radar Images

Clear target signals even at maximum operating range of a radar can now be achieved with Chance Vought's new Video Correlator, says the company. A distinct image can be maintained even under conditions which would normally obscure the target. The VC, according to its developers, performs post-detector correlation of the video signal—that is, it sorts out target pulses from degrading noise and interference. It does this by using the uniform spacing or delay between reflected pulses and eliminating all others.

Ryan Forms New Subsidiary

Ryan Communications—a newly formed subsidiary of Ryan Aeronautical—will specialize in solving specialized communications problems. Since H. F. Meyer is Executive VP of the company and co-inventor of the orbitalscatter concept, it is assumed that advanced research at Ryan will include such exotic methods of communications.

Plastic Fairing Guards Polaris Nos

Lockheed and Dumont engineers collaborate on producing reinforced plastic cup; inner shell of glass cloth layers wrapped with glass fabric tape gives lightweight insulation without degradation



POLARIS NOSE FAIRING is compression-molded to net dimensions with matched metal tooling in heated, high-pressure equipment.

THE KEY To both hydrodynamic and aerodynamic drag reduction of the *Polaris* missile is a cup-shaped nose fairing made of reinforced plastic.

The fairing protects the tip of the re-entry vehicle through atmospheric exit.

While it will not approach an arctic temperature during operation, the fairing's temperature will reach approximately 1000°F inside the structure and possibly as high as 2000°F outside before separation from the missile.

Successful fabrication of the fairing and its internal components was achieved by close collaboration between Lockheed design engineers and the Dumont Manufacturing Corp., San Rafael, Calif., a subsidiary of Dynatron Corp.

Reinforced plastic construction was selected for reasons of weight and to provide insulation. Silica tape is used for the nose piece to satisfy the high thermal environment. The stress requirements are all designed into an inner shell of glass cloth, which is then wrapped with a glass fabric tape.

The reinforcing materials are pre-impregnated with a heat-resistant polymeric resin which supplies the high tensile strength in the 500° to 1000°F range for approximately 125 seconds.

• **Wrapping technique**—Since an aerodynamically smooth surface must be maintained through exit conditions, the fairing has to perform without temperature degradation. An erosion-resistant surface is assured by means of a new technique involving shiny wrapping the outer shell with the tape.

The inner shell (see cover) of the fairing is the structural component of the assembly. Seven parallel plies of 181 glass cloth are performed on a male mandrel with each layer being tacked in place and trimmed before the next is applied. The mandrel is then mounted in a lathe for the tape wrapping operation.

Starting approximately 18 in. from the nose, a 1-in. strip of glass fabric

uring Exit

tape is spirally wound over the glass cloth to produce a shingled surface construction. Uniformly increasing wall thickness is built up by overlapping to expose $\frac{1}{2}$ to $\frac{1}{8}$ in. of the previous winding.

The tape is applied to within 3 in. of the nose through a cam-controlled metering device.

A nose piece, separately shingle-trapped with silica tape, is fitted to the preform after the glass tape is wound. This extends 5 in. down the fairing.

The preform is placed in matched metal tooling and press-cured for 1 hour at 300°F. Final machining is reduced to a bare minimum because of Dumont's tooling design. The fairing is molded to a tolerance of ± 0.005 in.

• **Strengthened structure**—Post-curing is accomplished in a specially designed fixture to minimize distortion and dimensional changes. The fairing's high-temperature structural requirements call for post-curing to a



OUTER SHELL is wound shingle fashion with overlapping layers of tape. The inner shell visible is composed of seven layers of glass cloth.

maximum of 500°F.

The inner structure of the fairing is the ejection mechanism. The parts are made of reinforced plastic and add to the structural capabilities of the assembly, while also serving to support it.

A dome-shaped bulkhead is bonded to the skirt of the fairing to stabilize its concentricity and to add strength and stiffness. A tubular piece connects the center of the bulkhead to the nose section.

The entire structure inside is bonded to the fairing with a high-temperature epoxy-phenolic adhesive (MIL-A-8431 Type II), which will maintain a required structural load in the 500 to 1000°F range maximum for less than 60 seconds. Since reinforced plastic is used instead of metal, structural adhesives could be employed. The insulation properties of the plastic keep the inner bond line temperature below 1000°F. ❖



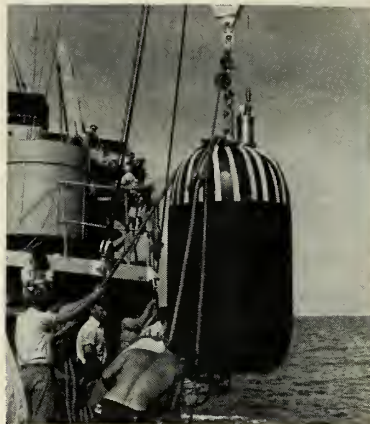
QUALITY CONTROL is maintained by Dumont at each step of fairing fabrication.



COMPLETED ASSEMBLIES contain the dome-shaped bulkheads for concentricity stabilization and stiffness.

Navy's AIDA Studie

←
MODEL OF AIDA shows its major components strung out as though for a descent to the ocean floor. At the top is a flotation bag, followed by instrument package, electromagnetic antenna and anchor.



USS STALLION crewmen lower gasoline-filled bag for 1½-mile test dive of AIDA.



AFTER INSTRUMENT package passed all of its tests, initial use was off Nassau.

THE NAVY HAS DEVELOPED a standard instrument for exploring the ocean at any depth. It's called AIDA— for Automatic Instrumented Diving Assembly.

It can be made for \$10,000—far less than the cost of a bathyscaphe—is reusable time after time except for replacing an expendable 2½-ton concrete anchor, and is unmanned.

The first successful test of AIDA components was completed off the Bahamas this spring; the first full-scale use of the complete device took place early this summer off Nassau. It will be used off Nassau again next month to make electromagnetic measurements.

Developed by physicists at the Naval Ordnance Laboratory at White Oak, Md., AIDA is now on its way to becoming a program device, a standard research tool for the Navy and its contractors.

The instrument was designed primarily to make magnetic, electromagnetic, radioactive and acoustic measurements at the ocean bottom. It can also be used for underwater photography, bottom sampling, and deep-ocean gravity and current measurements.

Depending on the experiment, AIDA can operate on a sea bottom for a period of many months, perhaps years. Weight is no problem, either: almost any heavy equipment can be lowered and raised by the same tech-

nique if an appropriate float is used.

Although the system is usually bottom-seeking, it can be ballasted to lay at any desired intermediate depth. AIDA is designed to resist 20,000 psi, a pressure equivalent to about 8½ miles of ocean depth, more than any sea known.

NOL physicist Abraham Silverstein conceived of AIDA. He points out that the device is free of self-generated sonic and electromagnetic fields. Extremely low-level background detections can be made, since only the measuring instruments themselves have to be quieted.

AIDA's center of activity lies inside a 29-in.-diameter sphere. This holds the sensors, recorders and power supply. Below the sphere are three 10-ft.-diameter antennas, and below these are anchor-release mechanism and a concrete anchor.

Above the sphere is a rubber gasoline-filled float topped by a small radio transmitter.

When the complete system is dropped over the side of the launching vessel, the anchor carries AIDA to the bottom. At a pre-set time, a clock mechanism in the anchor-release circuit fires an explosive coupling; the anchor is severed from the rest of the system and the flotation bag pulls AIDA back to the surface. Free of the water, the radio transmitter begins sending out a signal to monitoring stations. Recover-

Ocean at Any Depth, at Low Cost

by William Beller



ANTENNA FOR detecting electromagnetic fields is lowered for calibration tests.



FIRST OVERBOARD is anchor, cut loose by explosive bolts before AIDA ascends.

essels home on the signal and retrieve the device.

• **Nerve center**—AIDA's instrument case comprises two 29-inch diameter hemispheres of one-inch thick tool steel, which are said to be the largest pieces of fabricated tool steel ever made. They were forged and then machined and finished for NOL by Standard Steel of Lewistown, Pa.

The two-part housing hangs suspended at the junction of six stainless steel cables, three from above and three from below. They terminate in swivel joints to keep the cables from twisting.

Inside the instrument case is a conventional tape recorder—not the type used on satellites—which is multichannel and used to record phenomena such as sonic signals, particle impingements and electromagnetic radiations at sea bottom.

There is also a pressure gage of extreme accuracy, 1 part in 10,000. To get such accuracy, a strain gage and recording (multichannel) galvanometer combination is used. The gage picks up pressure-induced strains in the instrument case, which are then measured and recorded by the galvanometer. This method results in a twofold order-of-magnitude increase in accuracy over that obtained by usual pressure measurement methods.

The temperature data are taken by a platinum resistance gage whose out-

put is also measured and stored by the recording galvanometer.

Other items housed in the case are standard nickel-cadmium batteries for the power supply, an inverter, and transient devices peculiar to individual experiments.

• **Electromagnetic pickup**—Three 10-ft.-diameter loops comprise the antenna for receiving the electromagnetic signals. These run to a low-noise 3-channel amplifier mounted on top of the antenna. From here, the reinforced signals go to the tape recorder.

This antenna-amplifier system is highly sensitive, being able to detect signals three to four orders of magnitude less than are usually detectable—signals as low as $(5/f) \times 10^{-9}$ gauss, where f is frequency in cps.

The loops are set mutually perpendicular in order for the signal vectors to be known. These vectors can be oriented with respect to North.

A surprisingly strong and rigid structure is built out of the loops. They are made of #6 power line cable with 5000-volt insulation, wrapped in glass tape, and then impregnated with epoxy resin.

• **Finding AIDA**—To give the system a voice so that it can be found after it surfaces, a radio transmitter is attached to a platform on top of the float. The transmitter broadcasts a four-megacycle intermittent signal—one

second on, two seconds off. It is strong enough to be picked up by communication receivers a hundred miles distant.

The transmitter is for retrieval use only, not for telemetering. Signals are radiated from an eight-ft. antenna whip. Damage to the whip cuts down the power of the radiations but will not extinguish them or change their frequency.

A conductivity switch turns the transmitter off when it is immersed, and on when the radio breaks free of the water's surface. Such a switch draws negligible current when immersed—about five milliwatts—and, of course, no current when above water and not conducting.

Power comes from Silvercells, 80 watt-hours capacity. During transmissions, the drain is one watt. Therefore, the transmitter is good for about ten days' broadcasting. The system is transistorized for power efficiency and durability.

• **Flotation gear**—A gasoline-filled heavy carcass rubber bag is the last piece of assembly to go over the side prior to a dive. During the operation, the float and its entral is handled by a crane and winch.

A central steel cable runs through the bag to give it strength in tension. Except for a minor modification, the bag is essentially a standard commercial container made by U.S. Rubber. It measures four feet by seven feet, holds 520 gallons of liquid, and will support 1500 pounds when filled with aviation gasoline.

AIDA is at present set to descend at about six miles an hour, slow enough to get continuous and quite accurate readings of ocean phenomena down to the lowest depths. Thus the device provides a new and inexpensive tool for the study of one of the world's last remaining unknown areas.

The device may even be used for ASW. With a hydrophone replacing the electromagnetic antenna, AIDA would be a passive listener. It would be energized for a long period of waiting by a nuclear battery. When an enemy sub triggered its explosive bolts, AIDA would rush to the surface to broadcast the alarm.

✱



NEW \$3,500,000 FACILITY ANNOUNCED BY VOUGHT ELECTRONICS

On July 21, Vought Electronics broke ground for a new \$3.5 million facility in the Great Southwest Industrial District, midway between Dallas and Fort Worth. Completion date for the ultramodern 80,000 square foot building is January 1961, with expansion to 175,000 square feet projected within the next few years.

Complete Electronics Facility The completely self-contained facility will house engineering, assembly and manufacture, quality control, marketing, finance and administrative areas. Also included will be five laboratories — inertial guidance, servomechanism, fluids, microwave and environmental—all with advanced equipment.

Diversified Products Recent major Vought Electronics contracts include: production of actuators for the *Minuteman* ICBM, factory check-out equipment for the inertial guidance system of the *Titan* ICBM, guidance systems and autopilots for the new *Crusader* F8U-2N fighter.

Among other new products are an aircraft navigational system, space vehicle guidance units, ASW devices, advanced antennas, a commercial fingerprint identification system.

FOR COMPLETE INFORMATION ON HOW THE NEW VOUGHT ELECTRONICS FACILITY CAN SERVE YOU, write:

B. H. Ciscel, general manager of Vought Electronics (left) and A. G. Wynne, Jr., president of Great Southwest Corporation, check details of new facility.



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AF Turns to Transistorized Repeaters

by Charles D. LaFond

ANAHEIM, CALIF.—The ever widening encroachment of transistors upon traditional electron tube domains is being felt more and more even by the staid telephone field. Most recent victim is the small telephone repeater or amplifier used to build up voice signals.

As part of a campaign to modernize its communication systems around the world, the Air Force is installing thousands of the new Model 453A transistorized repeaters developed and produced by Altec Lansing Corp., to replace existing vacuum-tube amplifiers. One thousand of the compact devices were recently installed by IIT-Kellogg at Vandenberg AFB for its central inter-site communications network.

While military use is on the increase, there is also a growing acceptance of the unit by public utilities throughout the country.

Application potential for such a device on a worldwide basis is staggering.

• **Vacuum-tube limitations**—Telephone repeaters, in vacuum-tube versions, have been available for some time to build up the voice signal in telephone systems. But these vacuum tube amplifiers have several drawbacks limiting their broad usage. Power requirements are somewhat complex and heat generation becomes a problem when several hundred are ganged together.

A logical solution to these problems is the use of transistors in the repeaters.

Altec Lansing foresaw the need for solid state repeaters, and several years ago initiated design work on several versions. The amplifiers that resulted from this development appear to have proved superior to tube equivalents.

• **Transistor-type characteristics**—The repeaters themselves measure only 1¾ inches square by 6 inches in depth. Each unit is equipped with an eleven-pin plug to replace directly tube-type amplifiers.

The Altec 453A amplifier, is a two-stage negative feedback telephone repeater that operates from a 24-volt central office, a local battery, or a power supply unit available from Altec.

Since vacuum-tube repeaters need a relatively high plate voltage to operate, installations using this equipment must have a source of 130 volts DC.

This power is usually supplied from batteries or by a DC generator set—expensive items to purchase and maintain. In addition, the vacuum tube amplifiers require 24 or 48 volts to operate the heaters.

In contrast, the transistorized repeater can be operated with only a 24- or 48-volt supply, eliminating the need for the 130-volt source.

This represents an initial savings of a minimum of \$1,000.00 for an

acceptable power supply.

In describing the miniature amplifiers for M/R, Eric Mitchell, senior project engineer at Altec, said the comparative power consumption of the two types also places the transistor unit in a better position. It uses only ½ watt as opposed to 2.5 watts for the vacuum-tube type, said Mitchell.

In single line installations, the heat generation problem is minimal but usually repeaters are installed in large banks, close together because of space limitations. A bank of 100 vacuum tube amplifiers would then generate 250 watts, necessitating some type of correction or forced-air cooling.

This problem is non-existent with the 453A repeater since 100 of them would generate only 50 watts.

In performance, said Mitchell, this amplifier is capable of receiving a full 1-mw input signal set at maximum gain without harmful effects. It is temperature stable and will have a gain decrease of only 0.2 db for a rise from 75°F to 110°F.

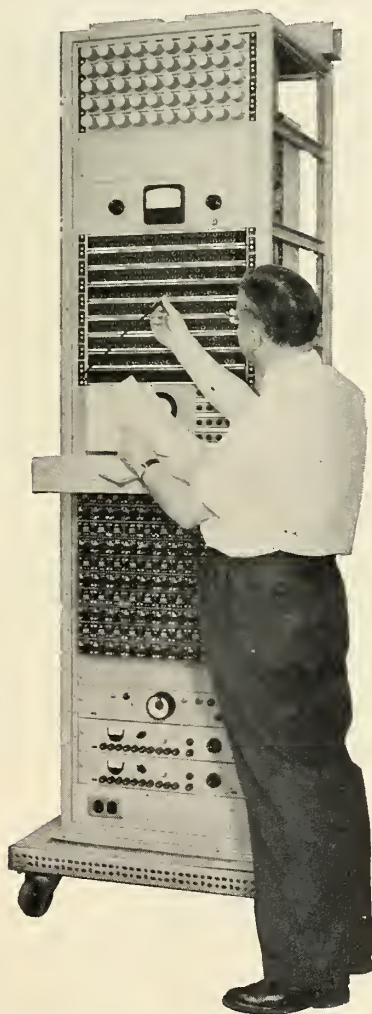
If the repeater is used with above-ground wiring in locations of high ambients, such as the desert, the power supply is reduced to 12 volts to assure maximum transistor life.

Amplification is assured, according to Altec, even with wide variations in power supply voltage. A 25% variation is compensated by a negative feedback circuit, stabilizing the gain within 0.3 db.

For dialing, or other DC signal purposes the amplifier can be bypassed by a built-in DC simplex circuit. A maximum current of 100 ma is permitted, said Mitchell, provided the out-of-balance current does not exceed 5 ma.

Besides the need for a compact, reliable repeater at the Vandenberg site, another factor, becoming more prevalent in many other communications systems, enters the picture. As the number of stations or subscribers on a system increases, it becomes necessary to use smaller cable to accommodate new lines and to reduce system installation costs.

At the Vandenberg installation 19-gauge wire previously used will be replaced with 22-gauge or finer, further necessitating the use of the repeaters. The use of cable carrying 22-gauge wire will also result in significant cost



TERMINATION BAYS, holding up to 75 transistorized telephone repeaters, are being assembled at Altec-Lansing for the Air Force Aircom program "Quick Fix."

savings, attributed to the use of much less copper wire in the new circuits.

At the same time these lines will be switched from 2- to 4-wire circuits to simplify the application of the amplifiers. In addition to improved transmission characteristics available by amplification, the 4-wire circuit affords much better balance.

• **First stock sold out**—When tested early this year by Bell Telephone Laboratories, Inc. for Western Electric Co., performance of the new unit was found at least equal to currently used vacuum-tube types. Even more significant, it was found that 18 transistorized

units would fit in the space formerly needed for one conventional device.

Early development of the tiny sub-system appears to have given Altec at least a 1-year lead over competitors. Two apparently similar models by other manufacturers were recently tested by Bell. Both were rejected.

Following the successful testing of the Altec repeater, the entire production then available (thought to be a 3 months supply) was purchased by Western Electric.

If the past is any indication of the future, the Altec repeater shows great promise as a high production item. ❄

Lockheed Develops Real-time TV Observation for Vehicles

REAL-TIME TELEVISION observation of missile and satellite performance is now possible both inside and outside the vehicle during flight.

Lockheed Electronics Co., has just developed for the Army a miniaturized television/telemetry system that will be used to monitor the operation of subsystems within a space vehicle.

Design engineers using the system will be able to view performance during flight from ground monitor stations, and study the same scenes later from motion picture film.

Cost of the camera system is roughly \$7500, but its proponents say that the savings which might be achieved through its use are enormous.

The use of television techniques in space research and development is not new, but the means for real-time read-out is a significant advancement for the U.S.

(Russian space scientists are believed to have used a similar system to obtain the unusually high-quality photographs of *Sputnik V's* canine passengers.)

• **TV camera highly refined**—Lockheed's Video Telemetering Camera System will be installed inside and outside of missiles and satellites.

Three systems have been delivered to date for test operation and evaluation by the Army. How many might be used on a given test flight would of course depend on the number of operating functions to be observed, and on available power.

When employed within a space vehicle, cameras will require a light source; but because of the system's fine sensitivity this source need not be strong (thus minimizing extra power requirements).

Fully transistorized, the three-pack-age battery-operated system is light-



VIDEO TELEMETERING camera system developed by Lockheed Electronics Co. will employ this 2-lb. TV camera to observe subsystem performance in spacecraft during flight. A special wideband FM/FM transmitter will telemeter data to ground monitors for real-time read-out.

weight and extremely compact. The 2-lb. camera itself is 7.75 in. long by 2.5 in. dia. Its control unit and sync generator are housed in a book-size container occupying 70 cu. in. and weighing only 2.6 lbs. A 20-oz. power supply is even smaller—less than 17 cu. in.

The video camera employs a standard 16-mm motion picture lens. Sensitivity of the unit, says Lockheed, is 5 foot-candles. Power requirement for the video camera system is 6 watts.

• **Wideband telemetry used**—A special FM/FM telemetry system consisting of a transmitter, receiver, converter, and ground monitor have been developed by Lockheed to support the camera system.

The missile-borne, 45-lb. transmitter is housed in a 19-in. cylindrical container, 9 in. in dia.

It is provided with 12 continuous IRIG-selected data channels—3 to 18 and A to E. Bandwidth is 20 mc, operating at a frequency range of either 225-245 mc or 245-265 mc.

Also battery-operated, the transmitter has an output of 5 watts, min., into a 50-ohm resistive load.

Potential uses of the miniature TV system are quite varied. In monitoring missile performance it can be used to view operation of latch mechanisms, missile-stage separation, burners, structural areas and even direct-reading instruments.

It could be used to help check out *Mercury* capsule performance from within. Real time readout offers the next best thing to the actual use of an astronaut but avoids the hazards to which such personnel certainly will be exposed during early trials.

For ground use the system offers similar possibilities. For example, when coupled with a DC-DC converter or AC-DC inverter and a monitor, the whole configuration would comprise a closed-circuit TV system for boresighting radar antennas. It might be similarly employed for short-range missile fire control and antisubmarine warfare detection.

The current system has been under development for over a year. Although they have not even flight-tested it yet the Lockheed Div. reportedly will have an advanced version of the system completed within the next 12 months.

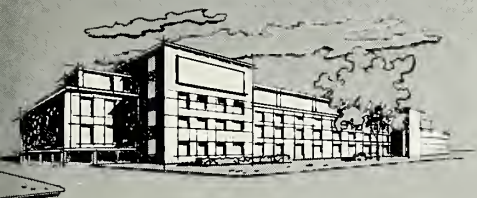
Panel Shows Pilot, Craft Condition Simultaneously

A sophisticated display panel that will instantaneously report the condition of both the pilot and his craft has been designed for the Air Force Flight Test Center by International Telephone and Telegraph Laboratories.

Intended to be monitored by a ground-based flight engineer and flight surgeon, the system is built for use with high-performance aircraft such as the *X-15*. ITTL says that it may also be used on "other space-type vehicle or man-in-space programs."

The first unit will be ready for operation early next year at Edward AFB, Calif.

The display console is separated into two units, Vehicular and Physiological, each about half the size of an office desk.

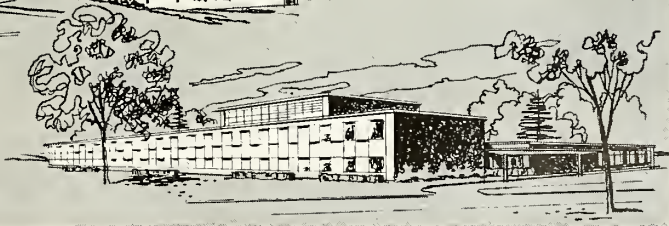


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and nearby space, the moon and planets,
interplanetary space and distant galaxies . . .

NASA introduces the new
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Space Flight Center



The Goddard Space Flight Center has just occupied an ultra-modern research complex situated on 550 acres of rolling parkland in Greenbelt, Maryland, a residential suburb of Washington, D.C. Here, many of our scientists and engineers work to advance space science and technology through a broad program of theoretical study, while others design, develop and construct scientific payloads for space vehicles and supervise their launchings. Our technical staff is also concerned with the analysis of space data obtained through Goddard's world-wide tracking and communications network, the nation's center for such activity.



With Tiros, Echo, Pioneers IV and V, Explorer VII, and Project Mercury, Goddard has already written scientific history. Technical men who wish to work in the van of progress are invited to join Goddard or any of the other NASA research centers listed below. Address your inquiry to the Personnel Director.



National Aeronautics and Space Administration

NASA Goddard Space Flight Center, Greenbelt, Md. • NASA Flight Research Center, Edwards, Calif.
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STRANGE "FISH" UNDER THE POLAR ICE!

Revolutionary RCA Magnetic Video Tape Recorder to Speed Navigation Training of Submariners

Aboard the nuclear submarine *Sea Dragon*, the first undersea magnetic video tape recorder will record and store data on under-the-ice characteristics from externally installed TV cameras. Upon return to base the recorded information will be displayed for the benefit of undersea service trainees, greatly increasing their understanding of hazardous polar navigation techniques. The recorder, a joint U.S. Navy-RCA effort,

is a marvel of compact design (dimensions: 20" x 100"). It nestles securely in the limited confines of a torpedo rack, yet represents a 60 per cent size reduction over existing commercial video tape equipment. Designed to the curvature of the torpedo rack, it will fit through the opening of a 24-inch hatch. Though small in size, the 4 megacycle recording it produces is fully compatible with its commercial counterparts.



Coming for business—a "video file system" capable of storing an entire encyclopedia on a single 2 1/2 inch reel, contents of which would contain 20 billion bits of information!



Coming for entertainment—the ultimate in color TV and video fidelity . . . via extremely portable recorders that will provide a panoramic view of world events virtually as they happen!



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exclusive RCA recorder developments now contributing to national defense include—the "Tiros" satellite recorder, designed for weather observation from space; a radar recording system to take the first pictures of a nose cone from a rocket vehicle; a unique tape cartridge adaptable to *any* size recorder. For information on opportunities in creative engineering write: G. R. Gordon, Director of Electronic Products, Radio Corporation of America, Camden, N. J.



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Glass/plastic Case Has Big Potential

by Donald E. Perry

MAKERS OF SOLID rocket motor cases may realize a multimillion-dollar market potential if they start now to develop techniques for manufacturing monofilament-wound fiberglass cases.

Already, many industry and government observers report, the business to be done in glass/plastic cases exceeds the available production capacity. They say the explanation probably is that very often qualified companies don't even answer requests for quotes.

The demand should be even greater in the future, with the trend toward high-performance systems—in ballistic missiles, upper-stage space boosters, and sophisticated military rocket-powered vehicles of all kinds.

As one top project engineer in a Naval laboratory puts it, perhaps exaggeratedly:

"By 1965 you will scarcely see a metal solid rocket motor case in volume production. I am talking about little as well as big motor cases. This isn't only *Polaris* . . ."

Where the monofilament-wound fiberglass cases may not apply—at least, not soon—is in the more pedestrian types of rocketry, such as tactical Chemical Corps rockets (flares, white phosphorus, gas, biologicals) which do not have particularly high-performance requirements but are procured in very large volume (100,000 to 400,000 unit production runs), and tactical bombardment rockets (Army Ordnance).

One big potential field is the sounding rockets used by the U.S. Weather Bureau.

• **Development**—Navy's Special Projects Office, through the Navy Propellant Plant at Cumberland, Md., about a year and a half ago set about financing development of sources of monofilament-wound fiberglass cases for *Polaris*' second stage. Static test firings are set for this month at Aerojet-General's Sacramento facility.

The plant contacted some 58 U.S. firms with a request for expressions of interest in this field. Through process of elimination, about 12 finally came on the program.

Each of the 12, at Navy expense, were to build a test bottle—about 18-in. nominal diameter, 24-in. overall length, 35-to-40 mils nominal wall-thickness. The bottles were to have a cylindrical center section with nominal hemispherical closures—in fact,



'GRANDPAPPY' of the monofilament-wound fiberglass rocket cases is the Altair X248 rocket motor developed by Hercules Powder Co. It's been used in altitude sounding (*Javelin I and III, inflatable spheres*); space probes, (*Pioneer I, Explorer VI, Argo I and II*), and to place satellites in orbit (*Vanguard III, Pioneer V and Tiros I*). Here's how it is attached to *Explorer VI*.

double ellipse—at either end plus a port at each end. They were to use six pounds of glass or less and be capable of withstanding 550 psi hydro pressure for one minute with no leaks.

If test bottles were successfully made and tested, the competing firms were to be given contracts to manufacture a test quantity—about three—of one-third-scale *Polaris* second-stage motor cases, including rubber insulation liner and the integral metal fitments for seven ports forward and five aft.

Heads and cylindrical section had to be wound as one, and lay-ups were required as reinforcing around the ports. These cases were subject to both hydrostatic and hydrodynamic test, and finally to actual static firing tests with high-energy (up to 20% A1 powder added) propellants.

Six companies successfully qualified through all of these tests. They include Aviation Products Division, B. F. Goodrich Co., The Brunswick Corp., U.S. Rubber Corp., Structure Materials Division of Aerojet-General Corp., Young Development Division of Hercules Powder Company, and Black, Syvalls & Bryson, Inc. Garlock Packing Co. now is in process of becoming qualified. The firm is one of the largest suppliers of the rubber liners.

• **High modulus**—These cases are being made of either Owens-Corning or Houze glass with an actual E (modulus of elasticity) of between 4 and 7 million, although some 10 mil-

lion is claimed for certain units. (This compares with 29 million for steel.) The resin is an epoxy. Mandrels used for winding are either collapsible metal or of the wash-away variety.

Currently, one-third-scale second-stage *Polaris* cases are being procured for between \$1500 and \$3500 each in small test quantities. Actual orders have been placed with Young Development, Black, Syvalls & Bryson, and B. F. Goodrich.

Navy Propellant Plant has stopped paying the way of companies into the business; their original intention was to create a competitive bidding situation, and they now have it. However, if a company wants to make the test bottles at its own expense, Naval Propellant Plant will supply necessary drawings, conduct tests, and if results are satisfactory, qualify the company.

• **Opening field**—Several factors indicate there will be a major swing to the monofilament-wound fiberglass case. Already a contract has been awarded to Young Development Division of Hercules Powder to provide a monofilament-wound fiberglass case for the third stage of *Minuteman*.

Some observers say there are no technical reasons why later modifications of *Minuteman* should not have glass-plastic cases in the first and second stages. *Minuteman* is suffering from the combined limitations on its guidance accuracy, warhead size and range; plastic cases could provide an appreciable improvement in mass ratio and thus, in payload.

A similar philosophy would apply in *Pershing*. The Army is making noises about sharply upgrading its performance. Monofilament winding is finding its way into other aspects of missile ordnance such as the telescoping launcher for *LAW* (Light Area Weapon—Army), an antitank anti-installation rocket shoulder fired after the fashion of a bazooka.

Most important, Aerojet General's Structure Materials Division has started developing techniques for winding a first-stage case, probably planned for the A-3, 2500-mile range *Polaris*.

The Navy, other than Special Projects, is still sticking to metal cases. There's a good reason for this. Monofilament-wounds have an attractive strength-to-weight ratio, but the Bureau of Naval Weapons is concerned with buckling. ❦

Test Separates Thor from AbleStar

Aerojet and Douglas engineers demonstrate that Thor guidance is not affected by second-stage build-up

THE PHOTOGRAPHS on these pages are from a sequence taken during *Thor-AbleStar* separation tests conducted by the Spacecraft Division of Aerojet-General Corp., Azusa, Calif.

The purpose of the tests was to determine whether thrust build-up of the second-stage had any effect upon *Thor* guidance and control systems.

In actual operation, the *AbleStar* engine is ignited after burnout of the *Thor* first stage, and prior to second-stage separation. The *AbleStar* vehicle remains attached to the first stage until thrust is obtained sufficient to overcome that of the *Thor's* vernier engines. The tests demonstrated that the build-up of second-stage thrust had no detrimental effects on *Thor* systems.

For the tests, Aerojet engineers used an *AbleStar* propulsion system with reduced tankage, and a *Thor* section consisting of a transition stage (top section with stripes) and an inner stage (middle section with vent holes and the striped bottom section). The vents were needed in order to avoid excessive concentration of heat and gases, which could damage the inner stage. Vents are not part of the normal assembly.

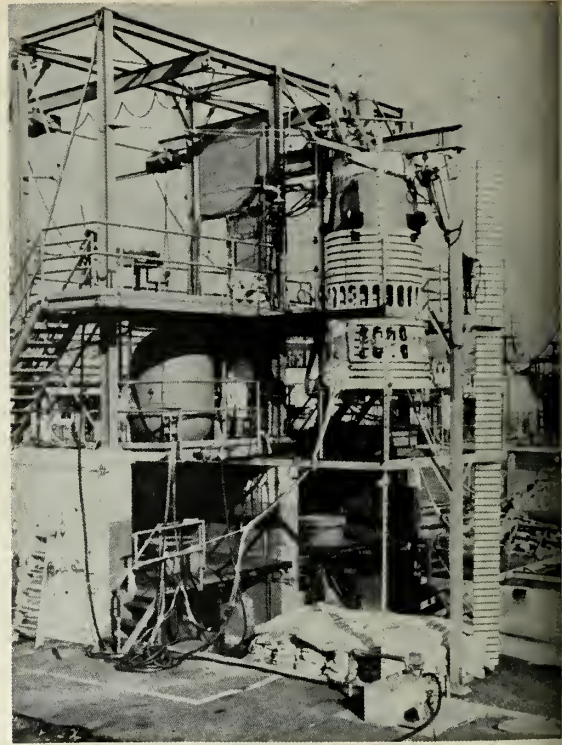
The bottom striped section of the inner stage was fitted with a first-stage fuel tank dome. Steel plates were installed over the dome to simulate the approximate weight of the *Thor* stage at burnout.

Cables were attached to the *Thor* transition section from the second stage. Grid marks (stripes) on the *Thor* sections and on the two vertical boards provided reference points for drop rate calculation from high-speed motion pictures.

During the tests, *Thor* guidance and control systems were monitored through umbilical harnesses attached to the unit's bottom.

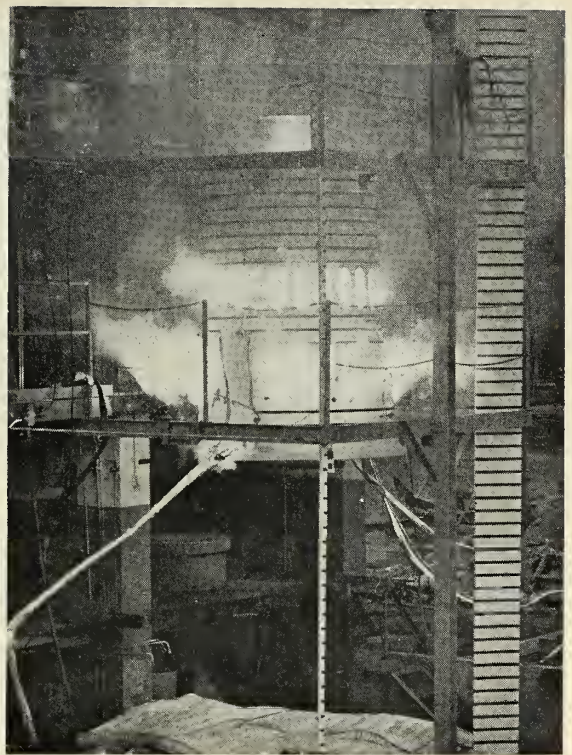
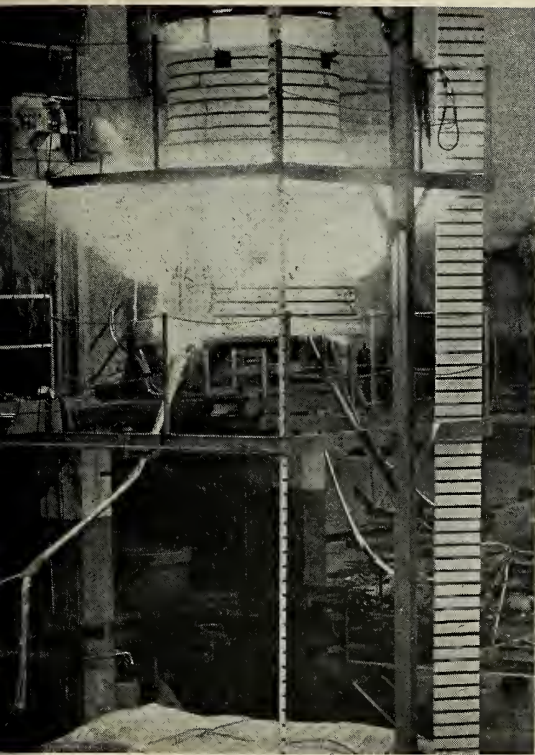
The entire test shown here required only three tenths of a second.

The test was made for the Air Force's Ballistic Missile Division, with Aerojet acting as the test conductor. The *Thor* components were provided by Douglas Aircraft engineers, who also monitored the lower-stage equipment. ¶

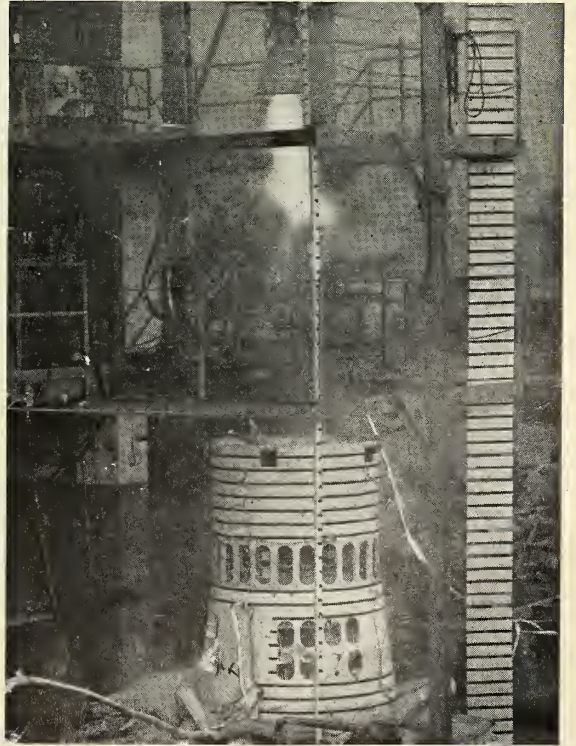
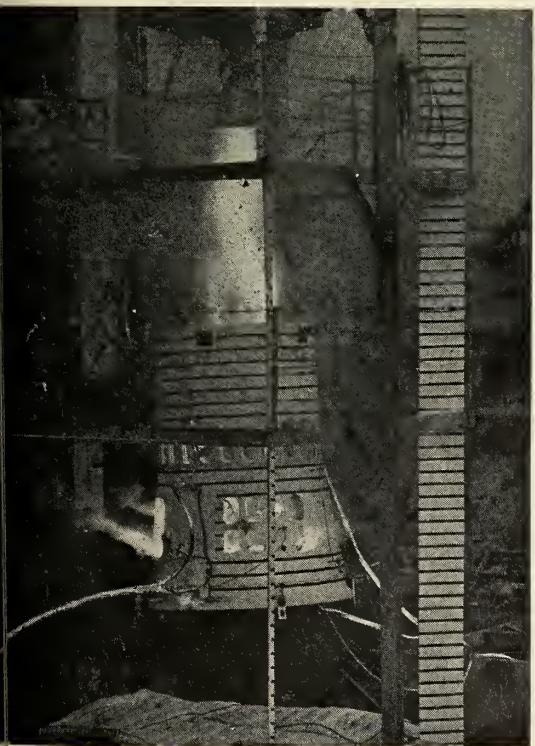


ENGINE UNITS ASSEMBLED on test stand prior to firing. In photo sequence 1-5, 3/10 sec. elapses before *Thor* lands on mattress.





2



5

Unique Sun Simulator Proposed

Bausch & Lomb system calls for installation of xenon and tungsten lamps in big underground cell to study radiation effects

by Hal Gettings

ROCHESTER, N.Y.—A sun simulator system on the boards at Bausch & Lomb would provide space researchers with a new tool to study the effects of solar radiation on vehicles in outer space.

Using a unique combination of xenon and tungsten lamps, filters, and programed control in a missile test

cell, the system is aimed at a stable, efficient, and accurate simulation of the sun's radiation. The basic theory was developed by Dr. Joseph Hall. Photometric measurements made in the test cell would be similar to measurements made in black space.

The simulated sun and earth would have the proper intensity and spectral distribution and the radiation would ap-

pear to come from the correct direction. Various relative positions of earth and sun radiation would be simulated by controlling intensity and angle of the light sources and by rotating the test vehicle.

The system proposed by B&L would be installed in an underground test cell to cover an area of approximately 227 sq. ft.

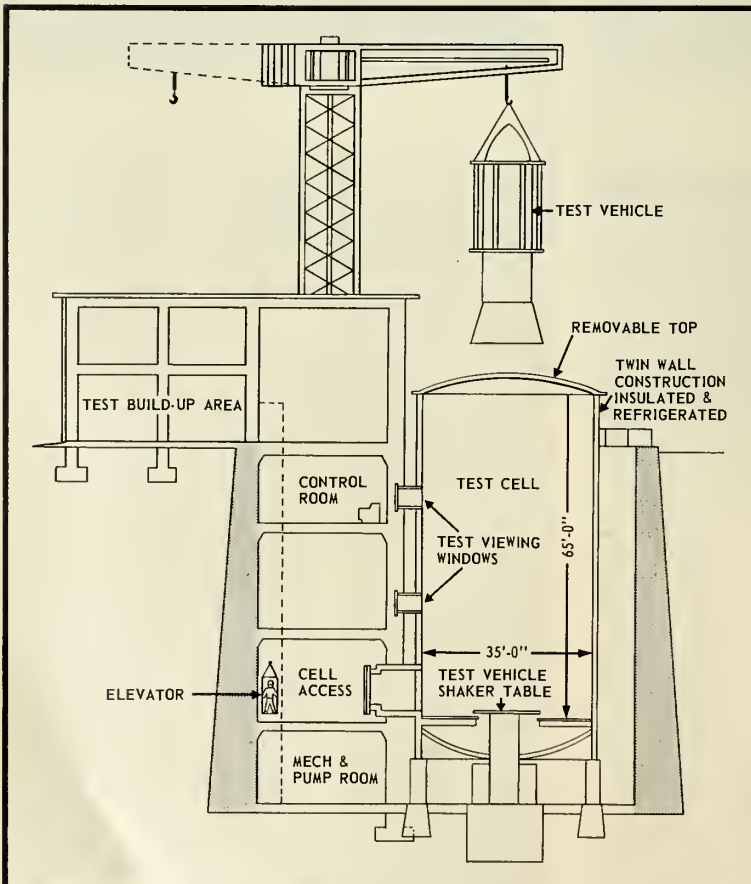
A vibration table in the base, temperature controls, the light sources to simulate the sun's radiation, and a high vacuum would provide the nearest earthbound approach yet to the environment to be encountered in outer space.

• **Sun difficult to duplicate**—Biggest problem in the design of the simulator is in duplicating the intensity and wavelength distribution of the sun's radiation. Not only direct sunlight must be considered, but also radiation reflected from the earth and its cloud cover in addition to direct radiation originating from the earth and clouds.

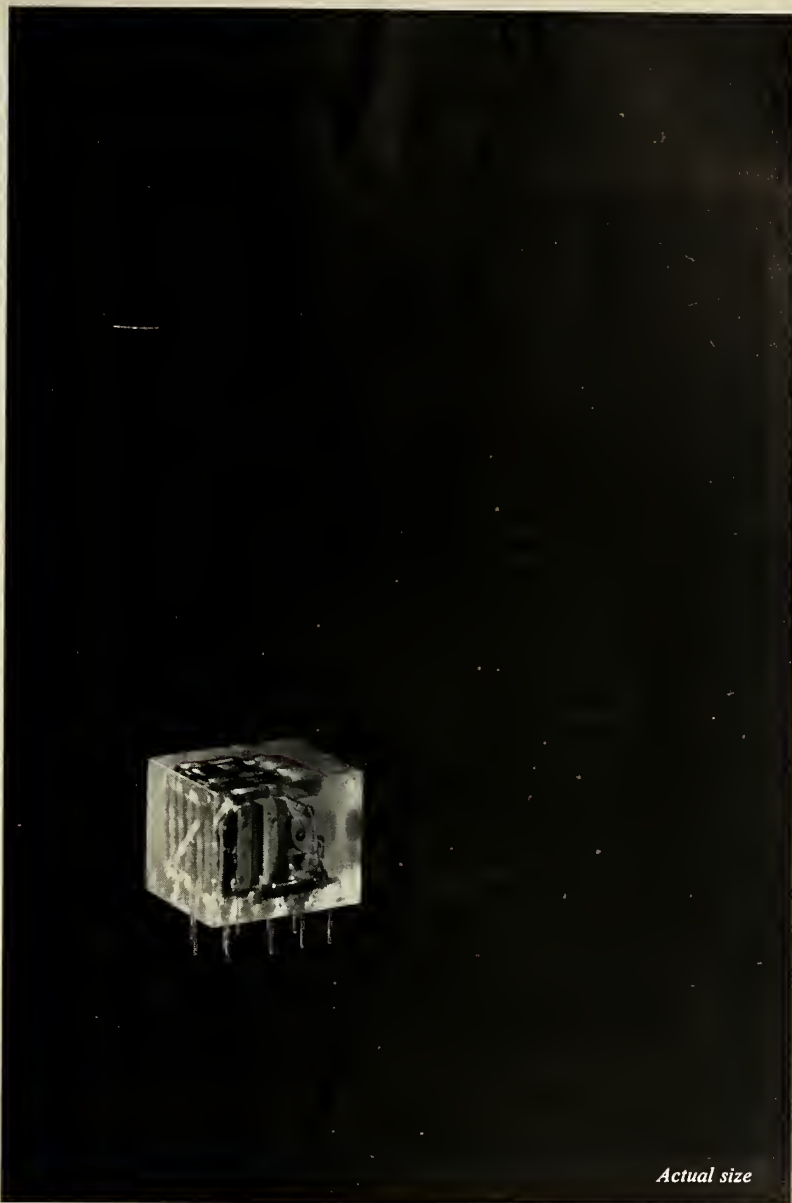
Relative direction of earth and sun radiation would continually change, and would the portions of the space vehicle's surface exposed to radiation. Directions and intensities must be accurately controlled to reasonably simulate these varying effects. An illumination accuracy of $\pm 5\%$ is the target of the design.

• **Simulation of direct sunlight**—Radiation from xenon and tungsten incandescent lamps—properly mixed and filtered—should simulate the spectral distribution and intensity of the sun. Lamps and associated circuitry at control instrumentation would be located outside the vacuum system for servicing and to reduce the intercooling problem.

The high-intensity radiation would be transmitted through small quartz windows in the vacuum chamber. The diverging radiation within the chamber would be collimated by modified Fresnel lenses covering a louvered wall inside the vacuum chamber wall. The louvers are small closely stacked tubes



SOLAR SIMULATOR in test cell would duplicate direct sunlight as well as both reflected and direct emission from the earth and clouds.



Actual size

FROM DELCO RADIO NEW IDEAS FOR DEFENSE

MINIATURE MODULES WITH STANDARD COMPONENTS

They are *building block modules*. They are a product of Delco Radio's newly developed, three-dimensional packaging technique. They are used to build light, compact, reliable airborne and special purpose digital computers for missile control. Each module, vacuum encapsulated with epoxy resin, contains up to 35 standard components per cubic inch—averaging more than 50,000 per cubic foot. The modules perform all the standard logic functions. They meet or exceed all MIL-E-5272D (ASG) environmental requirements and will operate over a temperature range of -55°C to $+71^{\circ}\text{C}$. They can be assembled in groups on printed circuit boards. There are 10 basic types and 15 variations of Delco Building Block Modules. With them, Delco Radio can quickly and easily build a compact, reliable computer for airborne guidance or any other military application. For complete details, write to our Sales Department. *Physicists and electronic engineers: Join Delco Radio's search for new and better products through Solid State Physics.*

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LING SYSTEMS USED BY BOEING TO SHAKE DOWN HUMAN FACTORS AND THE MINUTEMAN

Two modern Minutemen—man and missile—advance guards of the space-age, have taken this shattering ride on a Ling Shaker. The Boeing Airplane Company, as prime contractor on the Minuteman Program, is making extensive use of its complete Ling Vibration Systems to test assemblies for the solid-propellant ICBM. In other studies related to human factors, Boeing researchers checked out man's resistance to the punishing 28,000 lb. force of a Ling A249 Shaker—one of the few available shakers of sufficient size and force to make the experiment practical. The Ling system used by the Boeing Aero-Space Division for these tests is one of the largest systems ever built for random-sine wave testing. The installation reflects the emphasis Boeing places on vibration testing as a key factor in reliability. For details on Ling Vibration Systems which can help you to greater testing reliability, please write Dept. MR-6 at our Anaheim address.



L I N G
E L E C T R O N I C S

A DIVISION OF LING-TEMCO ELECTRONICS, INC. • 1515 SOUTH MANCHESTER, ANAHEIM, CALIFORNIA • 120 CROSS STREET, WINCHESTER, MASSACHUSETTS

The shaker used in the experiment shown at the left is only one part of the large vibration testing installation custom-engineered for Boeing Aero-Space Division by Ling Electronics.

Boeing selected the shaker for its impressive size and high force rating of 28,000 pounds—as well as its advanced closed-loop liquid cooling system. This liquid cooled design employs water and dissipates heat so efficiently that very little heat is dumped on the testing site—a distinct advantage.

In addition to the super-sized shaker, Ling supplied all associated electronics for the extensive Boeing installation—including control console, power supply, noise mixer, equalizer-analyzer, auto-servo systems and all the other equipment needed for complete random-sine wave vibration testing.



The Boeing installation was specifically designed by Ling Electronics to serve the company's needs. Like all Ling systems, it is the result of close cooperation between Ling and its customer. Whatever your own needs in high power electronics—vibration testing, acoustics or sonar—you'll find that you, too, can rely on Ling for practical design.

L I N G

ELECTRONICS

HIGH POWER ELECTRONICS FOR VIBRATION TESTING • ACOUSTICS • SONAR

missiles and rockets, September 26, 1960

with the modified Fresnel lens on the end near the wall.

The xenon lamp—which approximates the solar spectrum—supplies the major portion of the artificial sunlight. (Carbon arcs also approximate the spectrum, but due to flickering and constant need of servicing, are not considered adequate.) The xenon lamp is efficient and has an expected life of 1500 hours.

Radiation from the xenon lamp is similar to that of the sun in wavelengths up to about 0.8 micron. Between 0.8 and 1 micron there is a large emission band. Beyond one micron (near-infrared) the emission falls off to zero. A small portion of tungsten incandescent light is added to the xenon to supplement the infrared spectrum.

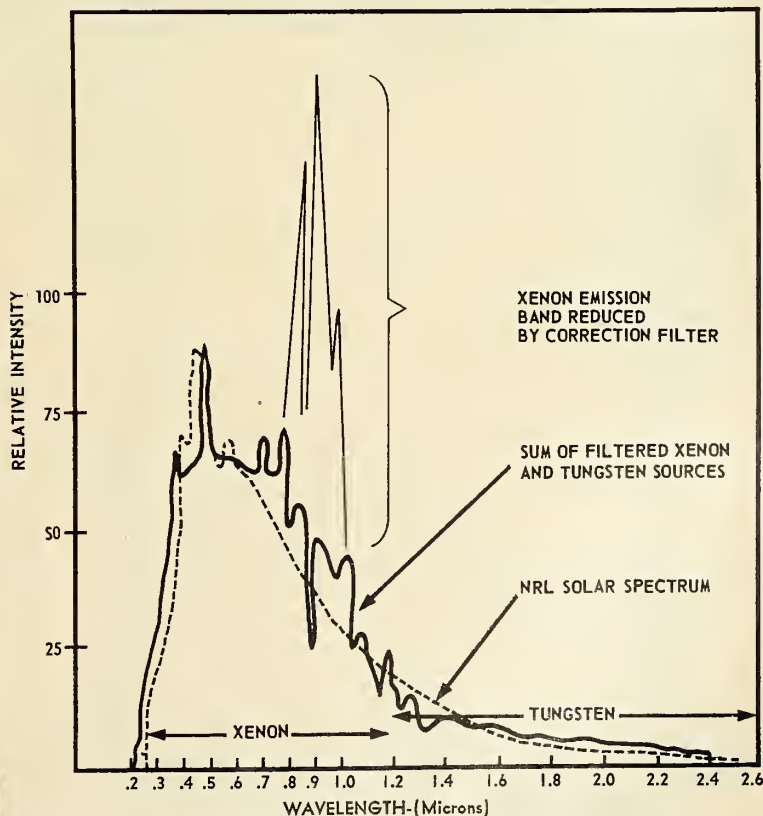
The large xenon emission band (0.8-1 micron) is reduced and the discrepancy in the tungsten emission corrected by filters to gain a spectral distribution more nearly like that of the sun.

The tungsten source correction filter can be made from anti-reflected silicon and the xenon source filter by using an inhomogeneous layer interference filter.

The radiation output of the xenon lamps may be varied over a 10:1 ratio without changing the color temperature. The illumination will be controlled by a variac on the supply voltage to the xenon lamp. The output of the various lamps will be kept uniform over the test area and with time by photo-electrically monitoring the output light level. The output of each lamp would be kept constant by means of a closed-loop servo driving the control variac.

The illumination output may be varied with time by programing the portion of the output of the photo-electric monitors that is sent to the servo. To decrease the light level, a potentiometer can be mechanically adjusted to send a larger voltage to the servo control to turn down the variac controlling the voltage to the xenon lamp.

The color temperature of an incandescent source changes with temperature, consequently the output of the tungsten source cannot be controlled through the input voltage. However, the output of the tungsten lamp can be varied by a diaphragm whose opening is controlled by the same mechanical



XENON-TUNGSTEN source combination closely matches NRL solar spectrum in relative intensity, spectral distribution. Filters cut emission in 0.8-1 micron range.

double-duty source package . . .

motion that changes the xenon control potentiometer. The entire output of the incandescent and xenon sources could be controlled by means of a diaphragm. However, since the maximum total power consumption of the simulated sun would be about 150 kw, it is considered more economical to control the xenon sources, the major power consumer, by means of the input power.

The orientation of the test vehicle with respect to the sunlight would be determined by rotating the vehicle on its pedestal.

• **Earth simulation**—The radiation from the earth would be simulated by a high-temperature source for the reflected sunlight and a low-temperature source to simulate the earth's emission. The basic high-temperature source and collimating system would be similar to the component used for the sun simulator. This system would be modi-

fied to project a rectangular area of light onto the test site. A second unit would be mounted beside the first to project the radiation due to the earth's emission.

Since the reflected radiation is similar in spectral distribution to sunlight, the same radiation source package and control used in the sun simulator would be used in the earth simulation system. The aperture would be altered to enable a rectangular area of illumination to be projected at an angle onto the test area. The intensity of the sources would be adjusted so that the integrated radiation from all the sources onto a test area would simulate the sunlight reflected from the earth.

Each of the seven columns of the earth simulation system would be programmed to simulate intensity and relative position with respect to the test site. Various columns can be turned on

to simulate relative orientation. For example, a test site located above the earth with an overhead noon sun would be simulated by the fixed sun simulator and a 180° cylindrical sector—using five columns of earth-simulator sources. The earth simulator sector would be on the opposite side of the chamber from the sun simulator. The 180° cylindrical sector would simulate the horizon-to-horizon view the test site would see toward the earth. Similarly, other positions of the earth, with respect to the sun, would be simulated by turning on various portions of the earth simulation system. A distant earth would be simulated by turning on only a small portion of the earth simulator system.

The illuminators in the earth simulation system would be controlled individually or in small groups; consequently, a variety of illumination configurations and intensities would be possible.

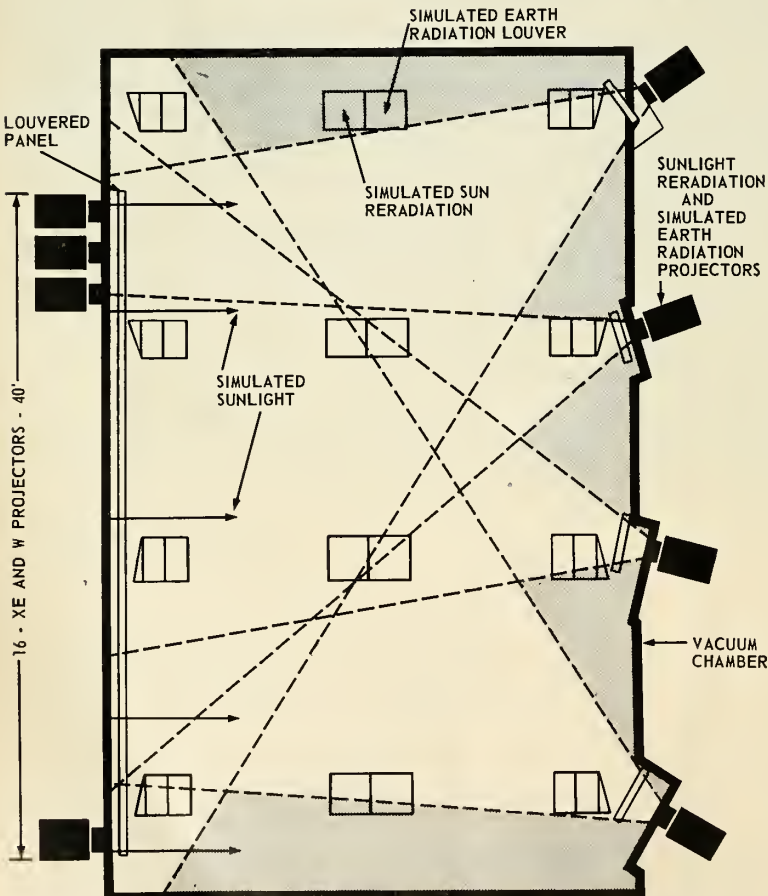
The sources illuminate only a specific test vehicle and not the walls; therefore, the cooling problem is minimized. Sources can be controlled by an automatic program.

• **Thermo-optical radiation cooling**—For removing the generated heat from within the vacuum chamber B&L proposes to use a multiple-stage radiation sink.

This method of radiation cooling separates optically the heat at various wavelengths and removes the heat at the various energy levels—or wavelengths—by means of heat sinks at different temperatures.

Reflected sunlight would be removed from the vacuum chamber by means of the 100°K cooling system and the low-temperature long-wavelength radiation at 4°K. The vacuum chamber wall would be surrounded with glass or fused quartz plates cooled to 4°K. Then sunlight would be transmitted and would not heat the glass. (Glass becomes opaque and has high absorptivity beyond 4 microns. Consequently the glass would absorb the long wavelength radiation.) The transmitted sunlight would be absorbed by the 100°K surface which would have high absorptivity for sunlight, but low total emissivity at 100°K. Thus the 100°K walls would not radiate energy—due to their higher temperature—to the 4°K walls.

In outer space, the environment is at 0°K and an object would cool to this temperature in the absence of sunlight. In the test chamber with thermo-optical radiation cooling, the environment appears to be at 4°K, and a test vehicle would cool to this temperature. An environment at 4°K is also important for testing various component whose efficiency depends upon proper radiation cooling—such as solar cells.¹



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Drugs May Halve Radiation Damage

Army project shows promise of providing protection for humans; NASA watches for possible space applications

by Heather David

CHEMICALS WHICH SOMEDAY may radically reduce the horrors of radiation damage to living organisms are now undergoing limited testing on humans at Walter Reed Army Institute of Research.

Although the compounds are being developed for use by Army combat troops on nuclear battlefields, the new DOD-NASA Aeronautics and Astronautics Coordinating Board is keeping tuned in—for the possible application of such drugs in spaceflight.

The Walter Reed project marks the first time anti-radiation drugs have produced hopeful results in tests on humans, although the idea has been considered since 1950.

A great deal remains to be done. But Dr. David Jacobus and Dr. Michael Dacquisto of Walter Reed are cautiously optimistic that a damage-decreasing "pill" may be possible by mid-1962.

Dr. Jacobus cautions that they could never be a substitute for atomic shelters or shielding. But they may be able to do this: They may reduce the radiation damage of almost any magnitude dose by one-half.

Extensive research with animals as proved this. In tests with humans,

cotton saturated with the chemicals was placed inside the cheek of the subject. The entire cheek was irradiated, enough to cause inflammation of the tissues on the inside of the mouth. Dr. Jacobus found that in all cases, if the chemical solution was strong enough, in the treated area damage was reduced by one-half. These patients suffered no side effects from the local use of the drugs.

The compounds with which the Army is working are derivatives of protein-bonding elements found readily in nature. But man could not consume enough in his natural food intake to provide effective radiation protection. Dr. Jacobus likens it to eating a pound of sugar.

When the project began several years ago, some 600 compounds were considered. Many universities and pharmaceutical companies have participated in the testing program, until the field has been narrowed down to 10 likely prospects. These 10 are in the same class of compounds as glutathione, cysteine, mercaptoethylguanine, and mercaptopropylamine—old acquaintances of the biologist.

• **How do they work?** Four things presumably happen in varying degrees when the chemically-protected cell receives a dose of radiation: a) free radicals are trapped by a lack of oxygen

produced by the chemicals, b) formation of free radicals is inhibited, c) proteins are shielded because their energy is syphoned off by combination with the chemicals, d) proteins are shielded because of a change in metabolic activity resulting from combination with the chemicals.

One or more of these reactions may take precedence. But the reaction is linked to living organisms only—the compounds had no effect on plastics.

The greatest problem confronting the Army medical men is the toxicity associated with the use of these drugs. The 10 now being researched are the least toxic of the group, but may produce nausea, hypotension, hyperactivity, and nervous disorders. But as Dr. Jacobus puts it: "We haven't killed anyone yet."

The problem now is to reduce the toxicity and increase the action. Dr. Jacobus' group is experimenting with "activators" or compounds which do not have anti-radiation properties themselves, but may increase the action of those which do.

Two types of compounds are mentioned for this use: methemoglobin producers and cytochrome oxidase inhibitors. These have been successful when combined with the mercaptans.

• **Long term use**—Dr. Jacobus reports that mice have been maintained

How Much Radiation?—Biochemists and Physicists Disagree

There have been some startling discrepancies in radiation measurements taken in important U.S. rocket shots—discrepancies which would mean life or death to space travelers.

In one Army *Jupiter* flight carrying biological samples, the living organisms showed 10 times as much radiation damage as the physicists' radiation counters indicated.

NASA Life Sciences radiation experts charge that the biological effects of combined types of radiation—including the possible unknowns—cannot be measured except by living organisms.

First, step, says NASA, is to develop an accurate biological damage indicator (BDI) to send on all shots.

It must be a standardized specimen or organ which could produce predictable reactions given a certain

amount of radiation. A number of things are under consideration, among them a mold spore called neurospora and the mouse testicle.

Neurospora looks the most promising, says NASA's Dr. Dale Smith. When the spore is exposed to radiation the mold will produce a mutation resembling a mothball. By counting the number of these "mothballs," the amount of radiation damage theoretically can be determined. A sample of neurospora was carried on the recent NERV shot.

Very important is the fact that a BDI will show damage from kinds of radiation which might not be recorded on the physicist's instruments. They measure only those kinds of radiation known.

When NASA perfects a BDI, it will be included on every space vehicle the U.S. sends aloft.

on the drugs for one month with no accumulated ill effects. However, the Food and Drug Administration requires an eight-month period of continual use by humans to prove they are safe.

Doses can be designed for almost any length of protection—one hour or up to 24 if desired. Since the compounds are so prevalent in nature, they are inexpensive to produce.

Some work along the same lines has been done at the Dept. of Radiobiology at the Air Force School of Aviation Medicine. The group was able to extend the life of monkeys by giving them aminoethylisothionium combined with cysteine before radiation. But in all cases, the monkeys eventually died. The Walter Reed group has since given SAM their compounds for evaluation in their program.

Dr. Manfred E. Clynes and Dr. Nathan S. Kline of Rockland State Hospital have projected the idea of drugs, and have come up with a working plan for space. In their paper "Drugs, Space and Cybernetics," they describe a Cyborg, a man-machine system. A servo-mechanism would signal an increase in radiation count, and trigger the administration of anti-radiation drugs. This would leave the pilot free to perform his normal tasks.

But these authors' assumption was based upon the SAM paper—not on any proven chemical compound.

• **Hibernation a possibility**—Much

thought recently has been given to the possibilities of hibernating a man during the long uneventful periods of space travel. Body temperature would be reduced to less than 20°C.

There is one study underway to determine whether there is any unusual resistance to radiation in the hibernated state, according to a state-of-the-art survey by Medical Nuclear Consultants of Washington, D.C.

Although details of these experiments have not been published, the survey disclosed that hibernated rats survived a dose of X-radiation which killed the control animals. And 25% of the hibernated animals survived three times as much radiation than did the control animals. The work is expected to be extended to higher mammals—dogs, then monkeys, and with other kinds of radiation.

The Atomic Energy Commission has let a number of contracts on the study of bone marrow as a combatant against radiation injury. Other studies have involved the use of spleen and liver extracts. No conclusive results of effectiveness against whole-body radiation in humans, especially for space-flight purposes, has been reported.

The National Aeronautics and Space Administration is not actively going into the field of chemical protection. Dr. G. Dale Smith, radiation expert on the Life Sciences staff, points out that NASA's prime interest is to

learn more about radiation in space—not only the extent and kinds, but the biological effects.

So NASA only looks over the shoulder of those who are doing chemical experimentation in the field of radiation protection. When NASA can determine what biological damages may occur (which may take years), then it may be in a buying position for chemi-protectors, if they are still feasible.

We may find that in the next few years that there are types of radiation from which no drug or shield can protect. Dr. Jacobus' compounds could protect from gamma rays and protons. Nothing has been developed that can shield heavy cosmic particles which might knock out the space ship by sheer energy alone. And there are the unknowns.

• **Outlook**—It's very unlikely that the first manned flight, or even "animal" flight into deep space will be made until the lowest point in the solar flare period. This will come roughly in 1965 and again in 1976—which would presumably be the first feasible time. In the preparatory years very intensive data will be gathered about radiation in space and what we can expect from it.

It may change all plans for shielding, for chemical protection. It may evolve new drugs. But all agree that the Walter Reed type of research is well worth watching. ■

NERV to Report on Radiation Belts

First launch of nuclear emulsion is completely successful and frees extra vehicles for additional experiments

DATA ON RADIATION LEVELS to be encountered in manned flight through the Van Allen belts is due in three to four weeks from last Monday's completely successful first launching of the NERV nuclear emulsion.

In its first flight test, from Pt. Arguello, Calif., a four-stage Aerolab *Argo D-8* solid rocket lifted the 83-lb. package 1200 miles into space to impact 1200 miles downrange, within six miles of the predicted area. It was recovered from the Pacific by the destroyer USS Rowan.

Three more *Argo D-8* vehicles, on hand for backup, now are available for other experiments.

The NERV package (M/R, Aug. 15, p. 30), put together by the Missile and Space Vehicle Department of General Electric, carried an exposable nuclear emulsion designed to record any particle with five million or more electron volts of energy (5 Mev), which

penetrated a tungsten shield. "Tracks" in the emulsion produce a permanent record of the number of particles entering, their charge, mass, velocity and direction of travel.

Iford Ltd. of London, England, is the only company in the Western world producing the material, which has been used for many years in balloon-borne investigations of the upper atmosphere. Because of its thickness, the emulsion takes two weeks to develop. Another two weeks will be required for study of the results.

• **Other experiments**—Although the primary purpose of the experiment was to measure the inner Van Allen belt, the probe also carried three unshielded packages of neurospora. This experiment, designed by Florida State University, will gauge possible mutation effect on the spora due to exposure to the radiation.

Another experiment, removed at

the last moment to avoid complications, would have measured micrometeorite density. It consisted of a finely polished lucite shield, on which craters would be examined to determine the velocity and mass of micrometeorites encountered.

Argo D-8, 62 ft. tall, has a first stage consisting of a Thiokol *Sergeant* rocket with two additional Thiokol *Recruits*. Second and third stages are the Grand Central *Lance*, and the final is the Hercules Powder Co. *Altair*.

Flight took about 37 minutes. About 115 seconds after lift, at 300 miles altitude, the emulsion moved out of the container and remained extended for about 25 minutes, through apogee and down to about 600 miles.

The recovery vehicle separated from the fourth stage a few seconds later. Made of Aluminum with an ablation heat shield, the vehicle was designed to give aerodynamic stability during re-entry. At about 40,000 ft., gravit loads activated a pyrotechnic timer which fired a mortar and deployed parachute and ejected radar chaff.

Expanding the Frontiers of Space Technology in

ELECTROMAGNETICS

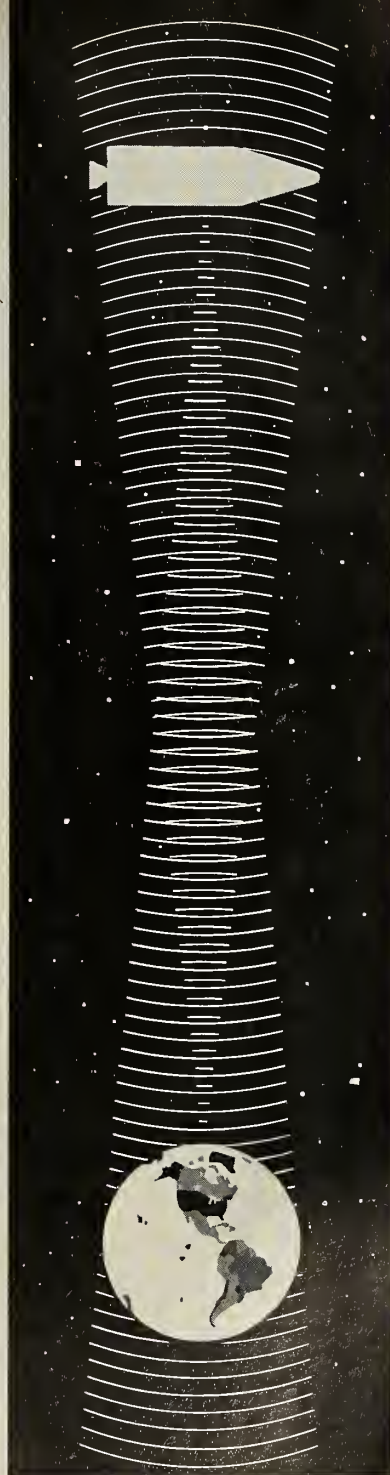
Lockheed Missiles and Space Division maintains extensive research capabilities for the development of antennas and electromagnetic devices for space vehicle applications.

Laboratory studies in antennas and electromagnetic propagation include the application of solid state materials to microwave transmission line component and parametric circuits; the design of antennas to survive the rigors of space flight; and the effects of scattering from missile and space vehicle structures.

Research is also being conducted in the application of MASERS; on problems of radio transmission between space vehicles and Earth; effects of reentry ionization on radio transmission and reception; and development of antennas for data link systems between satellites and ground stations.

Engineers and Scientists

Lockheed Missiles and Space Division has complete capability in more than 40 areas of science and technology — from concept to operation. Its programs reach far into the future and deal with unknown and challenging environments. If you are experienced in electromagnetics or in related work, we invite you to share in the future of a company with an outstanding record of achievement and make an important individual contribution to your country's scientific progress. Write: Research and Development Staff, Dept. H-29B, 962 W. El Camino Real, Sunnyvale, California. U.S. citizenship or existing Department of Defense industrial security clearance required.



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mergers and expansions

GENERAL ELECTRIC CO. has started operation in its new \$11-million Lexan polycarbonate resins production plant. The Ohio River plant can initially produce in excess of five million pounds of Lexan a year, but GE officials report that this can be doubled within a relatively short time.

AMERICAN SOCIETY FOR METALS has dedicated its national headquarters in Geauga County, near Cleveland.

LYTLE CORP. has opened its 10th office, this one at Oklahoma City, Okla. The office is under the administrative direction of C. J. Donnelly, manager and vice-president of the Albuquerque division. William T. Gosnell has been named acting branch manager.

CORNING GLASS WORKS has begun construction of a pilot plant on a 400-acre research and engineering center three miles west of company headquarters at Corning, N.Y. The two-story, 93,500-sq.-ft. plant will be first in a series of new buildings planned over the next five years.

ZIRCONIUM CORP. of America announced a change of ownership by which control was relinquished by the Oliver Tyrone Corp., Pittsburgh. The new ownership is reported to include substantial outside interests and greatly increased employee participation, with the former owners retaining a strong minority interest.

PENDAR INC., designers and manufacturers of illuminated push-button panel and console switch-light combinations, have sold a substantial interest in their company to American Technology Corp. The sale was made to augment working capital and to provide additional management direction. C. E. Fisher remains as president, with Ernest M. Lever, Walter H. Trumball, and H. Grant Theis also on the board of directors.

RADIO CORP. OF AMERICA's new Mountaintop, Pa., plant has started pilot production of transistors, with full-scale operations to start soon. The Wilkes-Barre area plant contains 120,000 sq. feet of floor area.

AEROJET-GENERAL CORP. has purchased a controlling interest in Space Electronics, Inc., a Glendale, Calif. subsidiary of Pacific Automation Products, Inc. Percentage of stock and purchase price involved was not disclosed.

James O. Fletcher, president, and Frank W. Lehan, VP, will continue in their present capacities. The SEI board of directors will include Fletcher and Lenan, plus Dan A. Kimball, Arthur H. Rude, W. E. Zisch, W. L. Rogers and R. I. McKenzie. Space Electronics just completed a 15,000-sq.-ft. addition to its facilities.

ROCKETDYNE will consolidate a major portion of its present laboratories at Canoga Park into a single laboratory organization in the Vanowen facility. At the same time a new group, the Materials Laboratory, has been established within the Development Laboratory section. Equipment and laboratory personnel of Materials Engineering and PDL laboratories have been combined into the new Materials Laboratory.

MARQUARDT CORP. has realigned its Power Systems Group to integrate its sales activities with its divisional engineering functions. Marketing activities have been decentralized to serve engineering divisions in support of specific project operations. The company also established a new special engines division and a combined Manufacturing and Materiel Division.

ALCOA has acquired the foreign rights to sell and license the manufacture of Sonobond ultrasonic metals joining equipment produced by Aero-projects, Inc., of West Chester, Pa. Marketed under the trade name Sonoweld, Sonobraze and Sonosolder, the joining tools are used to weld, braze and solder metals by application of ultra-high frequency vibrations.

financial

American Electronics—Net sales totaled \$13.4 million for the six months ending June 30, compared with the previous year's first-half sales of \$8.7 million. Net income for the period rose to \$264,991 from \$226,406.

Litton Industries—Net earnings of approximately \$7.5 million were reported for the fiscal year ending July 31, as compared to almost \$5 million the previous year. Sales totaled approximately \$185 million, against \$125 million in FY 1959.

Telecomputing Corp.—Reported record sales of \$38.2 million for the nine months ending July 31. Sales for the same period a year ago amounted

to \$28.5 million. Earnings for three quarters declined to \$417,955 as compared to income figures reported in 1959 of \$1.4 million. Reduced earnings were partially charged to \$1.5 million in engineering and development expenditures for the nine-month period.

Non-linear Systems, Inc.—A record \$4.9 million in sales was reported for the fiscal year ending Aug. 31—an increase of 80% over the previous year, a total of \$2.7 million. President Andrew F. Kay reported that during this period NLS captured more than 50% of the precision digital voltmeter market, both dollar volume and number of units sold. Anticipating another doubling in the current year, the firm expects to add an additional 135-175 employees. Construction will begin in 1960 on six 10,000-sq.-ft. buildings on several acres of the company's 100 acres at Del Mar, Calif.

Gertsch Products, Inc.—A 27% increase in sales for the fiscal year ended June 30 was listed by the company. Sales were \$2.9 million, compared with \$2.3 million in FY 1959. Net earnings were \$160,710, a drop from 1959's \$201,085. The company made an engineering reinvestment of 61 cents per share during the year, doubling engineering effort.

Automation Industries—A 24% increase in sales was reported for the months ended June 30, 1960. Consolidated sales for the first half were \$5 million, with earnings at \$153,364.

Electro-Tec Corp.—Substantial gain in sales and earnings for the first quarter ending July 31, 1960 was reported. Net sales reached \$1.3 million, an increase of nearly 34% over \$975,514 in the same period last year. Net income rose 66% to \$54,300, against \$32,835 a year ago. Current quarterly earnings is a consolidated total reflecting three months' integrated operation with a recently-acquired subsidiary—Lambros Precious Metals Company, now Precimet Laboratories, Inc.

Control Data Corp.—Sales for fiscal year ending June 30 rose to \$10 million, 111% over the 1959 total of \$4.6 million. Net income was \$551,600, or 95% over 1959 earnings of \$283,214.

Zero Mfg. Corp. net sales were \$5.4 million, compared with almost \$4 million the previous year. Net income was \$349,460, topping the previous year's \$296,929.

MATRA-Mirage: An All-French System

Highly successful marriage of Falcon-like bird to top French fighter could lead to standardized NATO air-to-air missile

by Bernard Poirier

THE MIRAGE III deployment of MATRA R. 530 missiles promises to be one of the finest Western airborne missile systems developed by European engineers.

The MATRA R. 530 air-to-air missile has been successfully fired against specially boosted" Mach 3 drones. The missile can be carried by Vautour Mirage III aircraft.

The Mirage III is the French Air Force's Mach 2 attack/fighter. All other aircraft made by Général Aéronautique Marcel Dassault.

France's new MATRA missile is only a second-generation R. 511 which has been in production for over a year at MATRA's Engins Spéciaux Armements Aéronautiques Division.

• **Bird resembles Falcon**—The R. 530 has homing guidance in two versions—one electromagnetic, the other infrared. The solid-fuel two-stage missile with delta cruciform wings looks very much like several GAR versions of the USAF Falcons.

However, unlike the Falcon the R. 530 apparently has the same classified homing guidance control as other French tactical missiles and therefore has no dynamic surface controls or reentry areas.

It is believed that the Mach 2.17 Mirage III can now take off in 2500 ft., climb to 60,000 ft. in 6 mins. with full armament load—or go higher to its maximum serviceable ceiling of 70,000 ft.—launch a 530 missile at a radar-located enemy aircraft, and hit it about 10 miles away.

This aircraft is pretty much Dassault's prime offering; it may yet be adopted by other NATO countries. The adoption of MATRA's new missile should help to bring about a standardized, all-European-fabricated air-to-air missile system.

One of the biggest arguments advanced by aircraft and missile makers to potential NATO buyers has been the desirability of standardization. But the meaning of standardization is about as varied as the languages within NATO, and the argument has often bogged down before NATO's procrastination in agreeing on a definition.

• **Four major subcontractors**—G. A. M. Dassault's aircraft is equipped with a variable-thrust, liquid-fuel SEPR 841 rocket booster for faster climbs or extreme altitude performance. It can use both a S.N.E.C.M.A. "Atar" jet engine having a thrust of 13,200 lbs. with afterburner, or a Rolls-Royce

"Avon" jet.

The R. 530 is about 6½ ft. long and its packaged fuel is a Hotchkiss-Brandt development. The system's launching system remains classified—although the radar units are known to serve both tracking and firing missions. The missile's velocity is believed to be better than 1200 ft./sec. ❧



MIRAGE III WITH new MATRA R. 530 air-to-air missile. An exclusive M/R photo.



MATRA R. 530, here mounted on Vautour, has electromagnetic and infrared guidance.

Sperry Gets Navy Contract For Sub Detection System

The Navy awarded a \$4.5 million contract for production of a new passive silent underwater detection system for submarines to the Sperry Gyroscope Co.

The system, to be installed in operational subs as well as those under construction, is compatible with existing fire control equipment.

AF Backs GE Plug Nozzle Program with \$1 Million

General Electric Co.'s plug-nozzle rocket program is being backed by more than \$1 million in Air Force contracts.

The Air Force funding supplements support given by the National Aeronautics and Space Administration. GE will investigate application of the concept to both solid and liquid rockets. Solid rocket studies will be done at the company's Evendale, Ohio, plant, while the liquid rocket work will be done at GE's Malta Test Station near Schenectady, N.Y.

The investigation will include improved methods of controlling direction and magnitude of solid rocket thrust, through varying the throat area of the combustion chambers.

Kurt Berman, manager of liquid rockets at the Malta station, explained that the most distinctive feature of the design is the provision for multiple thrust chambers, rather than nozzle configuration. "It is something like going from a one-cylinder to an eight-cylinder gasoline engine," he remarked.

Research to date has verified all the major advantages claimed for the design, Berman asserted, and GE is very close to the point of proposing its use in a research and development program. He listed these major advantages:

-A plug nozzle acts like an ideal nozzle, with high performance even at low altitudes.

-The engine is half the length of a conventional engine.

-Aerodynamic thrust vector control can be accomplished by varying chamber pressures in the outer chambers and keeping a rigid mounting.

-Stress distribution is simpler since smaller stresses are located at several points instead of one large stress at a central point.

-The manufacture of a large number of small parts instead of a few large parts improves reliability.

The Air Force contracts were awarded by the Directorate of Rocket Propulsion of Air Research & Development Command at Edwards AFB, Calif. NASA has said it expects to spend about \$1 million on plug-nozzle research in the current year.

soviet affairs

By Dr. ALBERT PARRY

Desoxyribonucleic acid went into orbit

in ampules aboard the capsule of *Sputnik V* (also known as *Spacecraft II*) and was safely brought back to Soviet soil, along with dog passengers Strelka and Belka. Russian biologists call this acid DNK—after three of the main Russian letters occurring in its full name (K stands for *kislota*, meaning acid).

In an interview published in the Aug. 27 Moscow *Literaturnaya Gazeta*, Dr. Vasily V. Parin, a member of the Soviet Academy of Medical Sciences and a foremost authority on space medicine, stated that DNK is "an acid with an important role in relaying hereditary features from generation to generation." This acid was put aboard the Soviet rocket because "it is of course important for us to know how DNK would react to this outer-space impact."

A high-molecular compound,

the DNK acid is (Professor Parin went on) "by its essence very close to live albumin" and ever-present as a component of cell nuclei. In recent years, he said, scientists have succeeded in "achieving its synthesis *in vitro*." Observations of its behavior in space-flights will be extremely valuable for manned rocket journeys—when these finally come.

'I don't want to play down the merits

of Belka and Strelka," the Soviet space medicine expert continued, "but, for science, the presence aboard the spaceship of other inhabitants of our planet had a meaning of no lesser significance."

The DNK acid was only one of a number of such "inhabitants" aboard *Sputnik V*. According to Dr. Parin, he and other Soviet scientists "attempted to include in the capsule the earth's animal and plant life in a so-called condensed variation."

Test tubes with bacteriophage, the ultramicroscopic agent which causes the dissolution of certain bacteria, and which Dr. Parin defines as "the simplest of living things" (while other scientists regard it not as a living agent but as an enzyme), were put into the rocket's capsule side by side with test tubes containing "cultures of more highly organized microbes." These were "intestinal bacillus (rod-shaped bacterium), staphylococcus, and actinomyces (ray fungus)—that is, actinomycins producing antibiotics."

Flies of a special variety

were also included in this momentous rocket flight and successfully brought back, the Soviets say. *Drosophila*, a genus of flies of the family *Drosophilidae*, was of particular interest in this Soviet experiment. According to Dr. Parin, "this fly has been studied by biologists most closely for many years."

Drosophila is, in the language of biologists, "very plastic," since its succeeding generations "sensitively react to any effects of the outside world to which their ancestors are exposed." (Here, Dr. Parin most likely means the vinegar fly, or *Drosophilidae melanogaster*, which is being extensively used in various countries in laboratory studies of inheritance.)

Mice and rats were added

to *Sputnik V*'s menagerie, and their presence in the capsule likewise yielded valuable data. "Mice," Dr. Parin remarked to his interviewers, "reach sexual maturity quickly and give plentiful progeny." Hence, he said, the effects of outer-space radiation upon the bone marrow or blood-manufacturing system of mice, or upon the highest nervous activity of rats, can now be studied not alone in those rodents who actually made the *Sputnik V* flight but also in their descendants, to investigate "remote results of this impact."

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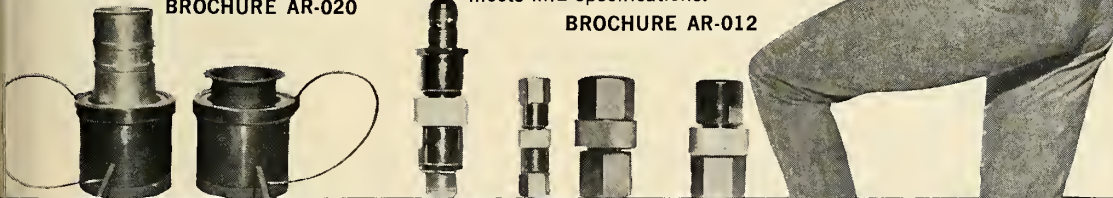
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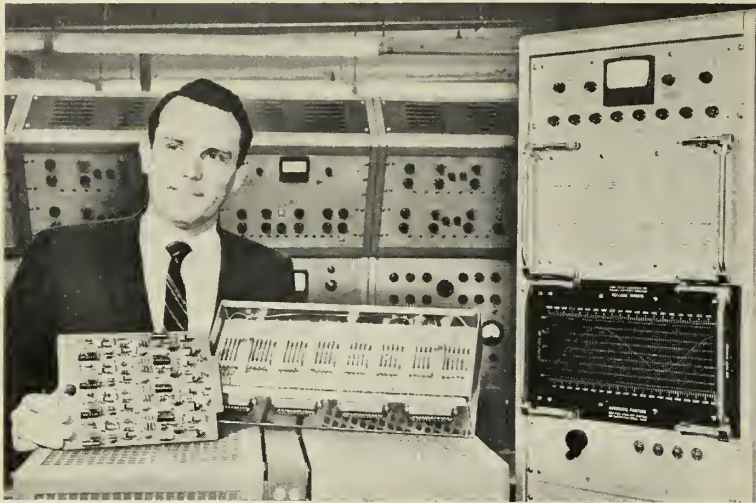


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The first fully automatic spectrum equalizer designed to equalize random motion vibration test systems used in aircraft and missile design and development programs is in production at MB Electronics.

The AE 80/25 automatic spectrum equalizer is geared to completely equalize vibration shaker systems within seconds. Automatic equalization will provide substantial savings in test time and

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High-Volt Si Rectifier

High-voltage silicon plug-in rectifiers manufactured by International Rectifier Corp. directly replace Types 8008 and 872A mercury vapor rectifier tubes. By eliminating the filament transformer and time-delay relay necessary to tube operation, they occupy half the space and weigh less than half of equivalent tube circuitry.

Rated at 10,000 volts peak reverse voltage and 1250 ma dc output (at 75°C), the ST-9 and ST-10 are equipped with tube bases to allow direct insertion into existing tube sockets.

Circle No. 226 on Subscriber Service Card.

Reverberation Chamber

An economical, 27-cubic-ft. reverberation chamber to subject missile and aircraft parts to the extremes of noise they meet in use has been produced by PAM Associates, Inc., an affiliate of Tenney Engineering, Inc.

The new PAM chamber generates 150 decibels of acoustic power (linear to 156 db) with a wide band noise

money by completely eliminating set-up time.

The instrument utilizes a multi-band compensation approach. The spectrum is divided into 25 cps increments. Continuous automatic equalization is achieved by using solid-state magnetostrictive filters with correct phase properties plus servo regulators on each of 80 channels in the 15 to 2000 cps spectrum.

siren powered by ordinary shop air supply. A separate air supply is also available. Known as the Stentor 203, the chamber provides random frequency down 5 db at 100 cps and 10 db at 10,000 cps, with instantaneous peaks to 155 db.

Circle No. 227 on Subscriber Service Card.

Strip Seam Welder

A utility strip seam welder which can be used in steel mill processing lines already equipped with a shear and other components is on the market from National Electric Welding Machines Co.

Built to specifications, the machine welds clean or galvanized metal up to 48 in. wide and from 16 to 30 gage thick at a speed of 30 fpm on clean stock. Welding power is provided by a 150 kva transformer.

Circle No. 228 on Subscriber Service Card.

Tri-Chambered Freeze Test

A three-chambered low-temperature production processing machine has been introduced by Cincinnati Sub Zero

Products. This unit is designed to increase versatility in production processing and research testing, by simultaneously providing three separate temperature liquid refrigerating chambers operating at the same or different constant temperatures.

Two chambers can be independently set to operate at any temperature from -70°F to -150°F. The third chamber will operate at temperatures from -70°F to -170°F.

Circle No. 229 on Subscriber Service Card

Transistor Thermal Tester

Designed to simplify measurement of transistor and diode temperatures, an instrument from Rescon Electronic Corp., offers a rapid and foolproof means of making practically all temperature measurements encountered



electronic equipment design. A spectromograph has been developed which permits rapid determination of the important transistor and diode junction temperature.

Circle No. 230 on Subscriber Service Card

Constant Flow Regulator

Precise flow regulations of fluid even under varying pressures is achieved with cartridge flow regulator available from Fluid Regulators Corp.

The regulator maintains constant flow to the system when the pump output or the upstream or downstream pressures vary.

Used in a single body or a multi-valve manifold, the valve is available in a wide range of 0.1 gpm to 6.5 gpm flows.

Circle No. 231 on Subscriber Service Card

AT UNIVAC...

Encapsulating Epoxy

Two semi-flexible epoxy powders meeting high heat resistance requirements for continuous operation in the high temperature class have been added to the "E" series of insulating resins supplied by the Marlette Corp.

Maraset #135E, an unfilled powder, and Maraset #136E, a filled powder, were developed for impregnating and encapsulating electrical and electronic equipment including transformers, coil windings, and other units. Both are single-component resins requiring no catalyst for hardening.

Circle No. 232 on Subscriber Service Card.

Remote Micrometer

Automatic Micrometer measurements to 10 millionths of an inch can be taken by an operator located far away from the actual point of measurement with the new Remote-Mike available from J. W. Dice Co. It consists of a highly accurate micrometer head operating on the screw thread principle, an operator's electronic control console, plus connecting cable of any length required.

Circle No. 233 on Subscriber Service Card.

Push-Pull Fluid Coupling

A miniature fluid connector especially suited for electronic cooling applications is being marketed by E. B. Higgins Oil Tool Company, Inc.

The connector (20 Series model), is available in size 1/4 in. with 1/4 in. thread, and features an automatic push-pull device for quick connect-disconnect operation.

Weighing exactly one ounce, the connector can withstand pressures up to 1000 psi and temperatures from -20°F to +400°F. Component parts are interchangeable.

Circle No. 234 on Subscriber Service Card.

Sealed Pin Connectors

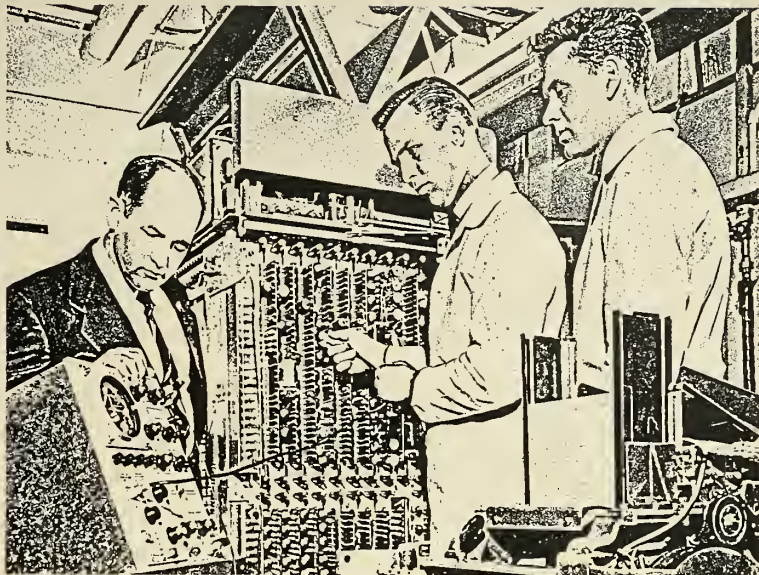
An extensive line of hermetically sealed connectors utilizing MS (AN) pin arrangements is available from Deutsch Co.

This DH02 line features a full insert of compression glass, providing maximum dielectric separation and higher voltage ratings than comparable connectors. Contact identification numbers are permanently imbedded within the insert.

Circle No. 235 on Subscriber Service Card.

Plastic Film Welder

An ultrasonic technique enabling cold bonding, threadless stitching, sealing and welding of plastic films and synthetic woven or non-woven fabrics has



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There's a fresh enthusiasm at Remington Rand Univac. The opportunity for personal progress and satisfaction has never been greater. We refer to it as Univac's *Atmosphere of Achievement*—an excellent environment in which engineers and scientists can enjoy unlimited opportunities for professional advancement.

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To perform reliability analysis and predictions, develop failure reporting procedures, analyze failures, recommend corrective action, set up and implement quality assurance programs.

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Engineering, Mathematics, or Physics degree with experience in weapons and missile guidance systems involving digital control, digital conversion, radar and communications information processing, and input-output equipment.

PRODUCTION ENGINEERS

To plan automated processes, methods and tooling for the world's most reliable computers. These openings on production programs require imagination and creativity. Engineering degree preferred, with experience on electronic equipment.

PHYSICISTS

B.S., M.S., and Ph.D. levels for research and development of systems, high speed circuitry of digital computers, and for physical research including evaporative thin film research and ferro-magnetic domain behavior as applied to computer elements.

MECHANICAL ENGINEERS

To design and develop miniature airborne electronic packaging which will meet severe environmental specifications.

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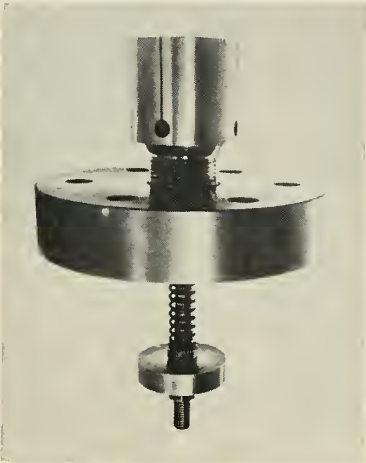


been developed by Ultrasonic Industries Inc. Using only high-frequency sound waves above the human audibility range, this method easily achieves splices or seals. No heat or dielectric currents are used.

Circle No. 236 on Subscriber Service Card.

Expanding Arbor

An inexpensive expanding arbor assembly for greater production results is announced by Craft, Inc., with replaceable arbors for easy machinability. The assembly consists of a face



plate, arbor master and expanding bar. The face plate is attached to the tapered spindle nose by six $\frac{5}{8}$ -in.-diameter bolts. The taper on the face plate is the American Standard taper of 7° and $7\frac{1}{2}$ in., usually found on most machines.

Circle No. 237 on Subscriber Service Card.

Metal-Composite Laminate

Metal-composite laminated plastics for applications requiring intermittent electrical contact have been developed by Taylor Fibre Co.

With the metal embedded in strong, durable insulation material, the products fill the need for metal-laminate combinations where the more intricate, close-tolerance printed circuits are not required.

Circle No. 238 on Subscriber Service Card.

Miniature Floated Gyro

A series of high-precision miniature floated gyros with a trimmed drift rate of less than 0.01 degrees per hour has been developed by the Reeves Instrument Corp. Identified as the ZERO ONE series, these gyros have an angular momentum of 300,000 c.g.s. units, and a mass unbalance of less than 0.4 degrees/hr/g.

Circle No. 239 on Subscriber Service Card.

new literature

PULSE GENERATOR—A 12-page booklet describing uses and applications of pulse generators, with particular emphasis on high-speed transistorized circuits, is available from Valor Instruments, Inc. The features, advantages and limitations of a new all-solid-state pulse generator designed for use with transistorized circuitry are fully explained in the booklet. The effect of output impedance on pulse shape distortion is illustrated.

Circle No. 200 on Subscriber Service Card.

ALLOY STEELS—A technical data book on the consumable electrode method of vacuum melting super-alloy steels has been published by the Metallurgical Department of Midvale-Heppenstall Co. The book has been written in factual style to supply metallurgists, design engineers and research and development men with the latest data on vacuum melting, the advantages of metals produced by this method and the properties of alloys made by the Midvac Process.

Circle No. 201 on Subscriber Service Card.

SELF-TUNING SONIC CLEANING

—A comprehensive guide to ultrasonic cleaning is available from Powertren Ultrasonics Corp. The bulletin provides a basic explanation of how ultrasonics works, what it can do to provide the safest and most consistent cleaning performance, and a guide to selecting the correct tank and generator sizes or console model for the user's needs.

Circle No. 202 on Subscriber Service Card.

FREE SPACE ROOM HANDBOOK

—McMillan Industrial Corp. offers a new 12-page report which provides design engineers with a discussion of the many elements of free space room design. Included are charts for estimating room dimensions according to frequency and antenna size, a table of absorber performance, three typical design problems and their solutions, a discussion of specification pitfalls, and a tear-out FSR questionnaire.

Circle No. 203 on Subscriber Service Card.

SILVER-ZINC BATTERIES

—A 10-page illustrated brochure on the compact Silvercel secondary batteries has been issued by Yardney Electric Corp. It describes the physical, electrical, and typical application characteristics of these rechargeable silver-zinc batteries, which come in two types: high-rate for complete discharge in less than an hour, and low-rate for discharge rates longer than an hour.

Circle No. 204 on Subscriber Service Card.

RADIATION REFERENCE SOURCES—An eight-page booklet from Barnes Engineering Co. gives comprehensive outline of the historical development and the scientific principles of 'black body' infrared radiation. It covers fundamental theory, the various radiation laws, and the curves and equations evolved by the major classical scientific contributors to the field.

Circle No. 205 on Subscriber Service Card.

ANALYTICAL STUDIES—A 10-page booklet published by AMP Inc., describes the firm's customer service program, Creative Analysis. The booklet defines the service and graphically illustrates the various analytical studies and procedures offered to the industry.

Circle No. 206 on Subscriber Service Card.

DESIGNING FOR STABILITY

—A two-part technical article, Incredible Notes #6 & #7, is available from Electronics Co. The first part describes the effects of hysteresis and temperature changes and various open loop methods for minimizing these effects. The principles and general considerations of closed loop, bellweather stabilization are also discussed. The second section deals with specific closed loop and weather stabilization circuits.

Circle No. 207 on Subscriber Service Card.

ELECTRONIC DIGITAL DATA HANDLING FOR COMMUNICATIONS

—A description of equipment now available, as well as techniques for devices presently in test for accurate and speedy flow of information between the computer and remote stations contained in a booklet published by Digitronics Corp. Included is a description of two types of hardware designed to enable communications to bridge the data processing gap. The D300 series equipment which immediately converts information between punched paper and magnetic tape in either direction. The D500 series provides for transmission as well as conversion of data.

Circle No. 208 on Subscriber Service Card.

COMPUTER CHEMISTRY

—A page report available from Comp Systems, Inc. describes a new and improved procedure for the "Correlation Optimization of Chemical Kinetic Models" with the new DYSTAC computer. A least-mean-squares evaluation of the constants from observed data provides the correlation for the model development; the model is then optimized to determine the most economical operating conditions. A complete solution with an accuracy of $\pm 0.1\%$ can be obtained for a given process in less than three minutes after the data have been set in the computer.

Circle No. 209 on Subscriber Service Card.

contracts

NAVY

- 0,000—Sperry Gyroscope Co., Great Neck, N.Y., for production of a new passive lent underwater detection system for submarines.
- 0,000—Bendix Corp.'s Radio Division, for providing technical services for the Pacific Missile Range.
- 000—Bischoff Chemical Corp.'s Riverside Plastics Division, Hicksville, N.Y., for investigation of plastic materials for use in sonar domes.
- 00—Thiokol Chemical Corp., Denville, N.J., for research and development work in the fields of rocket engines for aircraft and guided missile propulsion.

ARMY

- ey-Moore Associates, a division of Huston Fearless Corp., Torrance, Calif., for rocket tube assembly containers. Amount not disclosed.
- 0,025—Republic Aviation Corp., Mineola, N.Y., for drone surveillance systems modification.
- 8,162—Fairchild Engine & Airplane Corp.'s Missile Division, Hagerstown, Md., for modification of AN/USD drone surveillance system.
- 0,500—Western Electric Co., Inc., New York City, for additional schedule "A" facilities in support of the Nike-Zeus program.
- 8,000—General Precision, Inc.'s Kearfott Div., Little Falls, N.J., for hydraulic control systems for use in the *Pershing*. Subcontract from The Martin Co.-Orlando.
- 2,63—Chrysler Corp., Detroit, for engineering services on the *Redstone* missile system.
- 1,44—Raytheon Co., Waltham, Mass., for recurrent repair parts and replenishment repair parts for the *Hawk* missile system. (Two contracts).
- 7,41—Martin Construction Co., Cocoa Beach, Fla., for construction of *Minute Man* launch tubes launcher, Cape Canaveral Missile Test Annex, Patrick AFB.
- 6,18—Federal Electric Corp., Paramus, N.Y., for Nike technical assistance in support of simulator station, radar signal, guided missile system.
- 2,28—Douglas Aircraft, Santa Monica, Calif., for Nike replenishment spare parts. (Four contracts).
- 6,5—RCA Service Co., Camden, N.J., for services and materials required in connection with operation and material of government-owned experimental satellite tracking station (SPOT).

AIR FORCE

- Computer Equipment Corp., Los Angeles, for delivery of a special programable digital code reader. Amount not disclosed.
- 7,000—Laboratory for Electronics, Inc., Elton, for continued production of A/APN-131 self contained, airborne Doppler navigation systems.
- 7,838—Cook Electric Co.'s Advanced Communications Engineering Div., Chicago, for the intersite communications systems for three *Titan* and *Atlas* missile complexes located in the northwest portion of the U.S.
- 25,000—J. W. Fecker Div. of American Optical Co., Southbridge, Mass., for gyroscope equipment to be used at operational *Atlas* missile sites. Subcontract from General Dynamics Corp.'s Contract Astronatics Div.
- 00,000—General Electric Co., Syracuse, N.Y., for acquisition and tracking antenna systems on the *MISTRAM* project.
- 73,3—North American Aviation, Inc., Canoga Park, Calif., for depot-level maintenance for propulsion system.

- \$782,475—Goodyear Aircraft Corp., Akron, Ohio, for contractor maintenance and materials for missile weapon system.
- \$665,600—North American Aviation, Inc., Canoga Park, for installation of rocket engine program facilities.
- \$392,090—General Electric Co., Santa Barbara, Calif., for applied research on information processing, evaluation and decision-making in complex operational situations.
- \$275,490—General Electric Corp., Syracuse, N.Y., for depot-level maintenance for Model II and Model III IOC phase of guidance subsystem and associated ground support equipment.
- \$193,600—Data Display, Inc., St. Paul, Minn.,

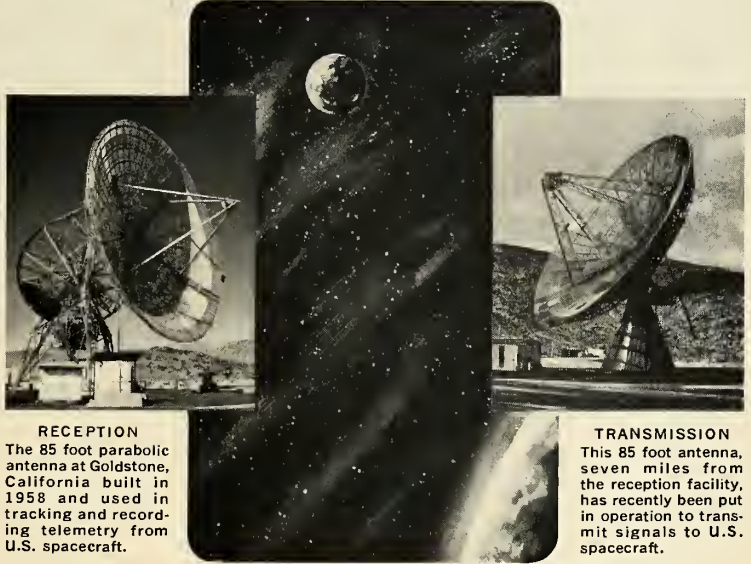
for two high-speed data display systems to be used in current satellite programs. Subcontract from Lockheed's Missile and Space Div.

\$180,000—Consolidated Electroynamics Corp.'s Datalab Division, Pasadena, Calif., for development of a sled-borne magnetic tape system to record the performance of missile components during high-speed tests.

MISCELLANEOUS

\$1,300,000—The Garrett Corp.'s AirResearch Manufacturing Division, Phoenix, Ariz., for production of an air turbine generator for the *Quail (GAM-72)* decoy missile.

LUNAR and PLANETARY COMMUNICATION



RECEPTION
The 85 foot parabolic antenna at Goldstone, California built in 1958 and used in tracking and recording telemetry from U.S. spacecraft.

TRANSMISSION
This 85 foot antenna, seven miles from the reception facility, has recently been put in operation to transmit signals to U.S. spacecraft.

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New opportunities involving advanced research and development projects are now open at JPL in the Laboratory's Telecommunications Division for engineers and scientists capable of assuming a high level of technical responsibility.

SOME SPECIFIC OPENINGS IMMEDIATELY AVAILABLE

Communication Specialists

Execution of RF tracking and communication system projects.

Radio Research Engineers

Design of advanced RF transmitter/receiver equipment.

Antenna Specialists

Analysis, design and evaluation of giant Antenna Structures and Servo Systems.

Research Scientists

Digital data and control system analysis and synthesis.

Mathematicians or Communication System Analysts

Analog and Digital system analysis. Noise, coding, information theory. Linear and non-linear filter theory.

Several openings also exist for supervisors of Research and Advanced Development Projects performed by industry for JPL.



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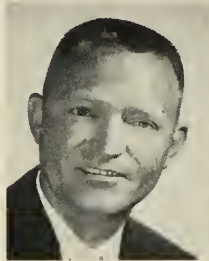
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ALLCHIN

Dr. Cataldo Cialdella: Appointed director of research and development at Hysol Corporation; **James P. Hornburg** becomes supervisor of technical services, and **Harry J. Markowski** joins the laboratory staff.

John N. Sherman: Named project superintendent of the newly-created Space Propulsion Dept. of Hercules Powder Co.'s Bacchus Works, responsible for development of solid-propulsion motors for space applications. Was formerly assistant superintendent of the rocket development department of Allegany Ballistics Laboratory.

Dr. Elliott L. Katz: Joins Ford Motor Co.'s Aeronutronic Division as senior staff specialist in Space Technology Operations' Missile Defense Activity. Was formerly head of the Advanced Propulsion Systems Section at The Martin Co.'s Denver Division, where he was responsible for the original efforts on the *Titan II*, *Dyna-Soar* and *Saturn* projects.

P. J. Lawson: Elected to Vactric Limited of London, England, board of directors.

Graham Barr: Joins the engineering staff of Technology Instrument Corp. as a transducer engineer. Was previously with Summers Gyroscope, Statham Instruments and Wyle Laboratories.

Dr. Saul Barron: Former director of research for the Hunter-Bristol Division of Thiokol Chemical Corp., elected director of research for Bell Aerosystems Co.'s newly established research department.

Robert L. Jannen: Former marketing director, becomes assistant vice president heading sales and marketing for the Leach Corporation. Was previously with the Marquardt Corp. prior to joining Leach last year as corporate marketing director.

Dr. Bruce H. Billings and **Dr. David Z. Robinson:** Rejoin Biard-Atomic, Inc., after more than a year's absence on government assignments. Dr. Billings was serving as assistant director of Research and Engineering with the U.S. Depart-

ment of Defense, and Dr. Robinson with the Office of Naval Research as scientific liaison officer with ONR's London branch.

Richard Allchin: Named president of The Rotor Tool Co., a subsidiary of The Cooper-Bessemer Corp., succeeding **H. P. Bailey**, now chairman of the board.

Philip B. Craighead: Joins Brooks & Perkins, Inc., as manager of their newly formed Military Structures Division.

Louis A. Exner: Promoted to director of contracts for the Propellex Division of Chromalloy Corp., with responsibility for customer relations and advertising.

Ralph V. Barnett: Appointed director of marketing for General Precision, Inc. Was formerly with the Librascope Division as vice president and eastern regional manager.

Robert W. Pike: Elected chief engineer in charge of research and development for Industro Transistor Corp., heading the firm's new Semiconductor Research and Development Center in Natick, Mass. Prior to joining the firm he was Clevite Transistor Products' senior development engineer.

B. William Miller and **Robert G. Evans:** Appointed manager of marketing and manager of prototype fabrication, respectively, for Space Technology Operations in Ford Motor Co.'s Aeronutronic Division.

Stan Burns: Promoted to manager of Engineering Development and Programming, Ground Support Division, American Electronics, Inc. **John R. Clifton** succeeds Burns as director of engineering.

William Kenneth Ebel: Vice president, engineering, of Canadair Ltd. for the past 11 years, named staff executive to the senior vice president for engineering of General Dynamics Corp. He will assist in coordination of engineering activities among all of the firm's divisions and its Canadian subsidiary.

Robert P. Whorf: Appointed manager of Product and Market Planning Services

in the newly opened New York office of Auerback Electronics Corp.

John M. Phipps: Named director of marketing for Electosolids Corp. Previous posts: Western regional sales manager for the Pesco Products Division of Borg-Warner Corp.; senior sales engineer for Meletron Corp.; research analyst for Northrop Aircraft, and statistical analyst with Douglas Aircraft.

P. W. Perdriau: General manager of B. F. Goodrich Aviation Products Division, named president of the company's Industrial Products Co. **Clinton B. McKeown**, general manager of manufacturing, steps up as division general manager.

Richard V. Carroll: Senior electronic engineer, promoted to senior application engineer in charge of R-F Instrumentation at Borg-Warner Controls.

Leon L. Berman: Former Army Ordnance Missile Command officer at Frankford Arsenal, joins American Electronic Laboratories, Inc., as Systems Division head.

Richard J. Bazard: Datex Corp. senior project engineer, promoted to systems engineering manager.

Dr. Zvi Prihar: Former professor of electrical engineering at the University of Wichita, joins Page Communications Engineers, Inc., as assistant director of telecommunications.

J. Gordon Neuberth: Former engineer with the Bendix Corp.'s Radio Division named vice president and chief engineer for Applied Microwave Electronics, Inc.

Dr. Hermann H. Kurzweg: Named assistant director for Aerodynamics at Flight Mechanics in NASA's office of Advanced Research Programs.

Lt. Gen. Roger M. Ramey (USA, ret.): Appointed president of Permanent Filter Corp. Was formerly vice president in charge of district offices for the Northrop Corp.



"We find its concise technical/news coverage of the missile and space market very valuable in keeping up with developments in this rapidly growing field." P. Della-Vedawa, Manager, Quality Assurance and Test Services, Satellite Systems, Lockheed Missiles and Space Division.



"I consider M/R an excellent source of information on new advances and applications in the missile/space field. It keeps us abreast of the state of the art in missiles and rockets for a better understanding of advanced requirements in antennas." A. F. Gaetana, Head, Electromagnetic Systems.

WHY DO SO MANY KEY PEOPLE AT LOCKHEED AIRCRAFT READ MISSILES AND ROCKETS?



1,080 PAID SUBSCRIPTIONS! In 1959 Lockheed Aircraft Corp. ranked *third* among all military prime contractors. Its missile and space achievements include the Polaris ballistic missile and the Agena satellite, plus many others. Therefore, it is natural for 1,080 of M/R's paid subscribers to be concentrated in Lockheed. And since many of these MISSILES AND ROCKETS subscriptions have high pass-along readership, there are many more that number of M/R readers.

"The weekly issues of M/R give us fresh coverage . . . not month-old news. Literally it is well written, sprightly and lively." J. L. Shaenhair, Assistant Manager, Polaris Missile Section.



Some of the many reasons why M/R commands intense readership at Lockheed are given in the picture story. They were obtained as a result of a recent visit to the company by M/R Executive Editor Clarke Newlon (insert). These comments and those of other key readers in other missile/space companies clearly show what M/R has known all along . . . that the missile/space industry is a separate, distinct market with requirements which change almost daily . . . a market that can best be interpreted by undiluted, *weekly* technical/news coverage. It is this kind of coverage which makes M/R the leader . . . explains its deep, penetrating readership and acceptance.

"M/R gives us what we want to read in the missile field. There is no waste of time wading through material foreign to our interests." L. H. Amaya, Manager of Lockheed's Digital Computer Operations.



Doubts on Dogs' Recovery

To the Editor:

It is a sad thing. Many free-thinking people in the world are losing their freedom of mind.

From the mouths of a well known foreign power came the words that "we did not shoot innocent people in Hungary." These same mouths said "an RB-47 violated our airspace (and we shot it down)." When forced to prove these claims in the United Nations, that foreign power could not produce.

Now this foreign power says they brought two dogs safely from orbit and everyone goes goofy about it. No proof at all—all they have to do is say "we did it."

They must certainly have captured the minds of free-thinking people when they can get away with something like that.

If you have the fight for it you should devote your columns to challenging the Soviets to prove their feat—and it might also be a good idea to inform them that the free world wants proof of a successful manned space flight. Their launching and recovery should be confirmed by an impartial, international board of scientists.

The attached material may help you understand why I feel that the Soviets have pulled a fast one. I'm not just screaming "sour grapes." I know they launched the first satellite, hit the moon, and took some sort of pictures of the far side of the moon, but this claim stinks to high heaven. For God's sake don't let them get away with these half-truths and lies.

Lewis Dewart
Personnel Dir. & Science Writer
Sunbury Daily Item
Sunbury, Pa.

Reasons for Doubt of Successful Recovery of Satellite from Orbit by Soviet Union Based on Soviet News Releases—

The first conflict in stories on the Soviet "space dogs" showed up when on Aug. 20 *Pravda* reported (while dogs were still in orbit) that they "were feeling fine and eating well." On the 21st, that same news service reported that immediately upon landing, food and medical supplies were rushed to the dogs. It would appear that if the dogs had eaten at least once during the voyage there would be little need to rush to them with food.

Secondly, the report issued after the "landing" and liberation of the dogs sounded as though it came from a dime store novel. The Soviets reported that "specialists . . . were the first to open the ship. Belka and Strelka rushed out of it. They ran about the meadow fawning upon people and barking merrily." This is ridiculous. If blood pressure, heart pulsation and other biomedical measurements were made in flight, the dogs must have had many restraints on their bodies to keep underskin electrodes, etc., from being accidentally torn loose. Also, the dogs would

have had to be restrained to protect them from the rigors of blastoff and landing. The TV pictures released by the Soviets showed no such restraints on the forward portion of their bodies. It is doubtful that a wise biomedical researcher would allow his specimens to "dance around the meadow" after such an intricate experiment.

No one knows anything about the experiment except the appearance of the dogs. Also, two days after the "feat" news releases from the Soviets dwindled to practically nothing. This is not customary Soviet behavior after space accomplishments.

Such an accomplishment is worthy of some boasting. But the lack of information leads one to wonder just what happened after all.

Dog-eared But Read

To the Editor:

I am employed as an electronics instructor by RCA Service Co., Inc. here. I of course enjoy every copy of M/R that I can get my hands on, but this electronics section that I work at only has one copy delivered, and it's well filtered by the time it gets down to us. (I think we get it solely through osmosis), but dog-eared as it is, we do like reading it. (A reprint order enclosed.)

Bernard Yudofsky
Aberdeen Proving Grounds, Md.

Preserving 'Alga'

To the Editor:

Now that algae are coming increasingly into astronomical literature as oxygen regenerators for space cabins, would you please insist that your contributors use the word grammatically as the plural of alga, and avoid such illiterate expressions as "algae is pumped . . ." and "algae is mixed . . .", which appear in your Aug. 29 issue on page 35.

It is already too late to tell any English-speaking technicians that "data" is the plural of "datum," because they just won't believe it. But it may not be too late, in the interests of literacy, to save "alga."

Alan E. Slater, Council Member
British Interplanetary Society
Dell Farm
Whipsnade
Dunstable, Beds.
England

We are caught green-handed in the case of "alga"; we'll try to avoid it in the future. "Datum" and "data" may be a different case; use of the latter with a singular verb is now sanctioned by some authorities—at least, on this side of the Atlantic. We are glad, of course, to receive corrections of the errata that creep(s) into the magazine.—Fd

ELEMENTARY INTRODUCTION TO NUCLEAR REACTOR PHYSICS, S. E. Liverhanc
John Wiley & Sons, New York, 447 pp
\$9.75.

Here is a text that is admirably suited for its designed purpose, teaching under graduate students the theory of nuclear reactors. Happily, the author eschews the purely qualitative description of nuclear theory and demands that the students have an elementary physics background and a familiarity with the rudiments of mathematics up to differential equations.

The book is easily read without an instructor and therefore is recommended for graduate engineers and scientists who want to gain some familiarity with the nuclear science field.

The book's first three chapters deal with fundamental aspects of nuclear physics. Subsequent chapters deal in logical order with the principle concepts needed to understand the workings of the various nuclear reactors, which are in turn discussed in the closing chapters.

FUEL CELLS, edited by G. J. Young, Reinhold Publishing Corp., New York, 154 pp., \$5.75.

This book is based on papers delivered at a symposium on fuel cells held by the Gas and Fuel Chemistry Division of the American Chemical Society in September 1959. The research of some of the contributors to the symposium has, in part, provided the impetus for the renewed activity in a field that up to recent years has received only casual study.

The book covers aspects of the design and principles of operation of various types of fuel cells. The contributors examine the industrial implications of fuel cells as ground power supplies, as power supplies for mobile engines, and as chemical reactors. Avoiding the popularized approach, the book tells with some degree of success where and how fuel cells can be applied today, and under what conditions they may be applied tomorrow and after that.

MAGNETIC AMPLIFIERS, Principles and Applications, Paul Mali, John Rider, Inc., New York, 112 pp., \$2.45.

Presuming a fundamental knowledge on the reader's part of electricity, this text starts with a review of the field of magnetism, electromagnetism, and magnetic circuitry. From here, the text carries the reader into the saturable reactor—the heart of this field. Discussed are self-starting and three-legged core magnetic amplifiers, compensating magnetic amplifiers, and variations of these.

The text next goes into amplifier gain, feedback, and general uses and construction. The important topic of maintenance and troubleshooting is covered from a practical viewpoint. A final section on system applications shows diagrammatically a number of practical applications of magnetic amplifier circuitry together with a discussion of each application.

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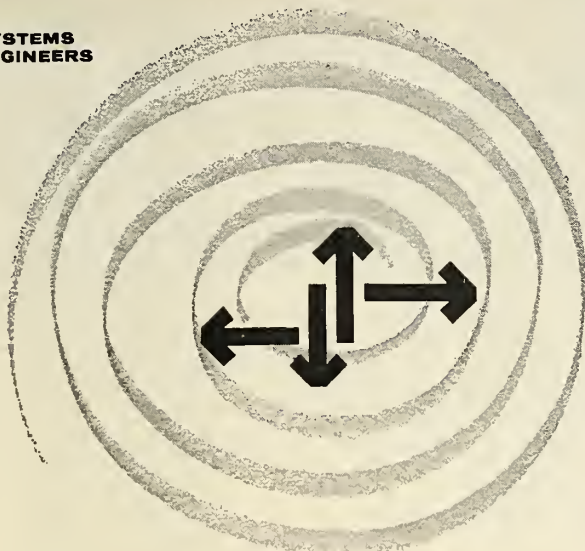
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The Russians Plan—We Don't

THE IMPACT OF the appearance of Mr. Khrushchev on the American scene this week might serve to bring home forcefully to the citizens of this country, particularly to its leaders, some of the very real facts of life—Russian versus American.

In a little more than 40 years Communism has taken complete economic and military control over one-third of the people of the world—and effectively softened up much of the remainder.

There is little doubt that the Red Chinese-Soviet bloc is matching or excelling us in overall military capacity. Actually, the emergence of Red China as a military power with an even more ruthless dictatorship than Russia's (and three times the population) makes it an even greater threat than the USSR.

Equally threatening, the Russians in recent years have shown a rate of economic growth more than twice that of the United States.

These things the Communists have accomplished starting from a level of knowledge, training, education and experience far lower than ours.

How have they done it? In a large measure, by setting a succession of well-planned goals and making any sacrifice or paying any reward necessary to meet or approach those goals. Their long-range plans have been carried out ruthlessly, with a complete disregard of human rights. Many times these plans have not been carried through to meet all objectives, but the overall progress far exceeded that of any western nation, including the U.S.

This selfsame planning—projection years ahead of the greatest possible economic, military and social strength in the institutions which we have built up over the last 100 years—is sadly lacking in this country.

There have been sporadic attempts to bring in people, on a committee basis and at a national level, to do forward planning.

There was the Gaither Report, the Rockefeller Report and the Draper Report. There have

been studies by MIT, by Harvard and by UCLA, all pointing to the absolute necessity for thorough, long-range national planning.

WHAT HAS HAPPENED to them? In a paper prepared for the University of California, C. S. Irvine, industry executive and lieutenant general USAF, retired, says:

"The majority of these reports have been so highly classified that people in government and industry who might find their contents useful have been unable to obtain access to these reports or utilize them for constructive action. They should have been published as feature articles."

Remarking on the effectiveness of Russian planning, General Irvine continues:

"It becomes obvious with the present progressive status of the Soviets and with the upcoming surge of the Chinese, that we should plan for military readiness, economic warfare and spiritual combat for the next 50 years in this country."

The planning necessary for the United States if we are to meet the competition of the East covers almost every aspect of our existence. It should insure a greatly intensified development of national resources, including nuclear energy. It should provide a constantly increasing rate of technological advancement and an increasing rate of automation. It should look forward to revision and modernization of our government operation and our tax structure, and to sociological advances commensurate with our increasing population. It should make allowance for the inevitable changes in our industrial system.

Planning is a natural and a necessary thing. Families, tribes, cities and countries have been doing it for ages. The Russians didn't invent it. One Egyptian Pharaoh did a pretty effective job of planning for the fat and lean years based on nothing more tangible than Joseph's interpretation of his dream. We have a great deal more to work with.

Clarke Newlon

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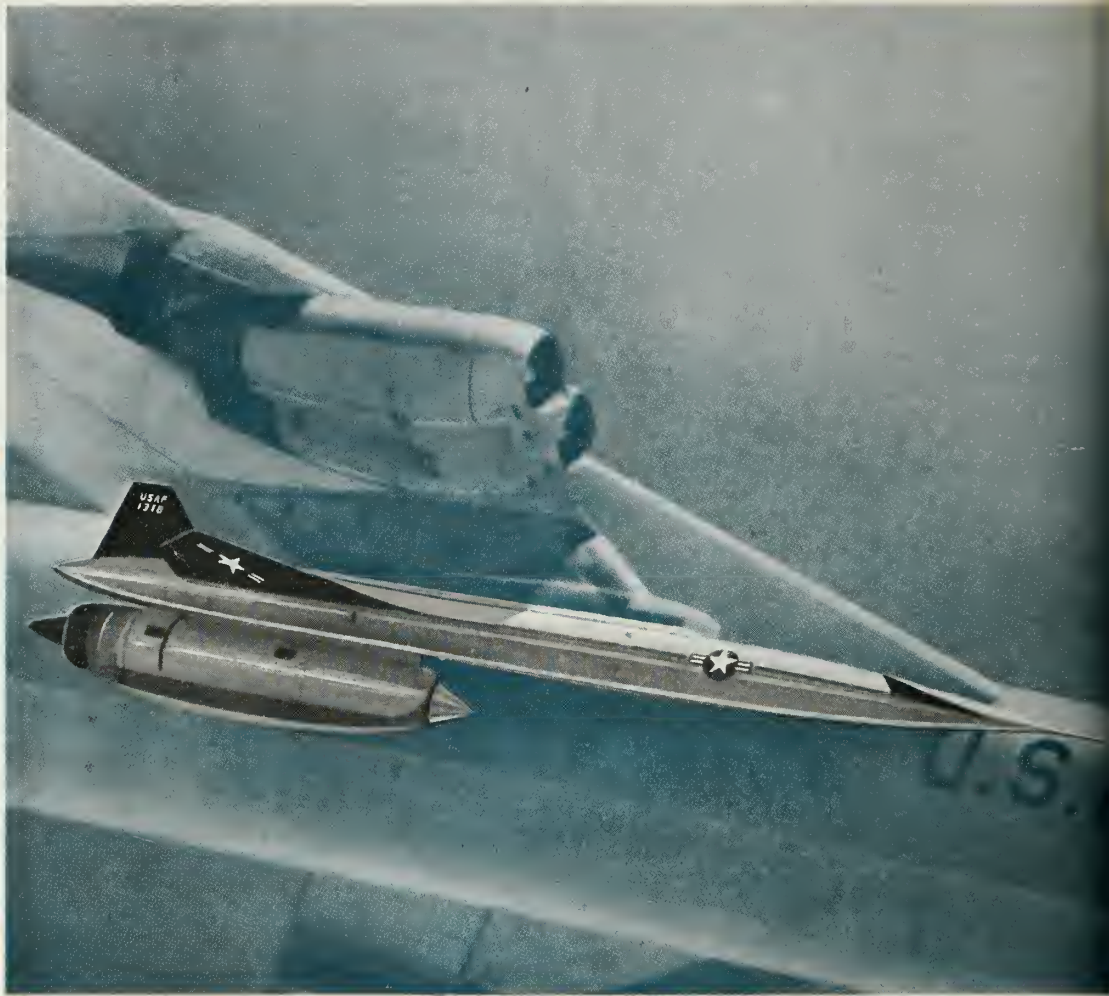
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