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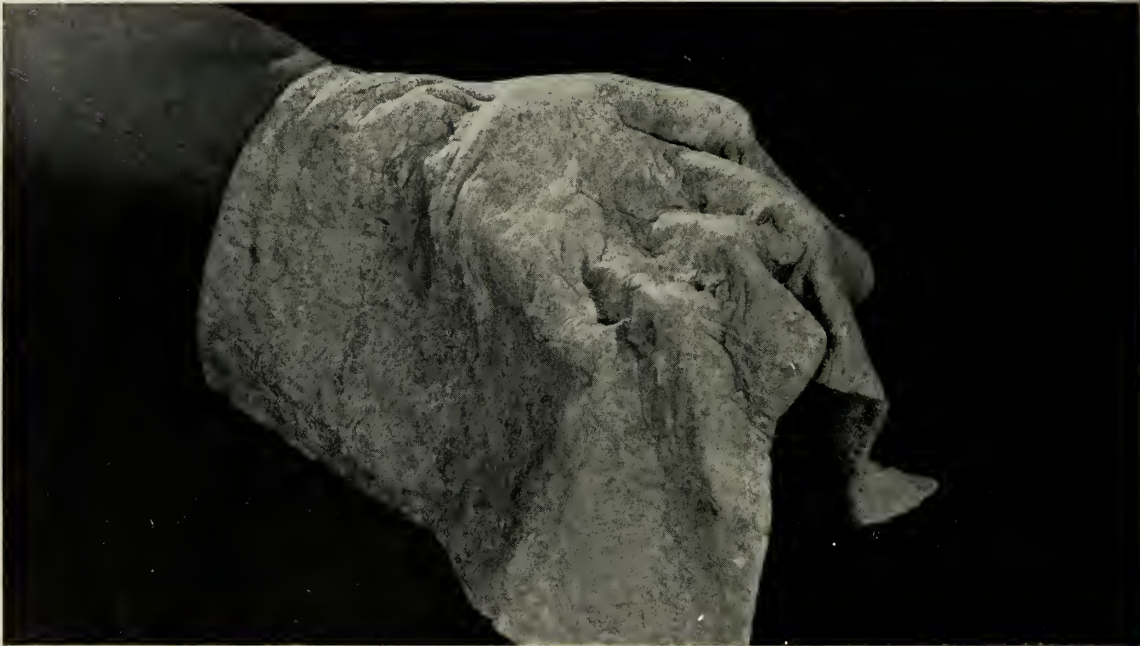
Rocket Operations Center: Ogden, Utah

Minuteman Motors produced at the Utah Division



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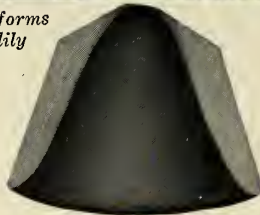
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# missiles and rockets

October 17, 1960

Volume 7, No. 16



## THE COVER

*Huge block house for Saturn test facility nears completion at Cape Canaveral. Contractor is Diversified Builders of Calif. Army photo by Lt. C. W. Stoughton.*

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**LOS ANGELES**  
 8929 Wilshire Boulevard  
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Leonard A. Eiserer  
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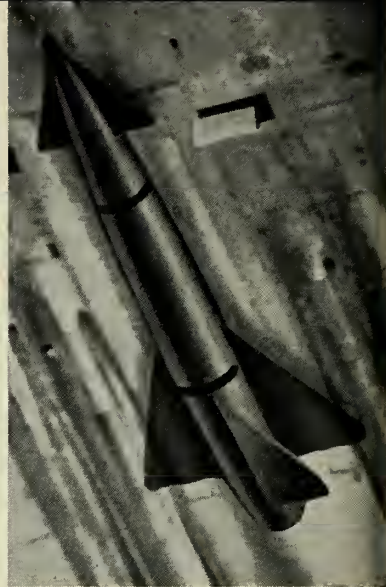
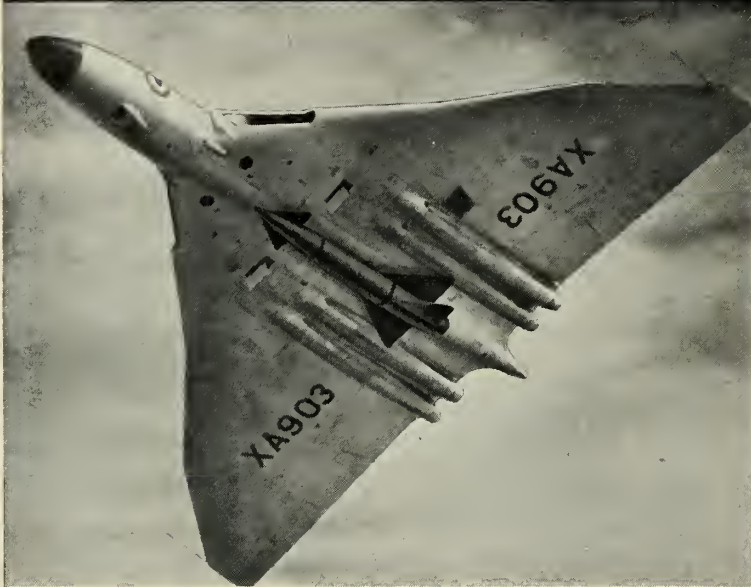
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Britain's new deterrent system relies on two high-performance vehicles ...



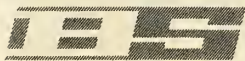
## ... AND BRISTOL SIDDELEY SUPPLY THE POWER

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# The Countdown

## WASHINGTON

### Candidates' Dilemma

Reluctance of the presidential candidates to commit themselves to hard defense spending figures for FY '62 can be attributed (at least partly) to this piece of news: Built-in increases in already going programs if allowed would force the next DOD budget being processed by the Budget Bureau to around \$43.5 billion. This is almost a \$2 billion jump in the current budget. So, if Kennedy or Nixon call for an increase, say of \$2 billion, are they referring to the built-in increment or do they want it on top? The total would then hit \$45.5 billion.

### Speaking of Figures

Despite reports to the contrary, COUNTDOWN hears there still is no money being made available to R&D for a tactical ballistic missile (*TBM* or *TBX*) . . . The amount spent to date in the ANP (aircraft nuclear power) program now totals more than \$1 billion with no flyable hardware in sight.

### Mercury Investigation

Congressional plans for investigating NASA's slipping *Mercury* program are still indefinite as to a starting date. One and possibly more committees will begin an inquiry when Congress reconvenes in January. But, if an Ivan goes into orbit sooner, the investigations could well come shortly after the election. (What ever became of that shot Khrushchev was expecting last month, anyway?)

### Probe May be Dropped

Another congressional investigation tentatively under consideration is a detailed review of slippage in the ICBM launching site construction program. Chances are that if slippage is stopped and some of the lost time is made up by January, the inquiry, which is still on the staff level, may be dropped.

### Anti-Tank Decision Again

The Army's long-awaited decision on procurement of anti-tank missiles once more is considered imminent. But COUNTDOWN is told the decision may cover only missiles to be fired from helicopters and armored vehicles. There is speculation that a hot new anti-tank weapon now in user tests could win the steeplechase—and it may be causing the delay in a commitment by the Army.

### Small Will Come Later

Expect the Air Force to hold off on issuing requirements for a third-generation ICBM, sometimes called "Project Small." The missile could be much smaller than *Minuteman* and more mobile; on the other hand, it might be about the same size but carry a much more powerful warhead. Or two missiles may be developed. Whatever the decision, it isn't expected to be made soon.

### Tactical Tryout

The Navy's Patrick Henry is going several hundred miles out into the Atlantic to launch *Polaris* missiles under conditions close to the real thing. The birds also will be close to the real thing—a tactical missile sans

H-bomb warhead. Telemetry will be handled by the test ship Observation Island.

## INDUSTRY

### What Recession?

If there's a business slump, few electronics companies say they can feel it. At the National Electronics Conference there was a general current of optimism over business conditions, with several firms predicting that fourth-quarter sales will surpass those of the previous three quarters. Profits, though, are lagging behind sales. Also on the optimistic side: Grumman President E. Clinton Towl says his company is in its most secure position ever. . . . American Machine & Foundry expects record gross profits and sales for the first nine months of the year. IBM earnings for the period are also up sharply.

### Space Platform Launcher

NASA-Huntsville is asking bids by Nov. 7 on a study for an orbiting space platform to serve as a space vehicle launching complex. The launcher would be put together by rendezvous spacecraft and would be used for manned circumlunar and manned lunar landings. Technology for the system must be projected to 1967.

### Raising Questions

Some people in industry (non-contractors) are openly skeptical of the Army's electronic environmental test range being built at Ft. Huachuca. They contend that the Army won't get anything out of its \$23 million-plus investment.

### More Mercury Delay

Very quietly, NASA has taken down the *Mercury-Redstone* from its pad at the Cape. Several capsule components have been shipped back to McDonnell Aircraft at St. Louis for minor modifications. This will probably delay the first shot of the bird until the beginning of November and push the first manned *Redstone* launch to February at the earliest—and possibly into March.

## INTERNATIONAL

### New German Combines

Several West German manufacturers are entering into combines designated Arge (for *Arbeitsgemeinschaft*) to produce NATO-adopted weapons. Arge 91 includes Dornier, Heinkel and Messerschmidt; Arge 104 Nord includes Focke-Wulf, Weser and Hamburger; Arge 104 Sud includes Dornier, Heinkel, Messerschmidt and Siebel; and Arge 160—Blume Leichtbau und Flugtechnik, Weser and Hamburger.

### Short's New Container

Short Brothers believes it has licked the container problem for naval missiles—both for preserving propellant life and for preventing handling damage. Its *Seaslug* for the British Admiralty is covered with skin-tight plastic, wrapped in fiberglass insulation and crated in a double steel wall, waterproof container with rubber shock absorbers.



Space Electronics Corporation is actively engaged in both creating and constructing a wide variety of advanced electronic systems vital to continued progress of the nation's missile and space programs. Significant demonstrations of this ability are two highly miniaturized systems conceived and fabricated by SEC for CalTech/NASA Jet Propulsion Laboratory. Consuming less than 1 watt each, they are the Digital Data Automation System and Spacecraft Radio Command System for the advanced lunar and deep space probe known as...



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Inquiries from qualified scientists and engineers are invited to the personal attention of Dr. James Fletcher, president.

## letters

### Optics Coverage

*To the Editor:*

Your Aug. 22 issue with Charles D LaFond's Optics Report has been like a stone in a quiet pond, causing ripples in ever widening circles as the weeks go by. To those of us who have been living Optics for many years (individually speaking, since Singer is a recent convert), it is good to see this recognition and evaluation. And the Editorial in the following issue is an excellent follow-up to the report, a repetition of the story we have been telling for a long time. We hope you will continue watching Optics.

The Fall Meeting of the Optical Society of America, in Boston Oct. 12-14 will probably not pass without discussion or comments on your Report.

P. C. Foote, Sr. Optical Scientist  
 Singer-Bridgeport Div.  
 The Singer Manufacturing Co.  
 Bridgeport, Conn.

*To the Editor:*

It has taken four weeks for your issue featuring optics to filter on down to me from the engineers who insisted on marking, underlining and commenting on the entire article.

From where I sit, I can't think of a better tribute to an obviously complete, well-edited report on an almost neglected subject so vital to our defense capability. Congratulations!

Richard G. Farrell  
 Director of Public Relations  
 Chicago Aerial Industries, Inc.  
 Barrington, Ill.

### Map Appreciated

*To the Editor:*

The map of missile bases in the 1 September issue of your magazine is such a fine job that we would like to reproduce it for distribution to our base commanders.

Office of Information  
 Headquarters  
 15th Air Force  
 March AFB, Calif.

Permission granted.—Ed.

### Map Corrected

*To the Editor:*

Hate to pick flaws in an excellent magazine, but in two issues you have placed Dyess Air Force Base and its host city, Abilene, in Kansas. I think the correct location is about 164 road miles west southwest of Fort Worth.

Roy P. Huff, Jr.  
 Alvarado, Tex.

*To the Editor:*

Reference your map of U.S. missile bases on page 41 in Sept. 19 M/R. Since when is Dyess AFB at Abilene



Can.? And since when is Abilene, Kan.,  
outhwest of Salina, Kan.?

A faithful reader,  
Capt. Henry P. Ames, Jr.  
Ass't AF Regional Civil Engr.  
Missouri River Region  
Schilling AFB, Kan.

to the Editor:

The *Atlas* missile base at Dyess AFB  
s located in Abilene, Texas and not Abi-  
ene, Kansas! This error has been carried  
rough several previous issues also.

Dick Reid  
Customer Training Dept.  
Convair-Astronautics  
San Diego

to the Editor:

This is to inform you that Dyess AFB  
s not at Abilene, Kansas, but Abilene,  
Texas. We are enclosing your map with  
ne correction marked on it.

Aubrey A. Wilson  
Wilson Manufacturing Company, Inc.  
Wichita Falls, Tex.

Yes indeed. It is unlikely that we'll  
ake that mistake again.—Ed.

## Regulus Clarification

to the Editor:

Checking over the *Astrolog* in the  
ept. 12 M/R, I spot a slight error con-  
cerning *Regulus*. Apparently there is some  
onfusion between *Regulus I* and *II*  
(*KD2U-1*).

Under "Contractors," *Regulus I* still  
ses Aerojet-General for propulsion; *Regu-  
s II* now is using Rocketdyne.

Under "Description," *Regulus I* has a  
00-mile range; *Regulus II's* range is more  
an 1000 miles.

Under "Status," *Regulus I* is deployed  
oard U.S. submarines and with Fleet  
mits as the Navy's only operational sur-  
ce-to-surface missile; *Regulus II* is being  
sed as a target drone in connection with  
e Air Force *Bomarc* program, operating  
ut of Eglin AFB, Fla. Chance Vought's  
ase of operations for this program is  
enice, Fla., where the Range Systems  
ivision has its *Regulus II* headquarters.  
ome *Regulus II* (*KD2U-1*) work also is  
eing done by the Navy at Pt. Mugu,  
alif.

Vernon B. Hobart, Supervisor  
Press Information Services  
Chance Vought Aircraft  
Dallas

M/R's September *Astrolog* inadver-  
ntly identified *Regulus I* as *Regulus II*.  
e appreciate the correction.—Ed.

## Entomological Conclusion

to the Editor:

The fly referred to by Dr. Parry (So-  
et Affairs, M/R, Sept. 26, p. 44) should  
e designated *Drosophila melanogaster*.  
*Drosophilidae* is the family to which it  
-longs, not its genus.

F. S. La Roche  
Lockheed MSD  
Sunnyvale, Calif.

# DELTA-COUPLES

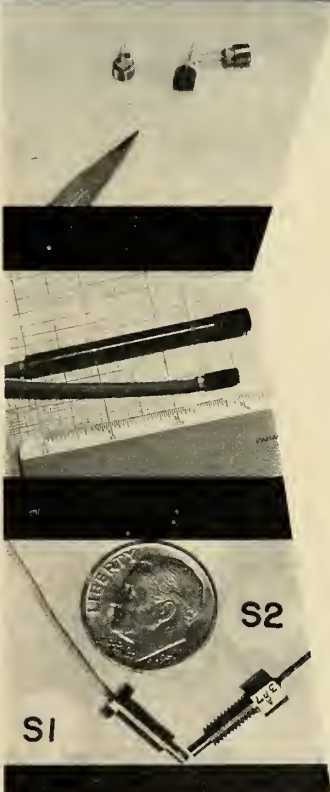
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# DELTA-COUPLES

'gigacycle spectrum' opened . . .

# FCC Move May Kill World TV

**Commission rejects pleas by common carriers, NASA and others that portions be saved for satellites**

by Jay Holmes

THE FEDERAL Communications Commission has taken an action that may make impossible worldwide television and other commercial applications of communications satellites.

Brushing aside the pleas of scientists, common carriers and other government agencies, the FCC on Oct. 5 threw open for private point-to-point communications systems one of the last uncrowded media—the microwave spectrum above 890 megacycles.

Thus, the day after the successful orbiting of the Army's *Courier 1* communications satellite, the commission rejected requests for setting aside portions of the so-called gigacycle spectrum for commercial communications by satellite.

The American Telephone & Telegraph Co., which has said it is willing to spend \$50 million of its own money on launching, ground transmitters and receivers, and spacecraft for initial system of 30 communications satellites, denounced the decision as "short sighted" and voiced hope it does not cause America to lose its leadership in world communications.

The FCC decision was by a 6-1 vote. Commissioner T. A. M. Craven, in a dissenting opinion, predicted that the commission will be forced to reverse itself in a few years and dispossess entrenched business enterprises before they have time to amortize their investments.

"I fail to understand," Craven declared, "how the commission could be so short-sighted as to encourage large businesses to invest huge sums of money for the purpose of using a portion of the spectrum which space communications may need on an unhampered basis."

The common carriers—AT&T, Western Union, the U.S. Independent Telephone Assn. (USITA) and General Television Service Corp.—asked the commission to set aside several bands 500 mc wide below 10,000 mc or to defer any action releasing the gigacycle spectrum for general use. The carriers

said space communications needs could not be spelled out more definitely until completion of preliminary experiments with communication satellites.

• **On horizon**—The FCC, however, decided that the immediate requirements of private users are more compelling than longer-term requirements for satellite communications. Near the close of a hearing last July, Commissioner Robert E. Lee asked one witness:

"How would you justify not using spectrum space on the theory that 20, 30, 40 years from now we may need it for something else when an important segment of our economy is clamoring for it, and maintaining that it would help them to more efficiently do their job?"

The witness, Andrew G. Haley, general counsel of the American Rocket Society, replied:

". . . There is ample evidence . . . which would indicate that it is not a question of 20, 30, 40 years from now . . . There are all kinds of uses for which we don't have the frequency space at the present time (or) that are right on the horizon, 18 months, two years, three years, four years from now."

• **How pressure built**—Here is the background of the dispute:

The tremendous growth of communications demands in recent years is applying a relentless pressure on existing facilities. Overseas telephoning is growing even faster than the average—at a rate of 15% a year. Even with the most modern techniques made possible by application of information theory, new transoceanic cables are just barely able to keep up with present demands.

Laying new cables is enormously expensive. Radio in the high-frequency spectrum is unsatisfactory because it is subject to interruption by sunspots and the noise level is high. By relaying messages in the gigacycle range from satellites, both of these problems can be overcome. And the satellite, of course, makes worldwide television possible.

If R&D continues successfully over the next four years, it seems certain

that direct television transmission of the 1964 Olympic Games from Japan to the United States will be possible. But there is now a question whether such a venture will be commercially feasible.

• **TV ups cost**—AT&T told the commission it could provide facilities for an initial system of 600 telephon circuits between the United States, Europe and Hawaii with 30 satellites. Charles M. Mapes, the company's assistant chief engineer, based his figures on a cost of \$30 million for the satellite system and \$2.5 million for each of eight ground stations—creating 2400 circuits at a unit cost of less than \$25,000. The most efficient overseas cables would cost substantially more per circuit, he added.

Mapes figured that adding television to the initial network would increase the cost of satellites to about \$60 million and of each ground station to about \$2.7 million, bringing the total cost to about \$82 million.

(Presumably, the satellites would have to be launched by low-cost *Scout* vehicles from government launching facilities if the unit cost is to be held below \$1 million. This would mean each satellite would be held to a maximum weight of about 150 lbs. Mapes did not go into these questions, however.)

The FCC took its first action Aug. 6, 1959, toward allowing private industrial applicants to operate private point-to-point communication systems in the spectrum above 890 mc. However, it temporarily stayed execution of the order on Oct. 5, 1959.

Meanwhile, several parties appealed for reopening of the case in view of the changing state of technology of communications satellites. The FCC granted the request on May 16, 1960 and held hearings the week of last July 6.

In addition to the common carriers the commission heard or received statements in favor of maintaining the stay from the Space Science Board of the National Academy of Sciences, the American Rocket Society, Director Jerome Wiesner of the Massachusetts Institute of Technology Electronics Research Laboratory, NASA Administrator T. Keith Glennan, Director Leo





**HORN ANTENNA** of world's most sensitive radio receiver helped prove principle of passive communications relay by receiving signals from Echo balloon satellite.

A. Hoegh of the Office of Civil & Defense Mobilization and the Institute of Radio Engineers.

Testifying on the other side were the National Assn. of Manufacturers, the Electronic Industries Assn, and some of the individual applicants for microwave channels. The NAM and EIA maintained that the use of privately owned microwave systems would reduce communications costs and effect savings, which would be passed on to the public in reduced prices.

• **Narrow bandwidths**—Another related problem is the national assignments of frequencies by the International Telecommunications Union (ITU). At the ITU's Administrative Radio Conference in August, 1959, the United States proposed that 10 bands in the microwave region be reserved for all forms of space communications. The conference, however, approved only eight bands.

The FCC said in its decision that it is virtually impossible to allot 2000 to 3000 mc bandwidths for communications satellites from the spectrum space assigned by the ITU. The commission has asked for comments by March 1, 1961 on what proposals this country should make at the next international radio meeting in 1963.

The Space Science Board told the FCC that the ITU agreed-upon frequencies are inadequate for the space search program of the next decade. The board reported that NASA re-

quirements for 10-mc band in the 900 mc area are still unsatisfied. NASA needs the band for high-definition television and Doppler shift.

Wiesner urged that the FCC defer promulgation of standards, selection of bands for satellite communications and the granting of all but the most urgent applications in the microwave region until adequate studies are made.

Hoegh called on the commission to exercise care in satisfying other services to avoid establishment of new "rights" in the gigacycle spectrum. He reported that his staff is circularizing all federal radio users to obtain the best estimates of space communication needs.

• **Plea for action**—Glennan wrote: "I am sure that the American people would be most distressed if, when the time came for the public at large to enjoy the fruits of NASA's research, it became impossible or at best economically ruinous to achieve the full potential of space exploration because of the failure of the government itself to foresee the problems and take timely action."

NASA needs wide-band channels, Glennan explained, for low-error-rate data transmission as well as for television. Generally, clear-frequency channels are desirable, he continued, but sharing may be possible if strict procedures are established for avoiding interference.

Although many applications of communications satellites have been

proposed, they are not being developed by the government. Glennan declared he is "relying on the ingenuity of American industry."

The NASA chief added:

"Our position, in view of the clearly foreseeable use of communication satellites in the near future, is that adequate portions of the radio spectrum be so allocated as not to inhibit the future exploitation of this new means of improving the quality, quantity and diversity of communication."

The commission held that the total bandwidth available to private microwave above 890 mc represents only a quarter to a third of the need AT&T stated for space communications. "We cannot find that the public interest would be served by adopting a policy which would limit the growth and development of conventional microwave systems using microwave frequencies for all users," the majority said.

"If future conditions warrant a reallocation of frequencies to provide for space communications needs, we will then take whatever action may be necessary."

• **Business before space**—Commissioner Craven declared in his dissent:

"Very little imagination or wisdom is needed to recognize the terrific influence which the use of passive or active satellites in the field of space communications will have on the world. And yet, despite this obvious future impact, the commission . . . authorizes an increase in the number of private businesses which will operate individually owned microwave systems on a primary basis in that portion of the spectrum which is best suited for space communications. As a consequence . . . space communications would necessarily find itself subsidiary to such frequency users as manufacturers, banks, department stores and grocery store chains . . .

"The evidence indicates that virtually every basic industry will become extensive users of the spectrum and that electronic radio equipment manufacturers are planning a sales campaign to sell millions of dollars of radio equipment to these new users. The aggregate investment in private microwave communication systems within the next few years could amount to a billion dollars or more."

Craven maintained that the decision may "have an adverse impact upon scientific research of the cosmos" and "will intensify the difficulties in providing for the radio spectrum requirements for space research at the 1963 International Radio Conference."

FCC sources said only three applications for private microwave channels are on file now but more are expected as a result of the decision.



# Defense Issue Still Eludes the Campaigners

LETTERS ARRIVING in ever-increasing numbers at the office of MISSILES AND ROCKETS, in the wake of the M/R open letter to the two Presidential candidates, demonstrate two things clearly:

1. There is a strong and concerned interest in the defense and space issue in this country.

2. Most of those writing in believe we are behind Russia in defense and space—and that it will take money, drive and leadership to catch up.

One writer spoke of the need of an "awareness of our need to win the space race." Another wrote:

"Inasmuch as both candidates have recognized domestic problems, I believe they should state their positions relative to the scientific and defense problems, and specifically their attitudes toward space exploration."

The nine points proposed by the editors of MISSILES AND ROCKETS as providing a starting point toward capturing the lead from Russia in the defense/space race (see box) were, with some notable exceptions, regarded favorably.

Several writers pointed out what they considered serious omissions—namely, the problem of public shelters and the anti-missile missile.

• **Basic agreement**—There was general agreement on the first and perhaps major point in the M/R proposal—that the government "Recognize as national policy that we are in a strategic space race with Russia."

In Senator Kennedy's reply, carried in last week's issue of M/R, he said:

"We are in a strategic space with the Russians and we are losing . . . Control of space will be decided in the next decade. If the Soviets control space they can control earth, as in the past centuries the nation that controlled the seas dominated the continents."

One writer, Richard F. Gompertz, a member of M/R's editorial advisory board, carried the point further. Emphasizing that his opinions were his own and not necessarily those of his employer, Rocketdyne, he wrote:

"Looking at your proposed space program, I feel that you picked rather

isolated projects which in themselves contradict the primary goal that you were after; namely, the establishment of *strategic programs* in space . . . There is a big step between an isolated space supremacy accomplishment and an *operational* space striking force, which I can envision would be modelled somewhat after our present SAC Air Force. I feel that any timetable should stress the operational date of such a force."

Another defense industrialist, who requested that his name not be used, had another view, writing in part:

"I would suggest as Item #1, that we recognize as a national policy that we are in a life or death struggle with international Communism and therefore must direct our efforts accordingly—this to include economical, political and defense (defense to be all-inclusive)."

## M/R's Proposal

1. Recognize as national policy that we are in a strategic space race with Russia.
2. Expedite present space projects to provide a new and bold program with the following goals:
  - Manned space platform—1965
  - A U.S. citizen on the moon—1967-68
  - Nuclear power for space exploration—1968-69
  - A spacecraft which can take off from earth, travel to and in space, return and land under its own power—1968-69.
3. Recognize that "space for peaceful purposes" is possible only if "freedom of space" is ensured; hence that the U.S. military must be given a predominant role in developing and carrying out the projects necessary to guarantee freedom of space.
4. Establish pre-eminent strategic, tactical and defensive forces with representation from all services.
5. Recognize the necessity of greater defense funding to accomplish this, including a supplemental budget in January, 1961, to make it possible to:
  - Speed up to a maximum degree the construction of ICBM launching bases, Polaris submarines and the Mach 3 missile-carrying B-70.
  - Provide the Army with funds to begin the immediate procurement of already-developed modern missiles, other weapons and airlift.
6. Establish further-on defense spending by need and not by budget ceiling.
7. Streamline defense regulations and procedures to make industry's role in the U.S. defense and space effort more effective.
8. Take what steps may be necessary to establish and promote national scientific objectives.
9. Re-establish decision-making in the U.S. defense and space organizations.

• **Candidates' positions**—As the campaign drew nearer its conclusion Senator Kennedy had contented himself with letting his reply to the M/R open letter stand as his position on the defense and space issue.

Vice President Nixon's position remained vague, although his reply to the open letter has now been promised for our next (Oct. 24) edition.

In addition to declaring that we are indeed in a strategic space race with Russia, Senator Kennedy in his reply included in his defense/space issue stand affirmations that:

Space is our great New Frontier freedom of space must be assured and the United States must have pre-eminence in security as an umbrella under which we can explore; the Department of Defense must be reorganized and streamlined; he would request a supplementary defense appropriation in January; he would establish defense spending by need and not by budget ceiling; he would streamline defense regulations and procedures to make industry's role in the U.S. defense and space effort more effective.

Mr. Nixon's firmest—and, so far almost his only—commitment on defense came with the Nixon-Rockefeller agreement reached just before the Republican convention. The main points

A nuclear retaliatory power capable of surviving surprise attack to inflict devastating punishment on any aggressor; a powerful second-strike capability; a modern flexible and balanced military establishment with forces capable of deterring or meeting any local aggression.

More specifically:

More and improved bombers, airborne alert, speeded production of missiles and *Polaris* submarines, accelerated dispersal and hardening of bases, full modernization of equipment and our ground forces, and an intensified program for civil defense.

Later, in Detroit on Aug. 24, he said:

"We have heard that our military strength has put us now in second place. Today we can say categorically and we can say proudly that the United States is first in the world militarily.

"We must always take advantage of the new technological developments we must not be frozen into acquiring and depending upon the weapons of the past to fight the wars of the future.

"At the present time we do not see any necessity of raising our taxes in order to maintain strength. But let us resolve that should the time ever come when, because of the necessity of maintaining our strength, we might have to tax ourselves more to do so, we shall put security first and the tax situation second."



# Debate Warms over M/R's Proposal

## Other Objectives Urged

To the Editor:

I have read your open letter directed to Vice President Nixon and Senator Kennedy, and have briefly reviewed the nine-point proposal on the issues of defense and space exploration. I would like to make the following comment:

Item #1. I personally do not feel that we are necessarily in a strategic space race with Russia. In my opinion, there is much greater danger from Communism within than from any achievement or accomplishment in space. I fully recognize the political aspects of space accomplishment; however, I do not agree that space programs should be conducted on this basis. I would suggest, as Item #1, that we recognize as a national policy that we are in a life or death struggle with international Communism and therefore must direct our efforts accordingly—this to include economic, political and defense (defense to be all-inclusive).

Item #2. I personally feel that we have a reasonably well-planned space program and that it should be continued on a sound technical basis. I can personally see no need for establishing goals of a manned space platform for 1965; a U.S. mission on the moon, 1967-68; or a spacecraft which can take off and return to earth, in 1968-69. I would suggest that a more productive program would be in the development of the systems now under contract, and I would add to the current list a satellite interception system. In my judgment, the interception and destruction of enemy satellites and space systems is a must, and a program should have been initiated prior to this. I agree with your suggestion on the development of nuclear power for space—the date of 1968-69 would appear to be fairly realistic; however, I believe the date should be established by experts in the field.

Item #3. I agree.

Item #4. I do not agree with the suggestion here which would, in my judgment, add to a single service. I personally believe very strongly that we need an Army, Navy and an Air Force; a single service would not insure the defense of our nation as well as the Tri-Service, operating independently under the Guidance of the Joint Chiefs of Staff. Of course, there is need from time to time to bring strategic, tactical and defensive forces under one command, but I do not subscribe to this as a national policy in peacetime.

Item #5. I personally do not believe that larger defense budgets or greater defense spending is the solution to our problem. The retirement of obsolete weapons systems and the deactivation of unnecessary bases would release funds which could better be directed toward the procurement of essential weapon systems to insure a modern and effective military force. I agree with your comments regarding ICBM launching bases, *Polaris* submarines, and the B-70, but these are only

a small portion of the whole and should not be highlighted in any national objective program. I feel that the Army should be given greater support in modernizing its equipment and its combat forces.

Item #6. It is my belief that we are, in effect, actually committing funds and resources to essential defense needs, with the exception stated in Item #5 above. Our defense spending is not necessarily controlled by a budget ceiling.

Item #7. I agree that there is room for considerable improvement in this area, and I feel that there should be a reduction in the numbers of people, located in the Pentagon—not only in the Department of Defense but in the headquarters of the three services as well. There should be more policy making at the top and less operational control. In other words, I am for decentralization—the trend during the past few years has certainly been towards centralization of control, which is not in the best interests of national defense. In the first place, it fails to develop people at the working level or instill in them a real sense of responsibility.

Item #8. I agree.

Item #9. I would like to refer you again to my comment reference Item #7.

In conclusion, I feel that your proposal should be restudied and more essential and productive national objectives established. One national objective that I may suggest, which would contribute more to our national defense than any other I can think of, would be to apply the \$41 billion to the procurement of modern weapons and to training and maintenance of a modern and effective combat force. Entirely too much of the budget is spent for political reasons and used in support of the national economy instead of the national defense.

(Name withheld on request)  
Maj. Gen. USAF (Ret.)

## Silenced by Policy

To the Editor:

This has reference to your invitation to comment upon your open letter to the presidential candidates concerning defense and space exploration. I believe it would be inappropriate for me, as a military officer, to comment because such a comment conceivably could be interpreted in a political context by some readers.

I appreciate your invitation to participate in the discussion, but regretfully must decline to do so.

Roscoe C. Wilson  
Lieutenant General, USAF  
Deputy Chief of Staff,  
Development

To the Editor:

I have been notified that current policy will not permit me to comment on your open letter to Vice President Nixon

and Senator Kennedy. I am extremely sorry about this.

The current position is that we in the Army must be very careful to keep ourselves disassociated from political activity, at this time in particular.

Arthur G. Trudeau  
Lieutenant General, GS  
Chief of Research and Development,  
USA

## Two Fields of Effort

To the Editor:

I have read with considerable interest the editorial open letter to Messrs. Nixon and Kennedy.

I certainly agree with the aims of your proposal. However, if I had been writing it, I should have placed more emphasis on the fact that there are two different fields in which U.S. space effort is needed. The first is the field of exploration, which includes flight to the moon and so on. The second is the field of consolidation, which includes meteorological satellites and others of the "earth-looking" class. Both of these are needed.

A further thought that I am not sure should be expressed in such a letter but which I believe is valid: neither of these is a proper field for pure scientists. The first is primarily a field for explorers in the Admiral Byrd-Edmund Hillary tradition, supported by the scientists. The second is purely an engineering problem based on application of the basic discoveries made so far.

R. P. Haviland  
Engineer-Satellites and  
Space Systems  
Missile and Space Vehicle Dept.  
General Electric Co.  
Philadelphia

## Evils of Bureaucracy

To the Editor:

Please accept my hearty congratulations on your open letter and editorial. Being a veteran of Air Force R&D, I have tried to analyze what is wrong in the United States, why we are unable to successfully sell advanced programs to our country. In my judgment it resolves to the following point: U.S. industry, which is unsurpassed, has learned to avoid bureaucracy; the Military has not. This is abetted by the fact that the Armed Forces are using public funds, and many checks and balances are required. At least this is what has built up in practice.

In about 1900, the Wright brothers tried to sell the Government an airplane based on world-record gliding and studies they had made. The bureaucracy at that time decided to select the outstanding aeronautical engineer to handle this problem and allocated funds for his work. The Wright brothers flew their machine in

1903, still trying to sell it to the bureaucrats, waiting for Dr. Langley and the governmental approach to the problem. The Wrights took their plane to Europe and, after generating interest in Germany, England and France, were called back and given a \$25,000 contract. Then in 1909, after losing six years, the Langley effort failed and the Government bought the Wright airplane. This approximates the pattern we are using today, except that today's pattern is many times more cumbersome. If we are going to cure this evil we must do two things: (1) We must eliminate all of the multitudinous staff levels and advisors, including committees, and let some one individual run with the ball. (2) The President's Scientific Advisory Board must keep the President and Congress properly educated to the desirability of advanced programs. It is tragic, but one has to laugh at the recent prohibitions against the words "missiles" and "space" and the abolition of the Air Force Office of Astronautics in the Pentagon.

J. W. Sessums, Jr.  
Maj. Gen. USAF (Ret.)  
Redlands, Calif.

## Would Add Shelter Loans

To the Editor:

You overlooked an Item 10, which should state: Immediate Federal Aid in a Fall-Out Shelter Program . . . long-term housing loans at low rates of interest to be made available.

According to various reports—some secret, some not, such as the Rand Report, the book *Fall-Out*, and the Congressional Civil Defense report, this country is in urgent need of shelters. *Shelters are as great a deterrent force as SAC and just as necessary.*

E. N. Kaufman  
Woodland Hills, Calif.

## Takes Issue with Kennedy

To the Editor:

The Department of Defense is a hug-a-boo to everybody, but it is the creation of the Democrats. Sen. Kennedy's 7th point is well made and I agree. However, his other comments do not seem to quite add up properly. It does not seem to follow his platform that while their program calls for enlargement and control of vast other phases of American Enterprise, they are going to save billions by streamlining DOD and at the same time spend more money for defense. Also, from his remarks in Point 4 he apparently has never heard of NORAD.

I would like to submit that it does not stand to reason that the Democrats are the only ones interested in the preservation of America. I wonder how much your magazine, as well as Sen. Kennedy, knew of the U-2 before it hit the headlines? This was almost as closely guarded as the Manhattan Project—does this not lead you to conclude that there are others?

Your fine magazine is crammed with

**MISSILES AND ROCKETS is providing a forum here to focus attention on the space/defense issue in the presidential campaign—and after the election. This is an issue which the editors feel warrants much greater attention by the nation's leaders and the American public.**

*Readers are invited to express their views on the vital questions of how this nation is to win the strategic space race with Russia. Correspondence should be addressed to:*

## Countdown for Survival

Missiles and Rockets  
1001 Vermont Ave., N.W.  
Washington 5, D.C.

information on what, five years ago, would have seemed unbelievable advancements and future wonders.

It is most unfortunate that our country has been offered by the Democrats a candidate for President who is so blind to any of the superb advances that have taken place under the Republican Administration; if he is elected, I wonder just how much change he would make, or how much of it he would really want to change.

M. L. Carlisle  
Washington, D.C.

## Chicago ARS Resolution

To the Editor:

The Chicago Section of the American Rocket Society is unanimously in favor of the "Modest Proposal for Survival," and wishes to congratulate the editors for providing this public forum.

Since the Chicago Section feels that the greatest gap in the Missile Race lies in a definite lack of unified leadership and direction, the enclosed CHICAGO RESOLUTION was submitted to the Annual Meeting of the American Rocket Society, Nov. 16, 1959. Whereas M/R's proposal lists decision-making as the ninth item, the Resolution recommends that the centralization of authority be presented as the first step for survival. With proper direction of the missile/satellite program, the U.S. arsenal will be stocked with superior weapons, the deployment of which can be assigned to existing military and/or space agencies.

The problem posed by the editors is one which must be faced by the presidential candidates, and a forthright reply from each is essential if the future of the American way of life is to be assured.

C. C. Miesse, President  
Chicago Section  
American Rocket Society

*The text of the Resolution of the Chicago ARS Section:*

*Whereas the United States program of space exploration is lagging appreciably behind the Soviet accomplishments; and*

*Whereas there is no single government agency vested with the authority and re-*

*sponsibility for the total national effort*  
*The Chicago Section of the American Rocket Society proposes the following resolution:*

*Resolved: That the American Rocket Society recommend to the President of the United States that a Director of Space Research be appointed, and that he be given the authority, responsibility and funds necessary to establish and maintain a leading position for the United States in the field of space exploration.*

## Amen, Mostly

To the Editor:

I submit the following *personal* comment on your nine proposals:

1. Amen.
2. Amen, except that the time scale for nuclear power development should be stepped up. Power is the "key" to space; chemical power has severe limitations and must be replaced as soon as possible.
3. Amen! The experiment with peaceful, separate, NASA has set us back a year or two already.
4. Concur with your goal, but the methods of achieving this are critical, and you well know.
5. & 6. Amen, again.
7. Amen, as necessary, *but keep industry and labor influence out of decision making processes!*
8. Amen.
9. Amen. Hallelujah!

As you have pointed out, achievement of the above goals requires the highest type of leadership and will to succeed from the highest position on down. We do not necessarily have to be hurried by dirt or suffocated.

Your cause is the finest. I wish MISSILES AND ROCKETS full and early success.

R. L. Kibbe, Captain, USI  
Director, Astronautics  
Operations Div.  
Office of the Chief of  
Naval Operations  
Washington

## Praises Unified Approach

To the Editor:

I was sufficiently impressed by the "Open Letter" to take the time to express my 100% agreement.

It seems to me that in dealing with Communist Russia, where there is no real distinction between "military," "civilian," "government" or "industry" as we recognize these terms, we are handicapping ourselves unnecessarily by trying to make these distinctions here, even if only for world propaganda purposes.

Furthermore, I believe that a single unified drive for world supremacy in missiles and space would be self-financing, e.g., the money saved by eliminating needless duplication of effort could be added to the funding for the major objective.

J. F. Waters  
Sunland, Calif.



# The Missile / Space Week

## Cancelled R&D Projects Listed

The full story of how the Pentagon spent more than \$2 billion on subsequently cancelled R&D missile and other weapons projects during the last three years is expected to be disclosed by the Senate soon after Jan. 1.

A Senate Government Operations Subcommittee headed by Sen. Hubert Humphrey (D.-Minn.) gave a preview of the subcommittee's forthcoming report in a statement this last week.

Sample Comment: "The subcommittee does not at present offer any conclusions as to the original or subsequent worthwhileness of these \$2.1 billion in cancelled projects. The Department of Defense would naturally contend that these projects were soundly initiated and were cancelled only when it became clear that it was in the national interest to do so."

Some of the projects named: *Navajo*, *Rascal*, *Regulus*, the F-108, *Goose*, *Dart*, *Rat*, the Sea Master and *Plato*.

## NASA Plans Courier-type Satellite

The National Aeronautics and Space Administration plans to launch active repeater communications satellites, a project until now exclusively handled by the military.

Pointing to the success of the Army's *Courier I* satellite launched Oct. 4, Administrator T. Keith Glennan said NASA has programed a demonstration of the feasibility of very lightweight active repeater satellites in an orbit 3000 to 5600 miles above the earth's surface. The 500-lb. *Courier I* has a 500-750 mile orbit. He noted that security of communications is of paramount importance in the heavier Army satellite.

Glennan said NASA will team with industry on technically promising proposals aimed at developing commercial communication systems. To the extent allowed by the law, he said, NASA will make vehicles, launching and tracking facilities and technical services available at cost to private companies if the plans fit in with the requirements of other licensing bodies.

## GAO Cites Reaction Motors Overcharge

The general accounting Office claims that Reaction Motors Inc., Den-ville, N.J., realized excessive profits by overcharges of \$103,500 on a \$511,400 subcontract with Convair in 1958 for propellant valves for the *Atlas*.

GAO said Reaction Motors, now a division of Thiokol Chemical Corp., provided for unwarranted contingencies and duplicate parts in its cost estimate.

Convair chose Reaction Motors on the ground of technical superiority, although its cost estimate was higher than those of competitors.

GAO said RM refunded \$87,800 to Convair under these subcontracts and \$47,200 under other subcontracts that it did not examine. The Congressional agency said it is pressing the Department of Defense to obtain the remaining \$15,700.

## Army Starts Missile Defense Studies

The Army's multimillion Field Ballistic Missile Defense System is under-way with the awarding of six feasibility study contracts, totalling \$1.5 million, to industrial teams. The breakdown includes Convair, Burroughs Great Valley Labs and Westinghouse Air Arm; GE and Chrysler; Hughes, NAA, Aerojet-General Nucleonics and R. G. LeTourneau; Martin and W. L. Maxson Co.; Raytheon, IBM, Dunlap & Associates, Inc., Avco and Northrop; and Sylvania with Ford Aeronutronics.

## From the Pad

*Polaris* demonstrated its tactical ability with a 700-mile shot from the Cape Oct. 19 . . . On the next day, the first advanced-design *Atlas "E"* with a new powerplant built to carry a heavier warhead halfway around the globe, hit a programed target . . . And on Oct. 7 a *Titan* lofted an operational-type nose cone to an "unusual" height. Next week, the Air Force is giving the Smithsonian the RVX 1-5—first re-entry vehicle recovered from a 5000-mile shot.

## Picking Up NERV

NAVY SWIMMERS from USS *Rowan* are shown being hauled aboard ship with the waterproof emulsion package they retrieved from the Pacific last month.

# Air Force Presses for Early Repeat of Samos Shot

*First launching fails to achieve a polar orbit of camera satellite; next try may come in November*

POINT ARGUELLO, CALIF.—Air Force pressure for rapid development of the *Samos* reconnaissance satellite is expected to result in a new attempt to launch an R&D model at the earliest possible date.

No firm date was immediately set, pending an investigation into why the first *Samos* launching Oct. 11 failed to place the camera-packing satellite into orbit. But some sources said another shot might be attempted next month.

Meantime, the unsuccessful test launching from Point Arguello raised anew the question of how the Russians will react to the passage of a U.S. reconnaissance satellite over the Soviet Union.

The launching took place at 12:34 P.M. PST. It was the first major test launching from the Navy's new test facility just south of Vandenberg AFB.

The Air Force announced two hours later that the 4100-pound satellite had failed to go into orbit.

First stage of the unsuccessful *Samos* was a modified Convair *Atlas* weighing 262,000 lbs. at launch and measuring some 77 ft. in height including the adapter section.

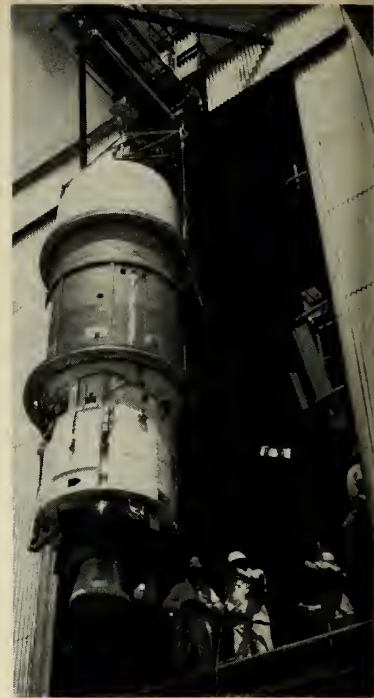
The second stage was a 22-foot Lockheed *Agona A*. It weighed approximately 11,000 lbs. before launching.

The cigar-shaped vehicle was aimed at a nearly circular 300-mi. orbit with a 94-min. period. Once there it was programed to tilt so that its nose cameras would point toward earth, constantly adjusting to maintain this position.

Transmitters aboard the satellite were expected to operate for about 20 days. Exhaustion of the gas supply for the jets which maintain the vehicle in its nose-down attitude would have been another limiting factor in its useful life.

• **Some equipment classified**—In addition to photographic equipment, *Samos* carried instrumentation to measure cosmic rays, micrometeorites and the earth's electrical field.

Air Force officers declined to comment on the remainder of the *Samos I* payload other than to state it included "test" photographic equipment." An announcement at launch said the satellite was the first in a research and development program intended "to develop new capabilities for making ob-



*SAMOS I* vehicle is hoisted onto gantry at Pt. Arguello to be mated to *Agona B* for range's first major system firing.

servations of the earth."

Brig. Gen. Robert E. Greer, Vice Commander, Satellite Systems, Ballistic Missile Division, refused to list the photographic equipment aboard the vehicle. But it was made clear that the satellite would be taking photographs and that means were available to assess the quality of these photographs. Whether they were to be transmitted back to earth was not immediately disclosed.

## Labor Heads to Fight Base Delays

TOP LABOR LEADERS are promising the Pentagon that they will tour ICBM construction sites during the coming weeks to help give local unions a sense of urgency in completing the Air Force's vast base-building program.

Defense Secretary Thomas Gates met with union leaders Oct. 7 at the Pentagon in the latest of his efforts to end slippage in the projects.

Gates had met previously with officials from all major contractors in the ICBM base program. At that time, he invited AFL-CIO President George Meany to attend, but Meany did not do so.

However, Meany was present along with eight other national labor leaders at the Oct. 7 session. Among the others were Nicholas Zonarich, director of the AFL-CIO industrial union department; A. J. Hayes, president of the International Association of Machinists; C. J. Haggerty, president of the AFL-CIO Building and Construction Trades Department; Gordon Freeman, president of the International Brotherhood of Electrical Workers; Peter T. Schoemann, president of the Plumbers and Pipefitters Association; and Joseph J. Delaney, president of the International Union of Operating Engineers.

Walter P. Reuther, president of the United Auto and Aircraft Workers, and David J. McDonald, president of the United Steel Workers, sent representatives.

Scores of work stoppages have cost the ICBM base program 75,000 to 100,000 man-days. Supervisory personnel have complained that many local unions failed to appreciate the importance of the program.

Work stoppages have occurred over such jurisdictional disputes as which local union should hang fluorescent lights in an ICBM block house.

Stoppages plus management snags at Warren AFB, Wyo., and Offutt AFB Neb., delayed the completion of ICBM sites up to six months, thereby affecting the nation's deterrent posture.



# 'Father' of the Minuteman-on-Rails

*Profile of AMF's Jack Blades, prime mover in the Minuteman train concept, who wants more ICBM mobilization*

DETERMINING THE FATHER of the *Minuteman* train concept may be as full of complications as a Hollywood paternity suit. In this case, however, the acknowledged father is merely a modest man who feels others should share the credit.

The railroading missile was no one-man idea, of course. But the man most generally given a large part of the credit is Jack H. Blades, manager of customer services for American Machine and Foundry, associate prime for the *Minuteman* train.

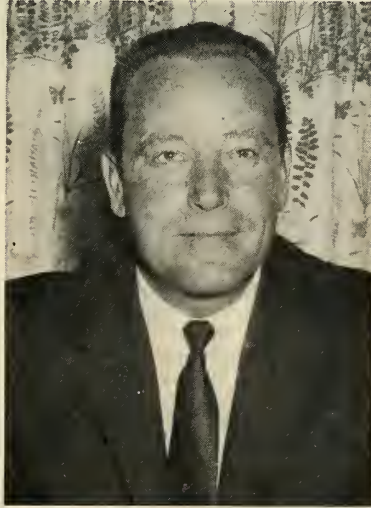
According to Blades, the idea came from a brain-storming group at AMF looking at the overall problem of mobility. AMF management had concluded that missile mobility must be a defense requirement in the near future. At the same time, the Air Force was thinking along similar lines. The concept of an ICBM on rails—capable of rapid movement over a wide area, quick reaction time, and an acceptable survivability ratio—seemed to fit well into this concept.

"Acceptance of the train idea was something less than enthusiastic in some quarters, however," Blades admits. "A few are still in there fighting new ideas."

• **Proposal for mobility unlimited**—Engineering of the mobile carrier-launcher generated some new problems, too, and strained the state of the art in some areas of rail transport. The big bird will be a pampered traveler; its delicate insides must be treated much more gently than the fussiest Pullman passenger. Development of special shock-mounting, environmental control, and the carrier-erector gave designers numerous headaches.

"All the problems haven't been solved, but the concept has been proved," Blades says. "I'm confident that the trains will be ready by the time the missiles are operational."

Blades declares that serious consideration should be given to mobilizing missiles in more ways than just on rails. He feels that an entire mobile ICBM system—based on a proven standardized missile—should be built around a number of different carrier-launchers: ships, barges, trucks. "These, coupled



*"WE SHOULD be at work right now on a 10,000-mile ICBM . . . and missile recall."*

with fixed bases, would give us retaliatory and survival capability in depth," he says, "essential to the defense of this country."

• **On waste and duplication**—Blades is acutely conscious of dollars, unlike some that cry for unlimited spending for defense. "We shouldn't spare any money, taxes, or contributions to develop the strongest defense possible," he says, "but the defense structure warrants reevaluation to get the most for our dollars."

He is an outspoken critic of the money wasted by the military and industry in present proposal-solicitation methods. "I personally know of instances where system proposals cost up to \$8 million and more. These costs, of course, go back to government in one way or another and add considerably to defense spending."

Blades advocates—as do many others—negotiated contracts awarded on the basis of demonstrated competence, so that more money would be spent on hardware rather than on piles of pretty paper.

Another of his pet philosophies is that weapon system duplication is unnecessary and costly. "After a certain

stage has been reached," he says, "the military should put all developmental effort into the better system rather than continue parallel work on similar missiles. We should be at work right now on a 10,000-mile ICBM and on a method of missile recall."

Blades agrees that the principal benefit to industry from defense contracts is the research and development and know-how gained that can profitably be applied to commercial products. Consequently, he thinks that the government should give full patent protection to its suppliers. "Such protection would be the biggest thing that could be done for small business," he says.

Questioned as to the general business outlook under a new Administration, Blades is confident that the country is in "damn good shape" and there's nothing wrong with business. He feels that both Presidential candidates are aware of the necessity of an accelerated defense program for survival and looks for an upturn in defense spending regardless of who wins the election.

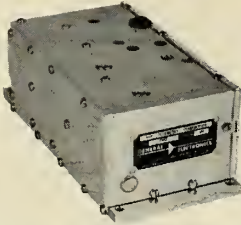
• **Engineer's manager**—Blades fits pretty well the popular picture of a self-made man. He was raised in St. Louis and, during World War II, worked there for McDonnell Aircraft. In 1943 he started his own business—Selb Mfg. Co.—building accessories, components, and equipment for aircraft. He sold out his interest in 1954 and joined AMF where he later became manager of manufacturing services. Still later he moved to Washington, into his present position as manager of customer services.

Blades is the type of competent extrovert you expect to find in such a position. In addition, his engineering and manufacturing background gives him a keen grasp of the problems and details that go into a working system. He apparently is no far-out dreamer, yet his work on the *Minuteman* train, for example, tabs him as a progressive thinker with his eye on the practical future.

About the only thing that appears to tax the competence of Jack Blades is coping with three daughters—two of whom are teenagers. ❧

# COMPLETE LINE OF VHF TELEMETRY EQUIPMENT

## MANY ITEMS AVAILABLE FROM STOCK

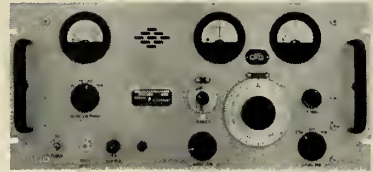


### TELEMETRY TRANSMITTER, 215 - 265 mc

Improved frequency stability, true frequency modulation, reduced harmonic distortions, and increased power output characterize GEL's VHF Telemetry Transmitter, Type 15A2, specifically designed to meet the exacting requirements of present day telemetry systems.

#### FEATURES

- *Shock:* 100g, 11 milliseconds
- *Vibration:* 15g, 2000 cps
- *Frequency Stability:*  $\pm 0.005\%$
- *Distortion:* Less than 1%
- *Modulation:* FM/FM, PDM/FM, PCM/FM
- *Temperature Range:*  $-54^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$



### TELEMETRY RECEIVER, 215 - 265 mc

Designed in conformity with IRIG requirements specifically for use in FM/FM, PDM/FM, and PCM/FM Systems, GEL's Telemetry Receiver, Type 11B1, provides a versatility heretofore unobtainable. Other bandwidths than those shown below, or special response characteristics are available on order.

#### FEATURES

- *IF Bandwidths:* Plug-in type, 100, 300, 500, 750kc
- *OSC Radiation:* Meets MIL - I - 6181
- *VFO or Crystal:* Operation selected by panel switch
- *Image Rejection:* Greater than 60 db
- *Noise Figure:* Less than 7 db



### FREQUENCY DISPLAY UNIT, SERIES 14

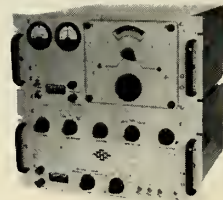
Accepting signals from GEL Receivers, Frequency Display Unit, Series 14, features good resolution, equalization  $\pm 3$  db, low spurious radiation, edge-lighted scale, and 60 db image rejection. A signal as low as 2 microvolts at the Receiver input gives full-scale deflection.

Sweep width, center frequency, and gain control are located below a 3" Cathode Ray Tube. Unit mounts in 19" Relay Rack. Series 14 Frequency Display Units are companion units to GEL VHF Receivers.

#### FEATURES

- Low Spurious Radiation
- Edge-lighted Scale
- Pentagrid Mixer
- Switch for Multiple Inputs
- 20k resolution
- Adjustable sweep width 0 to 3 mc

GEL Also Designs and Manufactures a Complete Line of Telemetry Equipment for Microwave Applications



### WIDE RANGE RECEIVER, 30 - 260 mc

GEL Wide Range Receiver, Type 17A1, is used in a broad variety of applications, and is designed to receive AM, FM, and Pulse information. This unit is characterized by extreme sensitivity to the reception of weak signals. The tuning head is contained in a completely shielded sub-assembly, and has very low oscillator radiation. Tuning range is covered in two bands selectable from the front panel. Panels are notched for 19" Relay Rack mounting. Power consumption is 225w at 115-230v a-c 50-60 cycles.

#### FEATURES

- *Input Impedance:* 50 ohm source with separate antenna input for each band
- *Frequency:* Band 1: 30-60 mc; Band 2: 55-260 mc
- *Noise Figures:* Band 1: Less than 5 db; Band 2: Less than 6 db
- *Oscillator Radiation:* 90 db below 1 mw at antenna terminal
- *IF Bandwidths:* 10 kc, 300 kc, 4 mc

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## ELECTRONICS

### Radar Reflectivity Reduction Studied

Studies aimed at reducing radar reflectivity of *Hound Dog* missiles are being conducted by North American Aviation. The goal is to make the air-to-surface missile less susceptible to enemy radar, so that it can sneak through to a target undetected.

### P.A. Feedback Howl Eliminated

A happy note in the continuing progress of electronics is the announcement of an acoustic antifeedback circuit for public-address systems. A frequency-shift modulator developed by Bell Labs effectively eliminates the usual feedback oscillations so often encountered in large meetings—particularly those sponsored by, and attended by, electronics experts.

### Direct Language Translation Predicted

Instantaneous automatic translation which would make possible telephone conversations between speakers of foreign languages is predicted within 20 years by Dr. E. G. Schneider of Sylvania Electric Products. The basic computer mechanism for automatic translation is already in existence, he said, even though it is primitive, and success has been achieved in artificially generating speech sounds.

### Army Continues Work on Side-Looking Radar

An investigation aimed at solving the problems involved in the primary extraction of mapping detail from side-looking radar photography is under way at Goodyear Aircraft. The work is funded by the Army Engineer R&D Lab at Ft. Belvoir, Va.

### Superpower Radar Tubes Developed

New superpower microwave radar tubes, many times more powerful than conventional types, have been announced by General Electric. According to GE, the developments were made possible by unique approaches in the fields of linear-beam and cross-field devices. Two new types—a “multiple-beam klystron” and an “Orthotron”—are presently in the works. Powers and frequencies are classified.

## GROUND SUPPORT EQUIPMENT

### AF Contract for Biggest Communications Net

The Air Force has awarded an \$11.5 million contract to Western Union for a communications network linking 100 air bases, depots, and civilian suppliers. Called the world's largest and most sophisticated wire network, the system will handle 100 million words per day involving logistics data, aircraft movements, air traffic maintenance, and flight control data. It is scheduled for full operation early 1962.

### Space Simulator for Astronauts Designed

A manned space rotational flight simulator for investigation of the effects of satellite tumbling and spinning on astronauts has been designed by Norair Div. of Northrop Corp. The trainer—to be installed at the AF School of Aviation Medicine, Brooks AFB, Tex.—includes a 10-ft.-diameter fiberglass ball riding on a cushion of air (See p. 32).

Missiles and rockets, October 17, 1960

## ADVANCED MATERIALS

### High-Density Graphites Produced

Recrystallized graphite usable up to 5500°F is being formed in a hot-working process at National Carbon. Some has been produced with densities of 2.16, closely approaching the theoretical 2.26.

### Free-Standing Forms By Plasma Jet

Almost any type of free-standing form can be fabricated through a process utilizing the plasma jet. Plasma-dyne Corp. says the method insures the absence of foreign matter in the material of construction.

### Plastic Case Future Sparkles

There is strong indication that the huge solid rockets of the near future will be wrapped in reinforced plastic cases. Although there's strong feeling that plastics development has some way to go, the technical problems are not considered insurmountable. The comparative low cost of plastics is likely to be decisive.

### Monocrystalline Films By Deposition

Atohm Electronics has come up with a technique of depositing numerous alloys and other materials onto virtually any substrate. Designated “plasmionic monocrystalline film deposition,” the process results in monocrystalline layers of conductors, semiconductors, or nonconductors as applicable.

### Cheaper Titanium Will Mean More Space Use

If the price of titanium falls to that of stainless steel, it will be attractive as a substitute for space applications, says Wernher von Braun. Three major missile systems—*Atlas*, *Titan* and *Polaris*—have switched already from heavier alloy steels to titanium for vessels to store gases and propellants under high pressure.

## PROPULSION

### Quarter-Million-Lb. Engine in Design

Rocketdyne has an advanced model of the *Saturn* engine on the drawing boards. Dubbed H-2, the new powerplant is intended to develop more than 250,000 lbs. of thrust—giving the eight-engine booster a total thrust of more than 2 million lbs. The advanced engine would use a direct-drive turbopump, eliminating the entire gas-generator system.

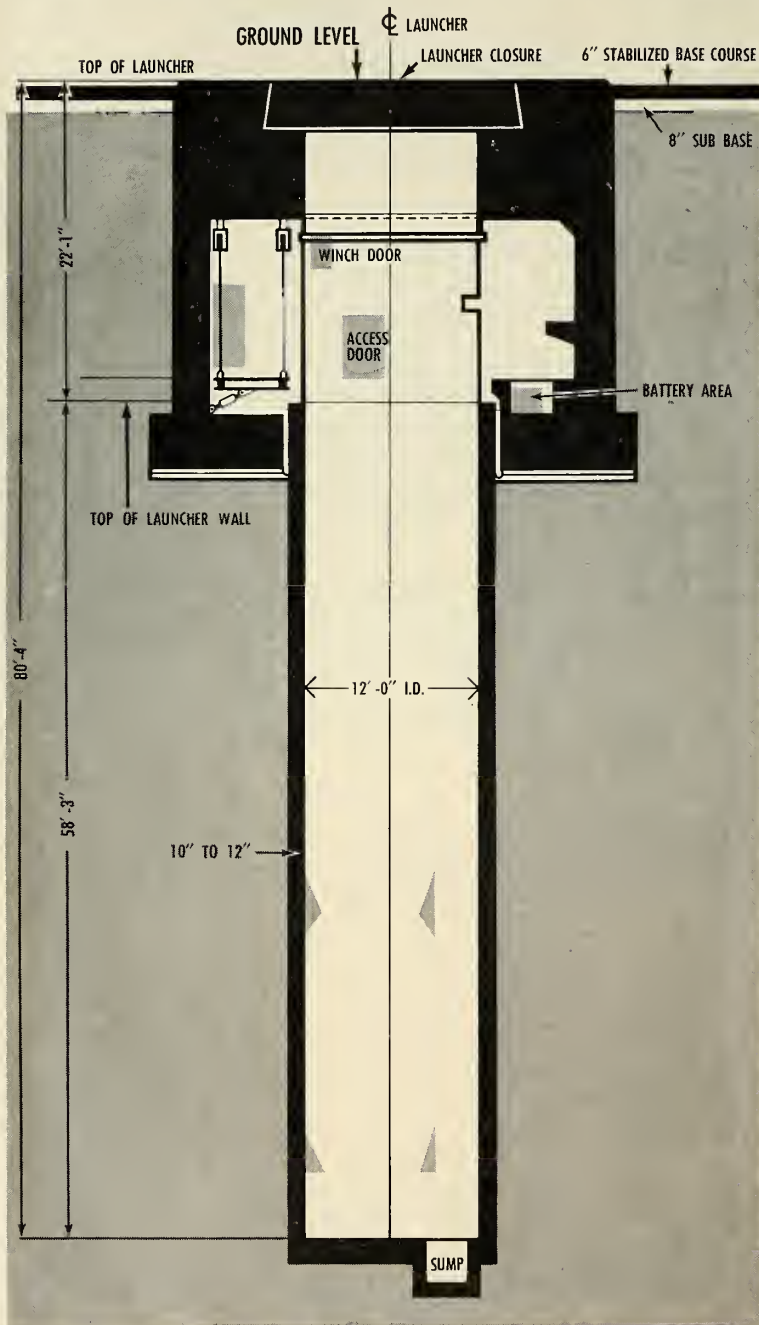
### Saturn Static Tests Scheduled Sometime

Dr. Wernher von Braun has given still another date for the start of the next series of *Saturn* static tests. At a Santa Monica, Calif., press conference, he said it will be late in October. Only a week previously, Von Braun's public information office had announced the shots would be delayed until mid-November. The disparity raises a question whether there was Administration pressure to get the tests going before election.

### Low-Temp Problems in Solids Solved

Thiokol reports it has solved the problem of crystallization in solid propellants at -65°F. A series of airborne launches of *Falcon* missiles at -65° has proved the propellant's reliability, company spokesmen said.

# First 150 Combat Minuteman Sites



CROSS-SECTION OF Minuteman reinforced-concrete launch tube, which includes annular reinforced-concrete area for equipment.

THE 150 *Minuteman* hardened launching sites about to be built around Malmstrom AFB, Mont., will all be located within 115 miles of the base. They will be operated by 15 launch control centers and will be completed before the middle of 1962.

Bids for constructing this \$40-million complex originally expected to go out on Sept. 23 and be opened on Nov. 3. However, because of changes in design criteria, the Army Corps of Engineers has delayed the invitation date until Nov. 4, and the opening-of-bids date until Dec. 6.

The sites are to be clustered around a line running approximately east-south-east through Malmstrom AFB. More than half of the 15 flights, designated by letters from "A" through "O," are within 60 miles of the base; the remainder stretch out to nearly twice the distance.

• **All-weather work required**—Indicative of the explosive, large-scale operation that will begin immediately after the contract award is the fact that work on the first 30 sites will be started before the end of this year. Twenty of these sites, intended for Flights "A" and "B," are to be finished within seven months.

Prospective contractors have been told that because of the "national urgency of the project," the successful bidder will have to make arrangements to work "unimpeded" by the severe winter climate characteristic of the region. The Army is also calling for multi-shift operations.

Each of the 150 missile launch facilities consists of a support building and an underground, reinforced-concrete launch tube more than 80 feet deep. This depth includes an underground reinforced-concrete annular equipment area.

The launch tube is to be constructed of either poured-in-place concrete or precast concrete sections. Trueness to the vertical is to be within one part in 500.

The launch tube cover will be horizontal concrete-and-steel sliding closure. Access through the closure will be by means of a hinged, hydraulically operated cover.

The support building is to be standard 12- by 24-ft., prefabricated insulated-metal building on a concrete



# Completed by Mid-1962

foundation. Its major equipment will be a 50-kilowatt electric generator and a 10-ton capacity water chiller with air-cooled condenser.

In each of the 15 launch control facilities, a reinforced-concrete access shaft will connect an underground, reinforced-concrete launch control center to an above-ground support building.

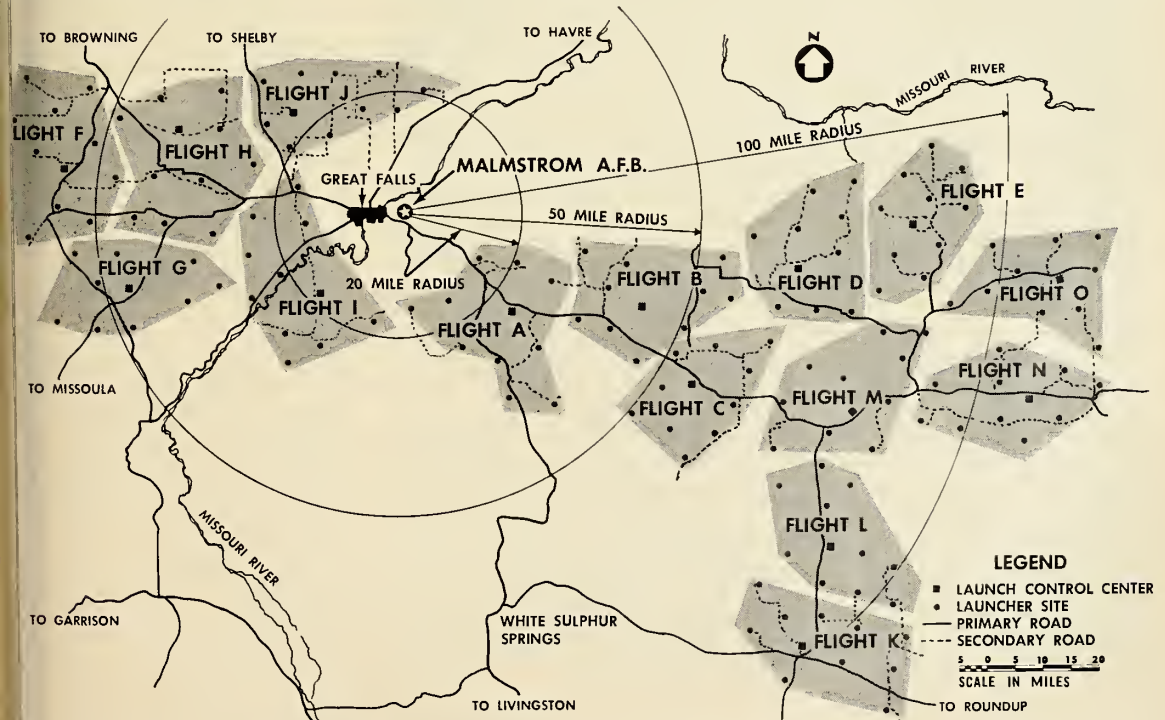
The launch control center comprises an underground reinforced-concrete capsule whose floor will be mounted on a spring suspension system to relieve vibration and shock stresses. Equipment will include an oxygen generator system and a 5500-gallon capacity water storage tank. The support building will contain equipment needed for feeding and sheltering the personnel.

Any firm wishing to be prime contractor on this project must submit a "Prequalification Statement" prior to October 28. Request forms from Corps of Engineers Ballistic Missile Construction Office, Operations Div., 9610 Bellanca Ave., Los Angeles. ❖❖

ITEM OF WORK	1960			1961												1962					
	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	
FLIGHT A One Launch Control Center & 10 Launcher Facilities																					
FLIGHT B One Launch Control Center & 10 Launcher Facilities																					
FLIGHT C One Launch Control Center & 10 Launcher Facilities																					
FLIGHT D One Launch Control Center & 10 Launcher Facilities																					
FLIGHT E One Launch Control Center & 10 Launcher Facilities																					
FLIGHT F One Launch Control Center & 10 Launcher Facilities																					
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FLIGHT H One Launch Control Center & 10 Launcher Facilities																					
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FLIGHT K One Launch Control Center & 10 Launcher Facilities																					
FLIGHT L One Launch Control Center & 10 Launcher Facilities																					
FLIGHT M One Launch Control Center & 10 Launcher Facilities																					
FLIGHT N One Launch Control Center & 10 Launcher Facilities																					
FLIGHT O One Launch Control Center & 10 Launcher Facilities																					

## Construction Schedule, 15 Minuteman Flights

EXCAVATION FOR 20 sites and 2 centers must start 10 days after the successful bidder gets his go-ahead.



MAP OF ENVIRONS of Malmstrom AFB shows locations of the 150 Minuteman launcher sites and the 15 launch control centers.

# GE Gyros May Solve Space Problems

by Charles D. LaFond

SCHENECTADY, N.Y.—Electrostatic gyroscopes now under advanced development by General Electric may solve many troublesome problems associated with conventional units in missile/space applications.

The new devices provide the lightweight, small-volume, and high-precision characteristics which are almost standard requisites for today's subsystems; their electrostatic suspension of the rotor assures these other advantages:

—Significant reduction in gyro drift characteristics.

—Elimination of friction and wear problems associated with conventional rotor spin bearings.

—Instant state of readiness (for missile use).

—Very low power requirements and long operational life.

—Eventual low production cost.

The gyros were developed for the Air Force by the company's Light Military Electronics Department, which is now studying their application for control mechanisms in future space projects. Reportedly, this, too, is under government contract.

• **Size will be cut**—Prototypes being tested by LMED's Advanced Engineering facility are from 1.5 to 2 times as large in size and weight as conventional gyros having the same capability. However, according to J. M. Cooper, systems engineer in charge of development, electrostatic gyros when ready for operational use will be two-thirds the size of conventional units.

Designed primarily for outer space applications, the two-degree of freedom

gyros would be two-body mounted for three-axis inertial reference. No gimbal would be used and the units would operate in an evacuated housing on non-servoed platform.

Each gyro consists of a ceramic housing in which an almost geometrically perfect metal sphere is rotated. Only an electric field supports the rotor.

Warmup for a gyro requires about 10 watts power input and about the same time needed by conventional systems. Average power required in a 1-g environment would be significantly less than for conventional gyros; in space with a near-zero g-environment, less than one-fourth of this would be needed, said Cooper.

The subsystem is designed to provide compensation for both normal gravity pull and ICBM g-environment. Greatest efficiency and highest precision is achieved, however, in a near zero g field.

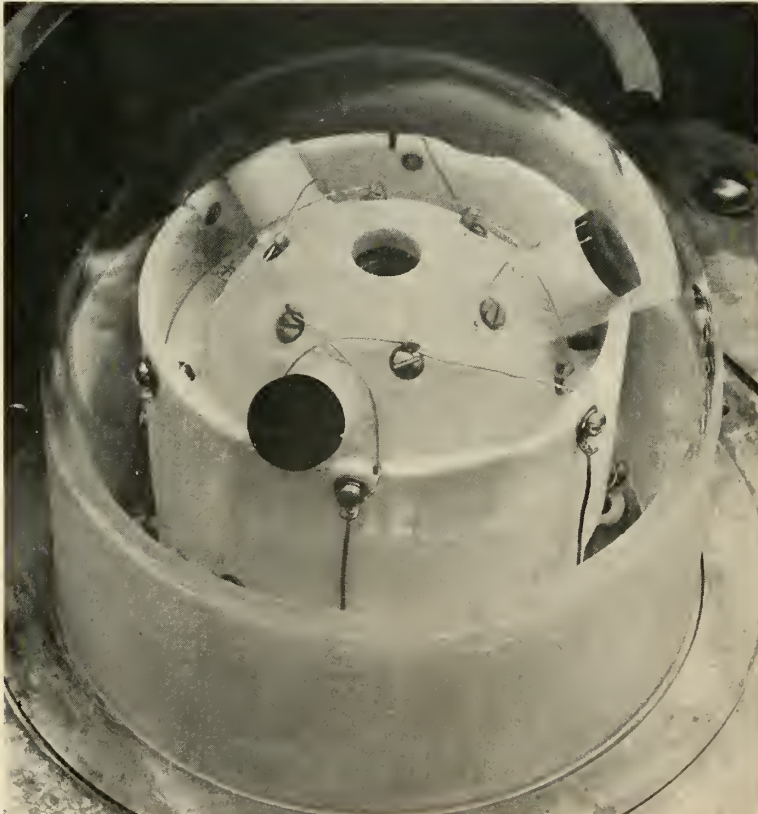
• **Drift overcome**—LMED's H. F. Haake and J. D. Welch, in a paper delivered before the recent IRE Space Electronics and Telemetry Symposium in Washington, D.C., said that the new gyros will offer "an inertial reference that is orders of magnitude better, from a drift point of view, than more conventional gyros."

In space, they said, a vast reduction in drift rate will result from the elimination of mass unbalance (or g-sensitive drift), usually considered the principal source of electrostatic-gyro drift.

A stable platform of the type proposed by LMED would require conventional guidance computer techniques. The readout system which has been employed provides a digital indication of the sphere spin axis relative to the spacecraft-mounted support electrode structure.

Optical readout techniques using a pattern on the sphere are employed. Three ports are used (as shown in the accompanying photograph) to observe the rotor.

In recent laboratory tests, during which a gyro was operated successfully for 100 continuous hours, similar automatic readout equipment was employed. However, recorded data were punched in cards and then fed into a digital computer for analysis and subsequent plotting. About 1000 cards were used during the 100-hr. test to determine

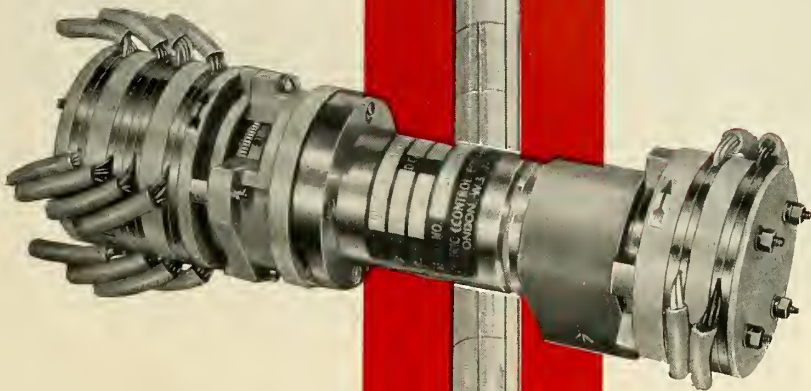


ELECTROSTATIC GYRO under development by General Electric's Light Military Electronics Department has recently been tested successfully for 100 hours of continuous operation. Units show promise of unusual reliability and high accuracy for control of spacecraft.



# Reliability

Vactric switches have time and again proved their unrivalled reliability under actual working conditions. They conform to the arduous specifications demanded by missile engineers during their full working life of 36,000,000 to 100,000,000 revolutions, depending upon speed.



## VERSATILITY

Design permits a wide range of configurations in terms of speeds, contacts and number of tracks. A.C. or D.C. drive motors can be used and as the switch banks require only a few gm. cm. torque even at high speed, the power consumption is remarkably low.

## HIGH SPEED

Sampling rates up to 12,000 contacts per second per track are commonplace yet speed ratios as high as 1,000,000:1 are available between the low and high speed banks.

## LOW NOISE

Maximum generated noise between 5 to 20  $\mu$ V. according to speed. Dynamic contact resistance in general better than 0.05 ohms.

## COMPACTNESS

The switch illustrated has a standard international frame size 11 D.C. motor and gearhead which gives a fair indication of the compact overall size of a complex unit.

## ACCURACY

High pulse positional accuracy permits units to be used with automatic de-multiplexing ground equipment.

## Vactric

## ROTARY SWITCHES

*Vactric High Speed Telemetry Switches have been designed for the British Ministry of Aviation and used on the "Black Knight" test vehicle. The power consumption is less than 3 watts with 4 high speed tracks running at 80 r.p.s. and geared to 2 low speed tracks rotating at precisely 1/24th of this speed.*



Size 11 A.C. Motor Tachogenerator



Size 10 A.C. Motor



Size 11 A.C. Synchronous Motor



Size 10 D.C. Motor



Size 11 D.C. Gear Motor



Size 11 Gearhead

Typical examples from the vast range of Vactric International frame size 07-18 servo motors and gearheads.

## Vactric (Control Equipment) Limited

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gyro rotor spin axis location.

(According to its developers, the amount of computation required is inversely proportional to the complexity of the visual pattern on the rotor.)

• **Some drawbacks**—Although GE's electrostatic gyros show promise of surpassing today's proven subsystems, the new units have some undesirable traits.

Limiting factors in minimizing drift rate are steadily being reduced through continued development. These include

sphericity, homogeneity of material, shielding against magnetic effects and compensation for extraneous electrostatic effects.

There is one other problem which appears to be solvable only through reliable power supply design of the suspension electronics.

If an electrostatic gyro is up to speed and a voltage loss occurs, the precision-finished surface of the sphere undoubtedly would be scored on contact with the housing. Thus the system

is unusually sensitive to continued power—but so are conventional missile-borne computers.

The Air Force still has security wraps on further details of the program. What space vehicle or satellite of the future will be first to employ such a system also is unknown.

However, M/R understands that GE has proposed that an advanced electrostatic gyro inertial system be used in the Air Force's third-generation ICBM.

# AF Moves to Avert Command 'Crisis'

*Industry and military may feel drastic effects from findings of year-long study of command and control systems*

by Hal Gettings

BEDFORD, MASS.—The Air Force is taking a searching look at the vital command and control systems required to wage defensive and offensive high-speed global war.

Termed a "crisis" by Maj. Gen. Kenneth P. Bergquist, commander of AF CCDD (Command and Control Development Division), failure to properly define and implement adequate command and control systems could cause the U.S. to lose command of its weapons systems—and lose a war.

Revolutionary advances in the destructive power of weapons and in the speed and range of delivery systems has created this "crisis." The extreme quantity and abstract quality of data, the compression of decision time, and the necessity for rigid central control to avoid accidents, have imposed this crisis on the operational commanders.

First task in charting this new course was assigned by the Secretary of the Air Force to a so-called "Winter Study Group." The WSG—made up of 139 top scientific and technical people from military, government, industry,

and consultant organizations—spent a year on the problem. A senior scientific guidance group, headed by Dr. A. G. Hill of Mitre Corp., monitored the effort.

Findings and recommendations coming out of the study have just been presented to AF Secretary C. Dudley Sharpe. Briefings to industry and military groups affected by the recommendations will follow shortly. If these are put into action widespread effect will be felt by all those concerned in building and operating C&C systems.

Basic task of the WSG was to "ex-

## Major Winter Study Group Recommendations

• Existing, or planned, command and control ("L") systems must be realistically appraised as to requirements, costs, and objectives of each system.

• A central strong major planning and analysis activity must be constituted to assure systems integration and develop plans and concepts covering all facets of command control problems. This central agency should:

—Have full responsibility and authority for making C&C design decisions.

—Contain a strong activity to develop standard operational techniques for command centers.

—Provide command centers with continuous technical assistance on costing, timing, and availability of alternate systems.

—Provide technical aid to command centers in setting requirements and in performing experimental work.

• More attention must be given to strategic choice\* before money is invested in sensor systems.

• Great emphasis must be placed on surviving attack and controlling reaction.\*

• Aggressive steps should be taken to assure full

understanding between conventional support systems and C&C systems of the future.

• Too little emphasis has been given to common means of effecting timely communications between various components of the command centers (intelligence, operations, planning, materiel).

• Steps should be taken to obtain, train, and retain sufficient personnel to operate the C&C systems and centers.

• The SPO (System Program Office) concept of systems management should be expanded to cover all aspects of the C&C problem as an aid to the command centers.

\*"Strategic choice" relates to the choice between quick reaction and survivability, which has a crucial effect on requirements for C&C systems. It involves the "first-strike" capability of launching retaliatory missiles before enemy missiles hit, as well as "second-strike" capability to follow up after attack. A quick-reacting force requires a highly reliable, high-data-rate C&C system that can be soft-based. A second-strike capability based on a hardened force requires a system which could survive with the force and control it. There is concern lest C&C system fall somewhere between these two positions—being neither fast and reliable enough to permit a quick strike before being hit by a surprise attack nor survivable enough to control reaction after being hit.



mine critically and objectively—from a technical point of view—the entire complex of existing and planned Air Force command and control systems. This includes an examination for technical realism of the needs and objectives of the individual AF operating elements, as well as a study of the problems associated with the integration of the various systems.”

• **Machined decision**—In future high-speed global war, decision-makers must have machines to help them evaluate enemy action and take the required defensive and retaliatory counter-action. Split-second decisions based on a mass of information—rapidly changing and with global consequential effects and considerations—is beyond the scope of man's brain.

What machines do we need to accomplish this task . . . how should they be built . . . what common language should they speak . . . what should they do . . . and who should be responsible for determining these things? These are the questions that must be answered, and these are the answers the Air Force is pursuing.

There are really four categories of equipment involved in command and control systems: command, control, sensor, and support. As a group, these systems comprise the machines necessary to gather data on an enemy attack, process, evaluate, transmit and display to a decision-maker in a form which would enable him to decide to retaliate in time to send firing orders to his forces. These are the so-called “L” systems, such as 416L (SAGE), 433L (weather observation and forecast), 466L (Space Track), 474L (BMEWS), 486L (AEGIS), and 496L (AUGUR), etc.

At the beginning of its study, WSG took a hard look at the L systems in being and planned. At first, the group considered making detailed recommendations as to the use, feasibility, and possible modifications of these systems. It soon appeared, however, that the task was much broader in scope.

The group decided that, individually, most of these C&C systems appear to meet present stated requirements and are technically feasible. Collectively, however, they fail to pass conceptual, integration, and costing criteria.” In other words, they are sufficient for the job they were designed for, but not for the job that's coming.

Probably the most significant fact brought out by the study was the lack of compatibility of these systems. Although \$10-15 billion would have been spent for such equipment over the next 10 years, there would still be no overall “system of systems” to do the job. Each is designed as an individual system without necessary correlation



### ‘Pedigreed’ Resistors

*TRAYS CONTAIN high-stability metal-film resistors which will join the growing list of “pedigreed” parts for Minuteman. Manufactured by International Resistance Co., they must meet a reliability objective of 0.0004% per 1000 hours operation—that is, one failure in 250 million unit hrs. IRC has announced its \$1.7 million contract for these resistors with North American Aviation's Autonetics Div., associate prime for Air Force Minuteman ICBM guidance and control system.*

between them. It was evident that vital data could exist in some one machine while a needing command would not know of its existence or where it could be located. The different machines talk different languages, and translations require time that may not be available. (An analogous situation is the growth of individual telephone systems in this country. Without certain standardization and compatible equipment, today's rapid and simple telephone communications throughout the country would be impossible.)

It is this compatibility—or lack of it—that gave rise to the “crisis in command” evaluation.

• **C<sup>2</sup> D<sup>2</sup> bids for task**—As a natural corollary, it followed that compatibility cannot be achieved without a strong central planning and design—or management—agency. WSG strongly recommended such an agency, and apparently, this responsibility will be centered at AF Command and Control Development Division and its associated “Hanscom Complex.”

In addition to CCDD, this group at L. G. Hanscom Field includes the Air Materiel Command Electronic Systems Center, MITRE Corp., MIT'S Lincoln Laboratory, and other AF strategic, tactical, and support opera-

tions. Rome Air Development Center is also considered a part of the Complex. Hanscom Field is the center for all the Air Force's electronic communications systems.

According to Gen. Bergquist, CCDD is ready to assume this responsibility and is actually at present performing many of the management agency functions. Last week he presented the WSG report to the Air Force, along with his estimate of its recommendations, and briefed the concerned commands on what CCDD is doing and can do to implement the central management agency.

### Goldsworthy Named First Minuteman Base Activator

Col. Harry Goldsworthy has been named the first Minuteman site activation task force commander, in charge of activation at Malmstrom AFB, Mont.

The announcement was made by the Air Materiel Command in San Francisco as the Air Force publicly unveiled for the first time the operational configuration of the Boeing Minuteman solid-fueled ICBM.

Goldsworthy was formerly with the Strategic Air Command as deputy wing commander at Malmstrom.

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Modern concepts of battlefield tactics require a high degree of ground mobility for many new weapon systems. Whatever the requirement — missile transporter launchers — radar or communication equipment — ground support equipment — cargo vans — troop transport — all can have full mobility with one or more standard military vehicles of the new M113 family.

This family of vehicles in either armored or unarmored versions is lightweight to be airborne, amphibious to swim water barriers, tough and dependable for continuous heavy duty.

Test data is available on request concerning the shock loads transmitted to missile systems being carried under the most severe cross-country conditions.

Put your mobility questions to FMC, since 1941 a leading designer and builder of military standard vehicles.

*For further information, write on company letterhead to Preliminary Design Engineering Dept., FMC Ordnance Division, P.O. Box 367, San Jose, Calif. Phone CYpress 4-8124.*

*Putting Ideas to Work*



**FOOD MACHINERY AND CHEMICAL CORPORATION**

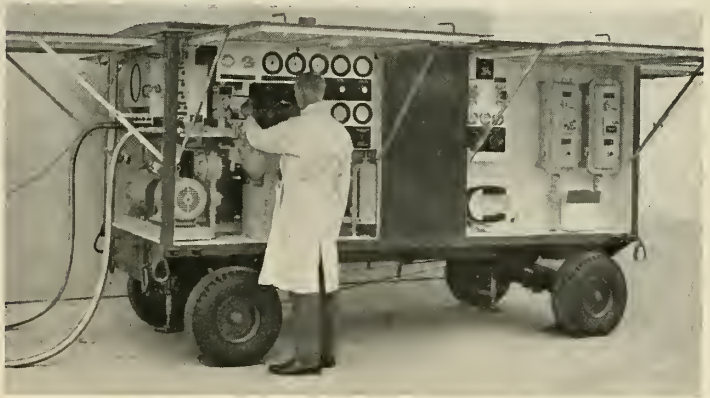
**Ordnance Division**

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## FMC's New Liquid Propellant Metering System Achieves Accuracy to $\pm 0.1\%$



Mobile metering and control unit for fueling liquid propellant missiles.

Illustrated below are the M113 and five vehicle adaptations of this basic tracked vehicle. All of the vehicles use the same military standard equipment, including engines, power train, and suspension components; thus reducing the military logistic burden and R&D costs in weapons systems.



M113 Armored Personnel Carrier



Radar Vehicle



Van-type Vehicle



5th-wheel-type Prime Mover



Utility Crane Vehicle



Missile Launcher

The crucial reliability of multistage missiles is influenced by the accurate measurement and delivery of liquid propellant to the missile tanks. For example . . . a small error in fuel weight could adversely affect the in-flight performance of the missile, causing possible failure of the entire mission.

Food Machinery and Chemical Corporation's Ordnance Division has recently developed a mobile liquid propellant metering and handling system which promises to solve many missile fueling problems. The advantages offered by this unique new system are many.

Accurately measures and records the amount of fuel delivered to the missile tanks. Original specifications called for a metering accuracy of  $\pm 0.2\%$ . Extensive tests, recorded by precision test equipment, show that the system is capable of metering and delivering missile propellants with far superior accuracy—to  $\pm 0.1\%$ .

Automatically compensates for factors influencing fueling accuracy. The fuel is continuously sampled and the flow corrected for variations in temperature and density. In addition, the fuel which vaporizes in the missile tanks is returned to the system, condensed, measured, and an equivalent amount added by the metering unit.

Adaptable to many different missile fuels. The system is designed to handle such storable liquid propellants as hydrazine, nitrogen tetroxide, Dimazine® (UDMH) and nitric acid.

Economical to manufacture and safe to operate. To reduce development, manufacturing and operating costs, the system makes maximum use of standard, interchangeable, and commercially available components. The simple and safe design eliminates human errors and danger to operating personnel.

Mobile and compact. All metering, pumping and control equipment is mounted on a single, portable trailer. The complete unit may be easily transported, rapidly positioned, and provides a single station for the monitoring of fueling operations.

The successful development of this mobile metering and handling system by the engineering staff of FMC's Ordnance Division is another achievement made possible by utilizing the unique combination of chemical and mechanical engineering talent available at Food Machinery and Chemical Corporation.

# AIA Forecasts Striking R & D Growth

AEROSPACE research and development during the next decade will probably see doubled interest in ultrahigh and super-high radio frequencies, sharp increases in human factors activities, and nearly \$80 million per year spent on simulation devices.

These are some of the conclusions reached by more than 200 research and engineering experts who cooperated in preparing the Aircraft Industries Association's seventh "Forecast of Technical Requirements." Other forecasts:

-Reliability requirements will create redundant, adaptive and self-correcting systems.

-For high-temperature operation, pneumatics will take over many functions now fulfilled by hydraulics.

-For panel displays, electro-luminescent light will be used.

-Operating range of hydraulic fluids will increase to the spread -50° to 850°F, but no single fluid will take care of the entire range.

-For the next five years, high-yield alloys (to 350,000 psi) will be available only in sheet and bar form.

-In sheet forming, the predominant development area will be explosive or high-energy forming.

-Uses of numerical tape control

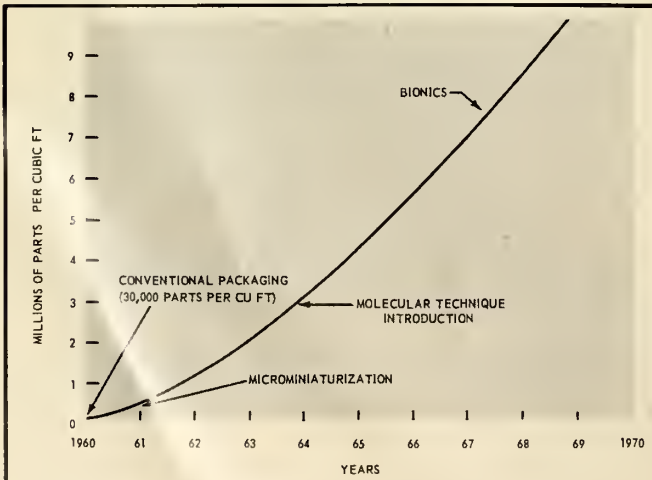
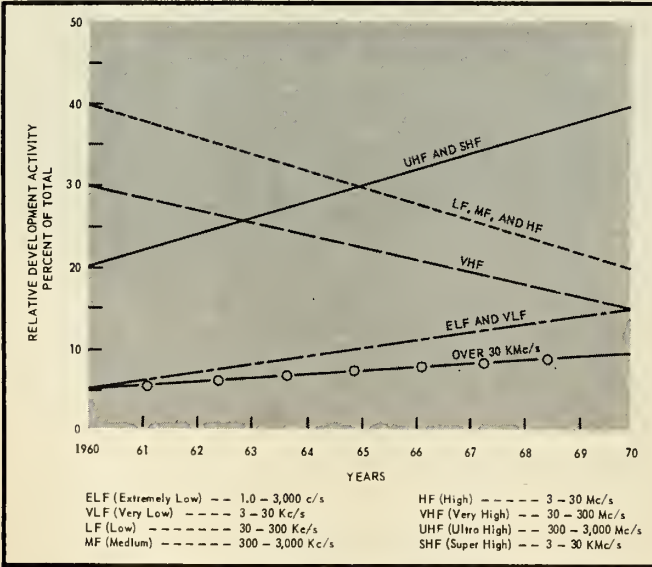
will rapidly extend to lofting, drafting, test inspection and systems checkout.

-Fixtures or dies for explosive welding to be developed for production use.

-Size and complexity of test equipment will rise about 300%.

The 92-page AIA document considers most technical areas—exotic environments, systems, equipment, materials, manufacturing processes, and testing. Oddly enough, the propulsion area is omitted.

The following charts are taken from the AIA document, and the interpretations are based on the association forecasts.



## Communications—Operating Frequencies

INCREASED ACTIVITY is expected in the 1000 to 10,000 megacycle range of the radio frequency spectrum. Reasons: (1) This range appears best for piercing the ionosphere and for minimizing atmospheric attenuation. (2) There is a need for higher data rates in telemetry and data links.

The crowded radio-frequency spectrum and the requirement for secure and private wireless communication will bring increased attention to (1) transmission at very low frequencies (below 30 kc), (2) use of the earth as a communications system, (3) modulation of waves in the visual and infrared ranges and (4) use of "bounce" techniques from natural or artificial reflectors, for example satellite mirrors.

In money terms, it is unlikely that there will be a decrease in any activity. An overall increase is anticipated in spending for developments in communications.

## Electronic Maximum Density Trends

MICROMINIATURIZATION will become a large-scale industry within the decade.

The maximum parts density of current airborne electronics is about 30,000 parts per cubic foot. Welded module construction will increase this number by about 60%, which marks the best compaction with conventional components. True microminiaturization begins with vacuum-deposited resistors, conductors and capacitors with micro-sized transistors as the active elements. Serious production of such microminiaturized or 1/2-million-parts-per-cubic-foot equipment will begin next year. Semiconductor (molecular electronics) circuitry with an even higher parts density will follow closely. After this, a new technology such as bionics—lifelike systems—will probably be developed.



# the '60's

## Data Storage, Processing and Display

THE QUICKENING need for high payload-to-gross-weight ratios will see reduced computer size, weight, and power requirements despite simultaneous requirements for more data handling and faster computing. It appears that one contribution to the solution will be the development of new types of components, notably the tunnel diode and the variable capacity diode.

Urgently needed during the '60's are large-capacity, inexpensive, storage devices that are small yet readily accessible for readout. As any components are developed, two major problems are: connecting the components, and requiring random access to the stored bits of information. Research will also have to be conducted on expanding the multiple uses of computer parts.

## Human Systems

A TWOFOLD or threefold increase in human factor personnel will be required by 1970 to cope with the problems of human existence and performance under increasingly severe environments and in ever more complex systems.

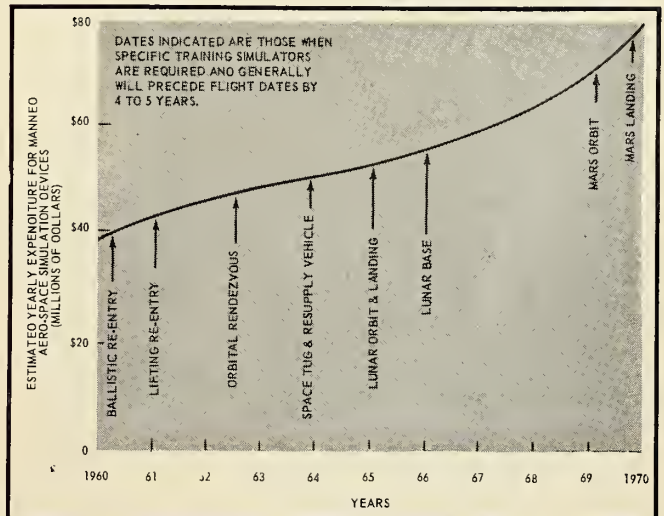
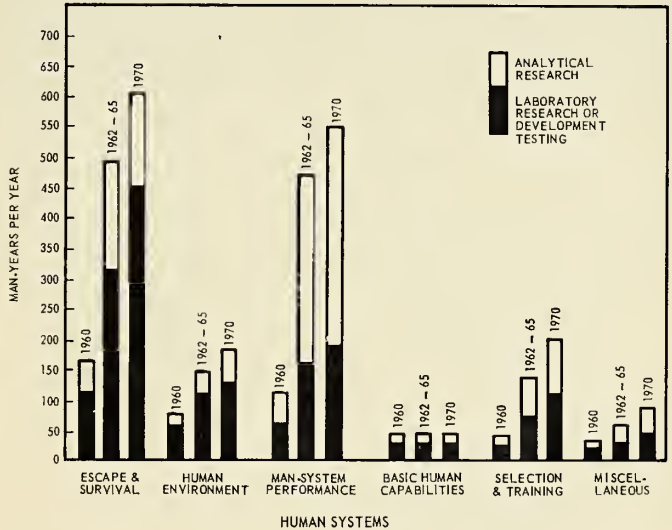
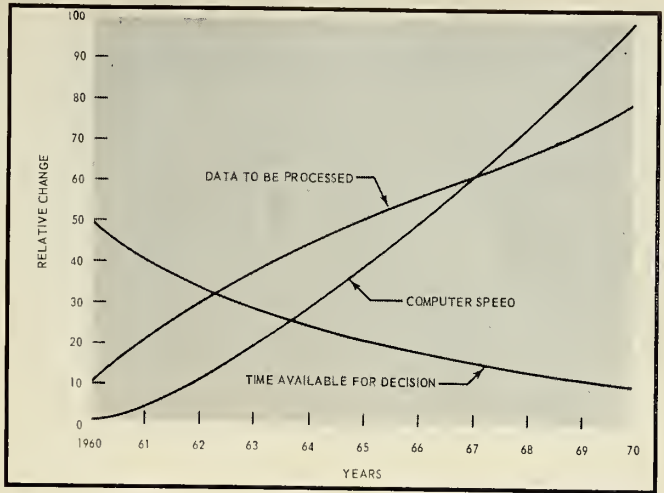
Major effort will be applied to problems of escape/survival and the performance of operators as components within systems loops. A more modest effort will be devoted to basic research in human capabilities and limitations; the trend is to determine these capabilities only within the context of specific systems.

## Simulation Facilities for Man-Vehicle Evaluation

THE PRESENT annual expenditure of approximately \$40 million for aerospace simulation devices may be expected to double over the next ten years, as flight training becomes more expensive and an increasing number of manned space flights are programed.

Considerable data are available on man's performance and capability under individual stresses, but very little is known about his performance under combined stresses such as noise, vibration, acceleration, high temperature and isolation. Since man's performance cannot be expressed adequately for analytical solutions, real-time flight simulators are needed for study and design phases of vehicle development—up to and including complete mission flights.

(Continued next page)



(Continued from preceding page)

### Training Equipment—Man in Space

DEVELOPING TRAINERS for space flight will be receiving a tremendous impetus as we enter the new flight regime. Such trainer will require much originality and diversity of function. Electronically generated displays and control stimuli will be used to provide close precision and reproducible-stimulus systems for space vehicle simulators. There is a growing trend toward using digital computers to describe the dynamic equations of motion, but the requirement most often expressed is for analog-to-digital and digital-to-analog conversions to permit simulation of complex flight characteristics with high fidelity.

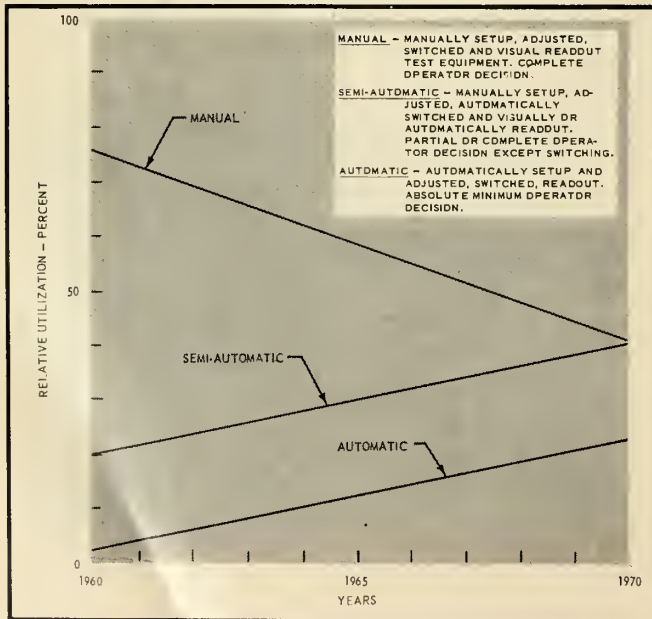
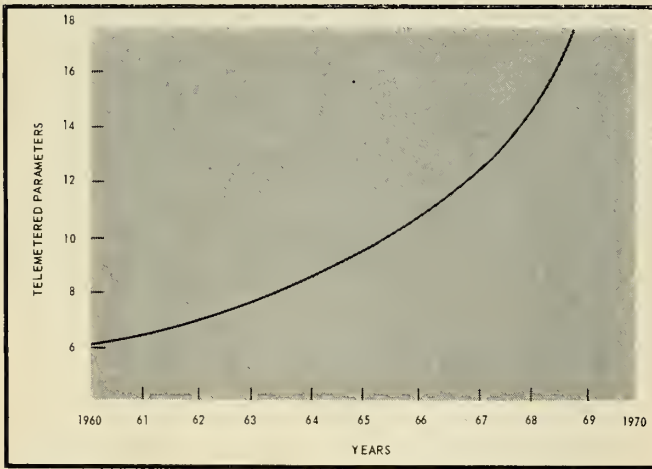
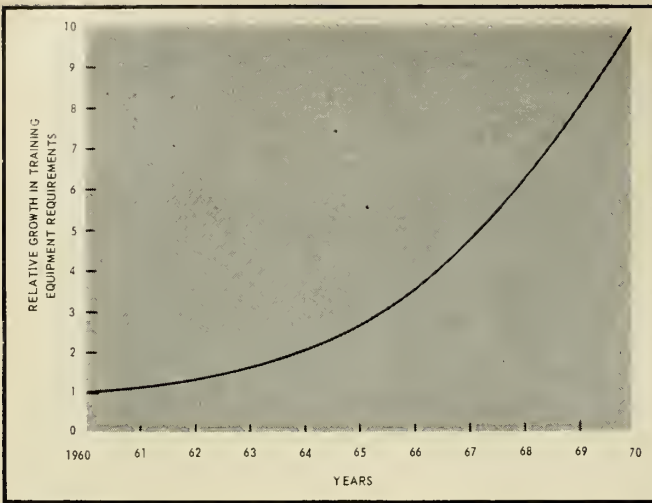
### Biological Factors—Bioinstrumentation

FOR EXTENDED space flight, instrumentation that permits the astronaut to know at all times what is happening to his atmosphere is very important. These data must be telemetered to the scientists on earth. Environmental factors that require constant monitoring include barometric pressure, partial pressure of oxygen and carbon dioxide, concentration of noxious gases, temperatures, radiation intensity, humidity and air movement.

The welfare of the individual can be determined by constant monitoring of oxygen and carbon dioxide in expired air and by his heart rate, body temperature, blood pH and pressure, respiratory rate and volume, galvanic skin response, electroencephalogram and electrocardiogram. The major problem is designing transducers that are acceptable to the crew member and do not restrict his natural movements or responses.

### Automation of Manufacturing Test Equipment

THE INTEGRATION of many complicated subsystems into a weapon system establishes a new requirement—rapid checkout. Automation was previously dictated by volume production and cost reduction. Today, however, it has become increasingly necessary to compare test data with standards at a rate that cannot be attained physically. If done manually, the volume of tests required would severely impair operational availability of the weapon system. Therefore, manual test equipment use will decrease, and automatic test equipment will increase correspondingly.





## Lockheed Uses Converted Trawler for Ocean Studies

A 50-foot steel trawler has been converted into a basic research vessel for oceanographic studies by Lockheed's California Division.

The former Puget Sound under-vent modification at a San Diego shipyard. First trial runs were conducted in mid-September.

Lockheed expects to use the ship for detailed analysis of the ocean's surface and underwater temperature variations, tying in with the company's antisubmarine research activities.

Large enough to accommodate all necessary research and navigation equipment, and also provide living quarters for eight crewmen and scientists, the ship has a 12½-foot beam, 4-foot draft and fully loaded displacement of 70 tons.

A winch, utilizing Lockheed-developed electrical controls, will carry more than three miles of conducting cable—permitting ASW specialists to probe far beneath the surface for instrument readings and water samples. The Lockheed research ship's 3000-gallon diesel fuel capacity is sufficient for two-month cruises—and a range of more than 6000 miles.

## Sperry Gyro Employees Reject AFL-CIO Agents

Engineers and technicians at Sperry Gyroscope have ousted the local AFL-CIO engineers union as their bargaining agent by a vote of 1724 to 1509.

More than 90% of the eligible voters in nine Sperry plants participated in the National Labor Relations Board election. The action was initiated by more than 1100 employees in the 3486-member EA-IUE Local 445. The 1100 members represented more than the 90% necessary to call for a decertification election.

The group had for 14 years been represented by the Engineers Association, but recently voted to affiliate with the IUE-AFL-CIO, which already had two locals for Sperry factory workers.

The Decertification Committee charged that "although the existing A-negotiated contract for engineers had provided the right to vote on affiliation questions to everyone in the bargaining unit, the union refused to recognize that provision and held two elections restricted to union members."

The Committee also said that professional engineers, constituting only a tiny percentage of the 400,000-member IUE, would be forced to accept union deals inconsistent with their own best interests and that the EA union actually no longer represented a majority of the bargaining unit.

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This remarkable liquid chemicals kit for the 23-109A is described in Bulletin CEC 1629-X3. The kit contains concentrated developer and stabilizer solutions in throwaway envelopes—eliminates mixing, handling and irritating odors.

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# NASA Names Life Sciences Advisers

**Committees drawn from broad range of industry, military and universities will meet several times during year**

The National Aeronautics and Space Administration has asked 28 outstanding scientists in the fields of Life Sciences to assist that office in its program.

The advisory group will be divided in three committees, corresponding to the organization of the NASA Life Sciences Program, according to Dr. Clark T. Randt, director. Each committee will meet three or four times a year.

The experts are:

• **Space Biology** (molecular biology and cellular environmental physiology, and extraterrestrial life): Dr. Melvin Calvin, Chairman, Professor of Chemistry, U. of Cal.; Dr. Philip Abelson, Geophysical Laboratory, Carnegie Institution of Washington; Dr. Sidney W. Fox, Oceanographic Institute, Florida State Univ.; Dr. Norman H. Horowitz, Prof. of Biology, CalTech; Dr. Henry Linschitz, Dept. of Chemistry, Brandeis Univ.; Dr. C. S. Pittendrigh, Dept. of Biology, Princeton; and Dr. Carl E. Sagan, Dept. of Astronomy, Univ. of California.

• **Space Medical and Behavioral Sciences** (Neurophysiology and psychology, metabolism and nutrition and cardiovascular and respiratory physiology): Dr. Robert S. Morrison, Chairman, Dir. Medical and Natural Sciences, The Rockefeller Foundation; Dr. Frank A. Beach, Prof. of Psychology, Univ. of California; Dr. Webb E. Haymaker, Chief, Neuropathology Branch, Armed Forces Institute of Pathology; Dr. Robert Livingston, Director of Basic Research, National Institute of Mental Health, NIH; Dr. George A. Miller, Dept. of Psychology, Harvard; Dr. Nello Pace, Prof. of Physiology, Univ. of California; Dr. Stanley J. Sarnoff, Chief, Laboratory of Cardiovascular Physiology, National Heart Institute, NIH; and Dr. Stewart G. Wolf, Jr., Prof. and Head, Dept. of Medicine, Okla. Univ. Medical Center.

• **Flight Medicine and Biology** (experiments in the space environment and biotechnology): Dr. W. Randolph Lovelace II, Chairman, The Lovelace Foundation; Adolph Bialecki, Head, Chemical Engineering Section, R&D Dept., Electric Boat Co.; Lt. Col. Joseph A. Connor, Jr., MC, AF, Chairman Aerospace Nuclear Safety Board, Div.

of Reactor Development, AEC; A. Scott Crossfield, Chief Engineering Test Pilot, North American Aviation, Inc.; Brig. Gen. Don D. Flickinger, MC, AF, Assistant for Bioastronautics, Hdqrs. ARDC; Dr. Robert Galambos, Chief Dept. of Neurophysiology, Walter Reed Army Institute of Research; Capt. Clifford P. Phoebus, MC, USN, Director of Astronautics, Bureau of Medicine and Surgery, Dept. of the Navy; Dr. Hennig von Gierke, Chief, Bioacoustics Branch, Biomedical Laboratory, Aerospace Medical Division, WADD; and Dr. Alexander C. Williams, Senior Project Engineer, Engineering Project Management, Hughes Aircraft Co.

## SAE Life Papers

### Cabin Instrumentation, Survival Gear Stressed

Two papers presented at the recent Society of Automotive Engineers meeting reflect the growing interest in engineering for life sciences.

Convair's R. B. Wilson told delegates to SAE's National Aeronautics Meeting that design of cabin instrumentation may be one of the most important aspects of the engineer's contribution to manned spaceflight.

For psychological reasons, he pointed out, it is very important that the crew has reliable, easy-to-read instruments.

Since adjustments in the life support system will probably be made manually in early voyages (to save weight), it is essential that the crew be constantly aware of cabin pressure, temperature, and condition of the atmosphere.

Wilson points out that any new instrumentation should be carefully and extensively tested to gain the confidence of the crew.

In another paper, Norair's E. A. Smith and R. W. Connor call for an "early emphasis" on disaster survival techniques in interplanetary voyages.

Emergency survival should be part of mission planning as well as vehicle design, the team charges.

Smith and Connor blasted the presumption that payload weight for a

Mars flight—life support system for several men and laboratory research equipment—could be kept down to about 70,000 lbs.

Survival redundancies will always be costly, they point out, but they will also be essential.

Missions which can justify a fleet of vehicles offer the best survival potential for the crew, they note.

If this is impractical, the best approach is to have the astronaut "stick with the ship" rather than try to fit him out with smaller escape vehicles.

Their reasoning is that in the parent vehicle he will have the benefit of the communications system, reliability of subsystems, radiation protection and propulsion, even if he has to drift for years.

A secondary vehicle designed with all these features, plus a life support capability of 300 days, could easily weigh over a million pounds—obviously ruling out the 70,000 lb. payload.

Some basically different design techniques will be necessary if the philosophy of "on-board survival" is employed. The Norair group proposed a compartmentalized cabin, with areas which can be jettisoned in event of damage, or closed off if contamination occurs.

## Fiberglass Ball to Spin Astronaut at 'Record' Speed

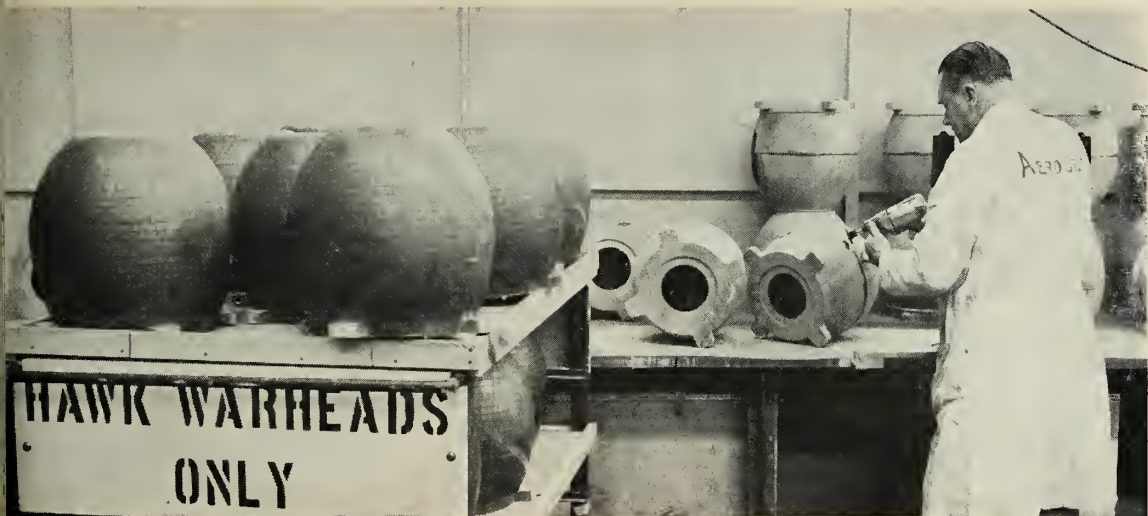
A 10 ft. fiberglass ball which will spin man almost as fast as a pre-war phonograph record is being constructed by Norair Div., Northrop Corp. for the School of Aviation Medicine.

Designed to simulate satellite tumbling and spinning, the device will permit study of man's ability to withstand extreme rotational conditions—up to 70 rpm. This will double the ability of current simulators.

The 4300-lb. vehicle will be constructed of bonded sandwich-type fiberglass honeycomb. It will ride smoothly on a circular stream of air six feet in diameter, also making it relatively noiseless.

Three inertia rings rotating within the inner surface of the sphere will provide control and rotation. The rings, powered by 20 horsepower motors, will be mounted on the axes of roll, pitch and yaw. Existing simulators are based on mechanically controlled gimbal systems.





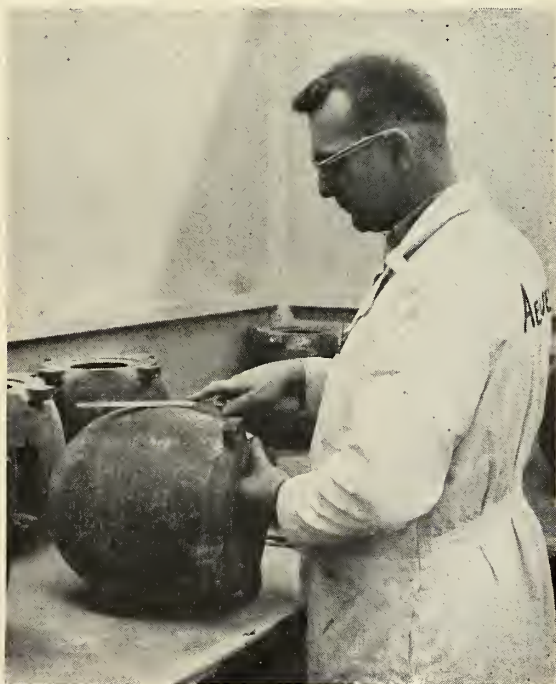
*DOME-SHAPED HAWK WARHEADS are formed on an inner plastic shell which melts with heat of detonation. Center is filled with conventional explosive. Steel slugs on outer surface form shrapnel cloud on explosion.*

## How Hawk's 'Business End' Is Made

*Aerojet wraps steel slugs around plastic shell containing explosive to form grenade-like warhead that has already scored missile kills for Hawk and Nike*



*INNER PLASTIC BODIES are cast in form of attached hemispheres (on shelf in background). These are separated, then tops and bottoms cemented together. Hollow shell is then wrapped with tape and covered with metal slugs.*



*SURFACE OF WARHEAD is smoothed prior to final painting. Dome shape is designed to produce most effective "shot pattern". These and similar warheads were used in recent successful missile kills by Hawk and Nike-Hercules.*





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# Flight Model OAO Coming in 2½ Years

FIRST FLIGHT MODEL of NASA's Orbiting Astronomical Observatory (OAO) is scheduled for delivery within 2½ years under a \$23-million contract won by a Grumman Aircraft-Westinghouse team.

If the R&D work proves successful, NASA plans follow-on procurement of OAO's that may bring total expenditure \$100 million over the next decade.

Westinghouse Air Arm, Baltimore, will provide electronic and stabilization equipment under subcontract to Grumman. The amount of the subcontract was not specified, but it was understood the sum would be just under half of the \$23 million. The Grumman-Westinghouse team was chosen from bidders.

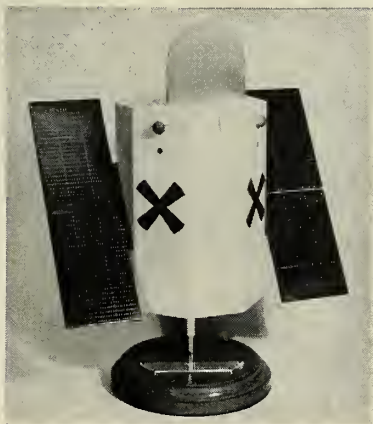
The first 3200-lb. satellite is to be delivered in 2½ years for launching in 1963 aboard an *Atlas-Agena B* vehicle into a 500-mile orbit from Cape Canaveral. Grumman proposes a satellite in the shape of an octagonal prism, ½ ft. tall and 6½ ft. in diameter, which will carry 1000 lbs. of experimental equipment.

• **New eyes for astronomers**—Use of an orbiting observatory will open an entire new era in astronomy. Knowledge of the cosmos has been limited to that received through two "windows" in the electromagnetic spectrum—one comprising visible light, infrared and near ultraviolet, and the other in the radio portion. The remainder is absorbed by the earth's atmosphere and cannot be detected at the earth's surface.

Telescopes mounted in the satellite will be used to view the cosmos by X-ray, ultraviolet and infrared. Presumably, later experiments may call for observation through very low-frequency radio and gamma radiation, also masked by the atmosphere.

First experiments will concentrate on the so-called Lyman-alpha ultraviolet radiation, with wavelength 1100 Angstrom units, which is the primary romance of the hydrogen atom. Lyman-alpha measurements from sounding rockets conducted by the Naval Research Laboratory in the last few years have developed revolutionary ideas about the structure of the galaxy, particularly in the relatively near constellation of Orion.

• **Room for varied experiments**—Stabilization, power and telemetry instruments will be fitted into a standardized shell, leaving space for variable experiment modules. The telescopes, with reflecting mirrors of diameter up to 6 in., will be mounted in a central cylindrical chamber.



OCTAGONAL form shows in model of NASA's Orbiting Astronomical Observatory, to be built by Grumman and Westinghouse.

The stabilization system will have fine pointing control able to track a star with an accuracy of a tenth of a second of arc—about the equivalent of looking at a basketball 500 miles away.

Pictures will be transmitted to ground by television to verify the direction in which the satellite is pointed. A ground command system will point the satellite, operate system and experi-

ments, verify commands it receives and store them for execution up to two hours later.

Solar cells on two paddles will provide 350 watts of power.

At least 100,000 bits of information from experiments will be stored in a memory for later reading. Several large dish antennas will be built at NASA Minitrack stations to track the OAO radio beacon, command experiments and receive telemetry.

• **Heavy work schedule**—These experiments are among those planned for the OAO:

—An ultraviolet map of the sky, proposed by the Smithsonian Astrophysical Observatory, with the use of several 8-in. telescopes, each coupled with a video tube.

—Measurement of the ultraviolet brightness of the stars, proposed by the University of Wisconsin.

—Use of a 36-in. mirror to study emissions from a wide range of celestial bodies, proposed by the NASA Goddard Space Flight Center.

—Study of cosmic dust and gas by observing them against the stars with a 24-in. mirror and spectrometer, proposed by Princeton University Observatory.

—Spectrographic examination of the sun, proposed by Harvard University.

## Tiros II to Report to 22 Stations

Cloud-cover photographs to be transmitted by *Tiros II* will be sent and received from 22 stations on the U.S. Weather Bureau's National High Altitude Facsimile Network.

Alden Electronic & Impulse Recording Equipment Co. of Westboro, Mass., under a Weather Bureau contract, is adapting facsimile weather map scanners to handle the cloud photographs.

Alden said *Tiros II* will be launched later this month. The bureau will prepare cloud-cover analyses based on the satellite data and transmit them regularly.

By having the photos shown in geographic orientation, Alden said, forecasters at network stations will be able to study in detail the actual cloud systems associated with weather activity.

Alden said all its scanners in the field, totaling more than 300 on several weather map networks, can be adapted to handle photograph copy by substitution of one plug-in component.

The Weather Bureau first sent out cloud-cover diagrams—which it called

NEPH analyses—as an experiment on May 25 with the use of *Tiros I* data. They showed cloud conditions in a band across the United States, Canada and part of the Pacific Ocean.

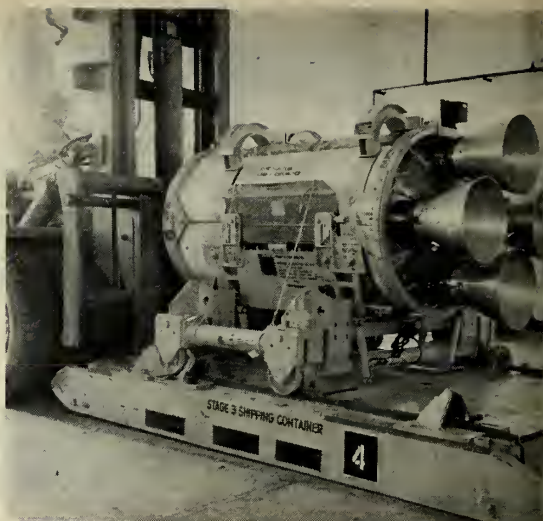
• **Frequent reports**—Alden said the television camera on *Tiros II* will be able to receive specific instructions, such as orders to focus its camera on suspected storm centers above heavy air. Fully translated weather reports will be available every two or three hours.

Four stations on the weather network—New York, Miami, San Francisco and Suitland, Md.—will be capable of both sending and receiving. Signals will be received by Boston, Philadelphia, Glen Burnie, Md., Ft. Monmouth, N.J., Arlington, Va., Romulus, Mich., Chicago, Franklin Park, Ill., Kansas City, New Orleans, Kenner, La., Burbank, Calif., Alameda, Calif., Naval Air Station, Portland, Ore., Seattle, Fort Worth, El Paso, Denver and Los Angeles.

The satellite data will be received by stations at Evans Signal Laboratory, Ft. Monmouth, and Point Mugu, Calif.



THIRD STAGE is lifted from truck during transport to Cape. Note Blowout ports in forward bulkhead, to terminate thrust.



PLASTIC-COVERED third stage is prepared for shipment Bacchus. Nozzles and actuator arms for swiveling are visible.

# Minuteman 3rd Stage Is Big Advance

*Hercules Powder Co.'s Spiralloy case combined with double-base propellant called major jump in high mass ratios*

BACCHUS, UTAH—Design of the third-stage propulsion system for the *Minuteman* ICBM constitutes a major step forward in industry efforts to achieve extremely high mass ratios in rocket motors.

Hercules Powder Co.'s design, successful entry in the drawn-out competition for the third-stage production contract, utilizes a Spiralloy case and a double-base propellant giving extremely high specific impulse and temperatures over 6000° F.

Thrust termination on the motor is provided by blowout ports on the side of the case, about a foot forward of the aft end. These ports direct gases forward during the termination phase and effectively equalize forward thrust. This unusual feature enables the range to be more accurately controlled and programmed. Four similar ports are located on the forward dome of the casing.

• **90% cheaper**—Spiralloy has been under development for 10 years at the Young Development Division of Hercules, and is claimed to have the highest strength-to-weight ratio of any known material. The case, with a constant wall thickness of about one-half inch, costs approximately 1/10 as much as a pure titanium case, and has a higher tensile strength.

The six-ft.-long rocket motor case is helically wound of continuous glass fibers, impregnated with an epoxy resin, and has a very small volume of metal parts constituting 45% of its total weight, not including nozzles. End domes, blowout ports for thrust termination, attach points, and exhaust nozzle fixtures are all integrally wound into the case structure.

Hercules says it can wind the cases to within  $\pm .005$  in. in diameter, with a capability of machining the case length to specification. Winding in the metallic fixtures for the case, the company can maintain  $\pm 3$  minutes of angle.

After winding and curing of the case is completed, a silica-filled rubber-based insulator is applied to the internal walls of the case. This insulator can withstand about 350° F during operation, and for the final 1/2 to 1/3 second of burning time, it protects the case against the combustion temperature. At this point, burnout occurs in the motor, even though the guidance system has already terminated effective thrust forward.

• **Classified coating**—As one Hercules engineer put it: "During the last second of combustion, when the burning propellant surface is approaching

the case wall, the entire motor glows as brightly as a light bulb."

Steel nozzles used with the motor are coated with a non-eroding substance before firing of the motor. Nature of the coating is classified. All four nozzle pivot during operation for thrust vector control, moving on one axis, as is the case of the other two stages.

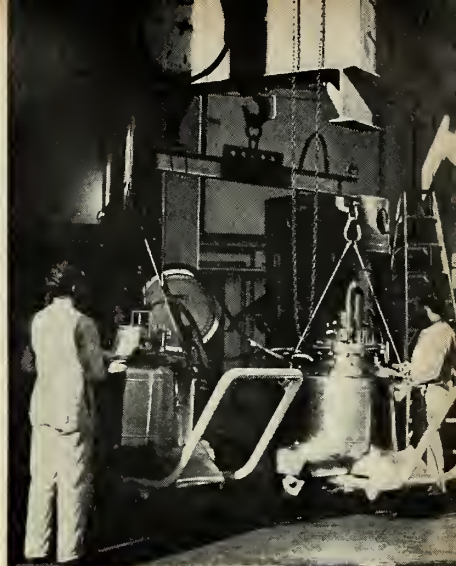
Most of the production work on the *Minuteman* third stage will be done at its Bacchus plant, the company says, with the base grain powder being produced at the Rocky Hill, N.J., plant. Nozzles, actuators, igniters, safe/arm devices and similar hardware will be sub-contracted.

Hercules says it has successfully fired about 200 solid-propellant motors of various sizes using the Spiralloy case, including a number of *Altair* units which have performed well in space probes.

Quality acceptance tests for the Spiralloy case are about the same as for a metallic case, Hercules says, noting that quality of the case has improved 100% in just the past year, through experience with working with the material, various winding patterns, and other variables of the material.

Hercules has a number of machines for producing the case simultaneously





**OPTICAL CHECK OF nozzle port alignment is made on third stage's Spiralloy case. Ports can be integrally wound into case with accuracy within 3 minutes of angle.**

**PROPELLANT is poured into third-stage case in a batch mix operation.**

and curing is done with heat lamps.

• **Modification within week**—"One of the wonderful things about this method," William Bogart, Chamber Development Supervisor says, "is that we need no big presses, forges, heat treatment furnace, or other metalworking machinery. We use a frangible mandrel during forming, we can use heat lamps or an oven for curing, and there is practically no limit to the size pressure vessel we can produce."

Bogart said Hercules has proposed a 5-million-lb. solid rocket booster to NASA, using the segmented approach with a Spiralloy case. The case would be wrapped on the launch site.

Pointing up the advantages of this approach, Bogart said a Spiralloy case can be loaded and fired and, within a week, Hercules could reduce the firing data, crank in design changes, and have a modified case ready for testing. A similar cycle on a metal case would take months, he said.

During fabrication, the fibreglass winding is applied in bands about one inch wide, giving a final product with a strength-to-weight ratio of 1.8 million. Hydrostatic burst pressure on the cases has averaged 550 lbs. to date.

• **End closure problem solved**—The most prevalent problem with filament-wound cases has been the retention of end closures in the final product. Young Development Division of Hercules, working on the problem, decided that the tensile strength of a filament-reinforced structure would be high, with respect to its other properties. Indication was that the end closures should, if possible, be retained by fibers in pure tension.

The company vetoed a number of schemes before determining that wind-

ing fibers along a helical path on a cylindrical surface and reversing these over a spherical end zone would properly retain end closures while still stressing the filament in tension only. A simultaneous indication was that the load on each fiber would be constant whether the load was generated by end retention stresses, or radial pressure within the cylinder.

To transform filaments of glass and epoxy resins into a useful structural material required that the designs be applicable to other than perfectly balanced cylindrical structures. Also, the unit must have acceptable strengths in shear, bearing and compression—although these need not be as high as tensile strength.

The two most desirable properties are determined by two features of the final structure; tensile strength of the bonded fibers and interlaminar shear indicating bond strength.

• **Quality through numbers**—Consistency in quality has been pointed out as one of the advantages of the Spiralloy case. Visual inspection of a unit may indicate its quality to be poor, but in tests, the unit will show up less than 10% below quality on normal cases.

The consistent quality is laid to the fact that all the fibers in the case are drawn into the structure under tension at correct location, leaving no chance for folds or poor distribution to develop.

There are so many filaments in the structure at any particular location that it becomes statistically impossible for a significant number of low-quality fibers to become superimposed and lower integrity of the case.

In some instances, it is necessary to introduce a "doubler" to the design so that localized areas may have higher strength. The doubler is formed by winding filaments locally on the cylinder from an independent source. It may be wound simultaneously with the helical winding of the primary casing, or consecutively. The first of these, the integral doubler, is most effective due to its intermeshing with the primary fibers. In the *Minuteman* case, this type has been applied to the retention of end closures.

The ovaloid end profile used in the case is difficult to arrive at mathematically, Hercules says, and an analog computer was programmed to set up the required diameter ratios and external forces to derive the winding curve correctly.

• **Methods of analysis**—The company says there are two systems of analyzing the Spiralloy type structure—a method considering the fibers a netting system sustaining only primary loads while the resin sustains secondary loads; and a system considering the structure as a homogenous material, with physical properties in various directions relative to the winding pattern.

High-temperature operating conditions are limited to the type of resin employed in fabrication of the case.

The case is corrosion-resistant, one quarter the weight of steel and needs no special tooling or expensive plant equipment to produce. Its physical properties are excellent—and it is cheap.

The future of the Spiralloy case seems bright. Hercules has proposed a second-stage *Minuteman* case of the material, and says it could even be applied to the first stage, if necessary. \*\*



## expansions

IBM has disclosed plans to construct a 150,000-sq.-ft. product development laboratory for Poughkeepsie, N.Y. Construction will begin next month. Completion expected in late 1961. The Poughkeepsie center is home to the STRETCH, the world's most powerful computer, and employs 10,000 people.

**NEEF INSTRUMENT CORP.** has moved to larger facilities at Durham, Calif.

**NORDEN DIVISION**, (United Aircraft Corp.) Data Systems department will occupy its new engineering-research and manufacturing facility at Chino, Mesa, Calif., on Oct. 17. The newly constructed 50,000-sq.-ft. facility will house the department's 200 employees working in leased plants and laboratories at Santa Ana and those formerly located at Gardena, Calif.

**MOTOROLA SEMICONDUCTOR DIVISION** has reorganized its national sales network to insure technical product service to the semiconductor field. In January, 1962, Motorola expects to have more than 80 sales representatives, account supervisors, and product specialists in the field to provide extension services.

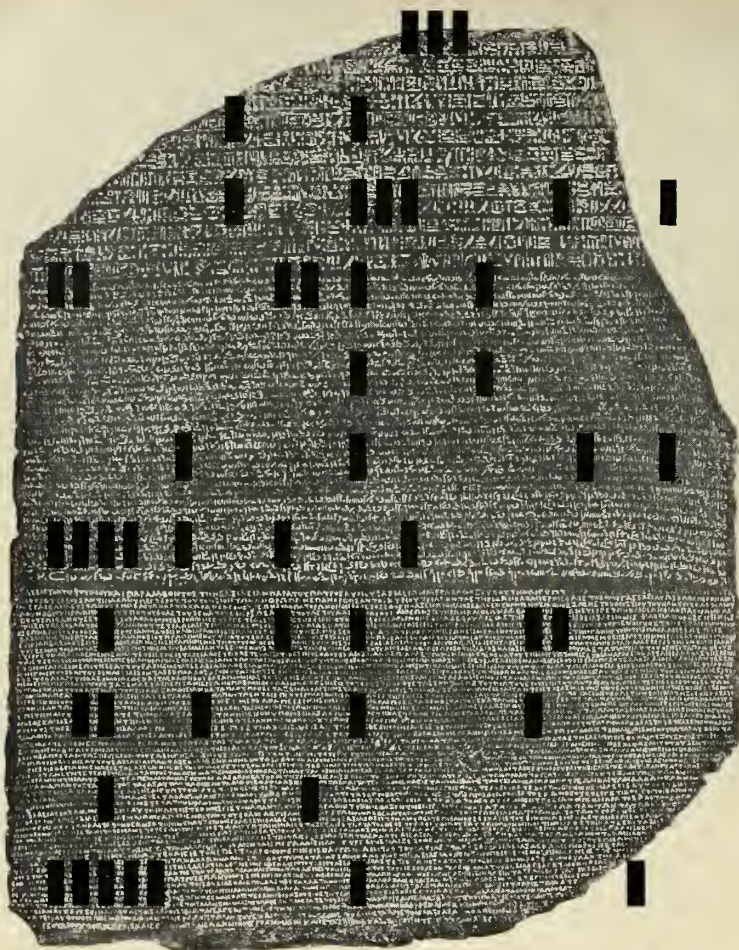
**AIRCRAFT ARMAMENTS, INC.** has acquired B&F Instruments, a Philadelphia electronics and electromechanical instruments firm, in an exchange of stock.

**DRESSER INDUSTRIES'** board of directors unanimously approved the purchase of Podbielniak, Inc., a Chicago company manufactures centrifugal solvent extractors, laboratory fractional distillation apparatus and packaged distillation plants. Dr. Walter Podbielniak, who organized the firm in 1928, will continue to direct the company's activities and further technical developments.

**TASKER INSTRUMENTS CO.** has begun operations in its new headquarters at Van Nuys, Calif. A 136,000-sq.-ft. building houses engineering laboratories, environmental facilities, production and administration activities. An additional 64,000-sq.-ft. production facility is planned. The electronic design and production company.

**ROBINS INDUSTRIES CORP.** has formed a new research and development division at Flushing, N.Y. Robins supplies record and tape-care accessories for hi-fi and industrial uses.

missiles and rockets, October 17, 1961



The Rosetta Stone unraveled secrets that had been buried for centuries. It bridged the gap between known civilization and unknown, ancient Egypt. The discovery of the Stone was an accident, one of those curious events that sometimes happen. ¶ Modern science faces a language problem much more complex than deciphering of hieroglyphics. And once again a Rosetta Stone is needed. But science cannot wait for an accidental discovery. ¶ Each branch of science has its own language which it uses to state problems. But electronic computers can solve problems only if they are posed in the language of the specific computer. Translating science languages into computer languages is enormously costly in time and money. UNCOL (Universal Computer Oriented Language) is a possible solution. The development of UNCOL will bridge the gap between a multitude of Problem Oriented Languages and an increasing number of Computer Languages. UNCOL is one task which occupies scientists at System Development Corporation. ¶ **SYSTEM DEVELOPMENT CORPORATION.**

A non-profit scientific organization developing large-scale computer-based command and control systems. Staff openings at Lodi, New Jersey and Santa Monica, California.





# Japan's Missilery Beset by Troubles

Industry leaders plead for stronger backing from government; public strongly opposes any nuclear weapons

by Frank G. McGuire

TOKYO — Japan's missile industry leaders are begging their government to take a firm and positive policy on defense.

Budget cuts, realignments and shifts in emphasis from month to month are harassing the planning departments of government and industry alike, a group of industry leaders has charged.

Without firm government direction, say members of the Guided Missile Association, the industry will remain in the dark about policies, future trends and business climate in the field.

Some of the snarls in the program:

—The defense program ranks lowest on the budget priority list. It's first to go when the economy axe falls.

—Japan has no plans for nuclear weapons. Not only is it barred by law from possessing nuclear weapons, but Japanese public opinion is violently opposed to them.

—It has money for a 25-mile test range at Niihima Island, but left-wing opponents and island residents have successfully blocked its establishment.

—Despite "close liaison" with Japan Defense Agency, U.S. Army Headquarters in Japan said it had never heard of JDA's most advanced missile project.

—The program is entirely open, since Japan has no security law, and thus there are no military secrets.

• **Nuclear weapons**—An understandable revulsion toward nuclear war has prompted the Japanese people to react violently to the presence of such weapons on their soil or in their armed forces. Demonstrations occur when a U.S. vessel, suspected of being nuclear-armed, arrives in a Japanese port.

The designation "Japanese Self Defense Force" is taken seriously. No offensive weapons of any great range are included in inventory.

Japan hopes to avoid being accused of having any nuclear capability, and consequently to be spared as a target in event of war. Even nuclear weapons designed to defend cities—such as the *Nike* series or *Bomarc*—are not wanted.

American forces with nuclear weap-

NAME	1962	1963	1964	1965	1966	REMARKS
MAT*	●	→	→	→	→	Thirteen batteries
LACROSSE				●	→	One battalion
HAWK		●	→	→	→	Two battalions
NIKE	●	→	→	→	→	Four battalions
TARTAR	●	→	→	→	→	Three DDG's
BOMARC					●	Perhaps HE Warhead
AAR*	●	→	→	→	→	Mighty Mouse Type
ASR*		●	→	→	→	Mighty Mouse Type
AAM* (IR)		●	→	→	→	Sidewinder Type
AAM* (Radar)		●	→	→	→	Falcon Type

\*Japanese Design, Development and Manufacture.

JAPANESE MISSILE program as presently planned, including estimated dates of the nine birds, of which five are American and four will be produced in Japan.

ons for the present are based in Korea, Okinawa, Formosa or other less sensitive nations. When Japan's attitude will change is extremely hard to predict; military planners hope that by 1970 the current "education program" will have its effect, and defenses based on nuclear weapons will be acceptable to the Japanese.

• **Domestic designs**—Of the nine missiles intended for the Self Defense Forces, five are American and four will be developed and produced by Japan. The inventory will include *Nike-Ajax* missiles with *Nike-Hercules* ground and guidance systems, *Hawk*, *Tartar*, *Bomarc* and *Lacrosse*.

Domestic production will include an antitank missile, *Mat* (TATM-1); a dual purpose unguided rocket for airborne use against aerial and ground targets; an infrared-guided air-to-air missile; and a radar-guided air-to-air missile. It is expected that all except *Bomarc* will be in use by 1965.

*Mat*, the most advanced missile in JDA's development program, will probably be in use by mid-1962. The original mid-1961 date slipped during the development of an advanced high-explosive warhead.

Kawasaki Aircraft Co. has been awarded a half-million-dollar preproduction contract for *Mat* and has produced from 400-500 test versions since the program began four years ago. Japanese sources told M/R that JDA hopes to have the U.S. Army and Marines evaluate the weapon for possible use in Asia and elsewhere.

However, when queried about the missile, Army Headquarters in Japan said it has never heard of the program although it has "close liaison" with JDA. The U.S. Military Assistance Advisory Group backed up this statement.

• **Dual-thrust missile**—*Mat* is a wire-guided weapon using a dual-thrust solid-propellant rocket motor developed by Dai Nihon Celluloid Co. The motor provides both boost and sustainer propulsion. A high-explosive warhead is under development by Osaka Metal Co.

*Mat* will be guided by means of wire control operated by a two-man team. Two gyroscopes powered by solid propellants will afford excellent accuracy, JDA says. Gyros are being produced by Tokyo Keiki Co., and the complete guidance system by Kawasaki and Nippon Electric Co.

The control system uses buttons on

## progress despite difficulties . . .

a control box in the hands of infantry operators, rather than the more common joystick arrangement. The missile has a conventional design, using standard metal materials. It has a cruciform wing configuration and is generally similar to the French *SS-10*.

Because of high costs of certain components (such as gyroscopes) in Japan, the *Mat* is expected to cost slightly more than the *SS-10* (less than \$1000). Contributing to the higher expenses will be a limited production rate—unless Japan can sell the weapon in foreign countries.

Also under development by Kawasaki is a training simulator, in both basic and advanced versions, using an analog computer and a visual display device.

C. Itoh & Co., Ltd., one of Japan's largest trading firms, will market the *Mat* in Southeast Asia. C. Itoh also has arrangements with Thiokol Chemical Corp. and Hughes Aircraft for the marketing of various products in Japan.

*Mat* will be deployed with both ground divisions and helicopters. Each of the programmed 13 divisions of the Japanese army will have one battery of *Mat*. The battery will be equipped with 12 launchers and 124 missiles, each launcher operated by two men. The ground forces will thus have 156 launchers in field use.

H-13 Helicopters armed with *Mat* will total about 60, if current plans are carried out. This figure was slashed from about 80 helicopters in budget cuts. Officials emphasized that deployment figures are tentative, and will probably be modified by the time full adoption is accomplished.

• **Dual-purpose, aerial rocket**—Development of a dual-purpose unguided rocket is in progress, patterned after the 2.75-in. FFAR "*Mighty Mouse*." JDA has funded the project through this fiscal year.

System manager for the project is Fuji Precision Industries, which also is producing rocket motor cases. Solid propellant, being developed by Nihon Yushi Co., will be a double-base type. Two companies are working on development of a VT fuze for the yet-unnamed rocket.

Toshiba Co. and Hokushin Electric Co. have both been experiencing troubles in the development program for the fuze, but unconfirmed speculation here holds that the contract will go to Toshiba.

Expected to be in use by mid-1962, the aerial rocket will probably not completely succeed the "*Mighty Mouse*"

as prime armament for JDA aircraft for some years.

Principal difference in the new JDA rocket will be in the stabilization method. The FFAR uses fins for stabilization; the JDA weapon will be spin-stabilized through use of propellant gases. Technical problems arising from this attempt at much better accuracy have caused slippage in the schedule.

Like the *Mat*, this weapon will cost more than its nearest foreign relative, but JDA feels that in both cases the additional accuracy will justify the cost. The new rocket will be used against both aerial and ground targets.

Launcher for the unguided weapon will be the F-86D and F-86F of the Japanese air force, which presently carry the *Mighty Mouse*. JDA has made the new rocket compatible with the fire control systems of both these aircraft and the missiles are interchangeable with all support equipment.

Estimated annual procurement of the new rocket may reach as high as 35,000 rounds when the new F-104J aircraft is put into service between now and 1965.

• **Replacing Sidewinder**—To equip the same three types of aircraft with a guided missile in the *Sidewinder* class, Fuji Precision Industries has been working on the *X-AAM-2*, an infrared-guided missile. In collaboration with electronics manufacturers like Nippon Electric and Toshiba, Fuji is attempting to have the weapon ready for squadron use by early 1963.

Using a solid-propellant rocket by Fuji Precision and Nihon Yushi, the *X-AAM-2* will be backed up by another missile using radar guidance, similar to the Hughes *Falcon* series. Both Doppler and pulse techniques are being evaluated on prototypes, and a choice is expected next year.

Until adoption of guided air-to-air missiles, JDA expects to use *Sidewinders*. Fourteen rounds have been delivered to Japan so far; an additional 150 rounds are expected.

A surface-to-air missile for area defense is planned. Both liquid- and solid-propellant motors are under consideration, but there are strong indications that the liquid-propellant development program will be dropped.

A liquid-propellant rocket system is being worked on at Mitsubishi Shipbuilding Co. Funds for continuation of research have been cut from the FY 1961 budget, and reinstatement is doubtful.

Mitsubishi Heavy Industries is developing the *TSAM-1*, a surface-to-air missile powered by a solid rocket from

Asahi Chemical Industries. Propellant for the solid version will be a composite type, ammonium perchlorate with plastic fuel and binder, including metallic additives. Initial flights are expected in 1962, with some acceleration anticipated thanks to the transfer of LPR development funds to the solid-propellant version.

A missile now in this class in JDA inventory is the Contraves Oerlikon GmbH of Switzerland surface air missile. This liquid-propelled weapon was purchased by JDA for evaluation. Ten missiles and one launcher were acquired.

License was granted to Mitsubishi Electric Co. for manufacture of a beam-riding missile, and the *TSAM* will have a beam-riding guidance system for test purposes until introduction of the *Nike* system, when command guidance will be emphasized. This is expected to occur sometime before 1962.

• **Only Tartar at sea**—The only shipboard missile presently scheduled for use by the Japanese Maritime Self Defense Force is *Tartar*, an anti-aircraft missile. A destroyer designed for the missile will be built within two years and special docks to be used in construction have already been started.

About 42 rounds of *Tartar* missile with associated equipment, will be delivered by the U.S. in time for the ship's construction schedule.

Of three such destroyers under consideration, only the one is firm as now. If all three are eventually built, 120 *Tartar* missiles with associated equipment will be ordered. The 2600-ton ships will be built at Nagasaki Mitsubishi Shipbuilding Co.

A 2.25-in. sub-caliber air-to-air rocket (*SCAR*) is scheduled for use aboard the P2V aircraft. Fuji Precision Industries will turn out the unguided rocket.

• **Target drones**—A design contract has been awarded to Kawasaki Aircraft Co. by JDA for a solid-propellant powered drone with eight minutes duration. A dual-thrust rocket motor is under development for this project by Dai Nihon Celluloid Co. Two prototypes are to be built initially, then six more for test and evaluation.

Another project is design of a ramjet-powered reconnaissance drone including a television camera. This supersonic vehicle, "*B-3 Revised*," has yet to be flight-tested. It is sponsored by JDA counterpart of the U.S.A.F. Air Research and Development Command. This organization, Technical Research Institute (TRI), has cognizance over many of JDA's advanced projects. Speculation is that the ramjet is a Kawasaki product, but no confirmation has been announced.



# Blue Water Will Boast 70-mile Range

Exclusive details of major new weapon scheduled to be operational in 1963; Sweden and Germany appear interested in the top-secret system

by Bernard Poirier

THE ENGLISH Electric *Blue Water* represents a major breakthrough in guidance state-of-art for one of our NATO allies.

The *Blue Water* has inertial guidance, mobility, solid fuel, and nuclear capabilities. Its relatively small size suggests that it could be carried on a multiple launching ramp. Its 70-mile range is only slightly less than that claimed for the U.S. *Sergeant*. Its speed is Mach 3. And it has been wrapped in one of the tightest security cloaks of any missile weapon system being developed in Europe.

—English Electric is the prime—but no one will admit making the guidance or propulsion.

—Germany is supporting its adoption by NATO—but no one will say if Germany will produce it if NATO does not.

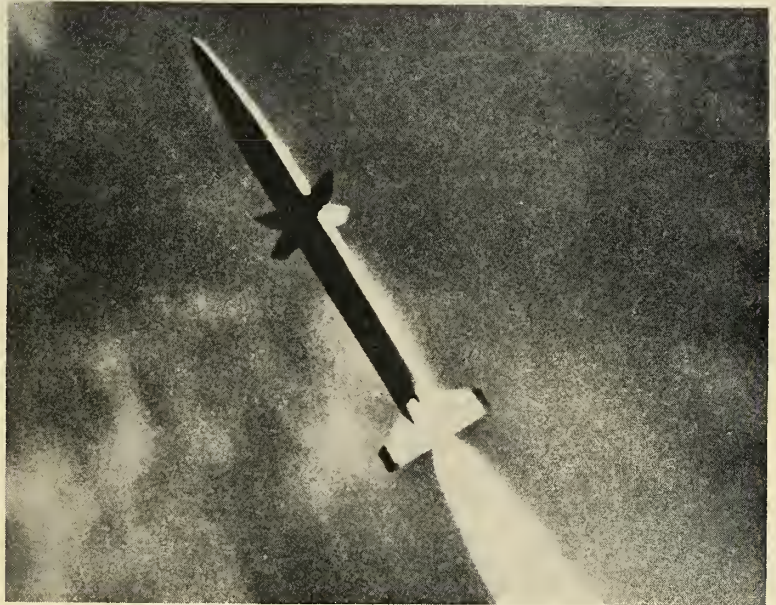
—The British Army has released one photograph of the missile—or a prototype; and no one will admit whether it is being flight-evaluated.

Woomera Range officials in Australia won't say they have seen it, let alone admit they might be testing it. A spokesman for the manufacturer isn't allowed to say if or where it has been, or will be, tested. In answer to queries, he replies, "I regret there is no further information available." Nevertheless, the *Blue Water* has all the ingredients of a truly refined tactical missile.

• **Blue Water warms Swedes** — English Electric—through its new parent organization, British Aircraft Corporation—describes the missile as lightweight, only 25 ft. long, 2 ft. in diameter, with a 6-ft., 9-in. wing span and a 6-ft., 5-in. fin span. It can be fired from a mobile carrier.

The British hope it will compete with the U.S. *Sergeant*, made by Sperry Gyro Engineering Lab. The *Sergeant* is operational, 36 ft. long, and has a range of around 80 miles. It can be carried by and launched from a Fruehauf transport vehicle. The U.S. Army has it deployed and it has been described as having both nuclear or high explosive warheads.

The *Blue Water* is in the develop-



FIRST PHOTOGRAPH of *Blue Water* surface-to-surface missile being developed by British Aircraft Corp.'s English Electric Aviation for the British Army.

ment and evaluation stage. British officials have been promoting its adoption by various European nations since early this year. Reliable sources close to the Swedish *Armén Markrobotar* Planning Group say Sweden is seriously studying this missile, but they discount any procurement plans before "the missile becomes operational in 1963." However, there are reports that West Germany has decided to buy it.

• Apparently the price and the promise are right—and it falls into the category of tactical weapons, meaning that West Germany is free to manufacture the missile in whole or in part under the terms of the World War II peace treaty.

Under the rules of the Treaty, West Germany can manufacture tactical and defensive weapons. It cannot manufacture strategic weapons, according to current interpretation of the pact.

The British have succeeded in making further details of the *Blue Water* as elusive as the details surrounding the original disappearance of its sparkling namesake—the *Blue Water* gem memorialized in *Beau Geste*. \*\*

## NRL Satellite

### A New Dimension in Study of Solar Storms

First continuous measurements of solar activity in X-ray and ultraviolet radiation are being transmitted by the U.S. Naval Research Laboratory's *Solar Radiation 1* satellite.

The satellite, orbited along with *Transit II-A* on June 22, has an expected operating lifetime of at least one year.

These solar weather reports can be correlated with ground-level observations to study behavior of the ionosphere as well as the mechanisms of solar storminess. NRL says the X-ray and ultraviolet monitoring satellite adds a new dimension to the study of solar storms, and permits monitoring the entire history of X-ray and ultraviolet emissions from start to finish. The sequence of early events in a solar flare storm is so fast that it was not possible previously to launch rockets in time to reveal the history of the flare's first few minutes.

# soviet affairs

By Dr. ALBERT PARRY

## How do you talk to the man in the spaceship

and he to you? This is asked by V. A. Sokolov, a Russian engineer, in a long article "The Spaceship-Satellite Is Speaking" in the August issue of *Nauka i Zhizn'* (Science and Life), published in Moscow by the All-Union Society for Dissemination of Political and Scientific Knowledge. This issue has just reached the United States. The Soviet author writes: "In order to make an astronaut's flight absolutely reliable and safe, Soviet scientists and engineers have yet to solve quite a number of complex problems and to foresee thousands of details, each of which demands close attention. One such problem is the creation of dependable, high-grade, uninterrupted, two-way communication between the astronaut and the Earth."

## The recent Soviet record

of successful radio- and tele-communication with the *Sputniks* and the *Luniks* is one reason why the Russians feel that "such contact with a spaceship via radio-lines can be brought about," Sokolov declares. But he points to "the many handicaps to be encountered by radio-waves between the spacecraft and the Earth." He names the ionosphere as chief of these hindrances. "In the non-ionized air the speed of the radio-waves' travel is steady; it equals approximately the speed of light," he said. "But in the ionized air radio-signals travel at a lesser speed. At that, the more frequently electrons and ions are encountered in the path of the wave, the more slowly does the wave push ahead."

## The lesser speed forces the radio-wave

off its course as it moves from a non-ionized area into one that is ionized, the author explains, adding: "The radio-ray, sent from the Earth to the spaceship, may not reach its destination when it is broken by the ionosphere in such a way that it is reflected by the ionosphere as if by a mirror. The radio-ray will then be returned to Earth."

This problem can be solved by correctly choosing the length of the radio-wave which the men on Earth use to keep in touch with the astronaut. This means setting the right frequency and making the right selection of the relaying and receiving antennas. In addition, everything possible should be done "to remove the signal's distortions" which may arise in the process of sending these radio-waves.

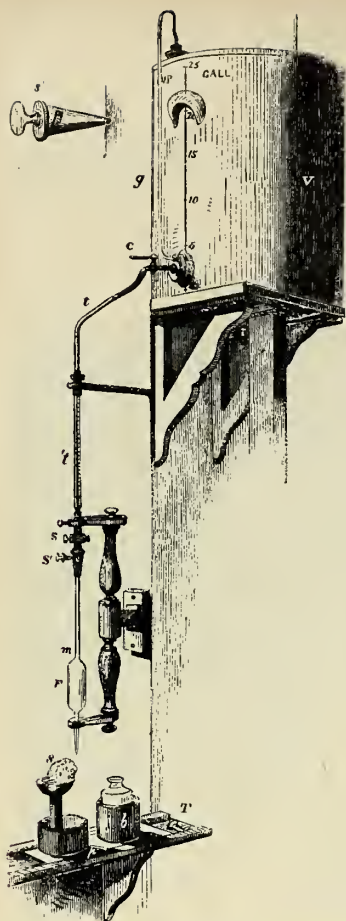
## What length should the radio-waves be?

Sokolov answers: "It is clear that in distances of outer space, waves longer than 100 meters must not be used, as they simply will not penetrate the ionosphere." He strongly recommends lengths between 10 and 100 meters. He mentions the wave of 15 meters as proving the best in communications to and from *Sputniks*. Waves shorter than 10 meters can also be utilized, but in such cases either "*Sputniks* playing a relaying role should be introduced" between the spacecraft and the Earth, or the Earth should be covered with a network of receiving stations "situated in such a way as not to lose the spaceship out of the field of sight."

This last-mentioned system would work very well if all such stations are connected by radio-lines with one central point of communication. In time, man can also use the Moon as a relay communication point—by establishing an automation relay station on its surface.

## To facilitate cosmic communication

the Russian engineer suggests, among other things, "a two-frequency system: one wave length from the Earth to the astronaut; the other, from the astronaut to the Earth." Clarity of voice messages at such great distances will be hard to achieve, and Sokolov lists reasons why this will be so. But he concludes that no matter how complicated each new problem, "it, too, will be successfully solved by our engineers and scientists."



## PHYSICAL SCIENCES

Another area  
of advanced inquiry at UTC

A comprehensive study of the basic phenomena in propulsion systems and their interaction with the environment is being conducted by a staff with unusual capabilities at United Technology Corporation's new multi-million-dollar research and development complex in the San Francisco Bay Area.

Specifics under investigation include:

- Steady and non-steady burning of solid composite and liquid propellants
- Detonation and explosive phenomena
- Aerothermodynamics of nozzle performance of two-phase gases involving the study of transport phenomena, adiabatic expansion laws, nucleation, phase lag, and radiation.

New concepts of major significance are evolving from this research.



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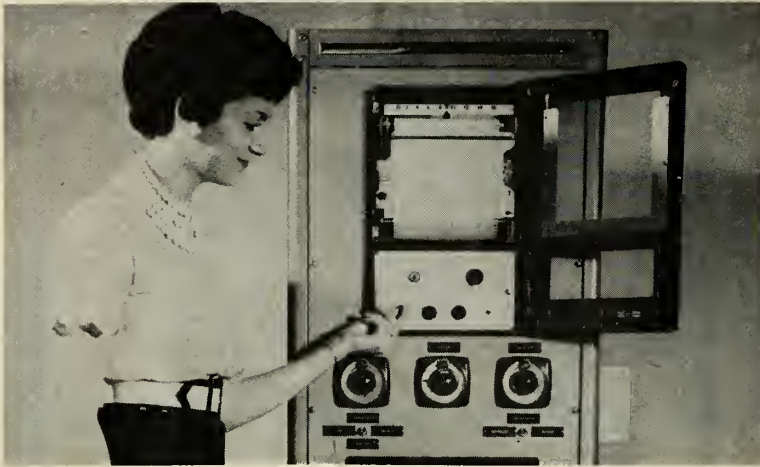
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## Flexible Process Control Assembly

A highly-flexible control facility, (Controlall), is being manufactured by Leeds & Northrup Co. This Assembly has been specifically designed for use in pilot plants, research laboratories and plant processes where there is need for a flexible system adaptable to practically any type of control problem.

The Controlall Assembly consists of a Speedomax H instrument, any one of three interchangeable Series 60

Control Units—C.A.T. (Current Adjusting Type), P.A.T. (Position Adjusting Type) or D.A.T. (Duration Adjusting Type), a programmer and a timer and interrupters all mounted in an enclosed mobile relay rack.

The Controlall Assembly is extremely versatile in operation. It can be used as a set-point, cam program or time rate controller.

Circle No. 225 on Subscriber Service Card.

## Electron Beam Shield

An 18 piece Netic Co-Netic magnetic shield which acts as a divisionary shield against magnetic effects reacting on an electron or proton beam being conveyed axially thru the center of the shield has been developed by Magnetic Shield Division, Perfection Mica Co. The Netic Co-Netic alloys are stable in vacua, therefore the entire assembly can be incorporated in a system that has to be evacuated. Removable tabulations extend beyond the perimeter and end cap to further increase shielding effect in the area of necessary access holes.

Circle No. 226 on Subscriber Service Card.

## Ultra-Vacuum Ion Pump

A line of ultra high vacuum ionization pumps has been developed by Hughes Aircraft Co.

The ion pumps, manufactured in several sizes, contain no moving parts, refrigerants, traps, oils nor heating elements. One model in the new line is a compact, lightweight six-liter pump that is only one-fourth the size of

conventional units with the same capacity. It pumps at the rate of six liters a second, can achieve pressures of less than  $10^{-9}$  mm Hg in either metal or glass vacuum systems, and can be used concurrently as a vacuum gauge.

Circle No. 227 on Subscriber Service Card.

## Miniature Clutch

A high-efficiency miniature magnetic clutch with a minimum torque rating of 10 oz.-in. at speeds to 1000



rpm is now available in four voltage ranges from Ultronic, Inc.

Torque loss with stainless ball bearings is less than 0.3 oz.-in. Field shaping and the steel-to-brass clutch face enables the clutch to deliver up to 100% of the load at 2.5 watts.

Circle No. 228 on Subscriber Service Card.

## Pulsation Eliminator

Pump pulsations are reduced to 1% or less of system pressure by a device known as a "High Pressure Ripple Filter," available from Auto-Contr Laboratories, Inc. The "High Pressure Ripple Filter" is a pump pulsation eliminator and noise trap for all classes of liquid pumps.

The device has no moving part contains no elastomer or flexible seal members, and is compatible with all liquids. The units are available in unlimited flow ranges, working pressure to 25,000 PSI, and temperatures from  $-450^{\circ}$  to  $1000^{\circ}$ F.

Circle No. 229 on Subscriber Service Card.

## Flux-Coated Brazing Alloy

Flux-coated silver-brazing-type alloy which will cut brazing time by two thirds through elimination of separate flux, is available from Eutectic Welding Alloys Corp. EutecSil 1020Flux eliminates the need for flux mixing and application and reduces the need for pre-cleaning and pre-heating.

Circle No. 230 on Subscriber Service Card.

## Universal Fatigue Tester

A Tatnall-Krouse Universal Testing Machine for combination fatigue testing has been put on the market by the Instruments Division of The Budd Co.

Labelled the Model LAZ-1, the new machine incorporates the fatigue testing principles of Dr. B. J. Lazan of the University of Minnesota. The machine provides for static or dynamic testing on a selective basis; creep or fatigue work may be accomplished with either of the machine's two sections: the static unit (LAZ-1S), the dynamic unit (LAZ-1D), or both.

Circle No. 231 on Subscriber Service Card.

## Sonic Delay Lines

Versatile wire sonic delay lines, with improvements in insertion loss, bandwidth, temperature stability and package size, are available to military electronics design engineers through General Electric Co.'s Heavy Military Electronics Dept.

The Delay Lines operate on the



physical principles involved in the propagation of ultrasonic stress waves through a special alloy wire. They can provide long delays per unit length of transmission line—all the way from 2 microseconds to 20 milliseconds!

Circle No. 232 on Subscriber Service Card.

## Gaussian Noise Generator

Automation Laboratories, Inc. is producing a signal generator which accurately produces a low frequency Gaussian output voltage.

The Gaussian Noise Generator has a flat output frequency spectrum which is flat to within one db from DC to



500 cps (Model 100-A) or DC to 500 cps (Model 100-B). The output signal is Gaussian to within 1% and is 5 volts rms, regulated to within 0.1 db. A continuously adjustable attenuator is provided to decrease the output voltage from this value. Output impedance is 200 ohms.

Circle No. 233 on Subscriber Service Card.

## Sound-Level Meter

A fully transistorized, battery-operated, sound-level meter weighing only 4 lbs. with patented, high impedance input, is being produced for The Kor-



miles and rockets, October 17, 1960

fund Co., Inc. by Dawe Instruments, Ltd., London.

Type 1400E, a self-contained acoustical instrument, features exceptional accuracy, stability, and sensitivity, giving direct readings of sound-pressure levels over the entire audio range from 24 db. to 140 db., on its 5 in. wide meter dial. Its transistors virtually eliminate microphonics.

Circle No. 234 on Subscriber Service Card.

## Argon Stable Cathode

An argon-stable cathode for Vaclon high-vacuum pumps has been developed by Varian Associates.

The pumping element containing the argon-stable cathode retains the simple diode construction of the standard Vaclon high-vacuum pump. The same power supplies or control units are used for either version of the pump and all replacement parts are interchangeable. The new pumping element is available in the entire range of sizes of the standard Vaclon high-vacuum pump including pumping speeds from one liter per second to 10,000 liters per second.

Circle No. 235 on Subscriber Service Card.

## Microwave Absorbers

B. F. Goodrich Sponge Products is marketing both hair and foam type microwave absorbers backed with flexible magnetic strips, designed to simplify installation in shielded anechoic test chambers having ferrous metal walls.

This permanent plastic magnet, a BFG KOROSEAL product, eliminates the use of adhesives, brackets, etc., thereby reducing installation time and costs. The BFG Microwave Absorbers can be readily removed from a chamber for temporary use in other experiments.

Circle No. 236 on Subscriber Service Card.

## Rugged Thermocouple Wire

Amperex Electronic Corp. is marketing "Thermocoax," a high temperature thermocouple wire for measuring temperatures from -200° to 1300°C. It is available in unprecedented lengths of up to 650 feet, and can be hammered, flattened and bent to extremely sharp angles with no short circuiting, loss of insulation, or rupturing of the sheath of inner conductors.

Circle No. 237 on Subscriber Service Card.

## RTV/Epoxy-Si Rubber

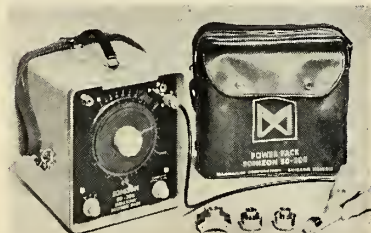
A series of materials termed Eccosil has been introduced by Emerson & Cuming, Inc. They are room temperature vulcanizing (RTV) silicone rubbers and epoxy-silicone rubber combina-

tions. The materials are featured by electrical excellence, particularly at elevated temperatures. As received, all are easily poured. Cures are simple. Eccosil 4640 is a silicone rubber formulation which is extremely low in weight—it is roughly 1/3 that of other commercially available materials.

Circle No. 238 on Subscriber Service Card.

## Portable Thickness Gage

A complete transistorized battery-operated ultrasonic instrument for measuring wall thickness between 0.025 and 2.50 in. has been added to the broad line of test systems available from Magnaflux Corp. The portable unit, design-



nated Sonizon SO-300, gives instantaneous reading by simply placing a transducer on the surface to be measured and turning a dial.

The unit measures with an accuracy of  $\pm 1\%$  when calibration is checked during tests against known sample of the same material. Three knobs provide complete control of the entire test procedure.

Circle No. 239 on Subscriber Service Card.

## High Frequency Meter

An ultra-high-frequency meter (Model 707, EV) produced by Electronic Ventures requires no cables, no external power supply, and no direct electrical connection to the circuit under test. With a frequency range of 400 to 800 megacycles and a sensitivity of 5 microwatts, Model 707 has an accuracy within  $\frac{1}{2}\%$  of 1%. It measures only  $1\frac{1}{2}$  in. diameter x  $10\frac{5}{8}$  in. length including a built-in probe. The direct-dial read probe is designed for accessibility to confined spaces.

Circle No. 240 on Subscriber Service Card.

## Silicone Insulating Tape

Continental-Diamond Fibre Corp., a Subsidiary of The Budd Co., has available a line of self-adhering unsupported silicone rubber insulating tapes.

Designated as CDF Level-Wrap tapes, they feature triangular cross sections that permit them to be readily wound on irregular shapes. Each tape is as thick at its apex as the required total insulation thickness. When wrapped

in overlapping halves, the tapes give smooth, even external surfaces. A colored center line guides the wrapping and overlapping.

Circle No. 241 on Subscriber Service Card.

## Cryogenic Dynamic Seal

A Cryogenic dynamic seal for use in O ring grooves with no leakage at temperatures from  $-423^{\circ}\text{F}$  to  $400^{\circ}\text{F}$  in contact with liquid hydrogen, nitrogen or oxygen is available from Balsells Engineering Co. The extreme flexibility of the seal makes assembly into an O ring possible. The seal consists of a seal ring made of teflon and a spring made of stainless steel which is oval in cross section and is wound at a slanted angle to provide the load required for good sealing.

Circle No. 242 on Subscriber Service Card.

## Amplitude Analyzer

Automation Laboratories, Inc. is now producing an Amplitude Distribution Analyzer which provides a direct reading of the amplitude probability distribution of the complex or random signals that occur in the design and test of false alarm and threshold circuits and in radar and infrared systems.

The analyzer, Model 200, measures the percentage of time that the signal



to be analyzed exceeds a known threshold. The reading is indicated by a meter calibrated in percentage. The threshold, which is calibrated internally with a known signal, is accurately adjusted by a helipot. The amplitude probability distribution of a signal can be determined to one percent.

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## new literature

**SCHLIENEN PHOTOGRAPHY TECHNIQUE**—A publication, which describes and illustrates the schlieren photographic technique for the study of the flow of gases, is now available from Eastman Kodak Co. The 20-page publication covers optical details of schlieren equipment, arrangement of components, accessory equipment, adjustment of the schlieren system, and photographic materials required. It is illustrated with diagrams of various schlieren methods, includes formulas to determine optical relationships, and provides examples of schlieren photographers.

Circle No. 200 on Subscriber Service Card.

**MAGNETS**—A permanent loose-leaf catalog listing stock permanent magnets manufactured by General Magnetic Corp. is available. The catalog incorporates all characteristics of new designs in multiple casts, blocks, bars, cylinders (solid and hollow) salient pole (internal and external radii), curved path and Genox® (ceramics) permanent magnets.

Circle No. 201 on Subscriber Service Card.

**SPACE AGE METALS**—A brochure published by the Lunex Co. describes and defines the properties of 16 high-purity, rare earth metals, most of which are available and are being used in the development of highly specialized products and metals. The application of high-purity rare earth metals as scavengers and alloying agents has improved mechanical and physical properties of both ferrous and non-ferrous materials.

Circle No. 202 on Subscriber Service Card.

**HIGH-PRECISION COMPONENTS**—Kearfott Division of General Preci-

sion, Inc. has published two new technical texts on the construction, performance, application, and testing of high-precision components. ("Technical Information for the Engineer—Servo Motors, Motor Generators, Synchros," describes in detail important technical aspects of servo components and their use in systems. The second text, "Technical Information for the Engineer—Gyros," discusses theoretical considerations of gyroscopic instruments and details performance, application, construction and testing of such instruments as gyros, rate integrating gyros, switches, free gyros, vertical gyro directional gyros, stable platforms, accelerometers.

Circle No. 203 on Subscriber Service Card.

**SPECTROGRAPHIC CONTROL**—Lebanon Steel Foundry has published a technical bulletin on spectrographic metallurgical control and its application to high-alloy steel castings. The bulletin discusses the advantages of spectrographic analysis as compared with conventional "wet" chemical analysis, and outlines the benefits to steel castings user through increased accuracy of analyses, production speed and uniform control and dependability of the end product.

Circle No. 204 on Subscriber Service Card.

**AEROSPACE FUSION WELDING**—Sciaky Bros., Inc. has published a part of developments in highly precision automatic fusion welding equipment. Featured within this 27-page report are actual applications with Automatic Fusion Welding equipment has been in use for the past two years in North American Aviation's B Program, Raytheon's Hawk process, as well as others. Equipment descriptions are also contained.

Circle No. 205 on Subscriber Service Card.

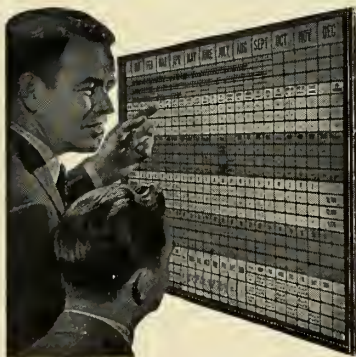
**AEROSPACE FASTENERS**—Rapid identification of more than 160 standard aerospace fasteners, by configuration, specification number and general name, is provided in a 10-page reference listing published by Standard Pressed Steel Co., Aircraft & Missile Div. The brochure consists of an eight-page directory of 133 National Air Standard (NAS), Air Force-Navy Aeronautical (AN) and Military Standard (MS) fasteners and related parts.

Circle No. 206 on Subscriber Service Card.

**EDGEGRAPHING**—A new technique for hand analysis of complex engineering data in 10, 20, or more variables is included in 16 pages of technical literature available from Statistical Engineering Institute.

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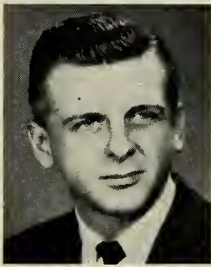
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# names in the news



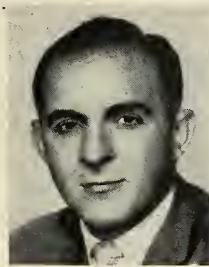
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MERL

**John Manniello:** Appointed to the new position of director of marketing for CBS Laboratories, a division of Columbia Broadcasting System, Inc. Was formerly manager of systems sales for Fairchild Camera and Instrument Corp.'s Defense Products Div., and prior to that manager Fairchild's Washington, D.C., office.

**Charles S. Ames Jr.:** Former chief project engineer and veteran member of the Atlas missile team, named program director-Atlas at Convair a division of General Dynamics Corp.

**Dr. Henry L. Richter, Jr.:** Joins Electronic Systems, Inc., as manager of the company's newly formed Advanced Electronics and Information Systems Division. Was previously chief of the Space Instruments Section of the Space Sciences Division of Cal Tech's Jet Propulsion Laboratory.

**Anthony Solazzo and Allen Sheets:** Research chemist and metallurgist, respectively, join the staff of National Beryllia Corp.'s Research and Development Div. Solazzo comes from the research division of Curtiss-Wright Corp. where he did R&D on ceramic and nuclear reactor fuel elements. Sheets was formerly with Pratt & Whitney Aircraft Corp.'s Material Development Laboratory.

**Kurt Merl:** Joins United Aircraft Corp.'s Norden division as supervisor of digital navigation computers, responsible for analysis, design and development of advanced methods for navigational systems using digital techniques. Was formerly head of the engineering department of airborne equipment at Sperry Rand Corp.'s Ford Instrument Co.

**Edward P. La Kaff:** Appointed chief engineer for Borg-Warner Corp.'s EM-COR Ingersoll Products Div. Was formerly design engineer for the Roy C. Ingersoll Research Center.

**Harry L. Hildebrand:** Promoted to manager of Process and Design Engineering at Taylor Fibre Co. **John G. Musselwhite, Jr.,** former general machining foreman at SKF Industries, succeeds Hildebrand as manager of the Fabricating Division.

**Lt. Col. Richard R. Prewitt (USA-ret.):** Former Deputy to the Logistical Service Div., Army Reserve and R.O.T.C. Affairs, at the Pentagon joins C-E-I-R, Inc. as assistant to the president, **Herbert W. Robinson.**

**Richard W. Benfer:** Director of Bell Telephone Laboratories' White Sands installation since 1953, promoted to department head and named director of the recently established Kwajalein Island Field Station, responsible for the Nike-Zeus test program there. **Louis H. Kellogg,** Missile Systems Development engineer, succeeds Benfer at White Sands.

**Richard A. Poyda:** Appointed vice president of marketing and sales for Faradyne Electronics Corp. directing functions of the Semiconductor, Capacitor and Page-Madden Divisions, as well as the seven affiliate companies which comprise the corporation.

**Walter I. Shevell:** Group manager of the Gyro and Servo Component Divisions of Giannini Controls Corp., elected vice president.

**Neville W. James:** Former member of the Atlantic Refining Co.'s research and development staff, joins International Resistance Co. as reliability-quality control engineer.

**Dr. Marvin E. Krasnow:** Appointed manager of the newly created technical products division of The Hallicrafters Co. Was previously manager of the chemistry and physics laboratory at Inland Testing Laboratories, a division of Cook Electric Co.

**George M. Bunker, Clarence W. Miles and Maxwell B. Bassett:** Three executives of The Martin Co., elected to membership on the board of directors of the Nuclear Corporation of America.

**Jack H. Frailey:** Elected director of the Programs Division of the Information Technology Laboratories, a division of Itek Corp. Was formerly manager of missiles systems in the Missile Electronics and Control Div. of RCA. Also served as project director of the X-7A ramjet test vehicle and Polaris missile programs at Lockheed Aircraft Corp.

**Victor P. Kovacik:** Formerly Research Requirements manager for the Tapco Group of Thompson Ramo Wooldridge Inc., moves into Tapco's New Devices Laboratories to direct preliminary design activities.

**Roy E. Godfrey:** Appointed deputy director of the Systems Analysis and Reliability Div. of the NASA George C. Marshall Space Flight Center. Was formerly deputy chief of the division's mechanical branch.

**Stanley C. Farrow:** Appointed resident engineer in the Huntsville, Ala., area for Emerson Radio & Phonograph Corp.'s Government Electronics Div. Was chief of the Mechanical Test Facilities Section, Industrial Operations, Engineering Div., Army Rocket and Guided Missile Agency.

**Donald A. Forbes:** Joins Corning Glass Works as chief development engineer in the Ceramic Dept. of the Electrical Products Div. Was formerly vice president and director of research at Hamilton Porcelains, Ltd.

**Harry A. Pearl:** Named supervising engineer of the materials laboratory at Republic Aviation Corp.'s new Research and Development Center. Was previously chief materials engineer for Bell Aircraft's Engineering and Research Laboratories.

**Dr. Gerald E. Pokorny:** Joins the staff of Litton Industries' Electron Tube Div., as a senior scientist in the division's research laboratory.

**Dr. Martin J. Swetnick:** Joins NASA as director of instrumentation of the lunar and planetary exploration programs. Was formerly chief physical scientist for the Defense Atomic Support Agency's Radiation Division.

**Ralph A. Escibano:** Former senior electronics engineer for Ets-Hokin & Galvan Inc., appointed manager of engineering sales and advertising for Delta Design Engineers, Inc.

**Frank G. Marble:** Former vice president and general manager of Boonton Radio Corp., a Hewlett Packard subsidiary, joins Systron-Donner Corp. as assistant to the president.

# contracts

## NASA

The Budd Co., Philadelphia, for development, design and fabrication of the stainless steel structure of the S-6 atmospheric satellite. Amount not disclosed.

\$23,000,000—Grumman Aircraft Engineering Corp., Bethpage, L.I., N.Y., for development of an eight-sided satellite, 9½ ft. high and 6½ ft. in diameter, weighing 3200 lbs. (Being negotiated).

## NAVY

Ford Motor Co's Aeronutronic Div., for comprehensive study of potential hazards involved in launching missiles. Amount not disclosed.

Laboratory for Electronics, Inc., Boston, for continued "research in ferromagnetics with applications to new storage devices."

\$41,303,720—General Dynamics Corp.'s Convair Div., for production of *Tartar* supersonic surface-to-air missiles. Will be produced at the Naval Weapons Industrial Reserve Plant, Pomona, Calif.

\$3,500,000—Aircraft Armaments, Inc., Cockeysville, Md., for development, manufacture and installation of an antisubmarine warfare training facility at Pearl Harbor.

\$250,000-plus—Pickard & Burns, Inc., Needham, Mass., for evaluation of equipment performance of the Navy communications center now nearing completion on the edge of Machias Bay.

\$100,000—George Rattray & Co., Inc., Hicksville, N.Y., for precision potentiometers.

## ARMY

\$4,277,000—Bulova Research & Development Laboratories, Woodside, N.Y., for further work on the warhead section of the new "shoot-and-scoot" *Pershing*. Subcontract from The Martin Co.

\$855,963—IGG Kellogg, div. of IT&T Co., Chicago, for *Atlas* and *Titan I* blast detection systems.

\$850,000—Packard Bell Electronics Corp., Los Angeles, for production of various electronic subsystems of a radio relay communications system used by field armies.

\$68,632—Raytheon Co., Waltham, Mass., for concurrent repair parts for the *Hawk* system.

\$67,397—C. A. Meyer, Orlando, Fla. for construction of *TM 76A* RFM launch pad trench complex.

## AIR FORCE

Hamilton Standard Div., United Aircraft Corp., Windsor Locks, Conn., for ground air conditioning carts for *Titan I*. Subcontract from The Martin Co. Amount not disclosed.

Elliott Engineering Co. Inc., Lynwood, Calif., for development of aluminum bellows for the *Titan*. Subcontract from The Martin Co.—Denver. Amount not disclosed.

\$2,352,788—Air Products, Inc., Allentown, Pa., for propellant oxygen and/or nitrogen. (Two contracts).

\$1,000,000—Space Electronics Corp., Glendale, Calif., for development of electronic and electrical systems for the *Ablestar* second-stage booster to be used for future launchings of *Transit* and *Courier* satellites. Subcontract from Aerojet-General Corp.

\$940,000—General Electric Power Tube Dept., Schenectady, for building 40 high-power, long-life klystrons for the FPS-7 radar system.

\$421,180—John E. Fast & Co., Chicago, for development and manufacture of capacitors to be used in the inertial guidance and control systems of the *Minuteman*.

\$153,362—Convair Div., General Dynamics Corp., San Diego, for spare parts applicable to airborne rocket launchers.

\$100,000—Avion Inc., Antenna Dept., Woodside, N.Y., for construction of a radical new type of modular antenna system for use in the first unmanned automatic missile and satellite tracking station to be built by the AF.

## MISCELLANEOUS

Space Technology Div. of Guardite Co., Wheeling, Ill., for designing and building a new hyper-environmental space simulation test chamber for Lockheed Aircraft Corp.

\$428,000—Dynamic Developments, Bethpage, N.Y., for design and development of a set of high speed, super-cavitating, submerged hydrofoils. Awarded by U.S. Maritime Administration.

## reviews

RESEARCH IN RADIATION DAMAGE IN SEMICONDUCTORS, J. W. Harrity and others, Order PB 161673 from Office of Technical Services, U.S. Dept. of Commerce, Washington 25, D.C. 157 pp., \$3.

A diode resistant to nuclear radiation damage was constructed in this research program as the result of extensive studies of nuclear irradiation effects on semiconducting materials.

The diode uses p-type germanium with resistivity of about 0.20 ohm-cm as the base material. Principal object of the study was to determine the mechanisms by which radiation degrades semiconductor devices.

The researchers state that one of the most significant accomplishments of the program was the development of the instrumentation and techniques of measurement used with the General Atomic electron linear accelerator. Results acquired by their experiments demonstrate that performing detailed measurements while the sample is being irradiated can be accomplished with minimum use of expensive accelerator and reactor time.

BASIC CARRIER TELEPHONY, David Talley, John Rider, Inc., New York, 176 pp., \$4.25.

This book's early chapters cover telephone carrier definitions and carrier system fundamentals—speech characteristics, the phenomena of modulations, demodulations and sidebands, and the different types of filter networks used in carrier telephony.

Having established telephone definitions and notations, the author goes into carrier telephony circuitry, discussing special types of modulators, carrier con-

trols, and switching. Final chapters with carrier system operations, describe the operation of the carrier channel; voice channel in four-wire carrier terminals and two-wire carrier channel operations.

SPACE BIOLOGY: THE HUMAN FACTOR IN SPACE FLIGHT, James S. Hanrahan, David Bushnell, Basic Books, Inc., New York, 263 pp. \$6.

The authors present a very thorough discussion of the biological problems confronting the space traveler, including history of the experiments contributing present knowledge. Drs. Hanrahan and Bushnell are scholar-historians at Holloman Air Force Base in New Mexico, one of the principal centers of research in the field, but the work is written in non-technical, narrative form.

HANDBOOK OF CHEMISTRY AND PHYSICS, forty-second edition, The Chemical Rubber Company, Cleveland, Ohio, 3400 pp. \$12.50.

This continually revised book is the only one-source reference in the world covering Mathematics, Physics and Chemistry in a single volume.

Over 200 experts have contributed the edition, which includes new tables: Diffusion of Metals into Metals, Interplanetary Orbits, and Standard Types of Stainless Steel, among many other subjects.

CERMETS, Edited by J. R. Tinklepaugh and W. B. Crandall, Reinhold Publishing Corp., New York, 239 pp., \$9.50.

The editors have followed the major areas of emphasis in cermets in the United States with the idea that the detailed information pertaining to titanium carbide and aluminum carbide might be applied to other cermets.

No effort has been made to include the European effort in this field. The physical chemical aspects of cermets are well covered. Through this the reader may become acquainted with the relationships between ceramics and metals which govern the selection of materials and the properties obtained. Surface energy as related to cermet theory is traced in considerable detail.

SYNTHESIS OF NEW HIGH TEMPERATURE MATERIALS, J. L. Engelke and others, Order PB 161720 from Office of Technical Services, U.S. Department of Commerce, Washington 25, D.C. 44 pp., \$1.25.

This research project was set up to study a number of mixed-transition metal carbides, borides, and nitrides as a basis for development of materials able to withstand severe operating conditions at ultra-high temperatures.

An impressive shock technique valuable for the synthesis of compounds which require high pressure to prevent thermal decomposition of metal was developed.

The report points out that much new knowledge is required in the field of high temperature chemistry. For example, an adequate theory of bonding is needed in order to predict new stable compounds.



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## OCTOBER

- Joint Meeting, Institute of the Aeronautical Sciences and Canadian Aeronautical Institute, Queen Elizabeth Hotel, Montreal, Oct. 17-18.
- ASME-ASLE Lubrication Conference, Statler-Hilton Hotel, Boston, Oct. 17-19.
- 42nd National Metal Exposition and Congress, Trade and Convention Center, Philadelphia, Oct. 17-21.
- American Ceramic Society, 13th Pacific Coast Regional Meeting, Ambassador Hotel, Los Angeles, Oct. 18-21.
- Annual Meeting, Society for Experimental Stress Analysis, Hotel Claremont, Berkeley, Calif., Oct. 19-21.
- Symposium on Space Navigation, Institute of Radio Engineers, Deshler-Hilton Hotel, Columbus, Ohio, Oct. 19-21.
- Conference on Hypervelocity Projection Techniques, University of Denver, Institute of the Aeronautical Sciences, Denver, Oct. 20-21.
- ASME-American Society of Mining, Metallurgical and Petroleum Engineers, Fuels Conference, Daniel Boone Hotel, Charleston, W.Va., Oct. 24-25.
- Medical and Biological Aspects of the Energies of Space Symposium, sponsored by USAF Aerospace Medical Center, (ATC) Granada Hotel, San Antonio, Tex., Oct. 24-26.
- Seventh Annual East Coast Conference on Aeronautical and Navigational Electronics, Lord Baltimore Hotel, Baltimore, Oct. 24-26.
- Government Contracting Course, National Defense Education Institute, sponsored by NSIA and Harbridge House, Inc., Detroit, Oct. 24-Nov. 4.
- 11th National Conference on Standards, Sheraton-Atlantic Hotel, New York City, Oct. 25-27.
- 1960 Computer Applications Symposium sponsored by Armour Research Foundation, Morrison Hotel, Chicago, Oct. 26-27.
- IRE Professional Group on Electron Devices Meeting, Shoreham Hotel, Washington, D.C., Oct. 27-28.
- IRE, 13th Annual Conference on Electrical Techniques in Medicine and Biology, Sheraton-Park Hotel, Washington, D.C., Oct. 31-Nov. 2.

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## Get the Issue into the Open

**T**HE PROBLEMS OF the United States lie uneasily all over the world today.

They are the problems of the new African states, of civil war in Indonesia, of Laos and Algeria, the strangulation of Berlin and the slavery of the Soviet Satellites.

They are punctuated by the hand-hammering of Khrushchev as he tries to control the United Nations or destroy it, as he threatens unilateral action of Russian military forces.

They are problems of diplomacy but they are more than that. They are problems of prestige and strength.

Military strength has been called the extension of diplomacy. Prestige, then, is the morale of diplomacy—confidence or lack of it.

The state of our military strength and the state of our world prestige are the two overriding factors in the struggle this nation is involved in today—the cold war against Communism.

Our international prestige is lower today than at any time in memory. Our military strength is at best a question mark when compared with that which might be hurled against us.

Prestige today depends on many things; one of the greatest of these—perhaps the greatest—is supremacy in the race for space. Defense is strength in being. The two of these are inextricably linked, a fact which is well understood, particularly by the leaders of the Russian military.

Two weeks ago we at MISSILES AND ROCKETS wrote an open letter to the two presidential candi-

dates. We proposed a nine-point program which we offered as a starting point from which our defense/space program could progress to leadership.

We said that the defense/space issue was one of the most important of the campaign and that it had not been discussed; that the public did not clearly understand the issue. We urged the candidates to bring it out into the open.

Senator Kennedy replied to our letter, a reply which was carried in last week's issue. Vice President Nixon has promised a reply which we hope to carry in our magazine of Oct 24.

**F**ROM THE LETTERS we have received (Page 13) it is obvious there is a tremendous interest in the state of our defenses and in the race for space. The public is concerned.

The letter from Senator Kennedy made his stand known to the voters. We hope and expect that Vice President Nixon's will do the same.

This is an excellent start. We are proud that we have started the movement to bring the defense/space issue out into the open—but this is not enough.

Each candidate should and must devote a major speech to the subject so that it can be reported by the nation's great mass media. He should recognize that our position in the world and perhaps our survival is at stake. He should spell out his views in full detail. All of the voters have a right to know.

**Clarke Newlon**



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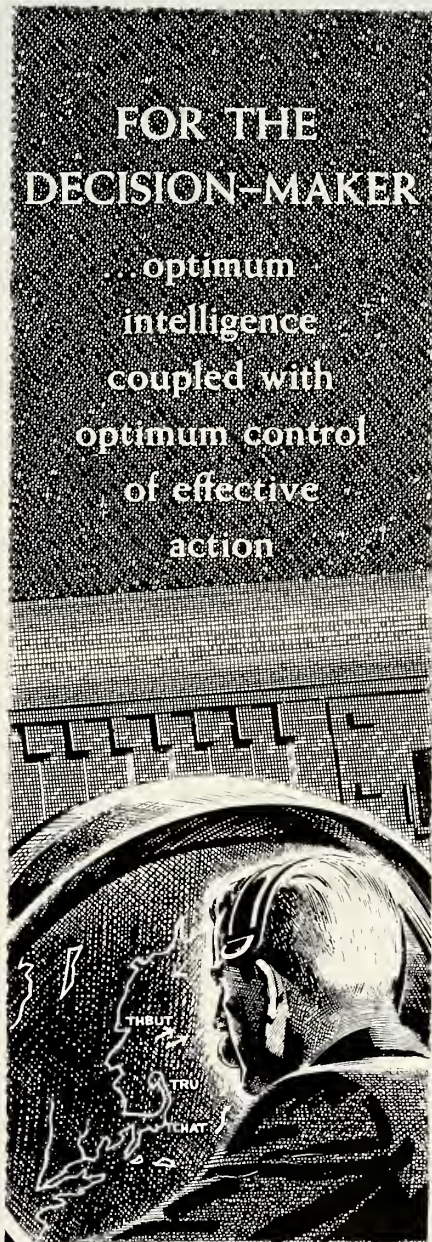
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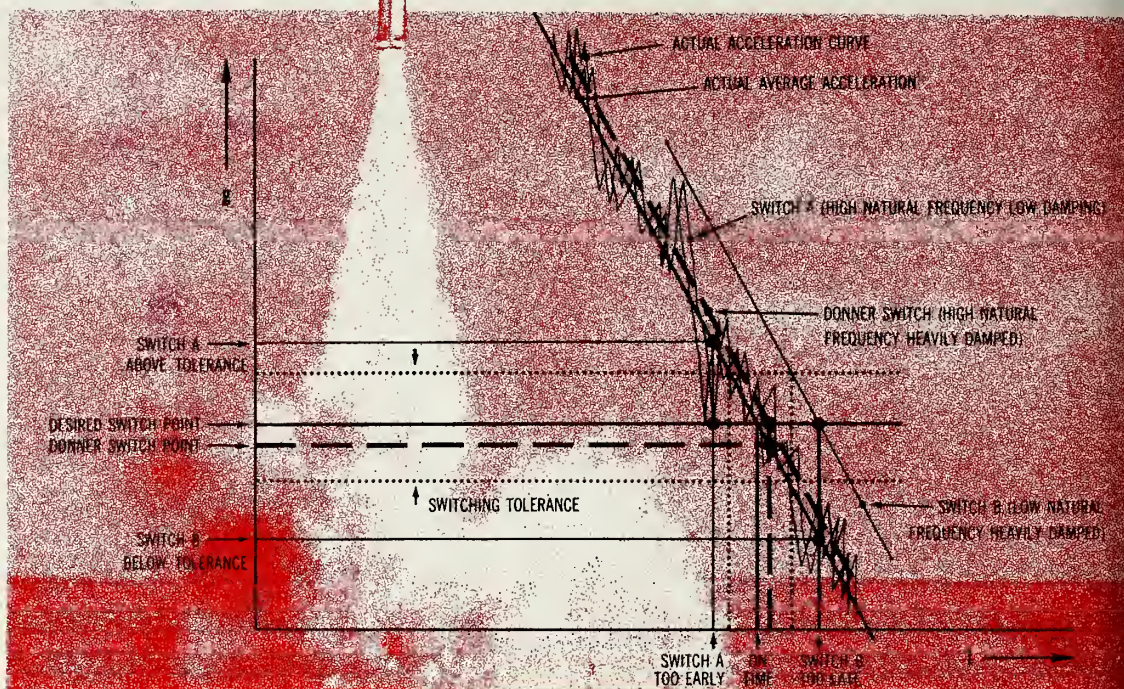
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# There's only one reason to specify Donner acceleration switches



## ..BECAUSE THEY UNDERSTAND THE MEANING OF ACCURACY

It's dynamic accuracy that counts. In truth, several firms make precision acceleration switches. But accuracy, like reliability, is a term with shades of definition. Some switches are accurate in the lab or on the test bench. That is, they provide *static* accuracy. Donner acceleration switches give you accuracy where it counts, on the operational missile. They are *dynamically* accurate.

Look at the graph above. Under static conditions, switch "A" with a better switching response, might be desirable. But suppose the missile were experiencing a 10 g vibration of a high frequency nature and proper thrust cutoff depended on detecting a 2 g switch point. Switch "B" would eliminate the problems of early switching, but introduce intolerable phase shift which in turn would make the switch "see" the event after it actually occurred. In other words, under the dynamic conditions of missile and aircraft flight, it is absolutely necessary to know when an event occurred rather than precisely where it occurred. Frequency response becomes a more important consideration than switch accuracy.

Heavily damped, with a high natural frequency, Donner acceleration switches have low phase shift providing the transient response necessary to follow rocket engine

operation and perform their task with meaningful accuracy.

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Because of the inherent flexibility of Donner's basic accelerometer servo system and associated electronics, Donner acceleration switches will satisfy virtually any requirement.

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