# Aviation Week & Space Technology

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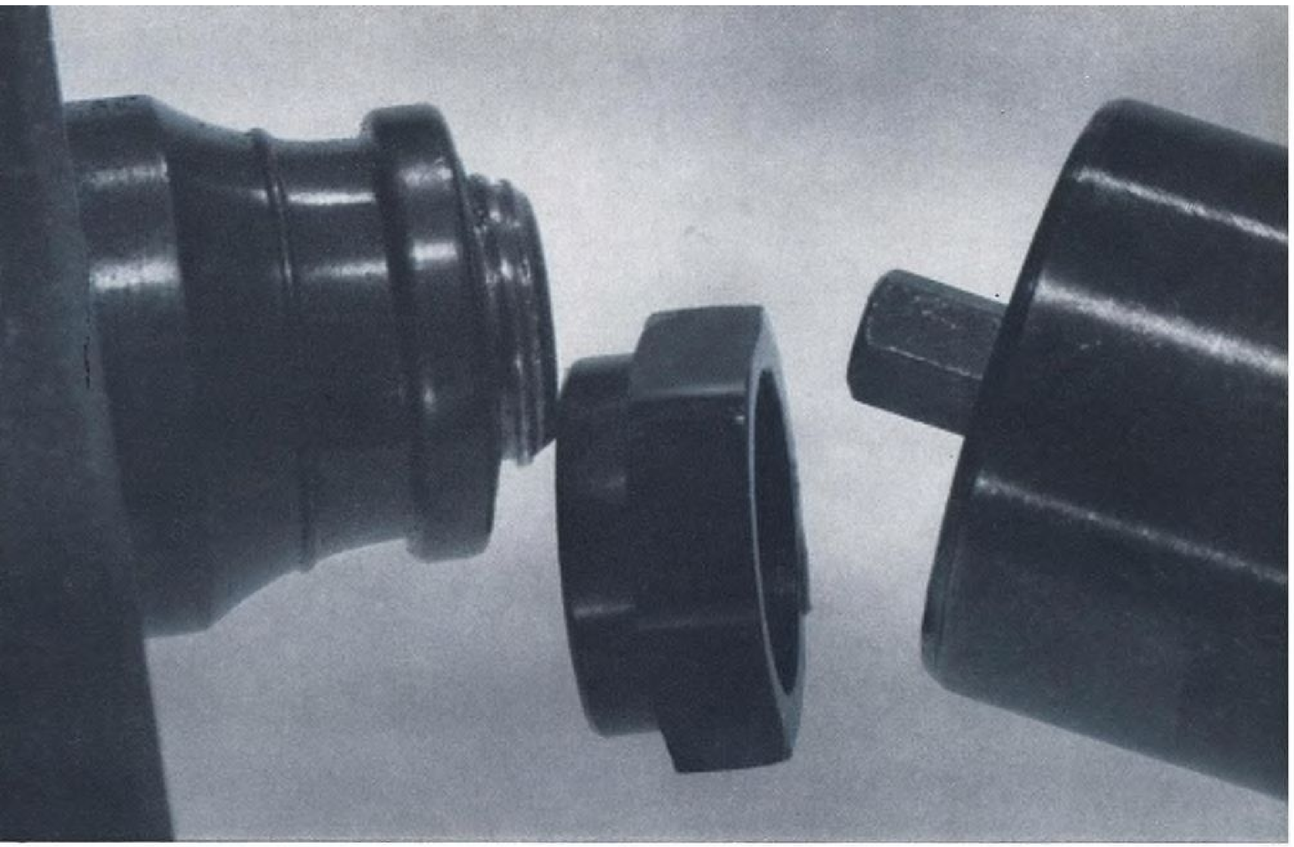
June 3, 1963


## Radiation May Boost Tube Use In Spacecraft




Saab 105 Twin-Jet Trainer

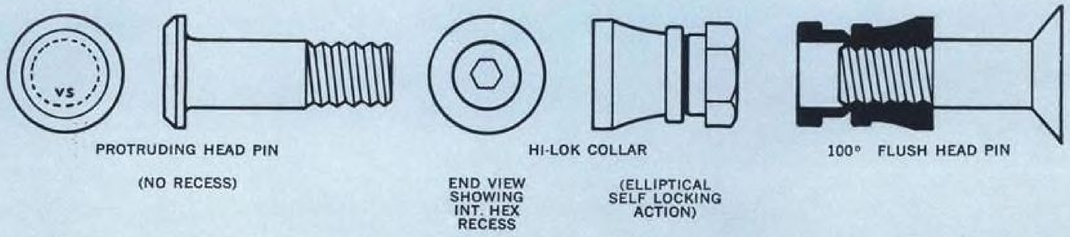
# USAF Air Commando Program Expands



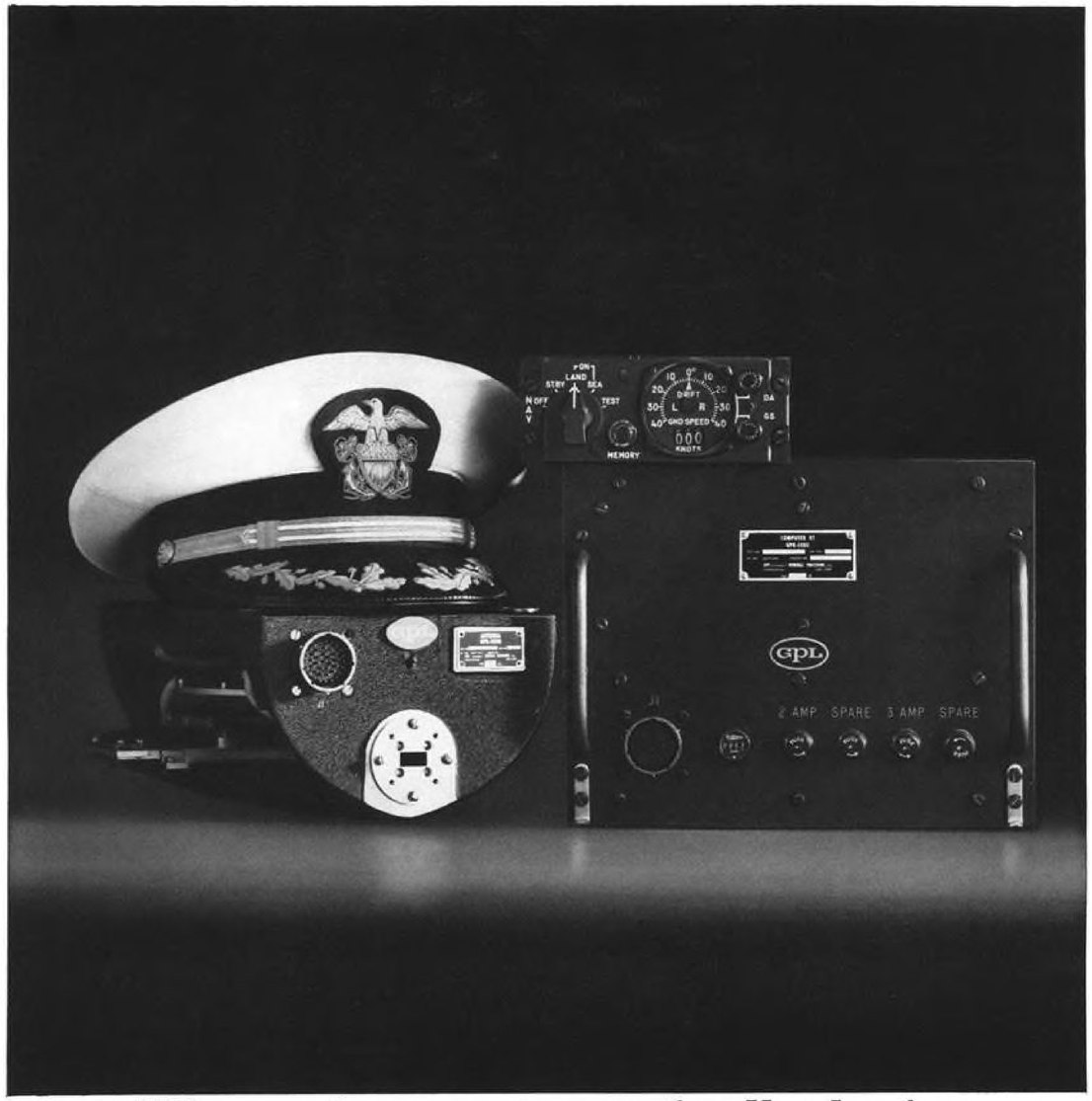
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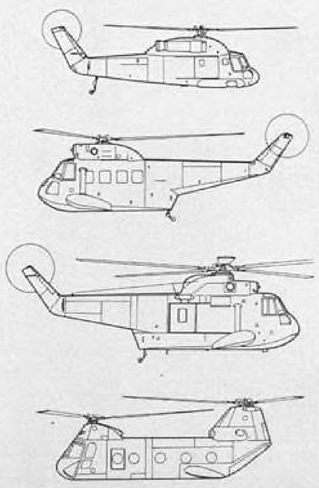

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## AEROSPACE CALENDAR

June 7-16—25th French International Air Show, Le Bourget, Paris, France.

June 10-28—Symposium on Lubrication and Wear, University of Houston. For information: Dr. D. Muster, Dept. of Mechanical Engineering, University of Houston, Houston 4, Tex.

June 11-14—Symposium on Plasma Space Science, The Catholic University of America, Washington, D. C., with the support of NASA and Goddard Space Flight Center.

June 12-14—Heat Transfer and Fluid Mechanics Institute, American Institute of Aeronautics and Astronautics, California Institute of Technology, Pasadena.

June 13-15—Great Lakes Navy Research and Development Clinic, Ohio State University, Columbus, Ohio, conducted by the Office of Naval Materiel.

June 17-20—Summer Meeting, American Institute of Aeronautics and Astronautics (AIAA), Hotel Ambassador, Los Angeles.

June 17-21—Summer General Meeting, Institute of Electrical and Electronics Engineers, Toronto, Canada.

June 17-21—71st Annual Meeting, American Society for Engineering Education, Philadelphia, Pa.

June 18-20—41st Meeting, Aviation Distributors and Manufacturers Assn., Chateau Frontenac, Quebec, Canada.

June 19-21—Fourth Joint Automatic Control Conference, University of Minnesota, Minneapolis, Minn. Sponsors: American

(Continued on page 7)

AVIATION WEEK & Space Technology

June 3, 1963

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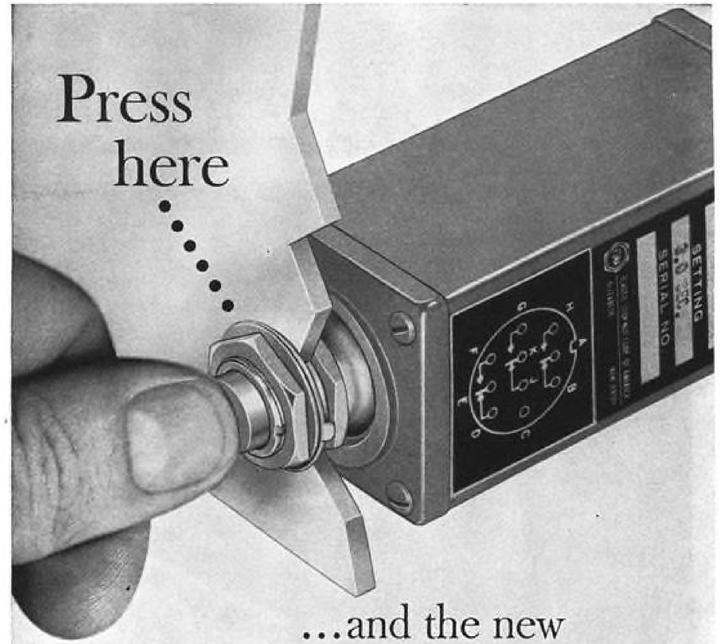
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**Magnetic Products Division 3M COMPANY**


## AEROSPACE CALENDAR

(*Continued from page 5*)

Institute of Chemical Engineers; Institute of Electrical and Electronic Engineers; American Society of Mechanical Engineers; Instrument Society of America.

**June 20-22**—National Meeting, Institute of Navigation, University of Michigan, Ann Arbor, Mich.

**June 23-28**—66th Annual Meeting, American Society for Testing and Materials, Chalfonte-Haddon Hall, Atlantic City.

**June 26-27**—10th Annual Symposium on Computers and Data Processing, University of Denver's Denver Research Institute, Elkhorn Lodge, Estes Park, Colo.

**June 26-27**—Symposium on Dynamic Load Problems – Helicopters and V/STOL, Statler Hilton Hotel, Buffalo, N. Y. Sponsors: Cornell Aeronautical Laboratory; Army Transportation Corp.

**June 28-July 3**—Second Annual Dorado Fly-In, Dorado Beach Hotel, Dorado, P. R.

**July 7-11**—Seventh National Conference on Aerospace Education, National Aerospace Education Council, Hotel Deauville, Miami Beach, Fla.

**July 9-11**—International Symposium on Space Telecommunications, Institute of Electrical and Electronic Engineers' Professional Group on Antennas and Propagation, Boulder Laboratories, Boulder, Colo.

**July 10-12**—Meteorological Support for Aerospace Testing and Operation, American Institute of Aeronautics and Astronautics and American Meteorological Society, Ft. Collins, Colo.

**July 23-26**—Torpedo Propulsion Conference (Confidential), American Institute of Aeronautics and Astronautics, U. S. Naval Underwater Ordnance Laboratory, Newport, R. I.

**July 25-27**—1963 Microminiaturization Congress, American Institute for Microminiaturization, Sheraton-Park Hotel, Washington, D. C.

**July 30-Aug. 4**—11th Annual Fly-In Convention, Experimental Aircraft Assn., Rockford, Ill.

**Aug. 4-9**—International Conference and Exhibit on Aerospace Support, Institute of Electrical and Electronics Engineers/American Society of Mechanical Engineers, Park Sheraton Hotel, Washington.

**Aug. 5-9**—Eighth Annual Technical Symposium, Society of Photographic Instrumentation Engineers, Ambassador Hotel, Los Angeles, Calif.

**Aug. 12-14**—Guidance and Control Conference, American Institute of Aeronautics and Astronautics, Massachusetts Institute of Technology, Cambridge, Mass.

**Aug. 14-16**—Fifth Biennial Gas Dynamics Symposium, Northwestern University/American Institute of Aeronautics and Astronautics, Evanston, Ill.

**Aug. 19-21** – Astrodynamics Conference, American Institute of Aeronautics and Astronautics, Yale University, New Haven.

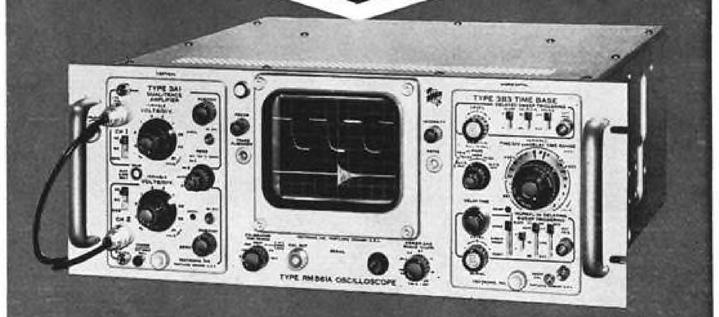
**Aug. 19-21**—1963 Cryogenic Engineering Conference, Boulder, Colo. Sponsors: University of Colorado; NBS Cryogenic Engineering Laboratory.

**Aug. 20-23**—1963 Western Electronic Show and Convention (WESCON), Cow Palace, San Francisco, Calif.

**Aug. 26-28**—Simulation for Aerospace Flight

(*Continued on page 9*)


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Type RM561A Oscilloscope—with Type 3A1 Dual-Trace Amplifier Unit and Type 3B3 Time-Base Unit—provides high sensitivity, wide-band, dual-trace operation *combined with calibrated sweep delay* in a compact, moderately priced package.

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## AEROSPACE CALENDAR

(*Continued from page 7*)

Conference, American Institute of Aeronautics and Astronautics, Deshler-Hilton Hotel, Columbus, Ohio.

**Aug. 26-28**—Conference on Physics of Entry into Planetary Atmospheres, American Institute of Aeronautics and Astronautics, Massachusetts Institute of Technology, Cambridge, Mass.

**Sept. 8-11**—International Symposium on High-Temperature Technology, Asilomar, Calif. Sponsor: Stanford Research Institute.

**Sept. 8-11**—Annual Meeting, Air Industries Assn. of Canada, Manoir Richelieu, Murray Bay, Quebec.

**Sept. 9-11**—Seventh National Convention on Military Electronics, Institute of Electrical and Electronics Engineers, Shoreham Hotel, Washington, D. C.

**Sept. 9-12**—18th Annual Instrument-Automation Conference & Exhibit, Instrument Society of America, McCormick Place, Chicago, Ill.

**Sept. 10-12**—National Symposium on Space Rendezvous, Rescue and Recovery, Edwards AFB, Calif. Sponsors: American Astronautical Society; Air Force Flight Test Center.

**Sept. 16-18**—International Aviation Research and Development Symposium, Atlantic City, N. J. Sponsor: Federal Aviation Agency.

**Sept. 18-19**—1963 Airwork Operations and Maintenance Symposium, Millville, N. J.

**Sept. 23-27** — International Telemetering Conference, Savoy Place, London, England. Sponsors: Institution of Electrical Engineers (London); American Institute of Aeronautics and Astronautics; Institute of Electrical and Electronics Engineers; Instrument Society of America.

**Sept. 25-26**—Second Annual Symposium on the Physics of Failure in Electronics, Chicago, Ill. Sponsors: Rome Air Development Center; Armour Research Foundation.

**Sept. 26-Oct. 1**—14th Congress, International Astronautical Federation, Paris.

**Sept. 30-Oct. 1**—Manned Interplanetary Exploration Meeting, American Institute of Aeronautics and Astronautics, Cabana Motor Hotel, Palo Alto, Calif.

**Sept. 30-Oct. 2**—Canadian Electronics Conference, Institute of Electrical and Electronics Engineers, Exhibition Park, Toronto, Canada.

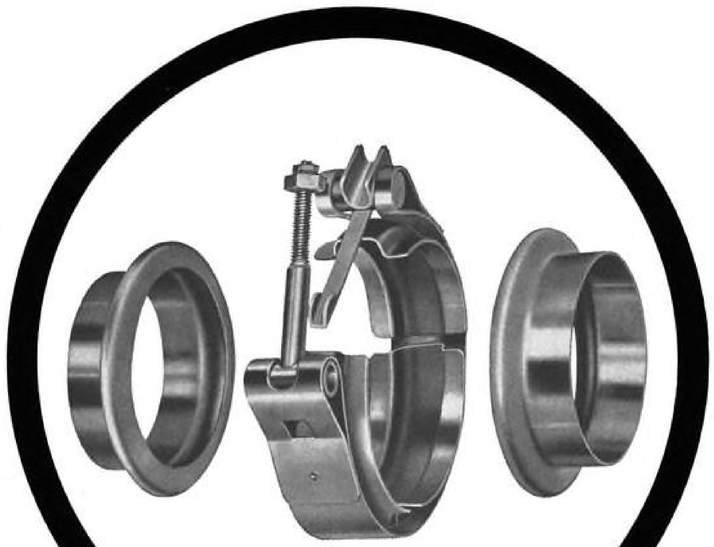
**Oct. 1-3**—Eighth National Symposium on Space Electronics, Institute of Electrical and Electronics Engineers, Fontainebleu Hotel, Miami Beach, Fla.

**Oct. 2-4**—National Assn. of Air Traffic Specialists, Sheraton-Oklahoma Hotel, Oklahoma City, Okla.

**Oct. 7-9**—Ninth National Communications Symposium, Institute of Electrical and Electronics Engineers, Hotel Utica, Utica, N. Y.

**Oct. 14-16**—Eighth Annual Exposition and Symposium, Air Traffic Control Assn., Statler Hilton Hotel, Dallas, Tex.

**Oct. 15-18**—Eighth Symposium on Ballistic Missile and Space Technology, Naval Training Center, San Diego, Calif. Sponsors: Air Force Space Systems Div.; Air Force Ballistic Systems Div.; Aerospace Corp.

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# So when I got back from lunch Jake was still up to his eyeballs in strip charts. They were spilling from the table onto the floor, and there was a big pile in the corner that he hadn't even touched. There was this wild gleam in his eye.

"Found out yet why Test Op Twenty-seven went ker-boom?" I asked innocently.

"Don't be a wise guy," Jake snarled. "I just got word from the Chief Engineer that he has to have some preliminary answers by fourteen hundred. Hah! I'd like to see *him* trying to line up forty-three channels on eight strip charts that were recorded at four different speeds."

"All it takes is a little patience," I reminded him. "You told me so yourself."

"All right, smart apple," he growled, "maybe I wish I'd recorded with one of those time code rigs like you said, but it's too late now. Don't just stand there, see if you can help me unscramble this mess."

"I'll do better than that," I said, "I'll give you your birthday present early this year." I pulled a reel of mag tape out from behind my back and showed it to him.

"What's that?" Jake said, looking as if it might bite him.

"I have to admit I played a dirty trick on you," I said. "I borrowed a time code generator[1] from Dr. Adams over at standards lab and patched it into the extra recorder along with the telemetry signal from the firing stand. The whole sequence is right here, timed with IRIG Format B."[2]



Jake's mouth was doing a beautiful imitation of a dying mackerel.

"I also borrowed a tape search and control system,"[3] I continued. "Step over to my test rack and see how the big boys do it."

I threaded the tape into the transport and selected the discriminators for the channels we were most interested in. "Do we know yet when the beast blew?" I asked Jake as I turned on the power.

"About T-zero plus eight," he told me weakly, "and I hope you're not wasting my time. In just ten minutes the Chief Engineer is going to walk in here roaring like a million pound booster."

"We'll be ready for him," I said. I translated T-zero plus eight into clock time. I preset the automatic start time at ten seconds before the engine had exploded and the stop time at five seconds after. You do it with decimal switches, and it's easier than playing Yankee Doodle on the piano with one finger.



I set the T S and C to "Automatic" and pushed the "auto search start" button. The transport revved up to search speed and the Nixie tube time display lit up showing days, hours, minutes and seconds. In a few moments the transport had reached the preset start time and overshot. It automatically reversed until it was positioned in advance of the starting spot on the tape. Then the search and control system's "drive playback" indicator light came on and traces started appearing on the oscillograph paper.

"What's that picket fence on Channel 1?" Jake asked, eyeing it suspiciously.

"That's the time code," I told him. "No more counting hundreds of pulses to correlate events. You can read days, hours, minutes, and seconds directly from the pattern of pulse widths in any segment of the recording."



"Who can?"

"You'll learn. It's easy."

Before the system had even reached the preset stop time, we were starting to get somewhere.

"Look," I said, "Channel 6 shows that flame was established at 10:48:19, but Channel 14 says the main fuel control valve still hadn't opened all the way at 10:48:22. Now look at Channel 20. By 10:48:24 pump pressure had gone off scale. Then it drops to zero."

"That must mean the fuel line ruptured. Fuel would have started spilling into the combustion chamber," Jake theorized.

"Yes, and she blew at just a hair beyond 10:48:26, that's when all the on-board transducers go dead. *Now* will you sign those requisitions for a time code generator and an automatic tape search and control of our own?"

"Wait a minute," Jake said. "Let's see if we can tell *why* the main fuel valve didn't open all the way." Some people are never satisfied.

It was hard to spot the fine-scale sequence of events at the tape playback rates we were using, so I showed him another jazzy trick. I set the system to magnify the time scale in the short critical interval just where the valve had failed to open. Then the answer became obvious. The combustion chamber pressure switch should have closed before the valve actuation signal from the sequencer, but it had closed several millisecs late. The blame was pinned on the switch.

"So now you're ready for the Chief," I said, rubbing it in, "and you still have thirty seconds to spare."

He didn't know whether to hit me or kiss me, so he did both. I forgot to mention that I'm pretty cute for a test engineer. In fact, I'm the only female in the department. Which goes to show that not even a woman[4] needs to rely on intuition, much less on counting pulses, when there's a time code system[5] handy.

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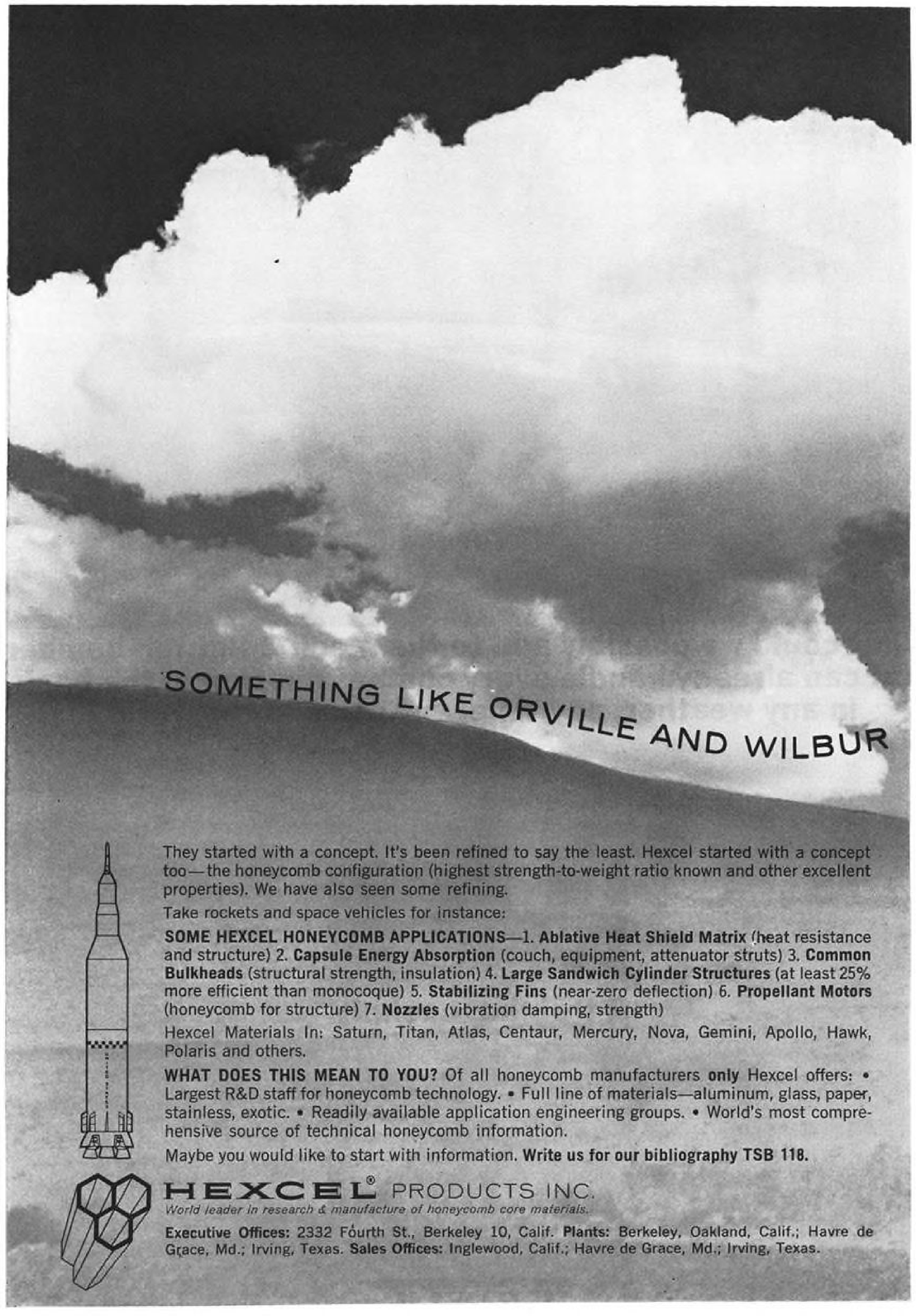
**1** Wise Dr. Adams loaned them an EECO 811 Time Code Generator. All solid-state, rugged card construction. Less than 40 pounds. Power consumption under 100 watts. This and other models available immediately for ground, mobile, airborne or seaborne applications. Brochures on request.

**2** Model 811 produces any four code formats simultaneously in both level shift and modulated forms including choice of any IRIG, NASA, AMR, etc. Other models furnish 17-bit binary, 20- or 24- bit BCD codes.

**3** It was an EECO 831 Tape Search and Control System (TS&C) which automatically searches modulated-time-code-referenced tape in IRIG or NASA BCD formats. It speeds up to 100 times recording speed or down to 1/20 recording speed, forward or backward. They might have used an EECO 835, for which interchangeable decoder modules are available to handle IRIG, NASA, AMR, PMR, WS117L, Eglin AFB, and White Sands, either modulated or level shift.

**4** In case you're wondering just how womanly she was, send for **FREE** engineering drawing and specifications of Terrific Terri the Test Engineer. Just circle this footnote and send to Mail Station 410, EECO. Include your name and address. **ADULTS ONLY** (Minors don't buy much timing equipment.) Naturally, you should also feel free to mention any timing system problems. EE 3-58R2

**5** EECO, of course. EECO's first timing system was designed in 1949. Every major test base in the U.S. employs EECO timing systems or products. For product and system information contact Electronic Engineering Company of California, 1601 E. Chestnut Avenue, Santa Ana, Calif. Phone: 547-5501. P.O. Box 58. Representative in Western Europe and Israel: Electronic Engineering S.A., C.P. 142, Fribourg, Switzerland.




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# Aviation Week & Space Technology

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EDITORIAL

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COVER: Prototype of the Saab 105 two-place, twin-jet trainer and tactical aircraft has been rolled out at the Saab factory in Linkoping, Sweden. Aircraft is powered by two Turbomeca Aubisque turbofan engines. It can also be configured as a liaison or personal executive aircraft. For more photos and details, see p. 29.

PICTURE CREDITS

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# EDITORIAL

## More Space Debate

The current debate over the size, scope and purpose of the U.S. national space program should eventually contribute greatly to better public understanding of how we are exploring space and why. No doubt it will cause passing anguish to some National Aeronautics and Space Administration officials whose pet programs and plans may be belted rather vigorously. But in the long run this debate will serve a very useful purpose.

Since President Kennedy's original decision to put this nation into a high-priority space exploration program, with a manned lunar landing as its major focal point, there has been too much of a tendency to view this program as simply a madcap dash to the moon, with serial rights to this lunar cliff-hanger being auctioned to the highest bidder. Unfortunately, the original mistake of having an astronaut's selection automatically equipped with a bag of serial-rights gold may be perpetuated by NASA if current plans to authorize a multi-million dollar public exploitation package for the new astronauts are not quickly squelched. This "show biz" type of astronaut promotion certainly provides an unnecessary Achilles heel on which critics of the space program can score at will. If the astronauts have a pay problem, it should be settled within the framework of how similar high-risk jobs are handled in the military and government service, and not by holding a commercial auction for their personality value in a multi-million dollar "package deal."

### Educational Value

The current debate has done much to explain to the public and Congress the real aims of the space program, which are the development of a broad capability in space technology that eventually can be applied to whatever national purpose or need that may arise in the future. Gradually, the point that the manned lunar landing Apollo program is simply the best possible focal point for this effort in its present phase is emerging from the verbal pyrotechnics of the current debate. It is becoming more readily apparent that Apollo is not just an "over-Niagara-Falls-in-a-barrel" type of dare-devil stunt, but a well-conceived program of broad exploration across the whole spectrum of space technology as we know it today.

The solid technical success of the Mercury program, particularly in the six- and 22-orbit flights of Cdr. Schirra and Maj. Cooper, has done much to make this point clear. It should be obvious now that Mercury, Gemini and Apollo spacecraft are really the Nina, Pinta and Santa Marias of space exploration, and are simply paving the way for whatever useful purposes this nation eventually decides to utilize space.

The Fiscal 1964 NASA budget, which will be one measure of how fast this program of space exploration will progress, faces rough but not yet crippling treatment in its passage through the legislative mill on Capitol Hill. Congress is still strongly behind the basic purpose of the national space program. But it can no longer afford to give NASA the rousing, blank-check votes with which it supported the Fiscal 1963 budget. This tenor of congressional support was valuable in providing NASA with its initial acceleration, so it could take full advantage of the technical momentum that built up so rapidly in the past few years. But it is not the type of support that can or should be expected as routine.

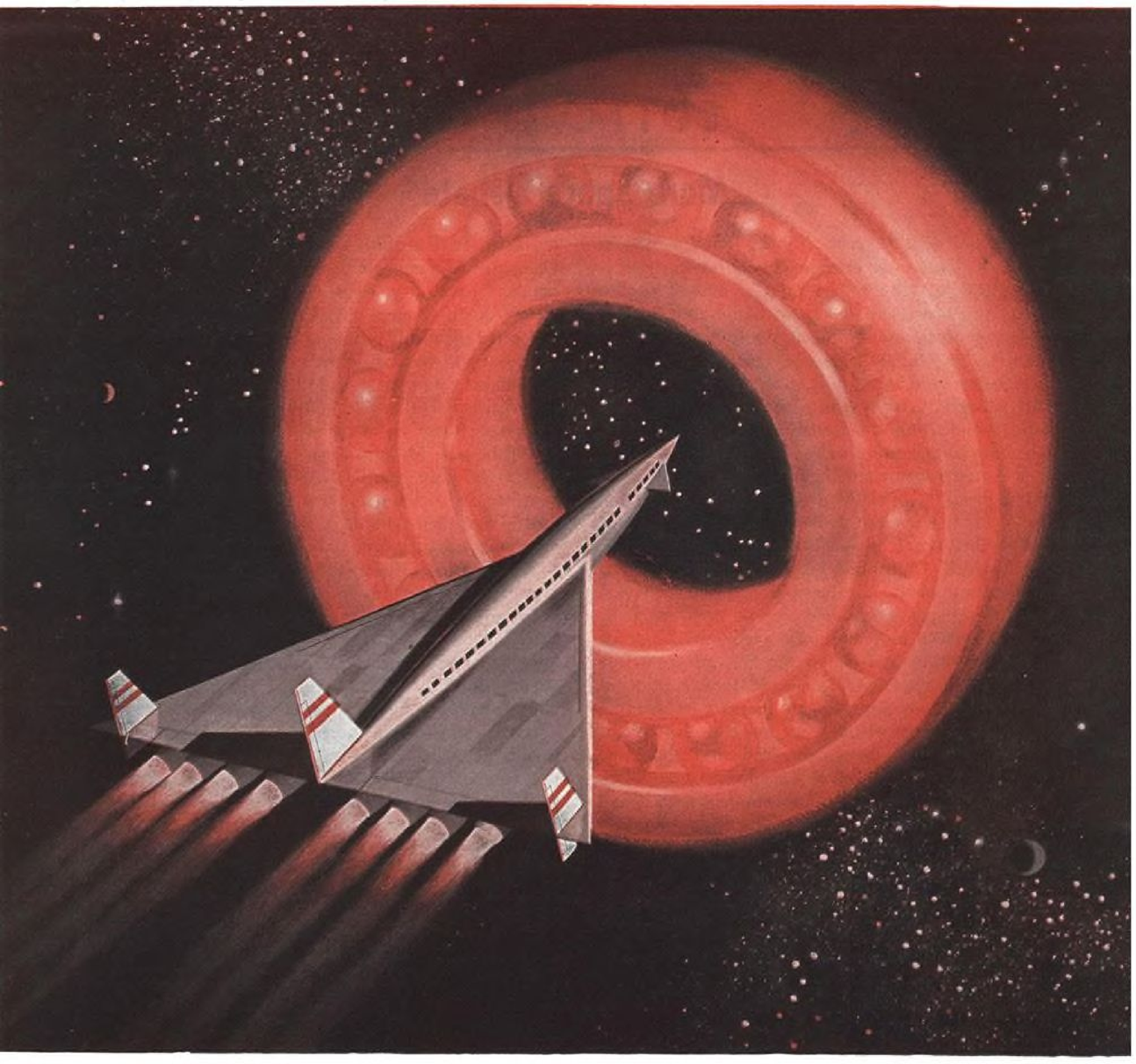
Congress must cut the NASA Fiscal 1964 budget to convince its constituents that it is exercising prudent control over their tax dollars, as well as to discourage any government agency from anticipating a blank check for all of its desires or whims. So far, NASA officials have been singularly obtuse in understanding this congressional mood. They have apparently taken the mere fact that Congress wants to pare anything from space as an intolerable insult to their managerial ability. Consequently, they have failed to cooperate with their legislative committees in arranging relatively small and highly selective cuts that will not affect the pace of the top-priority programs—particularly Apollo. As a result of this rather foolish tactic, NASA is likely to get a larger across-the-board percentage type-cut that will either nick the edges of the top-priority programs, or force NASA into a series of re-programings to protect its key projects—an action that is certain to arouse further ire on Capitol Hill.

The issue between NASA and the Congress is not whether the Fiscal 1964 budget will be cut, but what kind of a reduction NASA can absorb best—a highly selective pruning that can be done well only with NASA cooperation, or an across-the-board cutlass slash that is the only recourse of Congress when dealing with technical matters too complex for specific judgments.

### Debate's Main Issue

There will continue to be carping from the wings from some elements of the scientific community who feel the space program is diverting funds from their pet areas, but we do not feel these scientific bushwhackers have convinced any significant numbers that their criticism is valid. Neither did NASA's counter-blast from eight "tame" scientists (see p. 24), almost all of whom have some official NASA connection, fool anybody. But this is hardly germane to the main issue of the current debate, which is how effectively NASA shepherds its budget through Congress to provide the funds to keep its major technical program rolling as fast as technical progress will permit, and whether its managers have the skill and judgment to give up some of their less-essential plans to preserve the main core of the space exploration effort.

—Robert Hotz




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# WHO'S WHERE

## In the Front Office

**Holley B. Dickinson,** president and a director, Canoga Electronics Corp., Van Nuys, Calif., succeeding the late **George H. Nibbe.**

**Rex Taylor,** president, Vanguard Air & Marine Corp., Bala Cynwyd, Pa., succeeding **Edward G. Vanderlip,** now board chairman.

**William A. Sipprell,** vice president and general manager, Lear Jet Corp., Wichita, Kan.

**Charles D. Doxe,** vice president-research and development, Handy & Harman, New York, N. Y.

**Russell T. Lowe,** vice president and division manager of Barry Controls Div. of Barry Wright Corp., Watertown, Mass.

**Merwin Hoffman,** vice president-sales, ABC Air Freight Co., Inc., Jamaica, N. Y.

**G. L. Werly, Jr.,** marketing vice president, Air Reduction Sales Co., New York, N. Y., a division of Air Reduction Co., Inc., succeeding **E. S. Twining, Jr.,** now marketing manager for Air Reduction Co.

**Dr. John E. Tessieri,** executive vice president, Texaco Experiment, Inc., aerospace subsidiary of Texaco, Inc., New York, N. Y.

**Dr. Charles D. Harrington,** senior vice president, United Nuclear Corp., Washington, D. C.

**Joseph A. Fontana,** vice president and general manager-West Coast operations for Consolidated Controls Corp., Inglewood, Calif.

**Keigh E. Rumbel,** senior vice president, Atlantic Research Corp., Alexandria, Va. Also: **Dr. Raymond Friedman,** vice president-research, responsible for the Kinetics and Combustion Div.; Nuclear Engineering Div.; Aerothermodynamics Group; Flight Sciences Laboratory.

**S. J. Kuderer,** president and chief executive officer, Aeronca Manufacturing Corp., Middletown, Ohio, succeeding **John A. Lawler,** now board chairman.

## Honors and Elections

**Dr. Raymond H. Wilson, Jr.,** chief of applied mathematics in the Research Directorate of NASA's Office of Advanced Research and Technology, has received a $200 incentive award for invention of a method for magnetic steering of spacecraft by controlled spin-damping. Dr. Wilson's work solved the problem of orienting satellites in the earth's magnetic field.

**Lyndon M. Burch** has been named a Fellow of The Academy of Applied Science. Mr. Burch is the independent inventor of the manual control system which is used on Mercury and other U. S. missiles and space vehicles, including Telstar, Polaris and Mariner.

**Maj. Gen. Ben I. Funk,** commander of the Air Force Space Systems Div., received a Group Achievement Award from President John F. Kennedy on behalf of Space Systems Div., Aerospace Corp., and the aerospace industry, for managing the development and launching of the Atlas boosters used in the space flight missions of Project Mercury.

(*Continued on page 98*)

# INDUSTRY OBSERVER

►First Martin-built Titan 2 launch vehicle for National Aeronautics and Space Administration's Gemini program was to be installed in the company's vertical test cell at the Baltimore plant last week. Complete systems tests, less fueling and engine firing, will follow, including electrical system checkout, measurements of heat loads and analysis of the malfunction detection system.

►**Entire Fiscal 1964 Navy purchase of the Grumman A-6A Intruder two-place, twin-jet, all-weather aircraft will be for Marine Corps use. Navy hasn't convinced officials of the Office of the Secretary of Defense that this low-level attack aircraft is best for carrier use on a basis of cost-effectiveness analysis.**

►U. S. Navy sources estimate that the Russians are operating 83 non-Navy and 75 Navy oceanographic vessels, compared with 34 non-Navy and 33 Navy oceanographic ships operated by the U. S.; Navy has requested $107 million for its oceanographic work in Fiscal 1964, and has said that the precision mapping of the seas is a military necessity in view of the major strategic role played by Polaris-firing submarines. Defense Dept. trimmed the request by $200,000.

►**New techniques for development of an all-weather landing system for Army tactical aircraft will be sponsored in a program being monitored by Army Electronics Material Agency. Army has issued requests for proposals.**

►Experimental program aimed at developing a 30-kw. arc-jet engine for spacecraft propulsion will be carried out by Avco's Research and Advanced Development Div. under contract to NASA's Lewis Research Center. The center also is negotiating with General Dynamics/Astronautics for an investigation aimed at development of a coaxial plasma gun for space propulsion.

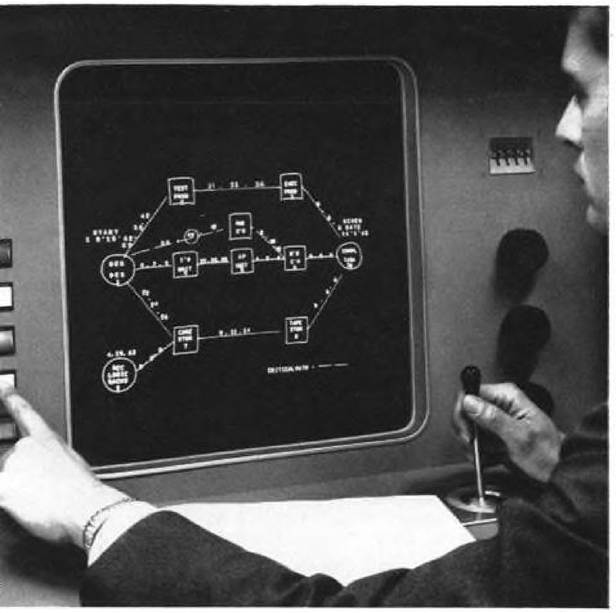
►**Major aircraft accident rate for USAF continued its downward trend during Fiscal 1962 with a figure of 5.7 accidents per 100,000 flying hours. Rate for 1961 was 6.3 per 100,000; for 1956 it was 15, and for 1951 it was 33. Major accidents decreased in number from 440 to 390 from 1961 to 1962; fatalities decreased from 347 to 296.**

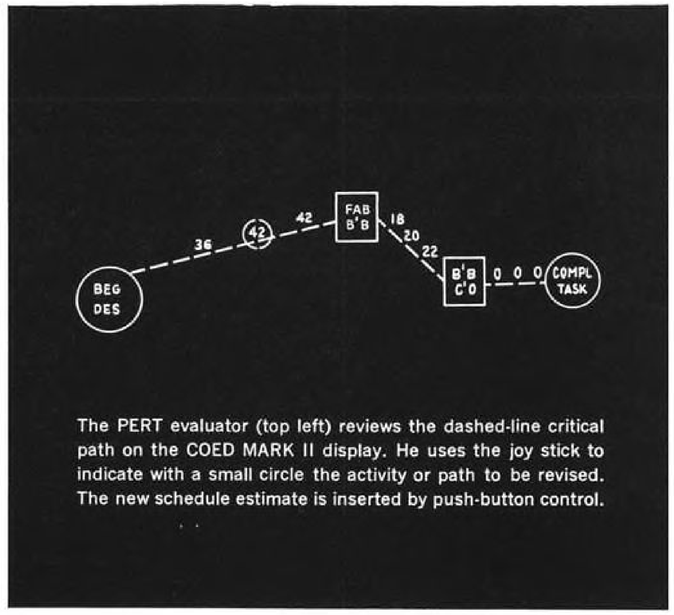
►Army is experimenting with what it calls "multi-year buys" in the hope of smoothing the cyclic swings in procurement of near-standard items. Plan is to commit the service to buying an item from one contractor for a time up to three years after the first contract is awarded, rather than holding a new competition before the entire purchase is completed.

►**Dynamic analysis of lenticular missile configurations—shaped like a double-convex lens—will be conducted by General Dynamics/Pomona under Army Missile Command contract. Army also has awarded a 12-month study contract for research on hypersonic interceptor control to General Applied Sciences Laboratories, Westbury, N. Y.**

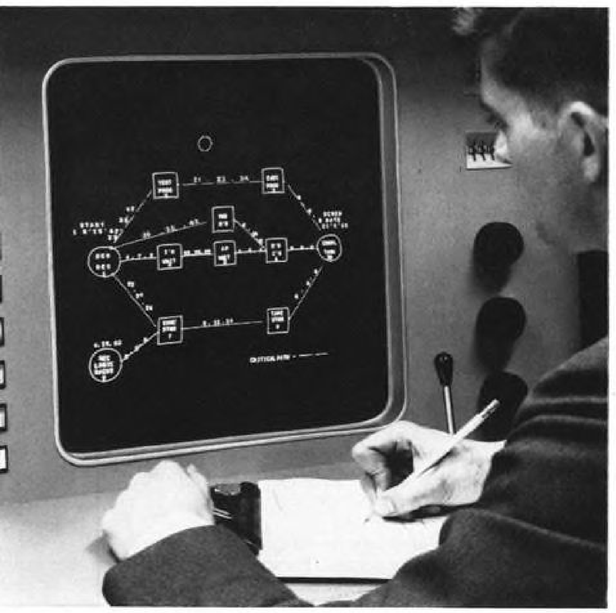
►Lycoming T53-L-9 turboshaft engines in the Army's Bell Iroquois UH-1 helicopters now are being overhauled every 800 hr., compared with 150 hr. time-between-overhaul two years ago. Maintenance cost per flying hour for the UH-1 is $120. This figure compares with $45 for the Hiller OH-23 Raven, $95 for the Sikorsky UH-19 Chickasaw, $120 for the Boeing-Vertol CH-21 Shawnee, $110 for the Sikorsky CH-34 Choctaw, and $300 for the Sikorsky CH-37 Mojave. Costs include all military and civilian labor used for organization, field and depot levels of maintenance, plus costs of airframe overhaul and consumable parts.

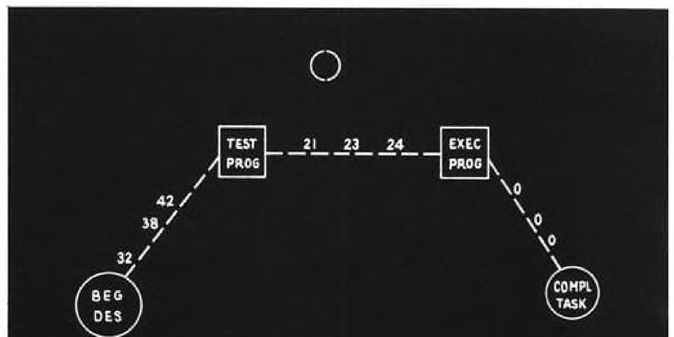
►**Difficulty in obtaining a standard spacecraft during the space vehicle development cycle is illustrated in the changes and modifications made during the Mercury program. Mercury Atlas-7 incorporated 63 changes from MA-6; MA-8 had 109 changes from MA-7. Maj. Gordon Cooper's MA-9 capsule incorporated 198 changes from the MA-8 configuration. Total program cost through MA-8, including the changes, is $314.2 million.**






The PERT evaluator (top left) reviews the dashed-line critical path on the COED MARK II display. He uses the joy stick to indicate with a small circle the activity or path to be revised. The new schedule estimate is inserted by push-button control.






A revised display (lower left) is generated instantaneously by the computer, and indicates the new critical path. Thus, program management can try and see at once the effect of proposed changes. The results of this "real-time" PERT analysis are then presented by an automatic computer printout showing new milestones for the development team.

**COED MARK II,** a second generation Computer Operated Electronic Display, applies the combined brain power of man and machine to the solution of space age problems. Other applications of the MARK II, in addition to PERT analysis, include real-time displays of helicopter flight control, lunar vehicle steering, missile guidance simulations, satellite thermal response, and polynomial curve fitting. Engineers interested in projects applying advanced display techniques are invited to contact our Personnel Director, Bendix Systems Division, Ann Arbor, Michigan—an equal opportunity employer.

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# Washington Roundup

## Moss on Sylvester

**Arthur Sylvester failed to persuade Chairman John E. Moss of the House special information subcommittee that there is any real justification for the Defense Dept.'s** secrecy rules covering Russian space launches and Pentagon contacts with newsmen.

**After a closed hearing last week, Rep. Moss said he is so skeptical that releasing information about Russian launches would, as Sylvester claimed, reveal too much** about U. S. tracking capabilities (see p. 28) that he is going to explore the matter further with other Defense Dept. leaders. He also will ask civilian space agency officials to assert themselves more on the issue, instead of accepting the Pentagon's secrecy policy.

**Subcommittee members gave Sylvester a rough time during the closed hearing about his stewardship of Defense Dept. information activities, complaining at one point that he denied making statements** that were later shown to be on a tape recording of his remarks (AW Jan. 28, p. 118). Rep. Moss said flatly that Sylvester's directive requiring Defense Dept. personnel to report their news contacts to him should be rescinded since "it serves no useful purpose." Rep. Moss said that of 1,019 news contacts reported under the directive, only one was investigated.

**Rep. Moss did say Sylvester released as much information as practical during the Cuban crisis. However, the subcommittee chairman contended the Defense Dept.** should have allowed newsmen to do more on-the-spot reporting.

## White Sands Campaign

**President Kennedy is to visit the White Sands, N.M., complex June 5. The New Mexico congressional delegation will be on hand to argue for a bigger space role** for the state.

**Chairman Clinton P. Anderson of the Senate space committee long has argued that the National Aeronautics and Space Administration as well as the military should make** more use of the well-instrumented facilities of White Sands and Holloman AFB. Sen. Anderson succeeded in getting the President to the Los Alamos, N. M., Scientific Laboratory last year, but the visit did not result in the hoped-for acceleration of Project Rover (AW Dec. 17, p. 28). Sen. Anderson was not space committee chairman at the time, however.

**The President will view missile firings at White Sands, and the next day will fly to inspect the aircraft carriers Oriskany and Kitty Hawk off of Pt. Mugu, Calif.** On June 7 he is to watch other missile firings at the Naval Ordnance Testing Site at China Lake, Calif.

**Watch for NASA to include a test pilot with a heavy scientific background when it selects another group of astronauts—probably about nine—this summer.** This hopefully would appease some scientists now assailing the space program.

## Aircraft-for-India Policy

**U. S.-British policy for the next 18 months calls for improving what aircraft India has rather than embarking on any full-scale procurement program.** But there will be continued attempts to improve India's airlift by providing aircraft that can be spared by the U. S. and Britain.

**U. S. is sending 24 Fairchild C-119s from Air Force reserve squadrons to India as part of this airlift improvement. India already has about 50 C-119s, about half of them equipped** with jet thrust augmentation (AW Nov. 12, p. 127). The additional C-119s will not be equipped with jet engines, but are being thoroughly checked by Fairchild's service facility in St. Augustine, Fla., before they are flown to India.

**There are no plans at present to give India U. S. or British supersonic fighters, but air-to-air missiles will be supplied for existing aircraft. U. S. officials say they** are using the Pentagon's "cost-effectiveness" approach in determining what weapons to send to bolster India in its border conflict with Red China. About $120 million in military aid to India already is committed, with the U. S. and Britain splitting the cost.

## Navy Procurement Boss

**Shifting Vice Adm. William A. Schoech from deputy chief of naval operations for air to chief of naval materiel is the first step toward his appointment** as procurement chief of the reorganized Navy, when he will bear the title of chief of naval support. In that position, the bureaus of weapons, ships, yards and docks and supplies and accounts, which now report directly to the secretary of the navy, will report to him.

**Only the bureaus of personnel and medicine and surgery will report directly to the secretary under the new setup. Adm. George W. Anderson, outgoing chief of naval operations,** unsuccessfully pressed Navy Secretary Fred Korth to put the procurement bureaus under the CNO. Adm. Anderson argued this was the best way to assure that the CNO could implement the weapons requirements he generated.

**Rep. Daniel J. Flood of the House Defense Appropriations Subcommittee is demanding that Navy lawyers write tighter procurement contracts. He told Navy leaders** during a recent hearing that "you have a lot of truck drivers down there disguised and wearing uniforms of JAG (judge advocate general) officers who look at some of these contracts . . . your contracts are so open a justice of the peace could drive through with a truck."

**—Washington Staff**

# Congressional Critics Eye DOD Civilians

**TFX issue stirring skepticism in Congress toward Pentagon leadership; effects could be far-reaching.**

By George C. Wilson

**Washington**—Senate's lengthy F-111 (TFX) investigation is shifting the focus of congressional skepticism away from the military and toward the civilians now running the Defense Dept.

This change could well be the most significant result of the whole F-111 affair, overshadowing the avowed purpose of the Senate Permanent Investigations Subcommittee to determine whether General Dynamics or Boeing proposed the better aircraft for the next USAF-Navy tactical fighter.

Deepening of this skepticism would at least lead to confusion and delay within the whole defense field, including the aerospace industry, and at the most lead to replacement of Defense Secretary Robert S. McNamara, either by his own choice or that of President Kennedy.

This could happen because a skeptical Congress can frustrate Defense Dept. leaders in a number of ways. It can deny money for specific categories such as aircraft, oppose reforms of the services, and publicly challenge—if not discredit—the major decisions of the defense secretary by holding one special investigation after another. All this in combination takes away the secretary's usefulness.

Skepticism in Congress about McNamara today is not deep enough to imperil his job, and his final appearance at the F-111 hearing may dispel some already created. But there is little doubt that the F-111 hearings have hurt the image of infallibility which insulated McNamara for so long against the standard rough-and-tumble treatment by Congress. A Republican senator said the hearings "have knocked a lot of gold off McNamara's halo," while Rep. H. R. Gross (R.-Iowa), probably the most outspoken member of the House, called the defense secretary "the self-anointed czar in the Pentagon," whose role in the F-111 case "is incredible."

Chairman John L. McClellan (D.-Ark.) insists that all he is trying to do in his F-111 investigation is determine whether the U.S. is buying the best airplane. But it is obvious that another one of his objectives is to portray McNamara as a fallible and high-handed defense secretary. Sen. McClellan already has said in the hearings that McNamara abused his power by not consulting the military leaders before reversing them (AW Apr. 15, p. 29). Also, Sen. McClellan cannot understand why McNamara discredited contractor estimates on the one hand and then awarded the development contract to General Dynamics for the same amount the company bid.

Sen. Karl E. Mundt (R.-S. D.), the ranking Republican on the subcommittee and a veteran of congressional investigations dating back to the McCarthy era, is among those who feel it is a good thing the F-111 hearings have shifted congressional attention from the military toward the civilian Defense Dept. leaders.

Sen. Mundt emphasized that no one on the subcommittee denies McNamara had the legal authority to reverse the military by awarding the F-111 contract to General Dynamics rather than Boeing, but, he said: "What we're doing is questioning whether he made the right decision. Congress certainly has the responsibility to examine decisions made by the Pentagon."

Testimony to date raises important questions about whether McNamara's F-111 decision was the right one, he said. "The hearing has demonstrated the need for Congress to continue examining decisions of civilians instead of regarding them as holy writ," he said.

"We have in the past," Sen. Mundt continued, "tended to always take the side of civilian authority" in military vs. civilian fights. But there has been a lack of diligence in exploring the rectitude of civilian decisions."

Congress is in the mood to correct this "lack of diligence" toward the civilian hierarchy in the Defense Dept., as evidenced by these developments:

• **'Little TFX' investigation.** Chairman John Stennis (D.-Miss.) of the Senate Preparedness Investigating Subcommittee said last week that open hearings will be held on the award of the X-22A V/STOL contract to Bell Aerospace Corp. after the Navy had recommended Douglas Aircraft Co. Sen. Stennis said information uncovered by the subcommittee staff indicated the award to Bell was made "by the specific direction of the Office of the Secretary of Defense." He said the inquiry will explore "the basis for rejecting the recommendation of the technical experts of the Navy." Sen. Henry M. Jackson (D.-Wash.), who requested the F-111 investigation, is also a member of the Stennis subcommittee. The pattern of the X-22A contract award is so similar to that of the F-111 that unofficially it is being called "the little TFX investigation."

• **Anderson repercussions.** Chairman Carl Vinson (D.-Ga.) of the House Armed Services Committee and Rep. Leslie C. Arends (R.-Ill.) introduced identical bills to fix the term for all the joint chiefs of staff at four years. This action followed the President's decision not to reappoint Adm. George W. Anderson, chief of naval operations, to a second two-year term and to appoint Air Force Chief of Staff Curtis E. LeMay to only an additional one-year term rather than the usual two. Adm. Anderson has agreed to serve as ambassador to Portugal when his term expires this August.

Adm. Anderson had serious differences with McNamara (AW May 13, p. 26), but Rep. Vinson denied this prompted his action. However, Rep. Arends said bluntly last week in introducing his bill that "with a fixed four-year term, with no right of reappointment, a secretary of defense will be less able to force his will on the joint chiefs of staff, and they will be less reluctant to express themselves frankly when so requested" by Congress. He said further: "I am not at all sure the present secretary of defense cares what Congress intends. He and his civilian aides presume to know all the answers, military as well as economic."

Under the bills, the President could remove a member of the joint chiefs at any time, but this would be looked upon as a more drastic action than the present practice of not reappointing a member after the expiration of his two-year term.

• **Budget cuts.** Congress this year ignored McNamara's plea that he had already pared the Fiscal 1964 Defense Dept. procurement budget as much as possible, and authorized $408.1 million less than requested (AW May 20, p. 35). Significantly, the Senate Armed Services Committee specified for the first time what items should not be bought to effect the economies ordered. "The committee will not concede that the programs submitted to the Congress are immutable or that the Congress is precluded from expressing its judgment on determination of requirements and on force levels," the Armed Services Committee said.

• **New military subcommittee.** New research and development subcommittee of the House Armed Services Committee is preparing to challenge civilian military leaders, especially those in the office of defense research and engineering, on such policies as the limited military space program.

These same civilian Defense Dept. leaders are being challenged by House space and appropriation committee members on their request for funds for a separate military communication satellite program. Skeptical congressmen contend the program would duplicate those existing or planned.

In sum, instead of waging the traditional fight against "battleship admirals," and the like, Congress is now mobilizing for a fight with a civilian defense secretary who has proved he can put stubborn military leaders in their place.

A dramatic showdown between McNamara and his congressional critics may come if the McClellan subcommittee recommends that a flying competition be held between General Dynamics and Boeing prototypes before more F-111 funds are committed. The question is how much pressure Congress could exert to force McNamara to conduct such a competition.

From their position on the Senate Appropriations Committee, Sen. McClellan and Mundt could press for tying such a recommendation to funds for the F-111 program. But even if such restrictions were achieved in the Senate, congressional observers feel Senate backers of a flying competition would need the support of Sen. Richard B. Russell (D.-Ga.), chairman of both the Senate Armed Services Committee and Defense Appropriations Subcommittee, to sell the idea to the House.

In the F-111 and other imminent congressional vs. executive contests in the military field, Sen. Russell's attitude looms as the most crucial one in determining McNamara's future relationship with the Congress.

## MA-9 Inverter Troubles Traced

**Cape Canaveral—Corroded insulation around two soldered connections has been identified as the cause of the malfunction in the inverters and the 0.05g panel light in Maj. Gordon Cooper's Mercury Atlas-9 (MA-9) capsule.**

**Inverter problem (AW May 20, p. 26) was definitely traced to corroded insulation around the connector which transmitted the a. c. output of the inverters into the amp cal (amplifier calibration) package, the logic circuit for the attitude control system. The inverters themselves were found to be satisfactorily operative after the flight (AW May 27, p. 25).**

**Insulation surrounding the lead from the amp cal to the 0.05g panel light was found to be broken in two places, either one of which could have caused a short on that line and thus caused the light to come on, officials believe.**

**Corrosion problem is believed to have been caused by excessive moisture in the spacecraft. Project officials said the moisture from a faulty water separator attached to Maj. Cooper's space suit could have caused the trouble.**

**Post-flight tests showed that the inverter and 0.05g circuit troubles during the flight were traced to independent electrical connectors that failed at different times. There is no indication that the failures were connected other than the fact that electrical insulation broke down in both cases.**

**NASA said corrective measures in future manned flights will include tighter control of moisture in the spacecraft, better protection of electrical circuits and visual check as well as electrical verification before launch.**






## CL-41R Radar Trainer Operational

**First photo of the Canadair CL-41R trainer (AW Mar. 11, p. 289), with operational F-104G NASARR radar and electronics systems installed, shows placement of the F-104G ventral fin on bottom of rear fuselage. Fin houses a UHF antenna and duplicates placement of the system on the F-104G. Bulge on side of fuselage is one of two saddlebag compartments which house the NASARR electronics packages. Trainer has F-104G nose section and radar system. Aircraft will be shown at the Paris Air Show June 7-16.**

## Soviets Test 'Improved' Space Rockets

**Soviet Union last week announced that it had fired rockets 7,500 mi. into the Central Pacific Ocean May 18 and 25 (AW May 20, p. 30). The Soviet news agency Tass has identified the rockets as "improved models of carrier rockets for space objects."**

**Tass said that the final stages of the rockets hit their targets "with a high degree of accuracy." The number of rockets fired was not disclosed.**

**The rocket firings came just before and just after the launching of the unmanned satellites Cosmos 17 on May 22 and Cosmos 18 on May 24.**

**Tass said that the first of two areas in the Pacific that had been closed to ship and aircraft traffic because of the tests is now open. The original restriction period had been May 15 to July 15.**

**Russia's last series of Pacific rocket tests took place last fall (AW Oct. 22, p. 27).**

# Sen. Anderson, Scientists Rebut Attacks on Manned Lunar Landing

By Alfred P. Alibrando

**Washington**—Sen. Clinton Anderson (D.-N. M.), chairman of the Senate space committee, last week expressed strong support for Project Apollo and said some critics of the manned lunar program, including prominent scientists, are "misguided and misinformed."

Earlier in the week, a group of eight scientists, three of them Nobel prize winners, also defended Apollo as a national goal important both to national security and advancement of the nation's technological and scientific capability.

Sen. Anderson's Apollo speech on the Senate floor was the most favorable he has made on the subject since succeeding the late Sen. Robert S. Kerr as chairman of the Senate space committee early this year.

Sen. Anderson also answered point-by-point criticisms of Apollo made in a statement by the Senate Republican Policy Committee entitled "A Matter of Priority." The statement said that Apollo was a wasteful crash program of doubtful value which will contribute nothing to the nation's security, and only a fleeting propaganda victory.

"The decision to try to land a man on the moon by 1970 does not constitute a crash program," Sen. Anderson said. "Work is done best—even by the technical community—when a specific goal is set. [The] objective . . . was chosen . . . that would permit us to work . . . in a rapid, yet efficient manner."

Sen. Anderson said the space race is a challenge as important as the military challenge.

"The mastery of space techniques learned in the [manned flight program] are all adding increments of military know-how in space," he said. "Most of the astronauts have been outstanding individuals from the services. Over 200 military officers . . . are on duty in NASA. . . . Development of this basic structure for space power and the scientific knowledge and technical skill required to enable men safely to explore the moon is probably of greater consequence than the lunar landing itself."

Sen. Anderson pointed out that the cost of Apollo—about $20 billion—amounts to only 1% of the gross national product. He said charges that Apollo is draining off too much of the nation's scientific and engineering manpower also are unfounded. By 1970, there will be 1.9 million scientists and engineers in the U. S., and only 114,700—or less than 6%—will be working for NASA or its contractors, he said.

Sen. Anderson said Apollo is not being carried out at the expense of non-space scientific programs and cited the increase in the budgets of those programs. He also said that NASA's unmanned flight missions have not been cut back because of the Apollo program, as charged by critics of the manned flight program. Sen. Anderson pointed out that Ranger, Surveyor and other NASA unmanned activities account for about $2 billion of NASA's $5.7-billion Fiscal 1964 budget request.

Eight scientists who expressed support for Apollo were Dr. Robert Jastrow, director of NASA's Institute for Space Studies; Dr. Joshua Lederberg, chairman of the department of genetics at Stanford University; Dr. Willard F. Libby, director of the Institute of Geophysics and Planetary Physics at the University of California, Los Angeles; Dr. Harold Urey, professor of chemistry at the University of California; Dr. W. Maurice Ewing, director of the Lamont Geological Observatory, Columbia University; Dr. Gordon J. F. MacDonald, Los Angeles; Dr. Lyman Spitzer, Jr., director of the Princeton University Observatory, and Dr. James A. Van Allen, chairman of the department of physics, State University of Iowa. The Nobel laureates are Lederberg, Libby and Urey.

In a joint statement, they said: "We believe that the support given to the enlarged space program by the people and . . . Congress was based on a conviction that this program will, for many reasons, make an important contribution to the future welfare and security of the U. S. The momentum and significance of the lunar program are derived from its place in long-range U. S. plans for exploration of the solar system. The heart of those plans is man-in-space."

Project Apollo has become a very complex issue involving differing opinions in the scientific community, politics and some understandable reluctance to commit billions to an endeavor which promises little in immediate, tangible benefits.

Republicans have chosen to make the space program a prime political issue. They have called for cuts as high as $800-million in NASA's budget, observing that some prominent scientists are opposed to Apollo.

Democratic leaders on both the Senate and House space committees have said they will examine the NASA budget closely and cut out anything that cannot be justified. This has been incorrectly interpreted by some as hostility toward the NASA program.

Leaders of both committees want to be in a position to assure members of their respective bodies that the budget they ask them to approve is an "honest" one.

Space committee Democrats—and some Republicans who believe in the space program—feel that a cut of $200 million or so by them in the NASA authorization bill will prevent a much larger and deeper cut in the appropriations committees or on the floor of the House and Senate.

House space committee leaders have tried to enlist NASA's help in making selective cuts in the authorization, but have not been very successful.

"We tried to get them to tell us what could be cut out," said Rep. Olin E. Teague (D.-Tex.), chairman of the House manned flight subcommittee, "but we haven't had much luck, so we're going to have to do the cutting ourselves."

## Snap 10A Re-entry

**Washington—Re-entry test in which a mockup of non-radioactive Snap 10A reactor was driven back into the atmosphere at a velocity of more than 15,000 mph. was satisfactory, National Aeronautics and Space Administration reported last week.**

**Mockup reactor weighing 482 lb. was launched on a Scout rocket from Wallops Island, Va. on May 22, to an altitude of 100 mi. (AW May 27, p. 33, Apr. 22, p. 74). The reactor re-entered about 750 mi. downrange, 250 mi. southeast of Bermuda. Optical observation from Bermuda indicated that components designed to disintegrate on re-entry burned as the mockup passed through the atmosphere.**

## West Ford Progress

**Transcontinental communication of voice, teletype, and high speed digital data by reflection of radio signals from orbiting copper dipoles was reported to be successful for limited periods of time in initial tests of the second Project West Ford experiment (AW May 20, p. 34).**

**The limited transmission times were attributed to stringent tracking requirements made necessary while the belt was being formed. Continuous transmission in the northern latitudes is expected when the belt is fully formed according to officials at Massachusetts Institute of Technology's Lincoln Laboratories which is conducting the experiment for the Air Force.**



# NATO to Share in SAC Nuclear Planning

**Ottawa, Canada**—Creation of the North Atlantic Treaty Organization inter-allied nuclear force—and an allied staff to direct it in conjunction with the U. S. Strategic Air Command strike force—was hailed by U. S. officials as a major step forward after the three-day NATO ministerial conference here.

Secretary of State Dean Rusk said the strike capability represented by the force (AW May 27, p. 27), which has been assigned to NATO's Supreme Allied Commander in Europe (SACEUR), represents more than just a paper move.

The inter-allied force, which was ratified informally and left unnamed to prevent a political rift within the alliance, will consist of three U. S. Polaris submarines, Great Britain's 180-aircraft V-bomber force and the fighter-bomber squadrons of six other NATO member nations.

"This [force] adds to the capacity of SACEUR . . . to get at those targets that are threatening Western Europe," Rusk said. "It also means that his allied staff will participate in the direction of these forces and that an allied staff will, for the first time, coordinate these forces with other forces, say those [of the Strategic Air Command] in Omaha.

"Now, this is a major step forward for the alliance, in my opinion, and represents an enormous increase in the strength capacities of NATO, if called upon for defense purposes," the secretary of state added.

Rusk said that the presence of an allied staff in Omaha participating in the operational planning for the nuclear force is in itself a major sharing of nuclear responsibilities among the allies.

"The importance of this perhaps ought to be more accurately identified than to just speak of it vaguely," Rusk said, obviously referring to the fact that the inter-allied force had not been given a formal name.

Leaving the force nameless and requiring only informal ratification of its formation were diplomatic compromises designed to satisfy the French, who opposed formal organization of the force because it would interfere with their plans to develop their independent nuclear strike force. Great Britain had been expected to take an opposite view and push for formal creation of the force, since political pressures at home following the recent Nassau agreements with the U. S. demanded some tangible evidence of increased British participation in formation of NATO nuclear strategy.

The compromise prevented a political squabble among the allied representatives, however, and left the extent and importance of future participation by the allies open to various interpretations.

Rusk pointed out that the force had in fact been organized, agreement had been reached on assignment of a deputy to the NATO commander to help direct the force, and that provision had been made for participation by allied officers on nuclear planning staffs both at the NATO command level and in Omaha.

When asked to define the contribution the force will make to the NATO alliance, Rusk said that for the past year the U. S. has been trying to give its allies an "enormous amount of new information in the nuclear field, so that the NATO governments can think realistically and seriously about nuclear problems.

". . . . the creation of a Soviet strike force, capable of hitting Western Europe and the United States, has introduced a new element in the situation in the last 10 years," he said. "And we feel that those governments who are directly involved with defense problems against such Soviet strike capabilities must themselves have full information in order to think hard and realistically about it."

Despite the new emphasis on exchange of information and the increased voice which will be given the allies in planning nuclear strategy, it was pointed out that the U. S. still will retain control of the major portion of nuclear warheads which will be assigned to the new force. Since the nuclear force will be under the control of the NATO commander, Gen. Lyman Lemnitzer, final authority to use nuclear weapons still will rest with President Kennedy.

Increased participation by NATO officers in target planning at SAC headquarters also will not mean putting SAC units under control of the new NATO command. Officers from at least seven other NATO countries will take part in target assignments made by the SAC target planning staff, previously open only to a representative from Britain and one from Canada, but will exercise no control over SAC strike units.

A NATO multilateral force also was discussed during the three-day conference, but its formation was not pushed for the same political reasons which necessitated only a vague reference to the full ramifications of the inter-allied force.

The multilateral force would consist of fully integrated forces with mixed-nationality crews manning Polaris-equipped surface ships and submarines. Increased control of nuclear warheads would be shifted to allied nations as would an increased share of the financial burden. Under the multilateral command control structure, allied nations also would have a larger voice in

## Pravda Cites MA-9's 'Serious Troubles'

**Soviet newspaper Pravda's article on the 22-orbit MA-9 flight of Maj. Gordon Cooper is indicative of how Russia reports U. S. space flights. The headline was "Serious Troubles."**

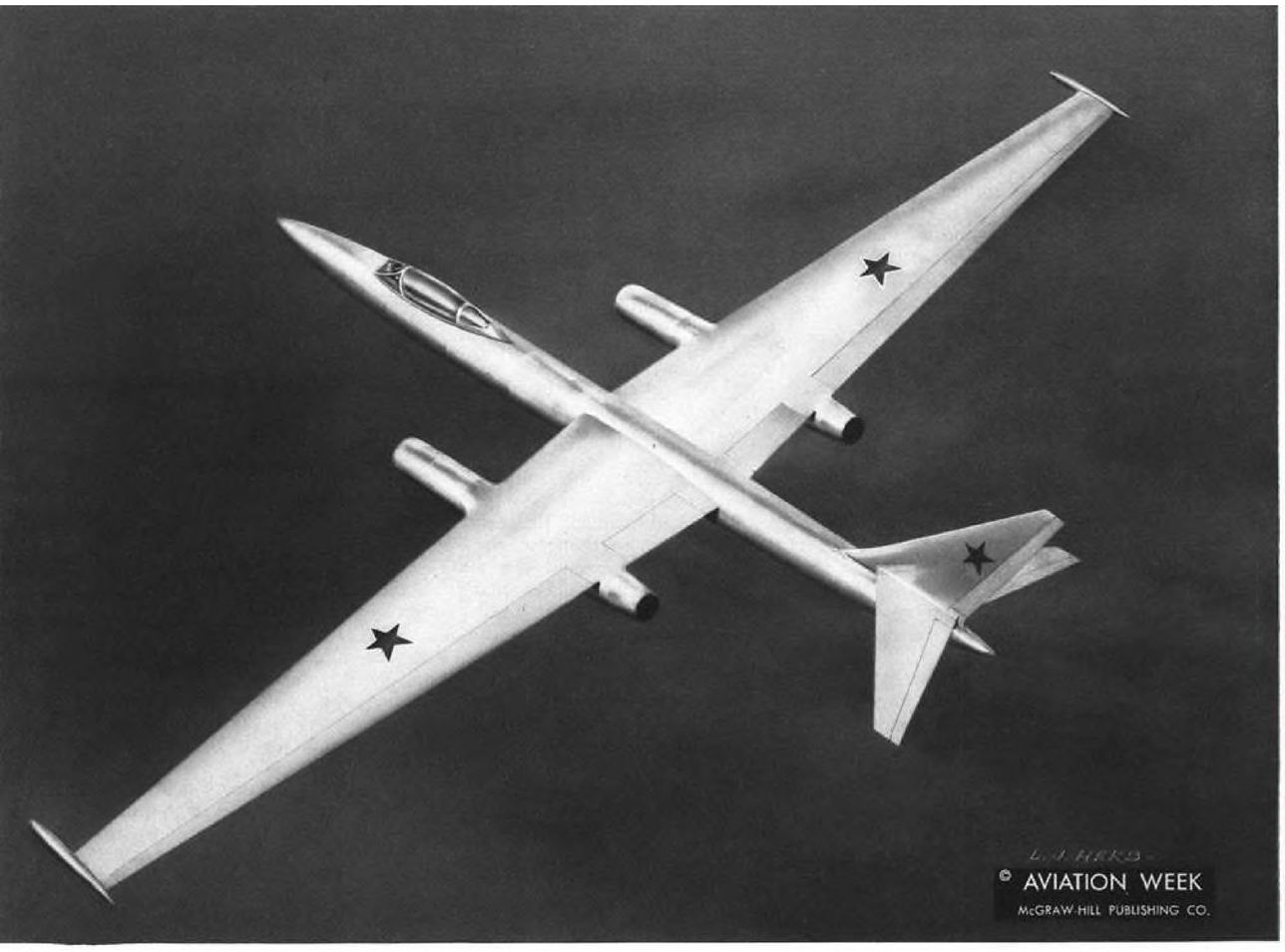
**Following is the complete text:**

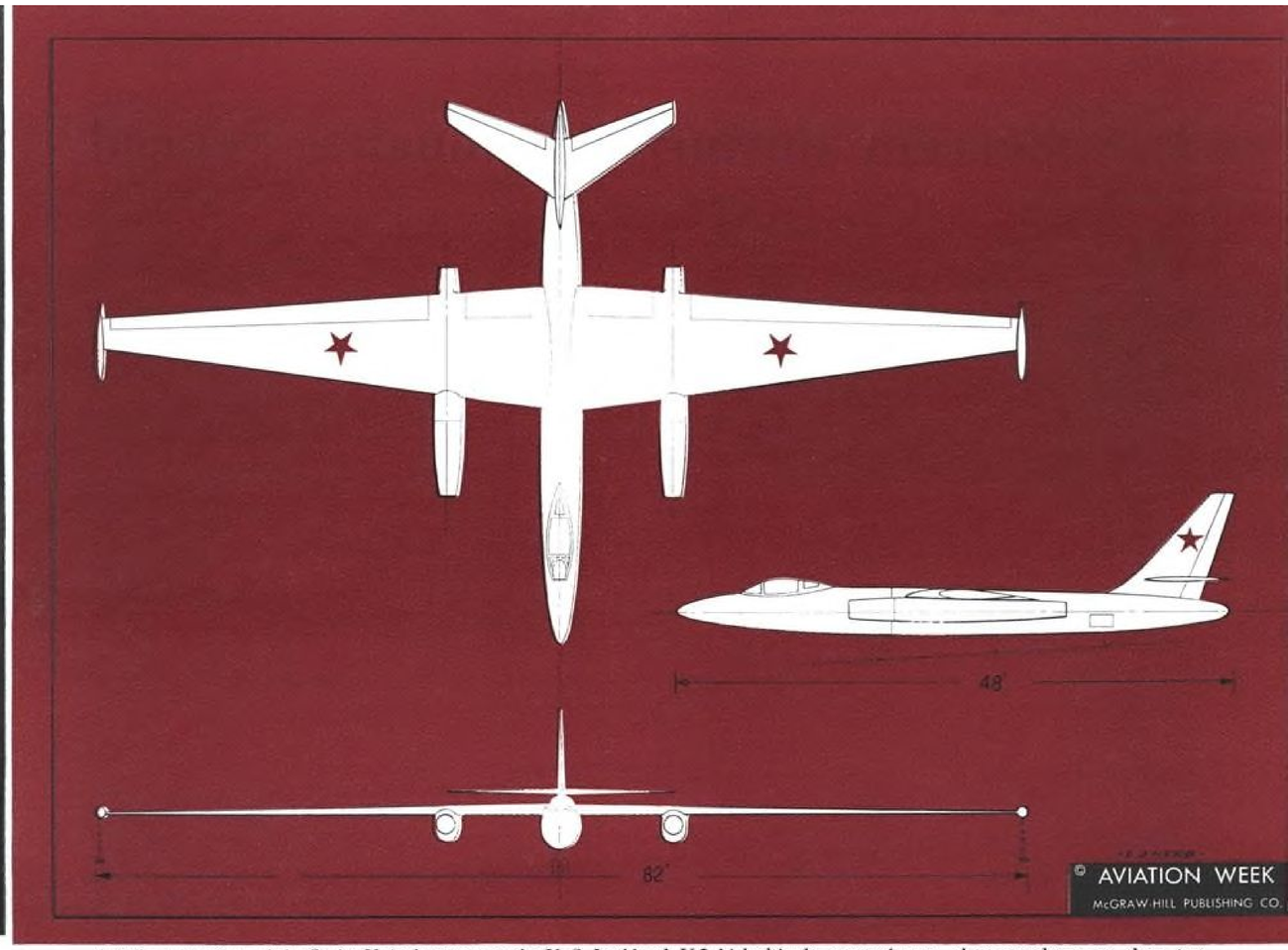
**The American press has reported new details of the space flight by Gordon Cooper. In particular, the newspapers note that there were serious troubles in various systems of the "Faith-7" spacecraft which could have affected the flight's outcome. As has become known from dispatches received from the aircraft carrier "Kearsarge," which picked up the capsule containing Gordon Cooper from the Pacific Ocean and took the cosmonaut to the Hawaiian Islands, Cooper experienced serious difficulties in taking food and water during the flight.**

**Cooper's doctors declared that the cosmonaut "was greatly dehydrated" and lost seven pounds during the flight. In their words, the weight loss was caused by the fact that Cooper could not use his supplies of ordinary drinking water due to difficulties with the container which was specially designed to permit drinking liquid in a weightless condition.**

**The cosmonaut decided not to use his reserve supply of liquid which was intended only for emergencies.**

**The newspapers pointed out that the food supplies aboard the craft were dehydrated and packed in containers which had a device for adding the water necessary for restoring the food's normal consistency. When this device also did not work, Cooper could not get a sufficient amount of food. The press emphasized that one of the principal tasks now facing "Mercury" project scientists, in addition to improving the spacecraft's automatic control system which went out of commission during the 19th orbit around the earth, will be to change these (food container) devices so that the cosmonaut can eat normally during flight.**




Artist's conceptions of the Soviet Union's answer to the U. S. Lockheed U-2 high-altitude reconnaissance plane are shown on these two pages. The plane is now operational with the Red Air Force and is capable of flights over 3,000-mi. range at altitudes above 80,000 ft. at subsonic cruising speeds. Known colloquially as the "Uski Twoski," this aircraft is believed to be the work of the design team headed by veteran Soviet designer Alexander Yakovlev. The aircraft is about 48 ft. long, with an extremely high aspect ratio wing of about 82-ft. span, comparing very closely with that of the Lockheed U-2. Gross weight is estimated at about 25,000 lb., and it is powered by two axial-flow turbojets modified for extremely high-altitude operation. It is apparently equipped with a bicycle-type landing gear similar to that used on the Yakovlev Flashlight all-weather fighter series. It is flown by a single pilot and carries a variable payload of photo and electronic reconnaissance gear. No sightings of this aircraft have yet been made over U. S. territory.

# Soviet Answer to U-2 Now Operational

assignment and use of the force.

Considerable interest in formation of such a force was registered during the Ottawa meeting, especially on the part of the British.

British participation in the multilateral force is a natural extension of the Nassau agreement between British Prime Minister Harold Macmillan and President Kennedy which provided for substitution of Polaris missiles for the now-cancelled Douglas Skybolt missile. Britain had intended to purchase the Skybolt to prolong the effective lifetime of its V-bomber force.

High U. S. officials said discussions of the multilateral force will continue on a bilateral basis with NATO allies. It was indicated that a full discussion of the multilateral force will be taken up in December at the next ministerial council meeting in Paris.

Between now and the Paris meeting, officials said, many details, such as questions concerning control and ownership of nuclear weapons, will have to be worked out on an individual basis with those NATO nations which have said they agree in principle with the multilateral concept.

"No government has said it definitely would go ahead regardless of the settlement of these basic questions regarding the organization of the multilateral force," one official said.

Questions concerning the balance of nuclear armament versus the conventional armament in NATO's defensive forces also were discussed during the conference. Prior to the meeting, there was a wide variance in thinking on the need for maintaining a conventional defensive capability in Europe.

The U. S. view generally was that the NATO forces should be prepared to withstand a Soviet conventional attack on Western Europe for 90 days without having to resort to nuclear weapons.

General feeling among European military officials was that a 60- or even 30-day conventional defensive capability was more realistic. The question of what constituted balance in the NATO forces was not discussed extensively, but in their final communique, the NATO ministers said the need to achieve a satisfactory balance between nuclear and conventional arms was recognized.

The permanent council was directed to consult with NATO military authorities and undertake "further studies of the interrelated questions of strategy, force requirements and the resources available to meet them."

According to some officials, these studies may be similar to the cost-effectiveness studies which have been employed by Secretary of Defense Robert S. McNamara to determine the relative value of U. S. military programs. Connected with this will be discussions about the imbalance in the acceptance of financial responsibilities within the alliance.

Political discussions occupied a portion of the conference agenda with NATO representatives expressing their views on subjects ranging from general East-West relations to specific discussions of the situations in Laos and North Africa. Disarmament, the nuclear test ban negotiations and the possibility of signing a non-aggression pact between the NATO nations and the Warsaw Pact nations also were covered. No positive recommendations were made on these points.

Most positive over-all result of the conference from the U. S. point of view, one official said, was a general realization that the U. S. commitments to the defense of Europe are solid.

"With 400,000 U. S. troops stationed in the NATO area and the growing participation by the other NATO nations in development of nuclear policy with the U. S., there no longer is a need for reaffirmation that the United States is in Europe to stay," the official said.

## Cosmos 18 Launched

Moscow—Eighteenth satellite in the Cosmos series was launched May 24, two days after the launch of Cosmos 17 (AW May 27, p. 23). Cosmos 18 was launched on an inclination of 65 deg. The orbit ranges from 181.4-129.3 mi., and the period is 89.38 min. Tass said Cosmos 18 is transmitting on a frequency of 19,996 mc.

## Alabama Firm to Build Saturn Launch Towers

Cape Canaveral—Ingalls Iron Works Co., Birmingham, Ala., has been chosen by National Aeronautics and Space Administration's Launch Operations Center here to manufacture three launcher-umbilical towers for Saturn 5 vehicles.

The mobile platforms, upon which Saturn 5-Apollo combination will be assembled and later launched (AW Apr. 8, p. 55), will each consist of a 25-ft. tall, 160 x 135-ft. launch table and a 380-ft. tall umbilical tower. Each tower is expected to weigh about 10 million lb. without the Saturn-Apollo.

Ingalls' bid of $11.2 million was the lowest of 10 submitted and almost $1.5 million below NASA's estimate of $12.6 million. Ingalls must complete the three units within 18 months after the award.

# U.S. Secrecy on Soviet Launches Scored

**Washington**—Incisive inquiry by the House subcommittee on government information is placing space agency and Defense Dept. officials on the defensive in explaining their policy of withholding information on Soviet space activities not reported by the Russians.

A principal witness was Dr. George L. Simpson, Jr., assistant administrator of the National Aeronautics and Space Administration, who is responsible for "technology utilization and policy planning," including dissemination of information (AW May 27, p. 21).

He told the subcommittee that the Satellite Situation Report published by NASA includes information on all unclassified U.S. and Soviet space launches. He said reports on foreign and Defense Dept. launches depend on unclassified information supplied by the North American Air Defense Command (NORAD).

Under a policy established about six weeks ago, the Satellite Situation Report now contains information on:

- **Foreign space activities** authorized for release by the office of the assistant secretary of defense for public affairs.
- **Foreign space activities** officially reported to the United Nations Registry, if confirmed by NORAD.
- **Foreign space activities,** including failures, which have been publicly announced by the foreign government and confirmed by NORAD.

Simpson's statement angered Rep. Porter Hardy, Jr. (D.-Va.), bringing on this exchange:

**Rep. Hardy:** You . . . are going to tell us about things that foreign governments have publicly announced. Now that is a real fine help you are giving us. Do you see how silly the darned thing is?

**Simpson:** Yes, sir.

**Rep. Hardy:** If you have any source of information other than the Defense Dept. . . . you can't tell the public . . . unless it was released by the office of the assistant secretary of defense for public affairs. So, he has got a lock on you pretty doggone tight, hasn't he?

**Simpson:** Yes, sir.

**Hardy:** I don't know why you are in the information business if the Defense Dept. is going to exercise this kind of control.

**Rep. George Meader (R.-Mich.):** . . . does NASA recognize the right of the Defense Dept. to prohibit NASA from publishing information about foreign space activities which have been made public by those foreign governments themselves?

**Simpson:** Yes, sir.

**Rep. Hardy:** Public information provided by foreign governments is being suppressed by NORAD and you are not permitted to release it to the American people?

**Simpson:** This has happened. It is not now the case. . . .

**Hardy:** . . . it looks to me as though there is some dereliction of duty in NASA.

Rep. John E. Moss (D.-Calif.), subcommittee chairman, said he wants to determine whether the Defense Dept. and NASA are justified in withholding information on Soviet space failures. He said this and other information on foreign space activities is "vital to public understanding of U.S. and Russian space efforts."

Subcommittee members pointed out that the policy on the amount and kind of information made available in the Satellite Situation Report has not been consistent. The report once contained information on all launches about which the U.S. had tracking information, or about which the Soviet Union had made available information. In 1962, the Defense Dept. drastically reduced the amount of information it supplied on U.S. military and Soviet launches. Then, six weeks ago, the policy was liberalized, as indicated by Simpson.

The subcommittee also pointed out that NASA Administrator James E. Webb last September found it possible suddenly to change the existing policy and report to the chairmen of the Senate and House space committees on six Soviet failures in attempts to launch spacecraft to Mars and Venus (AW Sept. 10, p. 34). Webb's report was detailed, listing dates, spacecraft weights and whether the failures occurred before insertion into earth orbit or in ejection from earth orbit.

It was suggested that since the information was provided so quickly following the request from the space committee chairmen, the request might have been prompted by NASA. At the time Webb disclosed the six Soviet failures, NASA had failed in two attempts to launch Ranger spacecraft to the moon and in one effort to send a Mariner spacecraft on a Venus fly-by mission. The second Mariner spacecraft was launched on Aug. 27 and was on its way to Venus when Webb reported the Soviet failures.

Principal reasons given by the Defense Dept. and NASA for withholding information on Soviet space failures are that such reports reveal information on U.S. tracking capability and that disclosing Soviet space failures embarrasses the Russians, threatening U.S.-Russian space cooperation.

The Moss subcommittee has shown no inclination to accept these reasons.

## New Tiros Coverage

**Washington — Wheel-shaped Tiros meteorological satellite, a new concept to be studied by Radio Corp. of America under a National Aeronautics and Space Administration contract announced last week (AW May 13, p. 37), would be able to photograph every area on earth at least once a day from polar orbit.**

**The satellite is envisioned as a conventional Tiros that has been tipped 90 deg. so that its spin-axis is perpendicular to its orbital axis, giving the appearance of a wheel rolling along its orbital path. Two wide-angle vidicon cameras, similar to those used in present Tiros, would be installed back-to-back looking out from opposite sides of the satellite's rolling rim.**

**The satellite would spin about its axis at approximately 12 rpm., enabling one of its two cameras to photograph 500,000 sq. mi. of earth's surface every 30, 60 or 120 sec. Pictures would be stored on magnetic tape and read out on command when satellite comes within view of a ground station.**

**The rolling wheel configuration in a polar orbit would enable the cameras to obtain continuous earth surveillance. Conventional Tiros' vertical spin-axis stabilization allows its cameras to view earth for one-quarter of each orbit.**

## CL-84 Engine

**Canadair, Ltd., has recommended to the Canadian government that the Lycoming T53 turboprop engine be used on the Canadair CL-84 twin-engine V/STOL transport (AW Jan. 28, p. 35), replacing the Canadian Pratt & Whitney PT6 engine originally chosen.**

**Decision to request the engine change for the CL-84, which is being financed with a $7.5-million government allocation and $2.5 million in company funds, was made following a change in mission requirements for the aircraft.**

**Previously, the aircraft was designed for liaison and reconnaissance missions, but the CL-84's new military roles will include armed helicopter escort, assault transport, search and rescue and V/STOL training. The armed escort missions will require attachment of fuselage stores and a greater aircraft weight.**

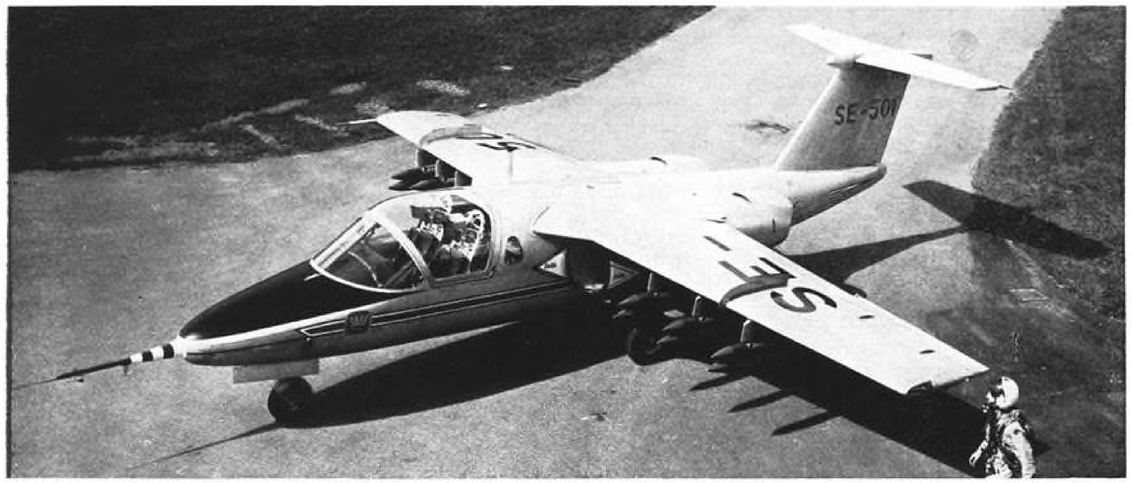
**Widespread use of the T53 engine by Army, considered Canadair's best potential customer for the aircraft, also influenced the decision.**

**The T53 offers 1,100 shp., compared with the PT6's projected 600 shp.**





Prototype of the Saab 105 two-place, twin-jet trainer and tactical aircraft (AW July 3, 1961, p. 37), recently was rolled out at Saab factory in Linkoping, Sweden. Above, the aircraft carries two Saab-designed air-to-ground missiles under the high wing.




# Saab 105 Shown in Liaison, Attack Configurations

Saab 105 also can be armed with 12 Bofors 13.5-cm. air-to-ground missiles, six under each wing, above. Below, aircraft is shown configured as a liaison, trainer or personal executive aircraft with underwing pylons removed. Swedish air force has promised to order a minimum of 130 aircraft if it meets performance specifications. First flight is expected in July. Executive version of the privately financed aircraft would be offered as a four-place plane. Aircraft shown is the first of two prototypes, both built with production tooling. Engines powering the Swedish aircraft are two Turbomeca Aubisque turbofans.



# STL Wins Parallel LEM Engine Contract

By C. M. Plattner

**Los Angeles**—Space Technology Laboratories, Inc., has been selected by Grumman Aircraft Engineering Corp. to develop the mechanical throttling descent engine for the Apollo program's Lunar Excursion Module (LEM).

The engine will be developed in a parallel effort with Rocketdyne's aeration-throttling engine. This eventually will lead to selection of a single contractor to develop the final system (AW Nov. 12, p. 29).

STL won the competition against three other bidders (AW Apr. 1, p. 23) to develop a 10,500-lb. thrust throttleable engine using a mechanical-injector system to control thrust rather than the aeration approach originally favored by Grumman, which introduces an inert gas into the propellant. The competition was initiated at the insistence of the National Aeronautics and Space Administration's Manned Spacecraft Center, which considers propulsion system development one of the most difficult areas in the LEM system.

Mechanical throttling technique used by STL involves controlling fuel and oxidizer flow with cavitating venturi valves located upstream of the injector and use of a variable-area concentric tube injector to control propellant velocities and impingement angles.

Accurate control over propellant flow rate is possible with the cavitating venturi valve since weight flow downstream of the valve is constant for a given orifice area in the venturi valve. It is insensitive to variations in pressure resulting from injector orifice area changes and thrust chamber pressure fluctuations.

Weight flow to the injector is controlled by varying a contoured metering pin in the cavitating venturi valve throat. Weight flow is proportional to the metering area. The system is designed so that cavitation in the throat continues throughout the throttling range, since cavitation eventually would cease as downstream pressures increased.

With the cavitating venturi valves controlling fuel and oxidizer flow, excellent control of mixture ratio as well as residual propellant has been achieved. Testing at STL has shown that residual propellant (amount of oxidizer or fuel remaining after the other has been expended) can be kept as low as ½ of 1%. The need for a propellant utilization system is thus eliminated. Accurate control of mixture ratio also tends to eliminate low-frequency combustion instability.

STL's injector has only one moving part—a sleeve—which is linked directly to the metering pins of the venturi valves. The entire linkage is connected to a single actuator. Movement of the sleeve, which also is accompanied by a change in fuel flow, causes fuel and oxidizer to be injected at different velocities and angles to compensate for the increase or decrease in weight flow of propellants.

The oxidizer (nitrogen tetroxide) flows through the hollow sleeve and is sprayed into the chamber through an annular orifice at the terminal portion of the sleeve. A conically-shaped injector tip, pointing downward, remains fixed. Movement of the sleeve upwards, or toward the top of the thrust chamber, allows the annular opening of the oxidizer orifice to increase, letting more propellant into the thrust chamber at optimum velocity.

Diffusion of the oxidizer is improved by small, cylindrical openings machined around the terminal portion of the sleeve. The original injector developed by STL did not have a diffuser ring and the oxidizer was injected radially through an unrestricted annular area.

Another design change instituted by STL was to reverse the oxidizer and fuel orifices. Originally, fuel was sprayed through the annular orifice in the injector sleeve but better performance has resulted from using this portion of the injector for oxidizer.

The orifice for the fuel (an equal mixture of UDMH and hydrazine) is an annular opening between the injector sleeve and the injector face. The sleeve is contoured so that as it moves upwards, away from the thrust chamber, the orifice opening increases. Fuel travels behind the injector face from the perimeter toward the central orifice to cool the injector and heat the fuel.

Outer contour of the sleeve is such that it has a maximum diameter when sleeve is all the way down and effectively closes off the annular fuel opening. When the sleeve is raised during maximum fuel flow, the diameter of the sleeve opposing the annular fuel outlet is at a minimum. The sleeve also is contoured conically from its minimum diameter toward the injector tip to provide optimum impingement angles.

Testing performed during development has shown that this type of injection system results in uniform throat erosion with negligible localized charring and ablation, according to STL.

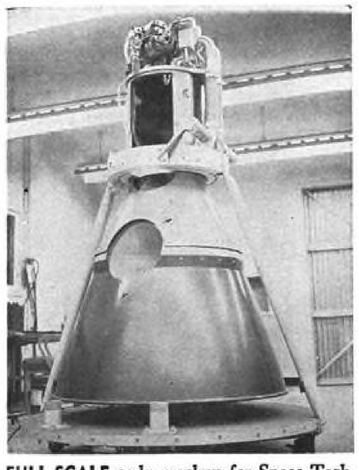
STL probably will use an ablative throat in its engine, although engineers there feel that a hard throat approach merits consideration if new materials such as zirkonia are proven and if coatings for present metals such as tungsten are developed to eliminate oxidation. About 97% of the LEM-engine specific impulse requirement is now being attained with state-of-the-art soft throats, according to STL. Company engineers are confident that the last 3% of specific impulse can be achieved with continued research on ablative material.

Stringent requirements have been dictated for LEM engine because during terminal portion of lunar approach closest to the surface, engine must still maintain high performance after having burned 6 to 7 min. at full power during descent-braking phase. STL is working closely with Tapco Div. of Thompson Ramo Wooldridge, Inc., in development of ablative materials.

The ablative material currently employed is oriented glass fiber in the throat and throat area and randomly-oriented fibers in the upper chamber and lower thrust chamber area. Randomly-oriented glass fiber material is less expensive than oriented fiber material.

STL decided to enter the rocket engine business more than two years ago. At that time, its principal activity in the propulsion field was system engineering and technical direction of the Air Force ballistic missile program, which included all of the related propulsion systems.

Based on extensive in-house studies of various space missions and attendant requirements for guidance, control and propulsion, STL decided to concentrate on developing with its own funds a deep-throttling engine for space applications utilizing storable hypergolic propellants. Decision to build a throttleable engine was based on the performance edge they would have over stop-start, constant-thrust engines.



**FULL-SCALE** early mockup for Space Technology Laboratories LEM descent engine shows details. Engine is 75 in. in length and exit nozzle is about 3½ ft. across. Valve and actuator package now has been moved to side of engine from top and skirt extended.

In the course of development STL has built a half-scale, 5,000-lb.-thrust engine and a 500-lb. thrust engine which have been primary tools in its research and development effort. A full-scale LEM battleship engine also was fabricated to test combustion instability with the bombing technique.

The LEM-contract will be the first prime engine development award STL has received with its engine design. Air Force has been interested in the engine and has been using an engine on loan from STL in evaluation tests at Edwards AFB.

Combustion efficiency demonstrated in tests over the 10 to 1 throttling range with STL's 5,000-lb. thrust engine ranges from slightly less than 96% at low thrust to over 98% at full thrust. Instability has not shown up in the testing program and the company feels that it has an inherently stable engine. Bombing tests with the full-scale battleship engine at chamber pressures of 80 and 105 psi. have damped out in the same time as would be expected with no combustion.



### Surveyor Verniers

**Los Angeles—Space Technology Laboratories has received a $345,000 letter contract to develop a backup vernier engine for Surveyor spacecraft from Jet Propulsion Laboratories' Propulsion Div.**

**Contract calls for feasibility demonstration of the throttleable, 140-lb.-thrust ablative cooled engine by the end of this year.**

**STL engine is a scaled-down version of its Lunar Excursion Module descent engine (see story) and will be throttleable over at least a 5 to 1 and possibly 10 to 1 range.**

**Thiokol's Reaction Motors Div. has been developing a regeneratively-cooled Surveyor vernier engine for Hughes Aircraft Co. (AW Oct. 8, p. 77), which is throttleable over a 3.5 to 1 range with maximum thrust of 100 lb. The upstream-throttling engine has experienced some difficulties in its throttling system during development by Reaction Motors Div.**

**Increased throttling range of the STL engine will permit a reduction in supply of propellant (mono methyl hydrazine with nitrogen tetroxide as oxidizer), although the engine will weigh slightly more because of its refractory cooling system. Surveyor vernier engines are considered critical for the midcourse correction maneuver.**

# New Rules on Gifts, Employment Outlined for Pentagon Personnel

**Washington**—It is permissible for a Defense Dept. official to accept a model airplane from a manufacturer, but he must draw the line at plaques for his office wall.

This interpretation of a new directive on standards of conduct for all Defense Dept. personnel was offered by Adam Yarmolinsky, who is a special assistant to Defense Secretary Robert S. McNamara.

The directive, based on a revision of the criminal code that became effective Jan. 21, covers a broad spectrum of rules governing post-Defense Dept. employment and the acceptance of gratuities.

The directive became effective on May 17.

### DOD Directive

On the subject of gratuities the directive says: "DOD personnel will not accept any favor, gratuity, or entertainment directly or indirectly, from any person, firm, corporation or other entity which has engaged, is engaged, or is endeavoring to engage in procurement activities or business transactions of any sort with any agency of the DOD where such favor, gratuity, or entertainment might affect, or might reasonably be interpreted as affecting or give the appearance of affecting the objectivity and impartiality of such personnel in serving the government."

The ban includes families of Defense Dept. personnel.

During a question-and-answer period on the provisions of the directive, Yarmolinsky and Deputy General Counsel Leonard Niederlehner said that some kinds of advertising matter could be accepted.

"I would say that a calendar from TWA, for example, is nothing but an advertisement and is not considered to be a gratuity," Niederlehner said. "It's a means of advertising, but if you get a set of drinking glasses or a crate of oranges or something like that, it begins to develop intrinsic value, shall we say, and you should be careful with respect to it."

### 'Improper' Plaques

Yarmolinsky said that he had received a set of plaques which he could have framed and hung on his wall. He considered it improper to accept these and returned them.

Yarmolinsky was asked, "How about . . . airplane and missile models and so forth. Are they acceptable? They do stand around as reminders that such-and-such company produced the thing."

"Well . . . I was sent one and I took it home and gave it to my 11-year-old son and I thought 'Is this proper?' and then I thought 'I guess I'll do it,'" Yarmolinsky said.

It was pointed out that tie pins are permissible gifts, and business lunches are a normal procedure.

No dollar limit was set by the directive for gratuities.

The language of the directive leaves much of the interpretation to Defense Dept. officials responsible for the actions of others as well as to individuals themselves.

### Retired Officers

In regard to post-employment activities, the directive standardizes different regulations that formerly governed the retired officers of the three services. Now all regular retired officers are barred from engaging in activities which involve selling, negotiating sales or contracts or liaison in connection with sales to the government for three years after retirement.

For the first time, reserve officers retired with pay after 20 years of active duty are covered by the same set of regulations. However, another category of retired reserves who participated in the reserve drill program for 20 years and then receive retired pay at age 60 is not affected by the selling provisions of the directive.

### U.S. Mercury Contact

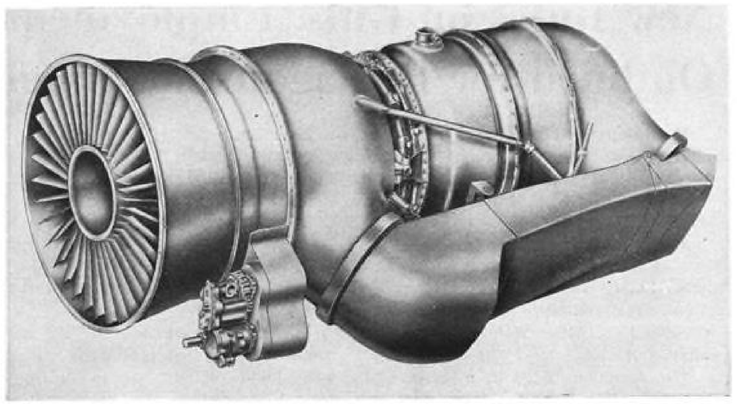
**Washington—First U. S. radar contact with Mercury, made over a 23-day period ending May 29, indicates the planet has a rougher surface than either Venus or Mars, the Jet Propulsion Laboratory announced last week. The Soviet Union in January claimed the first successful radar contact with Mercury (AW Jan. 14, p. 37).**

**The USSR, however, did not disclose the results of its experiment.**

**JPL scientists reported that contact with Mercury was established with an 85-ft. dish at the laboratory's Goldstone, Calif. tracking facility. They said the planet was about 60.5 million mi. away—its closest approach to earth—when the radar experiment began.**

**Radar reflectivity experiment indicated that the surface of Mercury is similar to the surface of the moon. The radar contact also fixed Mercury's distance from the earth to within ±100 mi.**

**JPL conducted radar experiments on Venus in 1961 and 1962 and on Mars in February, 1963.**



**Bristol Siddeley BS.100 Engine Changes Shown**

Several changes in the outer casing design of the Bristol Siddeley BS.100 engine are evident in this drawing. Changes from previous design (AW May 14, 1962, p. 30) include smoothed-over low pressure casing and a modification to improve blade containment, since the engine has larger blades. Entry guide vanes have been changed and the gear box has an integral oil tank. Vectorable thrust engine will power the Hawker P.1127 VTOL fighter.

# Air Force Space Goals, Projects Defended by Research Staff Chief

Dallas—USAF deputy chief of staff for research and development, Lt. Gen. James Ferguson, denied criticism often voiced in Dept. of Defense that the military element of the national space program has no clearly definable goal by citing two Air Force objectives—to augment existing military capabilities of U.S. and to provide military space patrol capabilities.

Gen. Ferguson, speaking during the Aviation/Space Writers Assn. 1963 annual meeting here, also stated that the Air Force hopes to proceed with an orbital space station soon. He said it could be designed to meet requirements of the National Aeronautics and Space Administration and other government agencies. USAF hopes to play the major role in such a program under the Dept. of Defense-NASA agreement covering cooperation by the two agencies in future manned near-earth space developments, he said.

He noted that even with such a space station, the Air Force would still have an interest in Dyna-Soar, Gemini and the Aerospace Plane concept.

Gen. Ferguson said that the clearly defined aspects of USAF's two-fold space program encompass space command and control communications, atmospheric weather surveillance, particularly in target and refueling areas, warning and active defenses against missile attack. USAF military patrol functions would include improved spaceborne detection and tracking systems, means of inspecting space devices and disabling them if necessary and a system for monitoring space phenomena such as solar flares in order to maintain prolonged space operations.

Other highlights of military service presentations during the meeting:

• **Guidance evaluation missile** (GEM) (AW Apr. 2, 1962, p. 13), is under study by USAF Systems Command. It will have an altitude capability of approximately 100 mi. and varying booster configurations to provide a variety of acceleration profiles. This program would extend capabilities of current rocket sled tracks in evaluating guidance components both in distance and duration of tests.

• **Tactical Air Command** Maj. Gen. S. J. Donovan, deputy for operations, noted moves made to provide closer liaison with Army forces, including assignment of two forward air controllers and one air liaison officer to each of the eight Army divisions in Stricom (U.S. Strike Command). Ten forward air controllers, most of them jump-qualified, have been assigned to each tactical fighter squadron and studies of cargo-extraction technique (AW Sept. 24, p. 122) are being extended to embrace spot troop deliveries via 20- to 40-man capsules that would be pulled from low-flying transports by a hook engaging ground-installed cables.

• **Turboprop YAT-28E** strike aircraft, prototype of which crashed in flight test program (AW Apr. 1, p. 31), showed so much promise in testing that Air Force definitely will continue this program, as predicted by AVIATION WEEK & SPACE TECHNOLOGY (AW Apr. 22, p. 23).

## British Aviation Group Leaves for Soviet Visit

London—British Minister of Aviation Julian Amery, accompanied by an industry and government technical team, was to leave last week on a visit to Soviet aviation installations. The group is traveling in a British Overseas Airways Corp. de Havilland Comet.

Despite considerable speculation on the political ramifications of the trip—since Amery is a son-in-law of Prime Minister Harold Macmillan—the visit is primarily scheduled for technical briefings.

It will include a demonstration of the Ilyushin Il-62 jet transport, along with visits to factories and airfields.

The British team also will be briefed on the Soviet supersonic transport program.

Amery will be accompanied by Sir Denning Pearson, managing director and vice chairman of Rolls-Royce; Sir Arnold Hall, managing director of Hawker Siddeley; Dr. M. J. Lighthill, director of the Royal Aircraft Establishment at Farnborough, and Sir Robert Cockburn, Ministry of Aviation director of guided weapons.

Invitation followed a conversation at a Soviet embassy cocktail party between Amery and Soviet Ambassador M. Soldatev, which was followed up by a letter from Amery to the ambassador detailing areas of interest.

After three weeks of silence, the Russians abruptly extended the invitation, which was promptly accepted. The British group will leave Moscow in time to attend later portions of the Paris Air Show, June 7-16.

One element involved in the visit to Russia is renewing of relations, which became somewhat cold when the Ministry refused last September to allow the industry to invite Russians as their Farnborough guests. The ban was made on the grounds that the courtesy was not returned by the Soviets.

### Personnel Change

David A. Anderton, technical editor of Aviation Week & Space Technology, has resigned to become an independent technical consultant in the aerospace industry. Mr. Anderton has been with this magazine for 13 years, during which he established its European office in Geneva, Switzerland, and also directed its expanding technical coverage of the aerospace industry from New York. Before joining Aviation Week & Space Technology in 1950, Mr. Anderton worked as an engineer on aircraft and missile projects at Grumman Aircraft Engineering Corp. and General Electric Co.



## Satellite Inspection Study Proposals Asked

USAF's Space Systems Div. has asked industry for proposals on a series of design studies intended to aid Air Force in taking a fresh look at the many phases of satellite rendezvous and inspection.

Proposal requests had been in the offing for several weeks (AW May 13, p. 23) and are believed to be in support of Air Force projections for operations in space (AW May 27, p. 31).

Proposals in at least four separate study categories are due at SSD June 17. Contemplated fixed-price study contracts will be of the so-called "phase zero" type—those which precede the program definition phase studies.

Proposals requested by Air Force cover:

• Acquisition, target and search (ATS) subsystem. This effort will examine various types of sensors applicable to an inspection vehicle's target seeker. Combinations of infrared sensing, radar and optical masers are to be examined and tradeoffs performed to determine relative advantages of a single sensor or combinations of sensors. A combination likely to be investigated will be optical maser range finding (laser radar) or RF radar for tracking, and passive techniques—infrared or ultraviolet detection—for detecting and acquiring a target. This request probably evolved from the sensor studies earmarked for Raytheon and Hughes Aircraft, which were part of the ill-fated manned Saint program (AW June 4, p. 34) killed by the Air Force last summer.

• Electronic imaging—visual and infrared techniques for obtaining pictorial information on non-cooperative targets of interest.

• Mass sensor. This will be an examination of techniques for determining the mass of a non-cooperative satellite to determine if it is sufficiently large to carry weapons or whether it is a decoy. One approach might be to rendezvous with, and then physically push the vehicle. Mass could then be determined by measuring the vehicle's acceleration under the application of a known force. Another approach might involve determination of density of the vehicle by nuclear methods.

• Universal module—an investigation of what is sometimes called "MUM"—manned or unmanned module—a standardized satellite module capable of maneuvering for rendezvous and inspection (AW Apr. 8, p. 29) with potentially hostile space satellites. The universal module might be added to a Gemini spacecraft and crowded with sensors—or it could carry a human cargo.

Several other sole-source contracts have been awarded by SSD in connection with this satellite rendezvous and inspection effort. These contracts include studies of unmanned satellite inspection, to Radio Corp. of America, and of Gemini vehicle adaptation to inspection. Others in the series are believed to include awards to Martin, for study of Titan 3 transtage use, and to Lockheed for use of Agena vehicles to fly by alien satellites for quick observations and measurements.

Additional competitive studies anticipated as part of the new Air Force effort include investigations of Elint techniques (passive electromagnetic countermeasures) and nuclear armament sensors.

## News Digest

**Rohr Corp.,** Chula Vista, Calif., will build engine pods and thrust reversers for Douglas DC-9 jet transports under a $28,300,000 contract agreement. Rohr is the third major subcontractor chosen so far by Douglas in the DC-9 development program.

**Australian government** has ordered 18 DHC-4 Caribou transports from de Havilland Aircraft of Canada for use by the Royal Australian Air Force. Delivery of the transports, valued at about $15 million, will begin in December. Australians also ordered a de Havilland DH-125 for use by the Director of Civil Aviation's office as a pilot trainer and a survey aircraft for radio and navigation aids.

**Watch for** Royal Air Force to order six Avro 748 turboprop transports, two of which will be assigned to the Queen's Flight to replace de Havilland Herons. The other four will be used as staff transports.

**Delivery of Tiros 7 to NASA** by RCA's Astro-Electronics Div., Princeton, N.J., was made last week. Launch is scheduled for early this summer at Cape Canaveral on a Douglas Thor Delta vehicle.

**Senate** Foreign Relations Committee last week voted a $15-million limitation on funds for the Arms Control and Disarmament Agency for the next two years.

**Sylvania Electric Products, Inc.,** has received a $97,000 NASA contract to study an information-gathering satellite which would be used to relay weather and oceanographic data collected from unmanned stations, buoys and balloons. Data would be collected through coded interrogation by the satellite and retransmitted upon command to ground stations.

**New Zealand** has informed NASA that the first Arcas sounding rocket launched from that country in a cooperative program with the U.S. space agency was successful. The rocket, launched May 22, was to measure electrical characteristics of the lower ionosphere. Two more Arcas rockets will be launched to measure turbulence at high altitudes.

**National Academy of Engineering** will be formed in affiliation with the National Academy of Sciences, Dr. Eric A. Walker, president of Engineers Joint Council, said last week.

**Kaman Electronic Systems Div.,** Bloomfield, Conn., has received a $376,752 contract from the Army to install "unidrone" universal drone equipment in 10 Bell OH-13 helicopters. The helicopters will be used as targets for ground small arms fire at Army's Combat Development Center, Ft. Ord, Calif. (AW Apr. 29, p. 19).

**USAF Maj. L. Gordon Cooper,** pilot of the 22-orbit Mercury Atlas-9 mission, received his pilot astronaut badge—pilot's wings embellished with a shooting star—from Air Force Chief of Staff Curtis E. LeMay in a Pentagon ceremony last week.

**Army has approved** flightworthiness of General Electric Co.'s lift-fan propulsion system that will power the Army's XV-5A V/STOL research aircraft. Ryan Aeronautical Co. is building two XV-5A airframes, and the first flight is expected this year.

**USAF-Martin Titan 2** exploded about 50 sec. after launch from Cape Canaveral May 29 when the first stage of the two-stage ICBM exploded. Cause of the explosion was not immediately known. It was the first total failure for the Titan 2 in sixteen research and development launches.

### Forecast Post

Los Angeles—Allen F. Donovan, senior vice president-technical of Aerospace Corp., will serve as scientific director of Project Forecast, a study into the future requirements of the Air Force (AW Apr. 15, p. 39).

Donovan will take the post on a loan basis from Aerospace Corp. for an estimated three to four months. During this period he will be relieved of corporate management responsibilities, including his post as general manager of Aerospace's El Segundo, Calif., technical operations.

# U.S., Canada Might Revise Bilateral Pact

By Donald E. Fink

**Ottawa, Canada**—Disagreement between U.S. and Canada over airline service between Toronto and Buffalo has renewed talk of renegotiating the U.S.-Canadian bilateral air transport agreement, which Canadian officials contend is outdated.

Canadian Air Transport Board and the Office of the Secretary of State for External Affairs are expected to approach their counterparts in the U.S. in the near future and ask for pre-negotiation discussions.

A major aim will be to obtain routes to West Coast cities such as Los Angeles and San Francisco, southern cities such as Dallas and Birmingham and possibly to Miami.

The Toronto-Buffalo route dispute stemmed from U.S. attempts to license Eastern Air Lines and Mohawk Airlines to serve the two cities. American and Trans-Canada Air Lines were licensed to fly the route under the original 1949 agreement.

American served the two cities with stops on its Toronto to New York flights, but gradually reduced the service and finally asked to terminate it because of declining revenues. TCA has never initiated service on the route.

### Mohawk Licensed

The route controversy was settled late last month, when Canada agreed to license Mohawk on the Toronto-Buffalo link. Mohawk, whose application was under consideration by the Canadian government for almost a year, will begin service on the route June 17, coinciding with American's termination of service.

Mohawk will serve the Toronto-Buffalo route with three daily flights each way. The flights departing Toronto will leave at 7:15 a.m., 3:10 p.m. and 8:15 p.m. All will terminate in Boston. In addition to Buffalo, the Toronto flights also will serve Rochester, Syracuse, Albany, Hartford and Providence, but no single flight will make all the stops.

Two of the return flights, 7:40 a.m. and 6:05 p.m., will originate in Boston. The third, at 4:15 p.m., will originate in Albany. Arrival times at Toronto will be 11:40 a.m., 7:00 p.m. and 9:45 p.m.

The Eastern application was rejected by Canadian air transport officials on the grounds that the route would give Eastern a Toronto to Miami connection in addition to its Montreal to Miami route. Trans-Canada presently serves Tampa from Toronto and for several years has made unsuccessful attempts to get a Miami route from either Toronto or Montreal.

U.S. air transport officials agreed to impose a two-stop restriction on Eastern's flights out of Toronto, requiring the airline to stop at Washington, Philadelphia or a comparable city after leaving Buffalo.

The two-stop restriction, coupled with the fact that the 3,000- and 2,600-ft. runways at Buffalo are too short for heavy jet airliners, would prevent Eastern from operating a Toronto-Miami flight. Such a flight would not seriously compete with TCA's Toronto-Tampa flight, the U.S. officials contend.

Despite the two-stop restriction, Canada rejected Eastern's license request amid protests from U.S. officials that the action violated the bilateral agreement. Under the agreement, both countries are free to license a carrier or carriers to fly certain agreed-upon, trans-border routes. All license grants must also be approved by the other nation.

Canada's objection to licensing Mohawk also revolved around the problem of through traffic from Toronto, in this case to Mohawk's route structure in the New England states.

Canadian officials at first required that a 150-seats-daily capacity restriction be imposed on Mohawk in accordance with Section 4 of the bilateral agreement annex. This states that "the air transport facilities available to the traveling public under this agreement and annex shall bear a close relationship to the requirements of the public for such transport."

The 150-seats-daily capacity was what Mohawk had anticipated in its license application, but the restriction was opposed by U.S. officials. They argued that it could not be imposed before Mohawk had gained enough experience on the route to determine the requirements of the traveling public.

Canada lifted the 150-seat limitation and granted Mohawk an unrestricted license, but reserved the right to impose a restriction at a later date, under the provisions of the bilateral agreement.

The bilateral agreement, first formulated in 1949, has not been altered since 1959. It is on this point that Canada is lodging one of its major objections.

The Canadian contention is that the agreement is technologically out of date because the routes were granted when the DC-3 was TCA's principal aircraft. TCA also was the only Canadian airline in existence at the time.

Since then, Canadian Pacific Airlines, a privately owned carrier, has begun operations. CPA overflies the U.S. on flights from Canada to Mexico and also stops at Honolulu on flights to Australia, but has no routes to cities in the continental U.S.

Canadian officials also point out that the airline agreement has an unfavorable economic balance for Canada and limits TCA to relatively short border hops, with the exception of the Tampa flights. They state that Canadian passengers are required to fly short hops across the border and transfer to U.S. airlines to reach most major U.S. population centers.

Under the original agreement, Canada was given 10 routes, while the U.S. obtained 16 in return. U.S. points served by TCA include New York, Chicago, Boston, Seattle and Tampa. U.S. carriers serve all of Canada's major population centers—Montreal, Toronto, Ottawa, Winnipeg and Vancouver.

### Pact Amended

In 1959, the agreement was amended, giving the U.S. eight additional routes and deleting one. Canada was given six additional routes.

To bring about a more favorable balancing in the bilateral agreement, Canada is suggesting these revisions:

- **Increase TCA connections** with major population centers throughout the U.S., instead of a few selected connections and a concentration of short trans-border routes.
- **Make all routes** that penetrate to population centers deep within the U.S. double-track routes, served by both the U.S. and Canadian carriers.

U.S. position is that the agreement constitutes a fair exchange between the two countries and that Canada would have to be prepared to trade route extensions with the U.S. in return for increased routes to U.S. cities.

Canadian officials concede they have little to trade, since they are victims of their own geography, which puts a major portion of Canada's population in a relatively narrow strip along the U.S.-Canadian border and further concentrates it in the eastern sector.

They maintain it is easy for the U.S. to serve all major Canadian population centers with relatively few flights, while Canada can serve only a few of the big U.S. population centers with the routes it receives in return.

This is countered by the U.S. argument that U.S. carriers do not serve only major population centers in Canada. The U.S. route system in that nation includes such connections as Great Falls to Edmonton, Seattle to Whitehorse, Boston to Moncton and Spokane to Calgary, for example.

Despite what the U.S. calls a fair exchange, Canadian officials feel the agreement should be renegotiated on a different basis than that normally used between two countries.

Canadians feel that the tradition of close ties and free travel across the U.S.-Canadian border, plus the amount of trade, business exchange and tourist travel between the two countries, should put the airline negotiations between the two countries on a unique basis.

Official Canadian position is that the agreement should be amended and updated. G. W. McConachie, president of Canadian Pacific Airlines, which presently serves no U.S. cities, is stronger in his objections to the bilateral agreement and has called it a "log-jam" in the flow of air transportation between the two countries.

McConachie said the most frustrating exception to the international direct-flight principle between countries is on the U.S.-Canadian border.

"Because of an obsolete air agreement between the two countries, Canadian and U.S. airlines are prohibited from providing the direct city-to-city, trans-border air services the traffic demands . . . Thus, if we can break the log-jam of the bilateral air agreement, the results will benefit the airlines as well as the traveling public," he noted.

McConachie said obvious routes which should be authorized are Toronto to Los Angeles, Toronto to San Francisco, Vancouver to Los Angeles, Vancouver to Chicago, Vancouver to San Francisco and Montreal to Chicago.

Another example used by McConachie to point up the air transport imbalance between the U.S. and Canada is the exclusive service on some U.S.-Canadian routes by airlines from other foreign countries. One such route is Montreal-Chicago—served by Lufthansa, Air France and Alitalia, but not by a U.S. or Canadian carrier.

U.S. maintains that specific route grants such as the Montreal-Chicago link have been given to foreign airlines in exchange for routes on the European continent and that these routes had been jointly agreed upon by the U.S. and Canada.

Canada, for example, was granted the Paris-Rome route by France in exchange for the Montreal-Chicago link. TCA has not been able to fly the route, however, because Italy vetoed the exchange of Paris-Rome rights and instead offered a Rome-Bangkok route.

Another factor influencing possible extension of Canadian service inside the U.S. concerned charges that TCA was promoting international travel from within the U.S. A specific example concerned TCA's plan for flying from Cleveland to London, as an extension of its Cleveland to Toronto flight. The U.S. protested that Cleveland to London promotion was unwarranted extension of trans-border privilege.

U.S. protest forced TCA to change its Cleveland to London advertising and also caused at least a token flight change at Toronto, which in some cases involves merely changing the aircraft flight numbers. U.S. officials note that the TCA flights are still billed as Cleveland/Toronto-London connections.

So-called Fifth Freedom rights granted to foreign air carriers operating between U.S. cities also are a point of contention in the U.S.-Canadian route extension discussions. Canadian officials use the example of European Fifth Freedom rights as justification for granting TCA extensions of its routes to southern cities.

U.S. feels this would mean doubled competition for U.S. carriers on a domestic basis and possibly on through or connecting international flights.

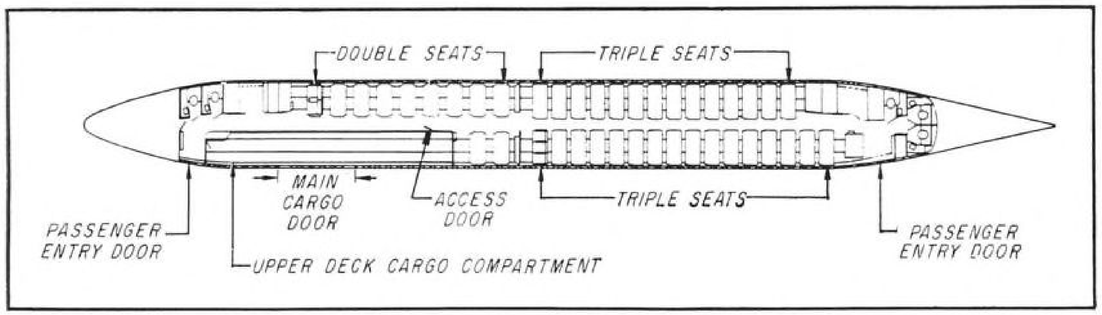
Further complicating the bilateral agreement discussions, however, will be the fact that U.S. airlines are not united in their feelings on the amount of competition that will be generated on specific routes.

Extension of TCA's route to Miami, for example, in return for a U.S. route from Chicago to Toronto, would benefit American Airlines, which presently serves Toronto, but not Eastern, which serves the Montreal-Miami route.




**Northwest Orient Boeing 707-351B Cabin Layout Shown**

Cabin arrangement which allows portion of the upper deck of a 707 fuselage to be used for large cargo items will be incorporated in the five 707-351B turbofan transports ordered by Northwest Orient Airlines. The aircraft are to enter scheduled transpacific service in July. Large cargo door, 91 x 134 in., is located between the leading edge of the left wing and the forward passenger door. Cargo area is opposite seats for 22 first-class passengers. Upper deck cargo area is 37 ft. long and has an average floor width of 50 in.



# IATA Fares Dispute Aids U.S. Airlines

By L. L. Doty

**Washington**—Political furor over the international fare situation subsided last week when a compromise was reached on a new rate, but European carriers were alarmed by an unexpected development: a slight but significant switch in advance bookings from foreign flag carriers to U.S. airlines on the North Atlantic.

It appears that the European airline faction has been fixed in the public image as a high-fare bloc as a direct result of the political fracas over the fare issue, and that U.S. carriers are being viewed as low-fare advocates victimized by threats of reprisal and sanctions (AW May 27, p. 34). While some U.S. travelers reacted to this impression by shifting their reservations, the Civil Aeronautics Board was probing the situation to determine just how realistic the position of the U.S. carriers is.

The CAB has never been given access to the minutes of the Chandler, Ariz., International Air Transport Assn. traffic conference (AW Nov. 5, p. 44), where the decision for higher economy fares was made. The CAB requested the minutes and had been given those of previous conferences in the past but, so far, it has been unable to lay hands on the Chandler minutes.

There is a suspicion among some Board officials and staff members that either TWA or Pan American—or both—may not have been as strongly opposed to the fare increase as has been indicated. Only the minutes of the conference will verify their exact positions during the six weeks of negotiation at Chandler.

This much is known: Lufthansa went to the Chandler conference determined to fight for an across-the-board fare cut on the North Atlantic. It reportedly drew no support for its low-fare proposals during the conference. In addition, the unanimity rule of the conference is evidence that both U.S. carriers voted for the fare raise.

During the recent Senate Commerce Committee hearings on the fare issue, John C. Leslie, Pan American's administrative vice president, gave this reason for casting a vote for the hike: Pan American believed, he said, that "this was the best deal we could come away with this year." He further indicated that the U.S. had bargained some favorable concessions on promotional and excursion rates by supporting the IATA resolution.

In the same hearing, Thomas Taylor, vice president of TWA, followed a similar vein. He said:

"The Chandler resolutions represented a compromise among those who felt that economic salvation lay with fare increases and those of an opposite persuasion. We believe these divergent points of view were honestly held and that the final resolutions involved a good deal of give and take on both sides of the economic fence."

Taylor did state, at that time, that TWA favored a reduction of first-class fares and "felt the economy fares were about right and did not seek an increase."

Two other aspects of the issue have caught the curiosity of observers. Why did European carriers stand so solidly behind Great Britain's intractable position against the U.S., particularly when several carriers—notably Lufthansa and Sabena—wavered toward the U.S. side in the last moments of the crisis? And why did the CAB delay the announcement of its disapproval until 14 days before the proposed effective date of the new tariff?

The answer to the first question appears to lie in a reluctance by all carriers to renounce the agreement reached within the IATA traffic conference. In addition, the firm position taken by Great Britain and some other European countries in threatening to confiscate the aircraft of any airline not abiding by the Chandler tariff—a threat deplored by Lufthansa—undoubtedly pulled wavering carriers back into the British line.

On the second question, CAB Chairman Alan S. Boyd admitted late last month in London that ". . . the decision was late, and that the lateness of our action has caused difficulties and we regret it. I don't think it will happen again." It is significant that the Board disapproval of the Chandler fare was a direct result of State Dept. pressure.

State Dept. forced the decision, and it is quite possible that without that interference the Board decision might have been an approval, in which case it would have come earlier.

Unfortunately, the airlines—both U.S. and foreign—are not directly responsible for the public impression of a split between a pro-high-fare group and anti-high-fare group. If such a split does exist, it can be revealed only by the minutes of the Chandler conference, which, like all others, was conducted in secret sessions.

The impression was made in the British House of Commons and the U.S. Senate. The charges and countercharges made in both chambers brought the dispute into the open, and were the real reasons behind the desertion of travelers from foreign flag carriers to U.S. airlines.

Net result of the Senate flare-up is that the CAB is now under a virtual mandate to bring about lower fares before the peak summer season of 1964. The compromise agreement—$7 reduction of one-way fares and lowering of the round-trip discount from 10% to 5%, in effect from July 26 through Mar. 31—will not satisfy an irate Senate Commerce Committee.

This support, plus the stigma of high fares now associated with foreign carriers, places the U.S. in a powerful bargaining position to get about what it wants in a revised fare structure.

Meanwhile, the drive for legislation that would grant authority over rates to the CAB, sponsored by Sen. Warren Magnuson (D.-Wash.), lost some of its impetus last week. The compromise agreement, reached late last month in Montreal at a special traffic conference, removed the air of urgency from the proposed legislation, and action was postponed until this week.

The Senate committee was to meet in executive session June 4 to decide whether it will introduce a bill giving the CAB rate suspension authority only, or a measure giving it full power to fix international rates. Chances are fair that some form of the proposed legislation will win congressional approval, although similar bills have been proposed in every congressional session but one since 1946 without success.

## Trippe Merger Views

**New York—Juan T. Trippe, president of Pan American World Airways, said last week that the Civil Aeronautics Board should renew its processes toward a merger of Pan American World Airways and Trans World Airlines as soon as a determination of damages is reached in TWA's $145-million anti-trust suit against Howard R. Hughes (see p. 45).**

**"A determination of damages is expected momentarily, in a matter of weeks," Trippe said in an interview following his airline's annual stockholder meeting here (AW May 6, p. 41).**

**Hughes has the right of appeal over any damages assessed against him, but Trippe said the merger question would not have to wait until the "cash was in hand."**

**He said the CAB's postponement of action on the merger was due almost entirely to the Hughes-TWA litigation, which has blocked a TWA stockholder vote on the merger. Hughes 78% controlling interest in TWA is in trust, but the trustees, apparently in view of the litigation, have not yet voted the stock for the merger.**



## Braniff Has First Quarter Loss

**Dallas—Fluctuating passenger traffic and a decline of 18% in first-class revenues as the switch from first-class to coach service continued, are reported as significant reasons by Braniff Airways for its net loss of $332,917 in the first quarter of Fiscal 1963, ended Mar. 31.**

**Loss sharply reversed improvements in the carrier's first-quarter financial picture in recent years. Net losses in this traditionally weak quarter had been reduced from $603,364 in 1960 to only $61,997 in this period last year.**

**Revenues in first quarter of 1963 totaled $23,087,065.**

**Decline of $1,981,640 was experienced in first-class revenues in the first quarter, against a gain of only $1,855,477 in coach revenues. Mail, cargo and miscellaneous revenues went up 9.68%, 8.63% and 19.27% respectively. A 1% reduction in aircraft miles flown was offset by operation of larger aircraft resulting in an 8% increase in available seat and ton-miles and an increase of 2.9% in operating costs.**

**Braniff President Charles Beard reports that preliminary data indicates a profit was earned by the carrier in April. He predicted that the carrier will show a profit at the end of the current fiscal year.**

# Further Financial Aid Depends On Florida Rights, Northeast Says

**Washington**—Northeast Airlines has indicated that renewal of its New York-Florida route authority is mandatory before its major stockholder, Hughes Tool Co., will provide further financial aid.

In an appeal filed with the Civil Aeronautics Board, Northeast asked that the Board overrule an examiner's decision that its Florida authority should not be renewed because of its precarious financial condition. The airline stated that retention of the routes was "indispensable" to its future recovery and would encourage Toolco to advance more financial support to Northeast.

Referring to the examiner's intimation that the route renewal might be granted if Toolco offered any definite plans to "rehabilitate" the airline, Northeast contended that it would be "unreasonable" to expect any new commitments from the company at this time (AW Apr. 22, p. 38).

Direct loans made to Northeast by Toolco now total an estimated $11 million, and last year the company paid $5 million to the Atlas Corp., a holding company, for a 56% stock interest in the airline. At the same time, Toolco assumed responsibility for $16 million in overdue debts owed by Northeast. It will require at least another $20 million aid before the airline can become financially sound, the examiner estimated.

Despite its heavy annual losses, which have totaled more than $43 million since it began the Florida service five years ago, Northeast contends that it has developed into a "vigorous and effective competitor" which should be given more time to solve its problems.

On June 12, CAB will hold hearings on both Northeast's request and an additional examiner's recommendation that a third carrier be retained on the New York-Florida route in competition with National and Eastern Air Lines, both of which oppose the idea. These hearings could last several months, after which Northeast could further forestall its removal from the route by legal appeal.

Many informed observers feel that Northeast's chances for renewal of the routes are far stronger than suspected, because of these points:

- **CAB originally certificated** Northeast on the route with full recognition that it might encounter difficulty in competing against Eastern and National. Part of the grant was intended to strengthen the smaller carrier and remove it from the subsidy roles as a local service airline in New England. In selecting Northeast, the Board rejected an examiners decision choosing Delta Air Lines for the route.
- **Northeast's losses** have been largely due to its initial inability to acquire jet aircraft to compete effectively. Its share of the New York-Florida traffic market has increased sharply during the past year.
- **Rejection of the renewal** would leave Northeast with only the New England routes, adding to the Board's problems of holding down subsidy payments. Although the examiner recommended that CAB also consider choosing another carrier to provide a local service operation in New England, subsidy would be necessary whether Northeast was retained in the New England area or a new airline selected.
- **Rejection of the renewal** would probably end any interest in a proposed merger between Trans World Airlines and Northeast, a prospect that possibly could solve part of the Board's current problem.

## Mediator Appointed For New Pilot's Union

**New York** – National Mediation Board last week appointed Alfred Della Corte as mediator to conduct a representation election for the Allied Pilots Assn., the new union which consists of American Airlines pilots breaking away from the Air Line Pilots Assn. (AW Feb. 25, p. 42).

Della Corte's appointment came after the mediation board notified the union's attorney, Martin C. Seham, that sufficient evidence had been presented to justify the election.

Allied Pilots Assn. filed for mediation board recognition after gaining authorization-to-act ballots from 90% of American's 1,650 pilots in a mail vote.

Della Corte was expected to arrive in the Allied Pilots office here today to begin preparing for the recognition vote. Capt. Nicholas J. O'Connell, temporary president of the new union, said the mail vote should be concluded in two or three weeks.

O'Connell said an organizational meeting for the new union would be held June 5-6 at Los Angeles.

Mediation board rejected a request from Henry Weiss, counsel for ALPA, that action toward recognition of the new union be postponed pending settlement of suits brought by ALPA and the Flight Engineers International Assn. The board emphasized that the court action had no bearing on its obligation to receive and, if justified, act on the requests of a group seeking representation rights.

ALPA is contesting the new union under the Railway Labor Act, claiming that the American pilots negotiated a new contract as members of ALPA. Weiss contends that the contract is unacceptable because it did not require flight engineers, who were to become ALPA members, to have commercial and instrument pilot ratings.

He said that ALPA was not kept fully informed of the contract's provisions and its progress toward a signing. The withdrawal of the American pilots from ALPA followed that union's refusal to ratify the contract.

FEIA is also suing American and the insurgent pilots, claiming that the flight engineer's job security is threatened by formation of the new union.

Weiss said last week that he has been instructed by Charles Ruby, president of ALPA to investigate the mediation board's action in respect to the Allied Pilots Assn., and to perhaps make further application to the board on ALPA's charges of Railway Labor Act violations.

Oral arguments have been completed in the court action, being conducted by Judge Inzer B. Wyatt of federal district court here.

# Airline Income and Expenses—January, 1963

| | OPERATING REVENUES | | | | | | Total Operating Expense | Net Profit (or Loss) |
|---|---|---|---|---|---|---|---|---|
| | Passenger | Cargo | Other Non-Mail | U. S. & For. Mail | Federal Subsidy | Total | | |
| **DOMESTIC TRUNKS** | | | | | | | | |
| American | 32,892 | 3,114 | 25 | 894 | ..... | 36,925 | 35,972 | 29 |
| Braniff | 6,328 | 335 | 157 | 188 | ..... | 7,008 | 6,771 | 56 |
| Continental | 5,537 | 284 | 55 | 108 | ..... | 5,984 | 5,631 | 109 |
| Delta | 15,136 | 924 | 78 | 326 | ..... | 16,464 | 14,926 | 579 |
| Eastern | 23,795 | 1,332 | 169 | 443 | ..... | 25,739 | 27,133 | (1,948) |
| National | 8,291 | 553 | 44 | 140 | ..... | 9,028 | 7,821 | 425 |
| Northeast | 4,338 | 192 | 135 | 47 | ..... | 4,712 | 5,207 | (616) |
| Northwest | 7,685 | 610 | 37 | 223 | ..... | 8,555 | 8,657 | (169) |
| Trans-World | 23,853 | 1,635 | 207 | 650 | ..... | 26,345 | 27,569 | (2,493) |
| United | 37,928 | 2,914 | 708 | 1,383 | ..... | 42,933 | 46,769 | (2,189) |
| Western | 6,444 | 227 | 67 | 103 | ..... | 6,841 | 5,622 | 474 |
| Trunk Total | 172,227 | 12,120 | 1,682 | 4,505 | ..... | 190,534 | 192,078 | (5,743) |
| **INTERNATIONAL** | | | | | | | | |
| American | 759 | 53 | 23 | 8 | ..... | 843 | 559 | 145 |
| Braniff | 727 | 50 | 42 | 50 | ..... | 869 | 1,090 | (115) |
| Caribair | 446 | 32 | 9 | 4 | ..... | 491 | 490 | (5) |
| Delta | 225 | 17 | ..... | ..... | ..... | 242 | 309 | (33) |
| Eastern | 3,046 | 195 | (1) | 69 | ..... | 3,309 | 2,893 | 331 |
| Mackey | 90 | 6 | 10 | ..... | ..... | 106 | 150 | (51) |
| Northwest | 1,995 | 354 | 190 | 900 | ..... | 3,439 | 3,164 | 93 |
| Panagra | 1,158 | 301 | 129 | 116 | ..... | 1,704 | 1,683 | (2) |
| Pan American | 26,400 | 4,965 | 3,516 | 3,727 | ..... | 38,608 | 39,397 | (771) |
| South Pacific | 31 | 1 | ..... | 1 | ..... | 33 | 81 | (61) |
| Trans-Caribbean | 655 | 104 | 251 | 1 | ..... | 1,011 | 1,001 | (47) |
| Trans-World | 4,790 | 874 | 67 | 1,193 | ..... | 6,924 | 7,458 | (806) |
| United | 2,084 | 99 | 33 | 120 | ..... | 2,336 | 1,690 | 285 |
| Western | 716 | 14 | 5 | 6 | ..... | 741 | 442 | 139 |
| International Total | 43,122 | 7,065 | 4,274 | 6,195 | ..... | 60,656 | 60,407 | (898) |
| **LOCAL SERVICE** | | | | | | | | |
| Allegheny | 1,197 | 87 | 10 | 23 | 524 | 1,841 | 1,928 | (67) |
| Bonanza | 755 | 20 | 14 | 5 | 261 | 1,055 | 827 | 96 |
| Central | 402 | 27 | 11 | 16 | 390 | 846 | 867 | (12) |
| Frontier | 744 | 50 | 17 | 16 | 668 | 1,495 | 1,356 | 69 |
| Lake Central | 495 | 33 | 22 | 12 | 328 | 890 | 925 | (48) |
| Mohawk | 1,484 | 69 | 39 | 25 | 400 | 2,017 | 2,093 | (57) |
| North Central | 1,369 | 87 | 30 | 37 | 667 | 2,190 | 2,238 | (35) |
| Ozark | 814 | 52 | 7 | 28 | 363 | 1,264 | 1,416 | (80) |
| Pacific | 569 | 20 | 14 | 15 | 356 | 974 | 957 | (4) |
| Piedmont | 1,056 | 52 | 40 | 21 | 475 | 1,644 | 1,656 | (41) |
| Southern | 560 | 28 | 14 | 23 | 496 | 1,121 | 1,144 | (17) |
| Trans-Texas | 547 | 34 | 13 | 21 | 404 | 1,019 | 987 | 19 |
| West Coast | 486 | 18 | 5 | 10 | 421 | 940 | 953 | 290 |
| Local Service Total | 10,478 | 577 | 236 | 252 | 5,753 | 17,296 | 17,347 | 113 |
| **ALASKA & HAWAIIAN** | | | | | | | | |
| Alaska Airlines | 236 | 32 | 441 | 70 | 166 | 945 | 907 | 2 |
| Alaska Coastal | 81 | 12 | 4 | 13 | 185 | 295 | 287 | 6 |
| Aloha | 349 | 7 | (15) | 2 | 20 | 363 | 421 | (78) |
| Cordova | 14 | 7 | 9 | 7 | 51 | 88 | 95 | (7) |
| Hawaiian | 480 | 88 | (7) | 5 | ..... | 566 | 670 | (117) |
| Kodiak | 7 | 2 | 1 | 1 | 5 | 16 | 34 | (17) |
| No. Consolidated | 48 | 28 | 6 | 64 | 158 | 304 | 266 | 12 |
| Pacific Northern | 580 | 116 | 3 | 93 | 100 | 892 | 1,197 | (166) |
| Reeve Aleutian | 76 | 27 | 5 | 56 | ..... | 164 | 214 | (14) |
| Western Alaska | 5 | 1 | 1 | 2 | 17 | 26 | 28 | (2) |
| Wien Alaska | 63 | 26 | 74 | 76 | 237 | 476 | 476 | (3) |
| Alaska & Hawaiian Total | 1,939 | 346 | 522 | 389 | 939 | 4,135 | 4,595 | (384) |
| **HELICOPTERS** | | | | | | | | |
| Chicago | 22 | 1 | ..... | ..... | 100 | 123 | 144 | (9) |
| Los Angeles | 67 | 15 | 1 | 7 | 153 | 243 | 270 | (32) |
| New York | 127 | 5 | 4 | 2 | 172 | 310 | 376 | (81) |
| Helicopter Total | 216 | 21 | 5 | 9 | 425 | 676 | 790 | (122) |
| **CARGO & OTHERS** | | | | | | | | |
| Aerovias | | | | Not Available | | | | |
| Avalon[1] | 9 | 1 | 21 | 1 | ..... | 32 | 39 | (5) |
| Flying Tiger | ..... | 820 | 1,672 | ..... | ..... | 2,492 | 3,273 | (341) |
| Riddle | ..... | 979 | 360 | ..... | ..... | 1,339 | 1,373 | 571 |
| Seaboard | ..... | 1,026 | 812 | 285 | ..... | 2,123 | 1,961 | (23) |
| Slick | ..... | ..... | 1,246 | ..... | ..... | 1,246 | 1,529 | (402) |
| Cargo & Other Total | 9 | 2,826 | 4,111 | 286 | ..... | 7,232 | 8,175 | (200) |
| Industry Total | 227,991 | 22,955 | 10,830 | 11,636 | 7,117 | 280,529 | 283,392 | (7,234) |

[1] One-Third of First Quarter 1963 Report

Prepared By Ray & Ray

# Airline Income and Expenses—February, 1963

| (In Thousands of Dollars) | OPERATING REVENUES | | | | | | Total Operating Expense | Net Profit (or Loss) |
|---|---|---|---|---|---|---|---|---|
| | Passenger | Cargo | Other Non-Mail | U. S. & For. Mail | Federal Subsidy | Total | | |
| **DOMESTIC TRUNKS** | | | | | | | | |
| American | 27,897 | 2,745 | 16 | 821 | ..... | 31,479 | 34,318 | (1,876) |
| Braniff | 5,649 | 319 | 112 | 180 | ..... | 6,260 | 6,481 | (166) |
| Continental | 4,791 | 279 | 82 | 113 | ..... | 5,265 | 5,255 | (85) |
| Delta | 14,416 | 874 | 46 | 312 | ..... | 15,648 | 14,202 | 584 |
| Eastern | 22,535 | 1,177 | 235 | 422 | ..... | 24,369 | 26,406 | (2,577) |
| National | 8,684 | 557 | 111 | 141 | ..... | 9,493 | 7,696 | 749 |
| Northeast | 4,753 | 203 | 74 | 50 | ..... | 5,080 | 4,770 | 187 |
| Northwest | 6,796 | 572 | 35 | 209 | ..... | 7,612 | 8,232 | (156) |
| Trans-World | 19,962 | 1,474 | 239 | 570 | ..... | 22,245 | 25,552 | (4,497) |
| United | 34,330 | 2,396 | 171 | 1,304 | ..... | 38,201 | 44,646 | (3,252) |
| Western | 5,813 | 219 | 61 | 94 | ..... | 6,187 | 5,260 | 337 |
| Trunk Total | 155,626 | 10,815 | 1,182 | 4,216 | ..... | 171,839 | 182,818 | (10,752) |
| **INTERNATIONAL** | | | | | | | | |
| American | 803 | 56 | 23 | 8 | ..... | 890 | 534 | 161 |
| Braniff | 799 | 83 | (2) | 43 | ..... | 923 | 1,048 | (69) |
| Caribair | 515 | 31 | 6 | 4 | ..... | 556 | 459 | 67 |
| Delta | 193 | 23 | ..... | 1 | ..... | 217 | 269 | (27) |
| Eastern | 2,912 | 188 | ..... | 64 | ..... | 3,164 | 2,868 | 221 |
| Mackey | 128 | 7 | 10 | ..... | ..... | 145 | 162 | (22) |
| Northwest | 2,272 | 400 | 216 | 836 | ..... | 3,724 | 3,281 | 196 |
| Panagra | 1,115 | 251 | 99 | 114 | ..... | 1,579 | 1,694 | (103) |
| Pan American | 24,429 | 4,537 | 2,468 | 3,455 | ..... | 34,889 | 37,704 | (1,722) |
| South Pacific | 25 | ..... | ..... | 1 | ..... | 26 | 76 | (62) |
| Trans-Caribbean | 573 | 59 | 183 | 1 | ..... | 816 | 840 | (45) |
| Trans-World | 4,055 | 768 | 184 | 1,118 | ..... | 6,125 | 7,615 | (1,605) |
| United | 1,841 | 71 | 30 | 117 | ..... | 2,059 | 1,641 | 1 |
| Western | 602 | 15 | 4 | 5 | ..... | 626 | 414 | 96 |
| International Total | 40,262 | 6,489 | 3,221 | 5,767 | ..... | 55,739 | 58,605 | (2,913) |
| **LOCAL SERVICE** | | | | | | | | |
| Allegheny | 1,120 | 81 | 17 | 21 | 480 | 1,719 | 1,855 | (70) |
| Bonanza | 702 | 20 | 7 | 4 | 195 | 928 | 803 | 49 |
| Central | 364 | 25 | 16 | 15 | 359 | 779 | 822 | (22) |
| Frontier | 680 | 54 | 10 | 16 | 609 | 1,369 | 1,352 | 16 |
| Lake Central | 469 | 28 | 15 | 12 | 302 | 826 | 913 | (100) |
| Mohawk | 1,372 | 76 | 57 | 22 | 362 | 1,889 | 1,964 | (51) |
| North Central | 1,168 | 72 | 32 | 35 | 601 | 1,908 | 2,171 | (133) |
| Ozark | 799 | 45 | 9 | 10 | 449 | 1,312 | 1,336 | (19) |
| Pacific | 527 | 19 | 11 | 13 | 316 | 886 | 877 | (13) |
| Piedmont | 954 | 44 | 33 | 19 | 435 | 1,485 | 1,591 | (141) |
| Southern | 570 | 30 | 16 | 15 | 444 | 1,075 | 1,168 | (55) |
| Trans-Texas | 471 | 34 | 13 | 15 | 362 | 895 | 943 | (31) |
| West Coast | 441 | 18 | 12 | 7 | 382 | 860 | 919 | (34) |
| Local Service Total | 9,637 | 546 | 248 | 204 | 5,296 | 15,931 | 16,714 | (604) |
| **ALASKA & HAWAIIAN** | | | | | | | | |
| Alaska Airlines | 236 | 33 | 441 | 70 | 165 | 945 | 907 | 38 |
| Alaska Coastal | 90 | 14 | 3 | 13 | 102 | 222 | 262 | (42) |
| Aloha | 352 | 6 | (9) | 2 | 18 | 369 | 409 | (59) |
| Cordova | 15 | 7 | 16 | 6 | 46 | 90 | 92 | (3) |
| Hawaiian | 480 | 77 | (13) | 4 | ..... | 548 | 652 | (119) |
| Kodiak | 8 | 2 | 1 | 1 | 6 | 18 | 37 | (19) |
| No. Consolidated | 62 | 30 | 9 | 70 | 130 | 301 | 252 | 16 |
| Pacific Northern | 442 | 126 | 15 | 84 | 91 | 758 | 1,162 | (214) |
| Reeve Aleutian | 65 | 20 | 6 | 49 | ..... | 140 | 200 | (61) |
| Western Alaska | 2 | 1 | 2 | 2 | 15 | 22 | 26 | (5) |
| Wien Alaska | 57 | 33 | 163 | 71 | 211 | 535 | 543 | 1 |
| Alaska & Hawaiian Total | 1,809 | 349 | 634 | 372 | 784 | 3,948 | 4,542 | (467) |
| **HELICOPTERS** | | | | | | | | |
| Chicago | 22 | 1 | 1 | ..... | 91 | 115 | 131 | (7) |
| Los Angeles | 49 | 14 | 1 | 15 | 138 | 217 | 245 | (29) |
| New York | 137 | 5 | 7 | 2 | 155 | 306 | 368 | (76) |
| Helicopter Total | 208 | 20 | 9 | 17 | 384 | 638 | 744 | (112) |
| **CARGO & OTHER** | | | | | | | | |
| Aerovias | | | | Not Available | | | | |
| Avalon[1] | 9 | 1 | 21 | 1 | ..... | 32 | 39 | (5) |
| Flying Tiger | ..... | 779 | 1,626 | ..... | ..... | 2,405 | 3,158 | (466) |
| Riddle | ..... | 658 | 268 | ..... | ..... | 926 | 1,131 | (289) |
| Seaboard | ..... | 878 | 730 | 296 | ..... | 1,904 | 1,875 | (185) |
| Slick | ..... | ..... | 1,122 | ..... | ..... | 1,122 | 1,395 | (392) |
| Cargo & Other Total | 9 | 2,316 | 3,767 | 297 | ..... | 6,389 | 7,598 | (1,337) |
| Industry Total | 207,551 | 20,535 | 9,061 | 10,873 | 6,464 | 254,484 | 271,021 | (16,185) |

[1] One-Third of First Quarter 1963 Report

Prepared By Ray & Ray

# WHAT MAKES "INSTRUMENTATION CABLE" DIFFERENT?

**It is no more like power or control cable than a Ferrari is like the old family sedan. Not knowing this can cause you a lot of grief: project delays, costly replacements, malfunctions.**

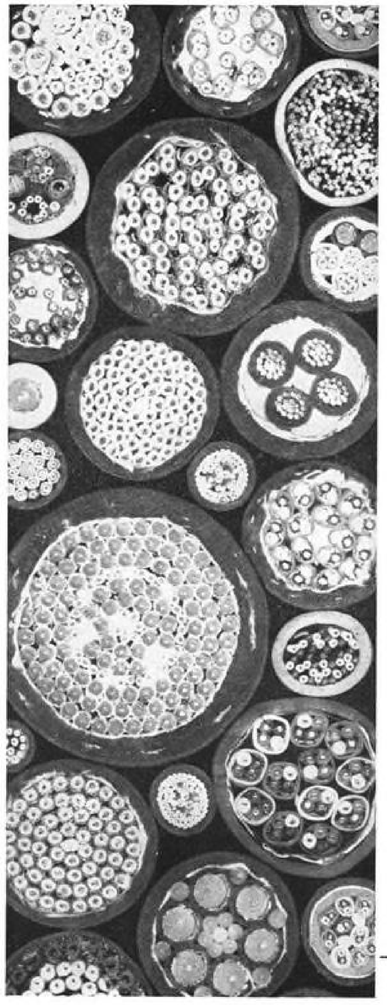
**THE THIN BLACK LINE** On your schematics, instrumentation cable is a black line from launching pad to blockhouse or from one part of a computor to another. In the broadest sense, it connects data or signal sources with display or recording or control devices. Its function is to carry those signals unfailingly and with the required reliability. In this day and age, it's no easy job.

**WHAT CAN GO WRONG** The improperly designed cable can simply fail. This has happened and at important sites. An untried saturant, lacquer or compound ingredient used in the cable may destroy the electrical integrity of this primary insulation. This sort of deterioration need not be sudden; only experts know which impregnants will migrate in a week or a month or more.

Or a relative lack of art in manufacture may create problems for the future. Under certain circumstances in use, variations in insulation thickness, conductor placement, or conductor unbalance in the cable lay-up may cause spurious or ambiguous signals to arrive at the display, recording or control panel. Your sharp, precise pulses become displaced in time, are a little too fuzzy, or are joined by other unwanted signals from another line.

**DESIGN IS HALF THE STORY** Configuration of conductors within the cable is important, for physical as well as for electrical reasons. For example, positioning of coaxial components within the cable is critical in order to assure maintenance of minimum standards of concentricity between the inner and outer conductors when the cables may be subjected to bending operations during installation work.

Selection of insulating, filler and jacketing materials requires expert knowledge and judgment. Some materials, as mentioned above, tend to migrate. Others harden or soften with cold or heat. Some change their electrical characteristics in time. These are not fundamentally new problems in cable design, *but in instrumentation cable the standards are far more severe than ever before.*



**MANUFACTURE IS THE OTHER HALF** Even a properly designed cable may well become unacceptable sooner or later if it is not manufactured to new standards of precision. This requires stranding machines that reduce circular eccentricity to remarkably low figures and help assure insulation uniformity, insulating machines of considerable precision, and highly precise cabling equipment. It also requires, as is so often the case in precision manufacture, an indefinable skill on the part of machine operators.

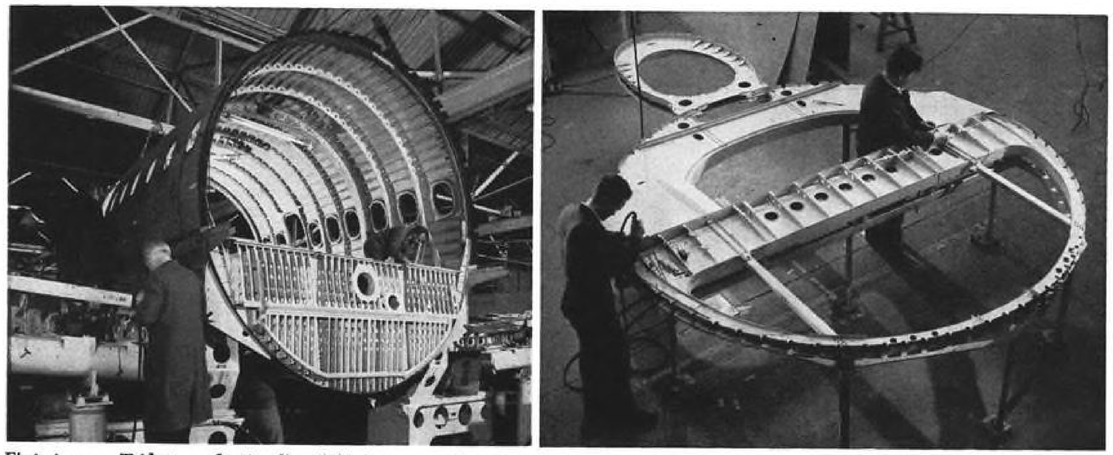
**ASK THE EXPERTS** To protect the functioning of your system, there's only one way to make sure the thin black lines on your schematics became cables with the requisite dependability: have them designed by experts, in consultation with you, and constructed by experts.

Rome-Alcoa is, frankly, one of the very few companies that qualify. We've been designing and constructing these cables since their first conception. If you're going to need instrumentation cable soon, call us, the sooner the better.

We now have a 24-page booklet titled "Instrumentation Cables, Cable Assemblies and Hook-up Wires." In it, we describe instrumentation cable constructions, production, military specifications and our qualifications. For your copy, write Rome Cable Division of Alcoa, Dept. 26-63, Rome, N.Y.

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DIVISION



First stage on Trident production line (left) is construction of center fuselage and stub wing section. Redux adhesive technique is used to bond stringers and reinforcings to wing and fuselage skins. Main fuselage frame (right) has transverse beam supporting outboard engine pods. Frame extends upward to include center engine intake duct, which stiffens the structure against torsional and bending loads.

# Trident Construction Shown; New Versions Planned

De Havilland Aircraft of Great Britain, builders of the three-jet Trident transport, is actively pushing two new versions in the world market to counter criticism that the aircraft was designed and developed for a single airline, British European Airways. BEA has 24 of the 1C versions on order.

BEA eventually will operate only Tridents on its European routes, but probably will order a batch of the new 1E and 1F versions to achieve a higher degree of route and operational flexibility.

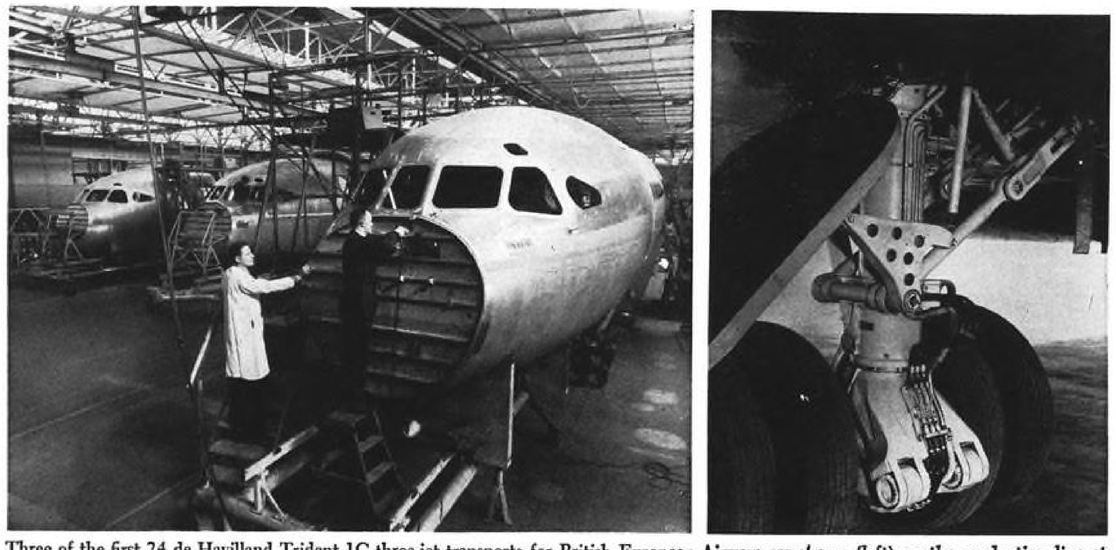
Trident now is undergoing its flight test program. The fifth plane off the line will incorporate all modifications found necessary during initial flight tests and those planned after No. 1 aircraft was rolled out. Powerplants on the current generation of Trident 1C are 10,400-lb.-thrust Rolls-Royce Spey engines.

The 1E and 1F versions will be powered by the RB.163-25 Spey, which will have a wet thrust rating of 11,680 lb.

The RB.163-25 has an extra low-pressure compressor stage and currently is undergoing bench testing at Rolls-Royce's Hucknall research facility.

Modifications on the two new versions will include leading-edge slats to replace the drooped leading edge on the 1C, although the double-slotted flaps will remain. Wing span will be increased to 95 ft. on both variants, from 89 ft. 10 in., and gross weight has increased from 115,000 lb. to 128,000 lb.

Fuselage on the 1F will be stretched from 103 ft. 6 in. on the 1C and 1E to 112 ft. 8 in., giving a capacity of 20 first class and 78 tourist passengers. Range has been increased to more than 2,000 naut. mi.

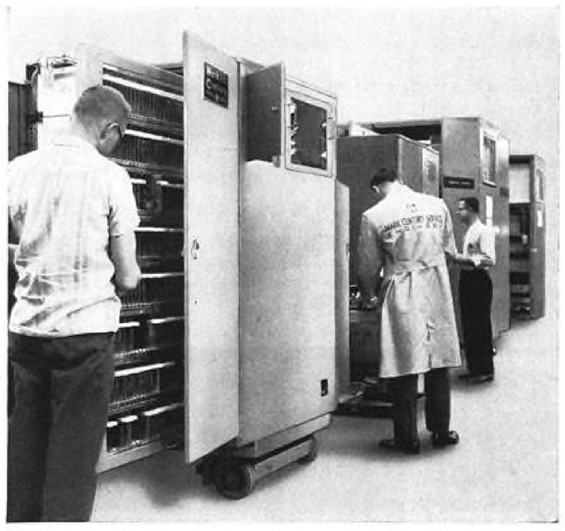


Three of the first 24 de Havilland Trident 1C three-jet transports for British European Airways are shown (left) on the production line at Hatfield, England. BEA also has an option on another 12 aircraft. Trident main gear has been replaced with the levered suspension type (right) due to rough ride caused by the original version. Gear now used twists during retraction.

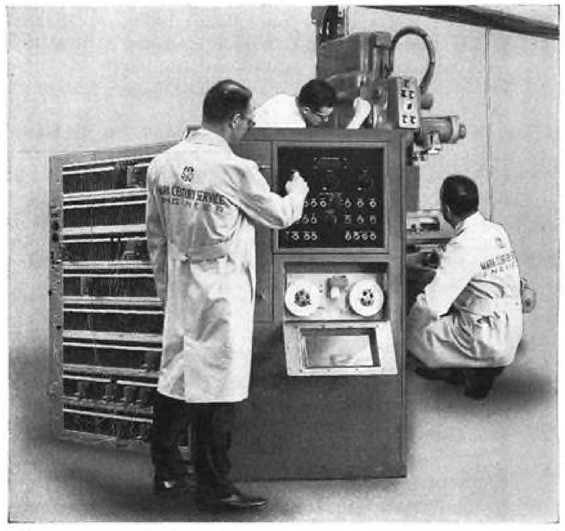
# There's a new look to Mark Century Service

Accent on VALUE

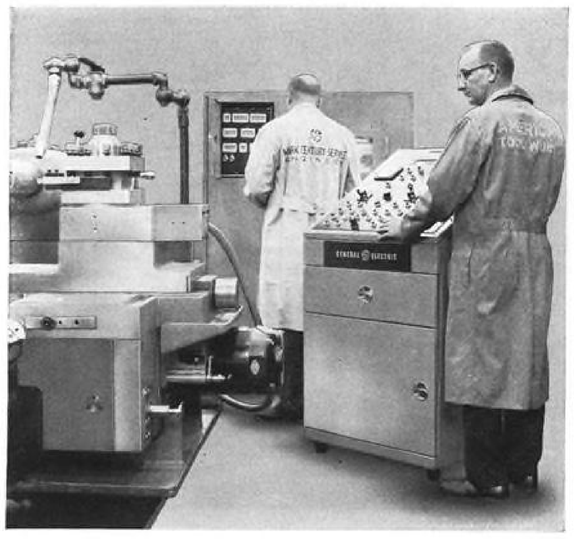
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*to your plant . . .*



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This is Mark Century Service: a totally new kind of service program for the metalworking industry that backs up every General Electric Mark Century numerical control system.

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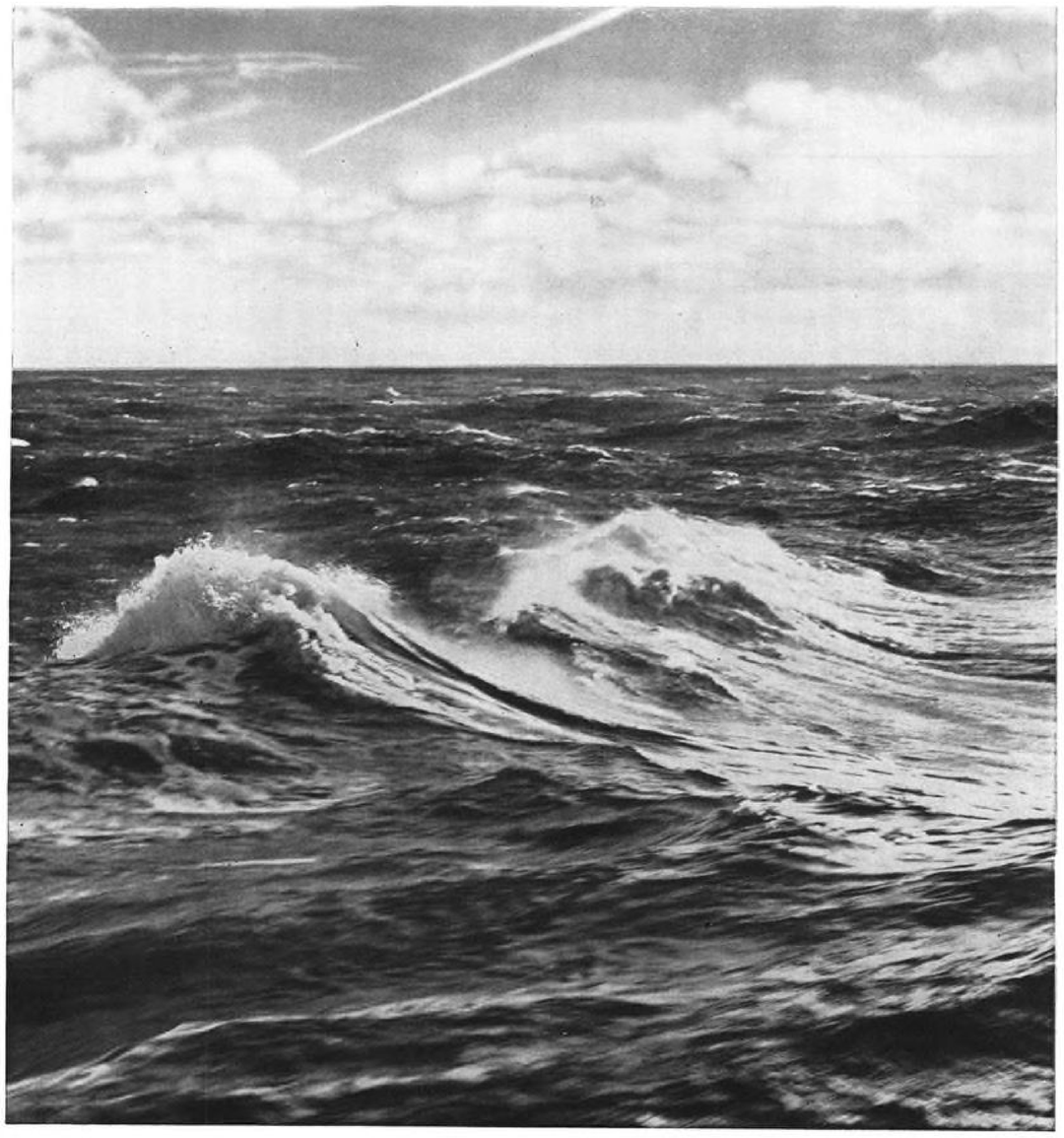
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## Oceans into ponds

The introduction of the Anglo-French supersonic airliner "Concord" will reduce the vastness of oceans to the proportions of ponds. Powered by four Bristol Siddeley-SNECMA Olympus 593 engines, "Concord" will carry 100 passengers at 1,450 mph – over twice the speed of the fastest airliners flying today.

The Olympus 593 turbojets are being developed and manufactured jointly by Bristol Siddeley and the Société Nationale d'Etude et de Construction de Moteurs d'Aviation.

As one of the world's largest manufacturers of aero-engines, Bristol Siddeley is playing a leading role in aviation development. The company's range of engines power almost every type of modern aircraft, from airliners, executive jets and helicopters to trainers, fighters, bombers and missiles.

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# Hughes Appeals TWA Default Judgment

**New York**—United States Court of Appeals has been handed the controversial question of whether the courts, rather than the Civil Aeronautics Board, have jurisdiction in the multi-million dollar litigation between Trans World Airlines and the Hughes Tool Co.

This was a key point cited by Chester C. Davis, attorney for Hughes Tool, in appealing the May 2 judgment rendered by Judge Charles Metzner of the Federal district court here (AW May 6, p. 41).

Judge Metzner's decision was based primarily on the failure of Howard R. Hughes to appear Feb. 11 for the taking of depositions in the case. This constituted a default by Hughes Tool Co., Judge Metzner held.

His decision did not include a final determination of the damages due TWA, which is asking $135 million plus divestiture of Hughes' 78% controlling interest in the airline. Delay of the final judgment could give the court of appeals time to consider the jurisdictional question.

Davis had earlier challenged the court's jurisdiction on the basis of the Supreme Court's refusal to decide a route dispute case involving Pan American World Airways and Pan American Grace Airways (AW Jan. 21, p. 42). The Supreme Court ruled that the CAB had jurisdiction in that suit.

"I am of the opinion that this order involves a controlling question of law as to which there is a substantial ground for difference of opinion," Judge Metzner said of the jurisdiction question. "An immediate appeal from this order is justified, since it may materially advance the ultimate termination of this litigation."

### Questions of Law

Sources close to the TWA-Hughes case said that only by advancing it to a higher court could a final determination be attained in anything like a reasonable time. So many questions of law have arisen in this, one of the largest anti-trust cases on record, that it could be stalled for years at the district court level, they said.

Judge Metzner charged J. Lee Rankin, special master who directed the taking of depositions in the case, with scheduling hearings to determine the amount of monetary damages due TWA.

Judge Metzner retained the responsibility of deciding whether Hughes must divest his stock interest in the airline, however. He also ordered dismissal of Hughes' counterclaims, amounting to over $300 million, brought against certain TWA executives, board members and the airline's lending institutions.

The counterclaims were ordered dismissed "with prejudice," meaning that they cannot be reinstated. Davis has the right to appeal the dismissal, however, although such an appeal is not included in the one he filed concerning the judgement favoring TWA.

The Court of Appeals has the choice of determining the jurisdiction question, or awaiting a final judgment on the damages before considering the case.

Davis, in his appeal, requested that the court proceed without waiting for the damage hearings.

"The time for determining that question [of jurisdiction] is now, rather than after the expenditure in a damage hearing of additional vast sums by Hughes Tool and TWA," Davis said. "Hughes Tool, as a stockholder of TWA, indirectly bears 78% of the expenses of TWA."

### Events and Reasons

In his appeal application, Davis recounted the events and reasons that led to his client's decision to rest on the merits of its position, rather than present Hughes for testimony.

TWA was suing Hughes Tool on charges that through the 78% controlling interest, Hughes was dictating the airline's equipment procurement program. Hughes followed a practice of buying aircraft himself, then leasing them to TWA. This hampered TWA's financial welfare, the airline charged.

However, Davis insisted on a more specific clarification of the misconduct that TWA contended was damaging. His primary defense was that Hughes' controlling interest in TWA, as well as all aircraft purchases, was approved by the CAB and thus, by law, was exempt from anti-trust restrictions.

Davis said that Rankin consented in October to a recess in the taking of depositions and postponed Hughes' appearance until Feb. 11. This, Davis said, was to allow time for clarification of TWA's complaint.

### TWA Position

But Judge Metzner, on Jan. 10, ruled to the effect that Hughes' appearance was the essential factor toward the speediest disposition of the case, and that TWA's precise definitions of its complaint could wait until 60 days after depositions were taken from Hughes.

Davis said this placed Hughes Tool in the position of either "incurring enormous expenses and subjecting itself to great burdens prior to any appellate review of decisions which it believes erroneous," or of "resting on the merits of the positions which it had heretofore taken."

Davis chose the latter alternative, and Judge Metzner's default judgment followed.

Davis' appeal includes the claim that the default judgement should not have been interpreted as an admission of guilt.

"Prior to the entry of any judgment, whether by default or otherwise, the court must satisfy itself that the plaintiff has stated a claim upon which relief can be granted," Davis said. "A default, even in failing to appear and answer, does not admit liability or that the complaint states a good case, and clearly, Hughes Tool has not, by its notice of position, admitted liability."

Davis also questioned whether TWA had proven anything prior to Judge Metzner's decision.

"The testimony of TWA establishes that its officers cannot identify any conduct by defendants supporting the charge of violation of the anti-trust laws asserted in the complaint," Davis said. "In fact, such testimony negates the existence of any conduct by defendants in violation of the anti-trust laws."

He said that the CAB approval of Hughes' control of TWA specified that any commercial transactions between him and the airline be restricted to property acquisition, not to exceed $10,000 annually or $200 per unit in cost. Anything above this had to be approved by the CAB, Davis said, and all the aircraft purchase transactions received this approval.

### Pan Am Freighters

**New York—Five more Boeing 707-320C jet freighters have been ordered by Pan American World Airways, giving that carrier eight such aircraft.**

**Pan American will inaugurate service with its first three 320Cs on June 17, using two on the North Atlantic and one on transpacific runs to Japan. Atlantic flights will be from New York to Frankfurt via London. Pacific schedules will link San Francisco, Hawaii, Tokyo and Saigon.**

**Airline's investment in jet freighters approaches $60 million with the new order. Pan Am will use the American Machine & Foundry mechanized cargo handling system, called AirPak, on its freighters.**

**The 80,000-lb. payload aircraft can be unloaded and loaded again within an hour.**

**Pan Am's cargo volumes have exceeded 100 million ton miles annually since 1958, and growth rate was 22% in 1962. A 25% rise is forecast for 1963.**

# AIRLINE OBSERVER

► World domestic and international airlines reported a 12.5% increase in traffic during 1962 compared with 1961, according to International Civil Aviation Organization. ICAO's preliminary statistics for 1962 indicate that member airlines will report an over-all operating profit of $60 million, compared with an operating loss of $118 million in 1961. Average passenger load factor for the world's scheduled airlines was 53.4%, the third consecutive annual decline from the high of 60% recorded in 1959. ICAO also reported that at the end of 1962, airlines operated 5,107 aircraft, of which 765 were turbojet and 892 turboprop. The Douglas DC-3 accounted for almost 25% of the total fleet. The year 1962 was the safest on record for the airlines: passenger fatality rate was 0.58 fatalities per million passenger miles.

► **Unanimity rule of International Air Transport Assn. traffic conference will come under close scrutiny in re-examination of IATA rate-making machinery, which is now considered by most observers as an inevitable result of the transatlantic fare debacle (AW May 27, p. 34). Unanimity rule, or a power of veto in traffic conference votes on tariff resolutions, is blamed by some officials for the lag in lowering of rates and fares.**

► Russia is seeking foreign customers for its An-24 turboprop transport. Initial sales pitch by the Soviet aviation export monopoly, "Aviaexport," is that the An-24 "is the latest in aviation technique, is designed for use in different climates, is indispensable for short and medium range flights, requires no special airfields, has a high payload ratio and is simple to service and operate."

► **British Ministry of Aviation is cracking down on overweight transport pilots to reduce the risk of heart attacks while airborne. Target is the 40-year-old-plus pilot. Some have already been grounded until they slim down. New regulation, coming into full force next September, also will demand that all pilots of International Civil Aviation Organization members have periodic cardiograph tests.**

► Jamaica Air Service, newly-organized Jamaican flag carrier, began intra-island domestic scheduled service last week with Beechcraft Bonanza aircraft. The carrier, a wholly owned subsidiary of British West Indian Airways, is operating three round trips daily between Montego Bay and Kingston, with two of the flights serving intermediate points of Ocho Rios and Port Antonio.

► **First and only scheduled airline to establish a service counter at Cape Canaveral, Fla., during a Mercury flight was National Airlines. Carrier set up a centrally located unit for MA-9 and the long-awaited service was fully utilized with requests for reservations and flight information.**

► United Air Lines President W. A. Patterson has charged that it is unrealistic to expect air fares to reach the level of bus rates. "The carriers are attempting to reduce seat mile costs by adding more seats in hopes of becoming competitive with cheaper forms of transportation. I place this in the same category as cheating at solitaire . . . ," he said.

► **Aeroflot will sell airplane tickets at all Moscow railroad stations, main hotels and a number of suburban towns this summer. In another move to make air travel more convenient, the Russian carrier said that "several times" as many tickets will be purchased by telephone this summer than ever before. These tickets will be delivered to the purchaser's home or office.**

► Trans-International Airlines is first carrier to provide jet cargo service for Military Air Transport service under MATS' new policy of contract preference toward cargo airlines with jet equipment. On its second MATS flight, TIA late last month set a new MATS operational payload record by hauling an 87,028-lb. palletized load from Travis AFB to Saigon, South Vietnam, in a Douglas DC-8F cargo transport.

# SHORTLINES

► **Aeroflot** will operate up to 40 flights daily from Moscow to resorts in the Crimea and Caucasus this summer. Service will include a record 22 Il-18 turboprop transport flights daily from Moscow to Adler on the Caucasus Black Sea coast.

► **Aloha Airlines** has opened a Tokyo ticket office in the arcade of the Imperial Hotel.

► **Braniff Airways** has been awarded a presidential "E" award by the White House for its promotion of "Visit USA" sales in Latin America.

► **Ethiopian Airlines** has added Boeing 720B turbofan service to its route between Addis Ababa and Accra via Khartoum and Lagos.

► **Federal Aviation Agency** survey indicates that approximately 80,000 certificated aircraft maintenance personnel are now employed in the U. S. Total includes 30,000 with the airlines, 44,000 in general aviation and 6,000 with manufacturers and the government.

► **National Airlines** cargo revenue increased 27% in the first three quarters of its fiscal year ending June 30, compared with the same period last year. Cargo ton miles rose 23% in the same period.

► **Pan American World Airways** completed its 7,000th round-the-world flight last week. Carrier now operates two such flights daily. Service was inaugurated in 1947.

► **Trans World Airlines** has reported a 45% increase in advance bookings on eastbound transatlantic flights for July, compared with the same month last year. Westbound bookings have increased 29% for the same period.

► **United Air Lines** has proposed a field trip fare 50% less than standard for school children, 12 through 21 years of age, traveling in groups of 15 or more between Chicago and Detroit. Civil Aeronautics Board has ordered an investigation.

► **U. S. Chamber of Commerce** is supporting legislation that will give the Civil Aeronautics Board power to suspend rates in international operations, but opposes Board authority to fix international rates.







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**CESSNA T-37,** one possible aircraft configuration for use in counter-insurgency warfare, was modified by the Air Force Special Air Warfare Center, Eglin AFB, Fla. Aircraft here is armed with bombs, but could carry napalm on the same pylons.

# Air Force Expands Air Commando Forces

By Larry Booda

**Eglin AFB, Fla.**—At first glance a USAF Air Commando is hard to distinguish from an Army infantryman. The commando's green field uniform, identical to those worn by the Army, symbolizes Air Force's accelerated effort to develop equipment and train men for counter-insurgency warfare operations in conjunction with the Army's Special Forces.

Gen. Curtis E. LeMay, chief of staff, established the Special Air Warfare Center here, under the tactical Air Command, on Apr. 27, 1962, when it was apparent that the Army, through its Tactical Mobility Requirements Board headed by Lt. Gen. Hamilton H. Howze, would try to assign its own aircraft to the Special Forces. The action was also influenced by increasing emphasis on broadening the U. S. capability to aid friendly governments in combating guerrilla-type insurrections.

Consequently, Brig. Gen. Gilbert S. Pritchard, the center commander, has had a green light on speeding training to increase the size of the center's First Air Commando Group, and has been receiving top priority in modifying what were considered obsolescent aircraft and developing special equipment for use with them.

Whenever the First Combat Applications Group, located at the main base here, needs a job done in a hurry, the term "Fast Coin" prefixing a dispatch or letter guarantees quick action. One "Fast Coin" operation was the crash program for modification of more than 700 North American single-engine, two-seat T-28 trainers to a close troop support configuration at the company's Columbus plant between May and August of last year.

Most of these aircraft are now in service in South Vietnam, flown largely by South Vietnamese pilots. These pilots were taught to fly and maintain the aircraft and its equipment, and trained in close-support tactics, by Air Commandos.

Work of the Special Air Warfare Center is a variety of field test operations in varied locations, combined in some instances with actual combat conditions. The commando group maintains three detachments in widely scattered locations.

Predecessor of the center was the 4400th Crew Training Squadron which was formed here in October, 1961, as the Air Force became aware of the Kennedy Administration's emphasis on the need to prepare for non-nuclear warfare. This squadron established an advanced training base of two detachments shortly afterward in the Republic of Mali, located in the western bulge of Africa. Detachment 2 was sent to South Vietnam when the situation there worsened.

When the center was established, the First Air Commando Group and the First Combat Applications Group were formed from the former 4400th Crew Training Squadron. Detachment 3 was formed and now operates at Albrook AFB, Canal Zone (AW May 13, p. 33).

At present, 2,200 personnel are attached to the center, most of them in the field. About 50 men are attached to the headquarters staff and training detachment of the Air Commando Group, and the Combat Applications Center accounts for another 50. Support personnel belonging to support squadrons and the Air Force Systems Command total 900.

When the center was formed, it had only 800 personnel. In 1961, a request for an additional 5,000 men was denied, but gradual increases since then have brought the center to its present strength.

The Combat Applications Group, commanded by Col. Benjamin H. King, who also commanded the predecessor 4400th Crew Training Squadron, has been responsible for development of new equipment and modification of existing aircraft and equipment.

Widespread use of pods for carrying a variety of payloads is the group's principal trademark. The pods can be hung on standard bomb racks installed on T-28, Douglas B-26, Helio U-10, and Fairchild C-123 aircraft to carry guns, chemical dispensers, rockets and electronic equipment.

Use of pods on counter-insurgency aircraft provides flexibility in the types of missions that can be performed by one type of aircraft. In addition, they permit rapid change whenever a package needs maintenance. Forward area units can keep a supply of spare units for use while others are moving to rear areas for repair.

These are some of the packages that are being put into pods:

• **Minigun.** This Gatling-type, 7.62 mm. machine gun has rotating barrels and can fire 6,000 rounds per min. Storage capacity is 1,500 rounds. Pods also carry .30 and .50 cal. machine guns. Storage capacity for these has recently been increased from 100 to 300 rounds.

• **Airborne radio relay pod.** The RRQ-5 or the AN/ARC-97, when carried to 10,000 ft. altitude by an aircraft would permit two ground RRQ-4 portable stations to contact each other up to 200 mi.

• **Cameras and infrared sensing gear.** Development is under way on a low-light-level detection package using the Army's low-light-level television system. Reconnaissance radar is not used because its use is of little value in jungle areas.

• **Doppler navigation pod.** This package is made up of a short range indicator, the AS-1349/APN-153(v) antenna assembly, an AN/ASN-25 Amplifier Computer and the RT-680/APN-153(v) receiver-transmitter radar.

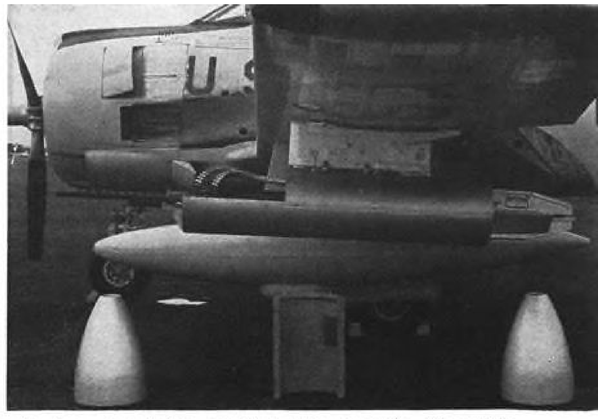
• **Rocket launcher.** This pod can fire 2.75-in. rockets.

• **P-2 dispenser.** This carries 80 World War 2 and Korean war type grenades of the white phosphorates, tear gas or explosive variety.

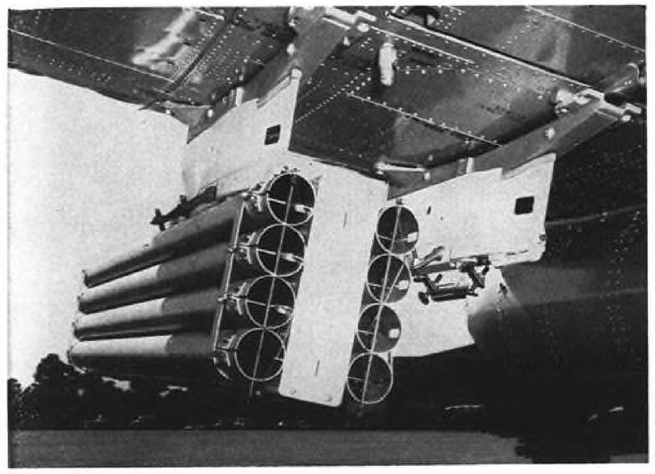
• **Jet pods.** These thrust augmentation packages can be hung under the wings of C-123 aircraft to aid in taking off from short strips.

All Air Commando aircraft are being



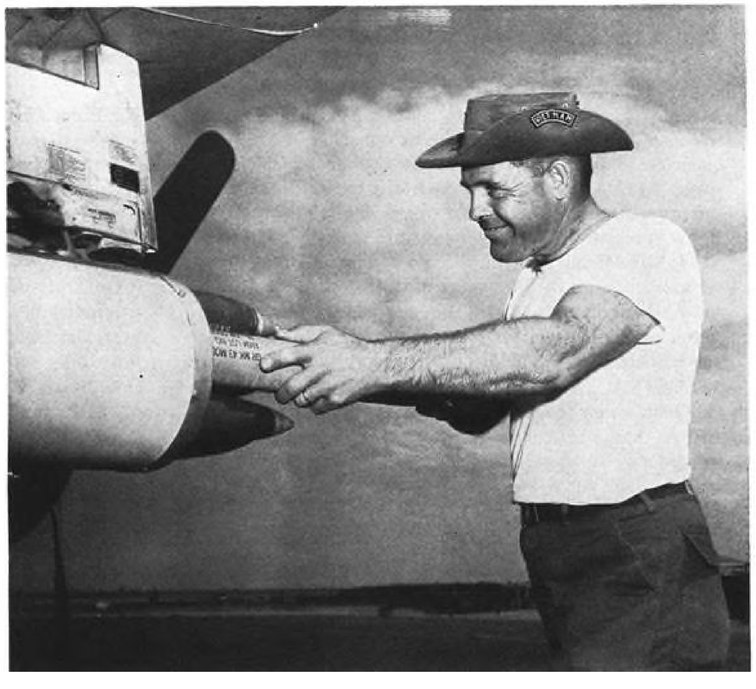


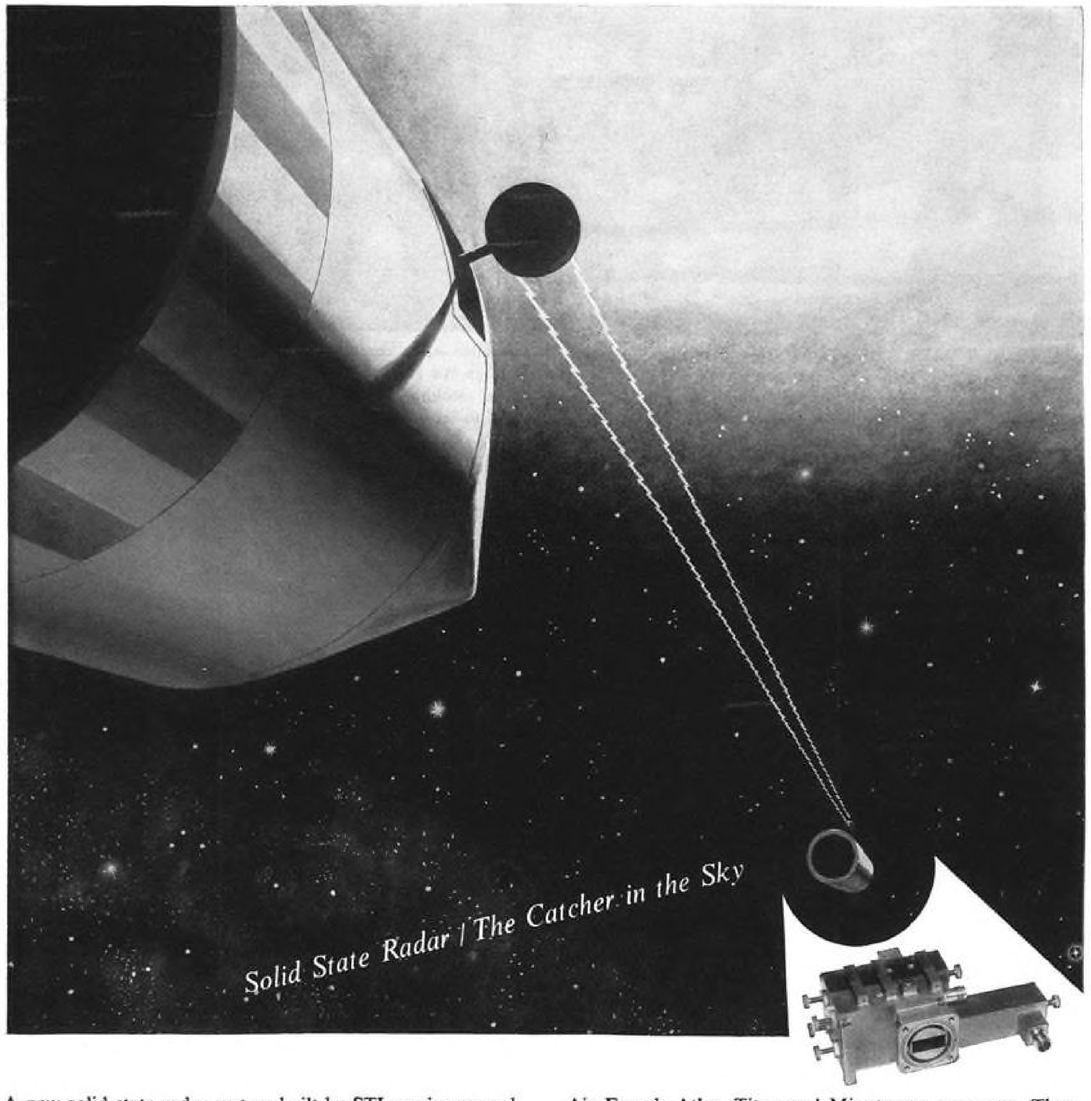
**AIR FORCE/NORTH AMERICAN T-28** trainer carries a variety of armament when converted to counter-insurgency work. **Above left,** aircraft is equipped with a multiple bomb rack developed in response to an Air Force requirement. Rack can carry a variety of bomb and flare clusters and also can be used on B-26 aircraft. Above right, .50 cal. machine gun pod is shown with access covers removed. Below, T-28 carries an eight-tube 2.75-in. rocket launcher and machine gun pod under wing.





**SPECIAL AIR WARFARE** rocket pods on T-28 counter-insurgency aircraft are loaded during operations in South Vietnam. Navy Zuni rocket also is being used and has been found more flexible.






A new solid state radar system built by STL engineers and scientists can send out and receive signals at X-band frequencies to help man rendezvous and dock vehicles in space. STELATRAC is its name. It is the first solid state system of its kind. The X-band transmitter is shown above. It has successfully passed temperature and vibration tests. STELATRAC can also be used as a command link between vehicles in flight. By altering its module design, the flexible radar system operates as an altimeter and doppler velocity sensor to guide spacecraft safely to the surface of the moon and planets. Today STL is busy on many such projects as STELATRAC. STL is also prime contractor for NASA's OGO and a new series of classified spacecraft for Air Force-ARPA. And STL continues Systems Management for the Air Force's Atlas, Titan and Minuteman programs. These activities create immediate openings in Theoretical Physics • Systems Engineering • Radar Systems • Experimental Physics • Applied Mathematics • Space Communications • Antennas and Microwaves • Inertial Guidance • Analog Computers • Solid State Physics • Computer Design • Telecommunications • Space Physics • Digital Computers • Guidance & Navigation • Electromechanical Devices • Engineering Mechanics • Aerodynamics • Propulsion Systems. For Southern California or Cape Canaveral positions, write Dr. R. C. Potter, Department A-6, One Space Park, Redondo Beach, California, or Box 4277, Patrick AFB, Florida. Your inquiry will receive a prompt reply. STL is an equal opportunity employer.

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**MODIFICATIONS OF AIRCRAFT** to make them usable in counter-insurgency warfare were developed by the Combat Applications Group under the Special Air Warfare Center at Eglin. Above are the Helio U-10, the North American T-28, the Douglas B-26, the Douglas C-47, Curtiss C-46 and the Fairchild C-123.

equipped with ARC-44 VHF frequency modulation radios compatible with the Army ground equipment. One problem during joint Air Force-Army operations had been the difference in radio equipment, with Air Force using amplitude modulation and the Army using FM.

Other equipment and techniques have emerged from field experience. One example is the psychological warfare technique in which airborne loudspeakers are used to talk to people on the ground. The first "Farm Gate" (code name for the South Vietnam project) aircraft sent to Southern Asia were equipped with loudspeakers which were inadequate for the job. CAG has now developed a lightweight unit that can be installed in any aircraft with a side door, such as the U-10 or Douglas C-47. The units can be combined to use more speakers and amplifiers. Installations in both types of aircraft can be heard distinctly on the ground.

CAG has done considerable work with pickup and delivery of cargo without stopping an aircraft. All American Engineering has developed a system whereby cargo can be extracted from moving aircraft on pallets by engaging an arresting wire system by a hook attached to the pallet (AW Sept. 24, p. 122). Smaller packages can be picked up by aircraft flying overhead and engaging a loop with a hook. A nylon line absorbs the shock.

An unusual technique of pickup or delivery is practiced by U-10 pilots. The pilot makes a tight turn after making a pass over a clearing and lowering a nylon line into a clearing. Personnel on the ground hold the line while the turn is being made and attach it to the package to be picked up. The pilot straightens out and climbs away, taking the cargo with him, then winches it into the cabin. A reverse process would be used for delivery, but the operation is more difficult.

U-10 aircraft are also fitted with cargo ramps and roller tracks in the cabin so that cargo can be handled easily. These short-takeoff-and-landing aircraft have a range of up to 1,400 naut. mi. at a speed of 100 kt. Most missions are relatively short and the heavy gasoline load can be replaced by other payload.

New, improved parachute flares have been developed to aid in night operations. They were tested in South Vietnam.

One problem in jungle and remote area warfare is how to direct aircraft to targets after they are located. Smoke rockets and smoke grenades have been used for many years, but are generally unsatisfactory. CAG is evaluating balloons, lights, radio beacons, dyes and improved smoke rockets. Local conditions dictate which type would be used for greatest effect.

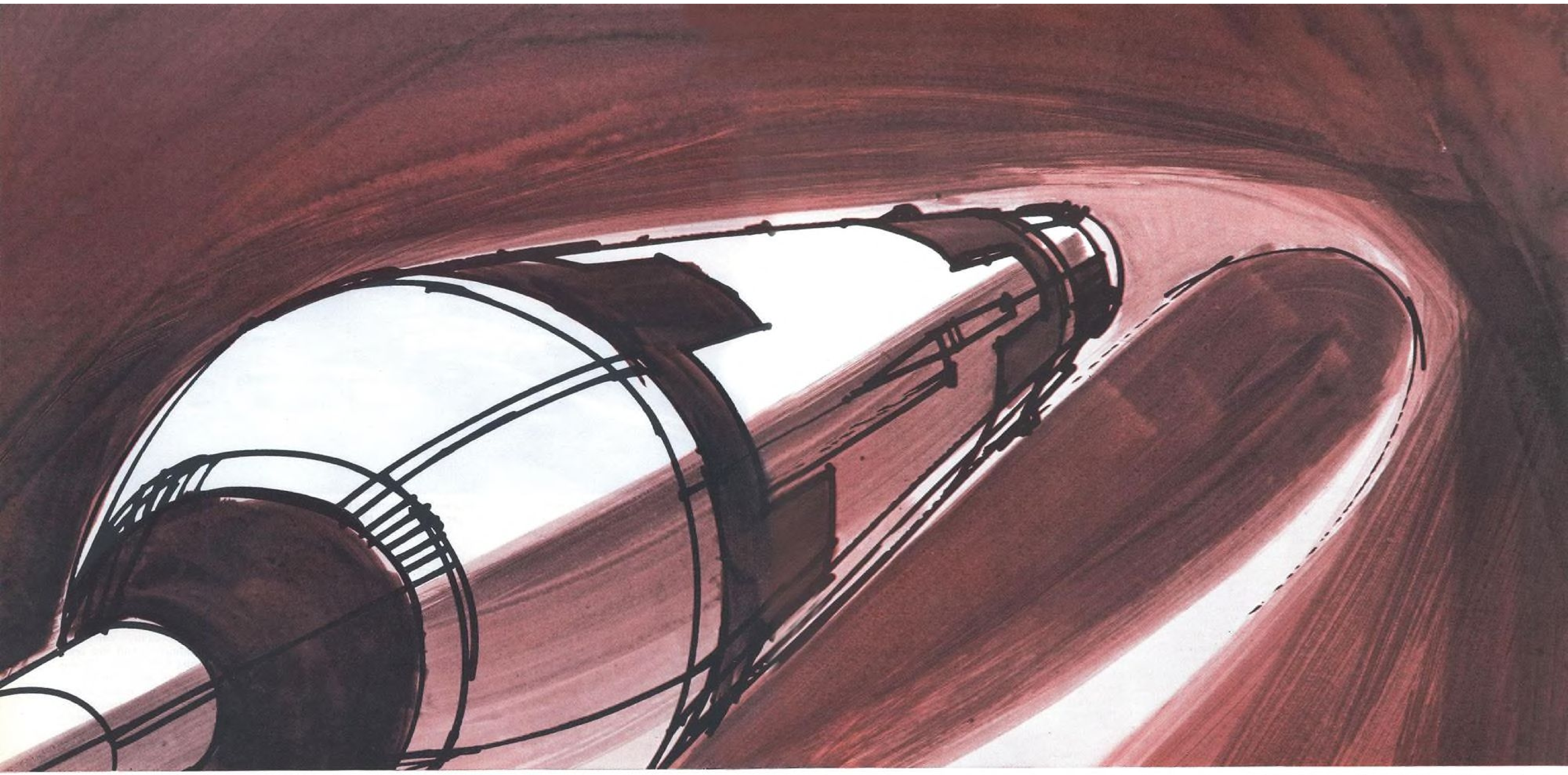
The T-28, as a trainer, had a baggage compartment, which has been modified on some aircraft to house a reconnaissance camera. The camera can shoot vertically and obliquely, and can operate at night, using flash bombs. Others are being installed in B-26 aircraft.

The Navy Zuni rocket, which is more versatile than the 2.75 in. rockets, has been tested by CAG. It can carry a variety of warheads, such as anti-personnel with a proximity fuze; anti-personnel wtih a sensitive impact fuze, adding destructive effects; general purpose warhead with delay fuzing; and others for target marking, smoke and chemicals.

The LAU/10D launcher can fire Zunis singly or four at a time.

Experience in South Vietnam and elsewhere has shown that the T-28, B-26 and C-123 need modifications to make them more satisfactory. These are the modifications either under way or planned:

• **T-28.** This aircraft has been modified into the YAT-28E by replacing Wright Aeronautical Div. 1,425 hp. reciprocating engine with the 2,450 hp. Lycoming T55 turboprop. Wings and empennage were strengthened and load-carrying capability increased. Additional fuel cells



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were added inside the fuselage, and use of external tanks made optional. Two machine guns were flush-mounted in the wing.

The first YAT-28E crashed recently during a test flight (AW Apr. 1, p. 31). Two more T-28s are being modified to the YAT-28E configuration at North American's Columbus, Ohio, plant.

• **B-26.** Those in the inventory were manufactured between 1941 and 1944. According to Col. King, they are "a bit tired, old and poorly engineered by today's standards, but they are still able to do an excellent job where their range and other capabilities are needed.

B-26 modifications now under way include replacement of the 2,000 hp. Pratt & Whitney R2800-75 engines with R2800-99W engines rated at 2,500 hp. each. JATO bottles will be added to aid further in short field takeoffs. Reversible-pitch propellers are being added, and the wheels will be of the Boeing KC-135 jet tanker type, providing anti-skid capability for use on gravel or wet runways. Addition of wingtip fuel tanks will increase range and reduce the stall speed by 9 kt., because they act as fences on the wings to prevent tip vortices.

The redesigned B-26 cockpit now has a modern flight and engineering instrument panel and an armament panel adapted to control of a variety of payloads. A larger rudder will permit positive control at lower speeds with single-engine operation. Automatic propeller feathering has been provided, so that in the event of engine failure on takeoff, the pilot can concentrate on flying the aircraft without having to divert his attention to performing the feathering sequence.

Landing gear in the modified B-26 will retract in 12 sec. instead of 22 sec. An electric emergency hydraulic pump has been installed and improved windshield wipers will work efficiently in tropical rainstorms. Modern photo-reconnaissance cameras have been installed. In four man-hours, the aircraft's metal nose can be removed and a glass one installed, or vice versa.

### Autopilot Installation

Six .50-cal. machine guns are installed in the wings. The glass nose will accommodate a photographer or a bombardier. An E-4 autopilot will permit accurate tracking for photography. The photographer will be able to control the aircraft from his nose station through the E-4. A gyro-stabilized driftmeter will also make photography more accurate and will aid in dead reckoning navigation. The driftmeter is part of a Norden bombsight that will be used for level bombing.

Further B-26 improvements include cockpit heating for cold weather and cooling for tropical operations, anti-icing for wing and tail surfaces and windshield, an oxygen system for high altitude operations, dual controls with provision for folding the right-hand control column and pedals out of the way and modern radios whose controls are in the middle of the instrument panel.

• **C-123.** A modification program for the C-123 type aircraft will begin soon. It was found in South Vietnam that the wheels were not large enough to operate in some mud conditions. Larger wheels and tires will be substituted. Boundary layer control for the wings is being investigated and under-wing jet engine pods are being tested in the YC-123H version.

• **Douglas A-1E.** The CAG evaluated the capabilities of the Navy-Marine attack aircraft and found that its load-carrying ability, combined with a two-man cockpit, made it an ideal vehicle for counter-insurgency use. About 150 aircraft from excess Navy inventories will be overhauled and slightly modified. Two squadrons will join the first Air Commando Group this year.

### Utility A-1E

In some versions the A-1E can carry about 8,000 lb. of external ordnance. It has four 20-mm. cannons. As a utility aircraft, modified to carry passengers to and from aircraft carriers, it will be possible to carry 2,000 lb. of cargo, 12 passengers or eight fully equipped paratroops. On the paratrooper mission it could operate carrying the 20-mm. cannon and ammunition plus 5,000 lb. of external ordnance or fuel. Powerplant is the Wright R3350-2700H.

The First Air Commando Group has its headquarters at Hurlburt Field, also known as Field No. 9, part of the Eglin complex. It is commanded by Col. Gerald J. Dix, who recently relieved Col. Chester A. Jack. Units of the group are the Sixth Fighter Squadron, the 319th Troop Carrier Squadron and the First Air Materiel Squadron.

When additional personnel and equipment are authorized, Gen. Pritchard will form a second group.

At present, Air Commando training includes tactics for day and night operations in different types of terrain, with emphasis on jungles and mountains. Every six weeks a class graduates from the Hurlburt course and the men are then transferred to one of the three detachments. Each Air Commando must have a working knowledge of a language other than English.

The training course emphasizes aircraft and equipment maintenance in the field, training of indigenous personnel, operations from strange rough landing strips, low-level navigation and operations in bad weather. In weapons delivery, the types studied are napalm, rockets, machine gun strafing and several kinds of bombing.

Methods employed by Air Commandos in countering guerrilla-type insurrections were demonstrated here recently to visiting Air Force chiefs-of-staff from more than a dozen Latin American countries.

### Night Missions

The visitors, accompanied by Gen. Walter C. Sweeney, TAC commander, were loaded after dark into two C-123 transports and flown to a dirt airstrip on the Eglin reservation. The flights were made without running lights and the landings were made without landing lights.

The group, briefed in Spanish, Portuguese and French, watched a 1-hr. version of a typical three-month counter-insurgency operation. The demonstration illustrated these events:

A U-10 flies over a predetermined location, picked after reconnaissance, and drops a commando or trained native by parachute. This man, carrying a radio, makes arrangements with friendly natives for them to accept help. If necessary, he is aided by leaflet drops and airborne loudspeaker propaganda. Leaflets dropped at night are made visible by applying phosphorescent paint to their edges.

When sufficient progress has been made, a C-47, guided by radio and flashlight, flies over and drops five to 10 parachutists carrying medicines and equipment to prepare for eventual countering of guerrilla activity.

The final buildup of strength occurs when C-123 aircraft bring in whatever number of troops are needed for the operation. In the demonstration, two aircraft-loads of men were flown in. The type of parachutes used in night landings descend slowly enough for the men to keep their feet where they land.

After the troops are marshaled and organized, weapons and supplies are dropped from C-123, C-47 and Curtiss C-46 aircraft, completing the strength buildup phase.

Then action begins. A target that needs softening is pinpointed. U-10, T-28, B-26, C-47 or C-46 aircraft drop flares to illuminate the target.

In the demonstration, T-28s attacked a target on the opposite side of the airstrip with napalm, 100-lb. bombs and machine guns. B-26s dropped bombs and fired 2.75-in. rockets.

After the target area is softened, the troops attack.

Air Commando and Special forces are in their theaters of action for the primary purpose of training local forces. But if they must, they go along on missions and shoot if they have to. Therefore, there have been casualties.



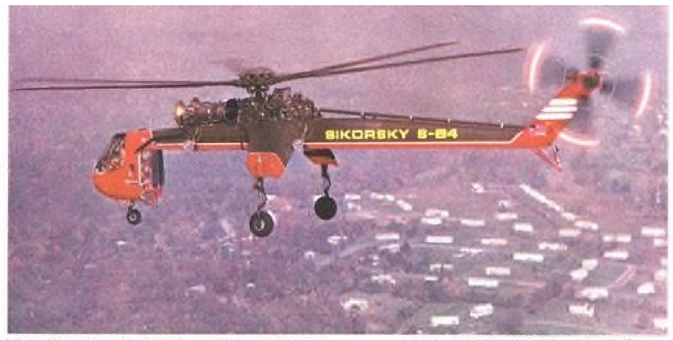


**New power for space** will come from America's first liquid-hydrogen engine, the RL-10. This upper-stage powerplant is being developed by Pratt & Whitney Aircraft for NASA's Marshall Space Flight Center. The RL-10 is designed to stop and start in deep space, with advanced models offering throttle control of power. Pratt & Whitney Aircraft provides design and manufacturing leadership in power for many applications, in and out of this world.

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ABOVE, GRUMMAN SA-16B ALBATROSS BELOW, REPUBLIC F-105 THUNDERCHIEF







ABOVE, NORTHROP T-38 BELOW, CESSNA 310G







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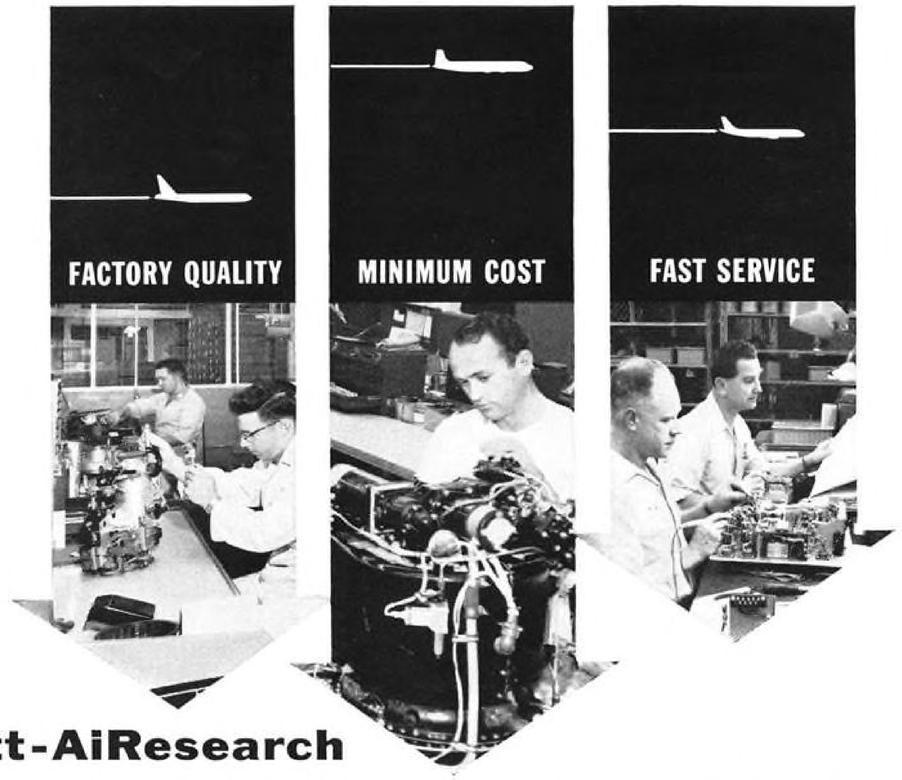
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## Vertol Shows Aerial Loading, Unloading

Vertol 107 lowers 4,500-lb. truck from rear ramp to demonstrate practicality of loading and unloading normal cabin loads while hovering. Boeing feels the technique is potentially valuable for recovering objects, including space hardware, from water, and unloading cargo in jungle and mountainous areas.

# PRODUCTION BRIEFING

**Carrier Air Conditioning Co.** has a $15.4-million Air Force contract for environmental control systems in Minuteman missile silos and control centers. Systems will be installed at Minuteman sites at Minot AFB., N. D. and Whiteman AFB., Mo.

**Whirlpool Corp.** has a NASA contract for development of a personal hygiene system for Project Gemini. System will provide for skin cleaning, oral hygiene and shaving for 14-day orbital missions. Work will be done at the company's research laboratories in St. Joseph, Mich.

**Emerson Electric Mfg. Co.** of St. Louis, Mo., has formed a Flight Systems Dept. for development and production of missile and rocket subsystems, aircraft armament systems and aerospace vehicular structures. Department will operate within the firm's Electronics and Space Div.

**Babcock Electronics Corp.**, Costa Mesa, Calif., has a $2.1-million contract from the Bureau of Naval Weapons for command and control equipment for remote control of helicopters and missile target aircraft.

**Goodyear Aircraft Corp.** will change its name to Goodyear Aerospace Corp. effective July 1. Firm had had its present name since 1939 when it changed its name from Goodyear-Zeppelin Corp.

**Bendix Corp.** has a $23-million Navy contract for continued production of the Talos missile.

**Martin Co.'s Orlando Div.**, has


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**PUMP PRIMERS**

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## How One Pump Can Serve Several Systems

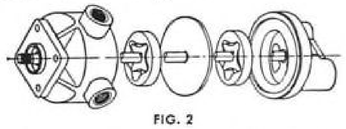
► Engine designers have been strongly attracted by Gerotor pumps which permit the incorporation of an extra pumping element in a separate chamber of the lubricating pump to provide fluid pressure for a control function or other use.

► **The Gerotor is a form of internal gear pump consisting of only two moving parts: an inner toothed element and an outer, meshing toothed element. The inner element has one less tooth than the outer and the "missing tooth" provides a chamber to move the fluid from the inlet port to the outlet. Pump capacity is measured by the volume of the "missing tooth" multiplied by the number of driver teeth and RPM. (Fig. 1).**



FIG. 1

► The unique construction of the Gerotor type pump permits aircraft systems designers to combine *several pumping functions* in a single pump housing mounted on a single pad and driven by a single shaft. Diversified systems such as lubrication, scavenging, low pressure hydraulic servo systems and motors up to pressures of about 1000 psi may be centralized in this manner. **(Fig. 2).**


FIG. 2

► **The designer has several variables to secure a given capacity within his space limitations: Gerotor *diameter* which governs the area of the pumping chamber, Gerotor *thickness* which, taken with area determines chamber volume and Gerotor *RPM*. Thus, it is possible to vary the diameter, length and speed to secure needed capacity.**

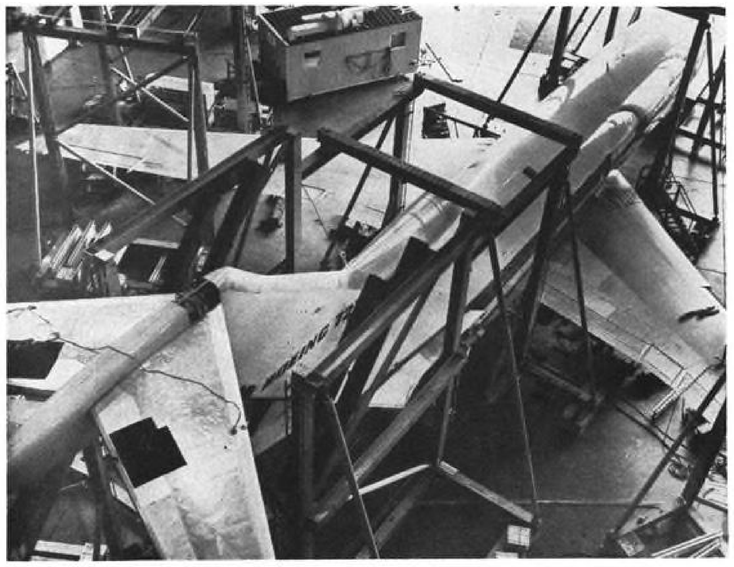
► The Gerotor pump is a positive displacement type, delivering a predetermined amount of fluid in direct proportion to speed. It is simple and compact in basic design. It is lightweight, valveless, provides exceptional performance at high altitudes and has low wear over a long service life. In addition, it is balanced and extremely quiet in operation.

► *Technical data is available and your inquiry is invited. Write:*

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## 727 Readied for Flight-load Tests

Third production Boeing 727 is housed in a structural steel support framework in preparation for a flight-load survey to begin this month. Preparations include calibration of over 800 strain gauges installed throughout the aircraft. Data will be used to confirm estimated design loads and structural strength.

broken ground on a new 127,800 sq. ft., $2.5-million research center at Orlando, Fla.

**Federal Electric Corp.**, an associate of International Telephone and Telegraph Corp., has been awarded an $18.8-million Air Force contract for the operation and maintenance of the Distant Early Warning (DEW) System during Fiscal 1964.

**Avco Corp.'s** Aerospace and Electronics Divs. have opened a joint engineering and development center in Huntsville, Ala.

**Western Electric Co.** has been awarded an $18.8-million Army contract funding continued development of an advanced radar designed for the Nike X anti-missile system.

**National Aeronautics and Space Administration** has awarded International Business Machines Corp. a 14-month contract to experiment with an information handling system to alert its aerospace scientists and engineers to technical information matching their interests. Engineers and scientists would indicate an area of interest and a computerized system would indicate reading material pertinent to their query.

**Lear Siegler, Inc.**, has a $1-million Army follow-on contract for guidance fin servos for the Sergeant surface-to-surface missile. Work will be done at Lear Siegler's Power Equipment Div. in Cleveland, Ohio.

**Radio Corp. of America's** Astro-Electronics Div. has won a $117,000 contract to study camera resolution requirements for the synchronous meteorological satellite, and Hughes Aircraft Co. received a $60,000 award to study ways to modify the Syncom communications satellite to carry weather cameras.

**Sperry Phoenix Co.** is investing about $1 million in a 50% plant expansion for about 500 additional personnel needed to manage new engineering and production programs. Projects range from terminal control and guidance instruments for the Air Force X-20 (Dyna-Soar) space glider to autopilots and guidance instruments for modern aircraft.

**NASA deep space** tracking station at Tidbinbilla, Australia, near Canberra, will be operated by a consortium of the Australian subsidiaries of the Hawker Siddeley Group, Elliott-Automation and Associated Electrical Industries.

**Lycoming Div.** of Avco Corp. placed purchase orders totaling $62,520,000 during the 1962 calendar year, the company has reported. A total of 2,431 suppliers made sales to Lycoming. Majority of the business went to the New England area.







## We've got 4,500 pounds by the tail

Picking up a load and swallowing it whole—without having to touch down—will be a unique feat for a helicopter.

This new technique of aerial rear-ramp loading will add important new capabilities to the already impressive versatility of the Boeing Vertol 107. The ability to lift a 4,500 pound truck in this manner is one of the many advantages of the tandem rotor configuration.

Helicopters have an impressive new range of operating flexibility when they're freed from landing-site loading. They can pick up heavy objects such as radar equipment, and pallets for personnel and supplies in any kind of terrain—jungle, marshy or mountainous. They can retrieve certain space hardware from the water. They can change pick-up or drop areas on call. And once having made a pick-up, they can put the normal payload inside the cabin where it belongs...and proceed at rated airspeed.

The Boeing Vertol 107 is another example of creative engineering, forward thinking weapons system program management and the vast resources of the Boeing Company.

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# How much will one USAF StarLifter lift?

**154 troops or 127 paratroopers.**

This is a typical example of how the new C-141 StarLifter will give MATS the airlift power to increase the Army's air mobility.

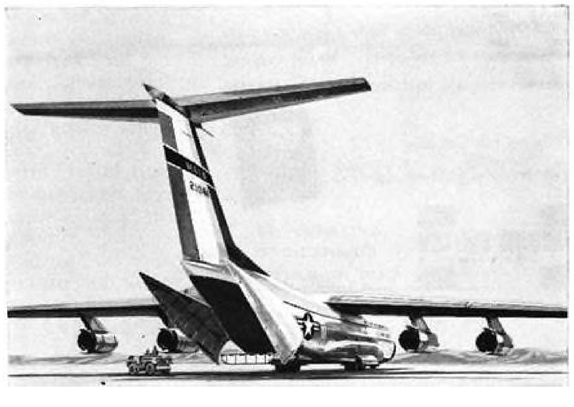
The StarLifter will also carry many combinations of men and machines, including outsize vehicles that could never be airlifted by jet before.

The C-141's truck-bed height or drive-on ramp rear-loading design permits immediate access to the 7,000 cubic foot clear cube cargo area. For palletized cargo, the C-141 will use the new 463L mechanized loading system. In a matter of minutes, the big turbofan airlifter can be loaded and be on its way to a destination anywhere on earth.

Progress report: The first C-141 StarLifter will fly this December.

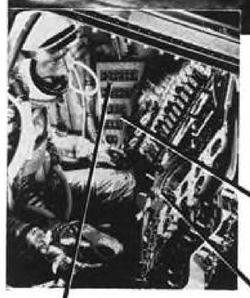
## Lockheed C-141 StarLifter

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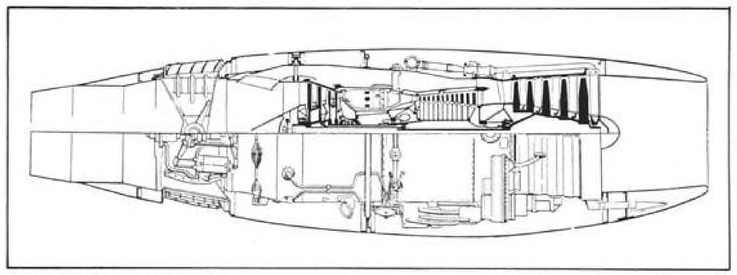
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**ROLLS-ROYCE SPEY-25** bypass engine, to be used on the 1E and 1F versions of the de Havilland Trident transport, has takeoff thrust rating of 11,400 lb.

# Spey-25 Bypass Turbojet Engine Has Additional Compressor Stage

**London**—Rolls-Royce Spey-25, now being developed with government support, has been revealed as basically the same as the Spey-2 except for one additional stage at the rear of the existing four-stage low pressure compressor plus turbine modifications for improved efficiency. Thrust is increased 10% for a takeoff rating of 11,400 lb.

Spey-25 is a bypass turbojet with a maximum basic dry weight of 2,312 lb. and an intake face diameter of 32.45 in. High pressure compressor is a 12-stage axial flow unit. Cruise fuel consumption at 20,000 ft. and 505 mph. true air speed is 0.79 lb./hr./lb. thrust.

The Spey-25 utilizes considerable Conway experience, such as the turbo-annular combustion system with single fuel nozzles. Fuel manifold is mounted outside the bypass duct, as on the Conway.

To avoid servo amplification of small signal forces, the Spey fuel control system used control forces acting directly on large metering orifices which handle the entire fuel flow. Fuel heating system protects against filter icing.

The thrust reverser is designed and stressed for inflight use and has been tested in these regimes on the de Havilland Trident. Outlet ducts of the reverser are fitted with cascade vanes which prevent hot gas reingestion or ingestion of stones thrown up from the runway.

The company said first stage high pressure turbine blades are of the same material as the latest Conway blades, but have higher cooling standards and substantially lower stress. Conway blades have run 0.9 million engine hours without a primary failure.

Rolls has conducted tests with aircraft intakes fitted, simulating 90 deg. crosswind conditions, and engineers said the Spey has operated satisfactorily. The company is also using a simulated aircraft fuselage to obtain suitable effects of air flow pattern in the intake.

Other features detailed by Rolls:

- **Modest loading** of low and high spool compressor blading to ensure engine working conditions well away from a compressor stall.
- **Inlet guide vanes** are non-radial to reduce stress attributable to differential expansion.
- **Compressor blade tip** speeds are moderate to reduce intake noise and to permit high air flow with a minimum frontal area, without inducing high helical Mach numbers on the front compressor blades.
- **Large axial clearances** between rotors and stators to minimize damage due to blade deflection during entry of birds or other foreign objects.
- **Low pressure compressor air** is fed to all main shaft bearings to ensure cool bearings, low oil temperature and oil consumption and freedom from coking. Oil is not changed during the life of the engine.

Although design advances produce the 10% increase, Rolls is holding initial thrust rating to 6% above the Spey-2 to achieve more rapid buildup of overhaul life.

Predicted time-between-overhaul is 2,600 hr. by mid-1966.

# GAO Says Air Force Overstated Plug Needs

**Washington**—Air Force overstated its Fiscal 1963 requirement for platinum electrode spark plugs by about $4.6 million because it failed to use spark plugs already on hand, according to a recent General Accounting Office report to Congress.

USAF has already bought $3.6 million against this requirement. GAO said procurement of the remaining $1 million worth has been indefinitely postponed.

"Our review disclosed that using activities were not obtaining the minimum desired service life from platinum electrode spark plugs and that relatively unused spark plugs were being returned to the San Antonio Air Materiel Area for reclamation or scrap disposal," GAO said.

GAO also claimed that USAF was using platinum electrode spark plugs costing up to $4 each for testing when massive electrode spark plugs costing only about $1.25 each would have served the purpose.

Three other GAO reports to Congress charged over-pricing by defense contractors.

These were:

- **Westinghouse Electric Corp.** Air Force paid $404,500 in "unwarranted profits" on a prime contract with Boeing Co. for Bomarc missiles because it included inflated costs on a subcontract with Westinghouse, according to GAO's report.

Westinghouse supplied Bomarc missile target-seeking systems. The prime contract with Boeing was negotiated in 1959.

GAO stated: "The subcontractor quoted a price to the prime contractor based on cost estimates that were higher than those justified by its most recent cost experience; the prime contractor, without adequately reviewing this price, included it in its proposed initial estimate of the prime contract cost; and the Air Force not only accepted the prime contractor's proposed price for the subcontracted items without adequate review, but also allowed target and incentive profits to be based on this price. . ."

- **Hazeltine Corp.** Hazeltine Corp. received an "unwarranted benefit" of $428,800 by over-pricing subcontracts with Grumman Aircraft Engineering Corp. for spare parts and modification kits for aircraft radar systems, according to GAO.

Grumman awarded three purchase orders for the parts, totalling over $3 million, on a non-competitive basis in 1958 and 1959.

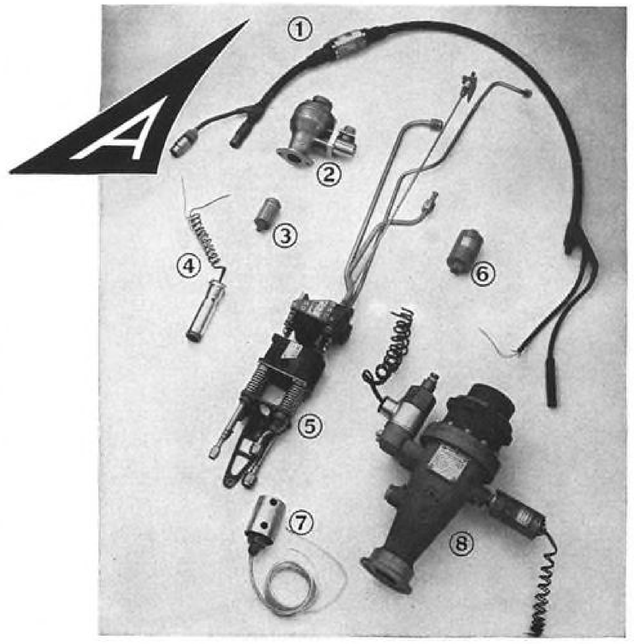
The Grumman prime contract was with Navy Dept.

GAO commented that "we found no evidence to indicate that the Navy questioned the prices agreed upon by Grumman and Hazeltine."

- **Burroughs Corp.** GAO said Burroughs Corp. over-charged the Army $556,000 on three contracts for spare electronic parts.

The contracts were awarded in 1959 and 1960.

GAO said: "Burroughs proposed prices that were higher than those justified by its most recently experienced cost data, and the U. S. Army Procurement Office, Ft. George G. Meade, Md., accepted Burroughs' proposed labor cost estimates without adequate review."




## CAPABILITY—RELIABILITY... an Aerotec Tradition

Whether the application is for aircraft, missiles, ground support or land and sea ordnance, Aerotec supplies the most important ingredients . . . capability and reliability. Inherent with Aerotec is the ability to conceive, design and develop a component to difficult requirements, and complementing this are manufacturing techniques assuring production of equipment that will operate reliably under severe service conditions.

New concepts of flow indicators, pressure switches, valves, level indicators and disconnects are constantly being produced at Aerotec. A call to 203 JE 1-8400 will bring a prompt response. Or write: Aircraft Equipment Division, Aerotec Industries, Inc., Dept. A W, Greenwich, Connecticut, for help with your system or component problem.

**Illustrated and listed below are a few of the Aerotec designs developed to specific customer requirements.**

1. DA1640—Oxygen and communication services disconnect designed for rough service use by aircrewmen.
2. RV67—Stainless steel, solenoid operated, hot gas shut off valve for jet engines.
3. M620—Gage pressure switch for 5 psi to 1000 psi operating pressures, produced with a variety of port, mounting and electrical connector configurations.
4. B224—One of a variety of Aerotec flow indicators featuring low pressure drop and accuracy.
5. DB4705—Composite disconnect for crew escape capsule provides variety of services, including high pressure gases at hot temperatures and multiple electrical contacts.
6. PAB1-18N—Compact aneroid pressure switch suitable for wide range of applications.
7. F203—Small, inexpensive float switch, fully qualified and available in top, side or bottom mounted configurations.
8. ZVP-1—Solenoid shut off valve for control of high volume gases, incorporating pressure switch for warning indication.

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AIRCRAFT EQUIPMENT DIVISION · GREENWICH, CONNECTICUT

*Other Divisions:* **AEROTHERM DIVISION** Aircraft Lounges, Passenger and Crew Seating
**INDUSTRIAL DIVISION** Dust Collecting Systems, Gas Scrubbers, Fans, Stacks and allied equipment.



## *New Raytheon System Uniquely Combines Air-to-Ground, Air-to-Air Radar Functions*

Raytheon's offensive system for advanced tactical aircraft is the first to provide a unique combination of precise terrain avoidance and ground mapping with air intercept radar functions. The system includes a proven air-to-air missile with all-weather, all-altitude and all-aspect capability.

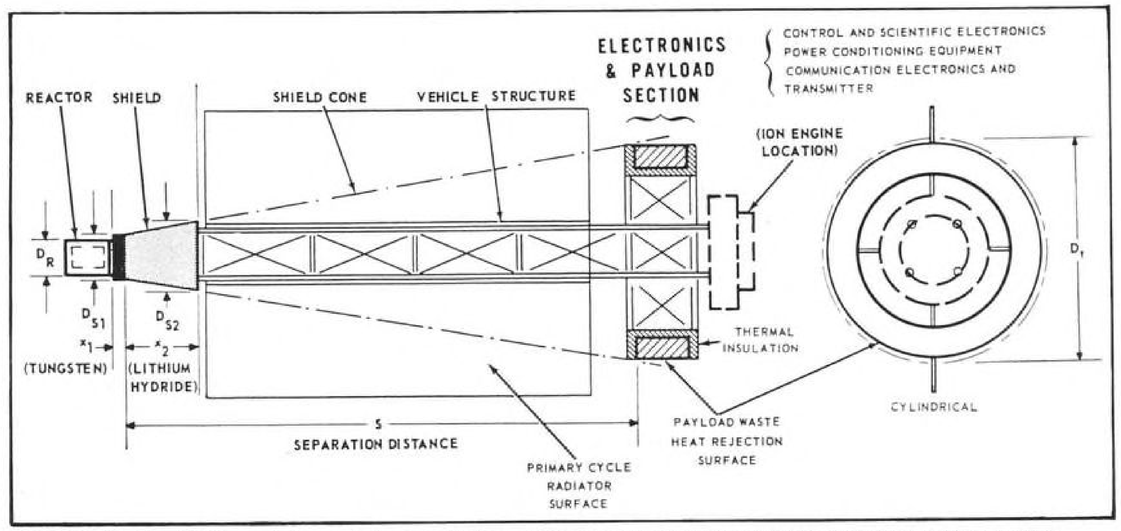
The ability to conceive and design the system is an outgrowth of Raytheon's progressive and continuing effort in airborne radar and missile technology.

Related experience includes design and production of the bomb/nav search and terrain avoidance radar for the B-52, the bomb/nav radar for the B-58, management of SPARROW III and HAWK weapon systems, plus detailed study and analysis of mission requirements for advanced attack aircraft.

For additional information, contact *Missile Systems Division, Raytheon Company, Bedford, Mass.*

RAYTHEON




**BENDIX** design for shielding avionics control and payload in nuclear-powered spacecraft uses both physical separation and shield.

# Spacecraft Radiation May Boost Tube Use

By Philip J. Klass

Dayton—Intense radiation environment aboard a nuclear-powered spacecraft, coupled with the radiation vulnerability of semiconductor devices, may boost the use of vacuum tubes in such vehicles.

Data showing the crossover point in weight saving between semiconductors and tubes was reported by James J. Edmond, Bendix Research Laboratories, during the recent National Aerospace Electronics Conference here.

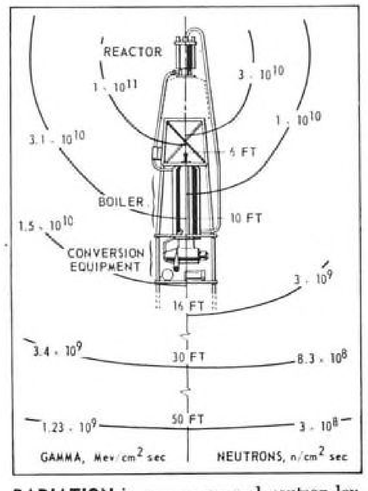
Bendix study considered the weight of the avionics payload aboard a nuclear-powered spacecraft, the weight of shielding required to protect it and the fraction of the weight of the nuclear-produced power required to operate the payload.

On this basis, Bendix found that in a spacecraft powered by a 3-kwe. (kilowatts electrical) SNAP-2 reactor, the use of semiconductor devices offers a net weight saving only if the number of active elements (tubes/transistors) exceeds about 4,000. For a smaller number of active elements, use of vacuum tubes will save weight, the Bendix study indicates, and the tubes gain as the nuclear power level increases.

For example, a spacecraft using a SNAP-8 generating 30 kwe. will save weight by using tubes if the number of active elements is less than approximately 10,000, according to curves presented by Edmond.

Spacecraft equipped with a SNAP-50 operating at a 300-kwe. level would realize a weight saving through the use of tubes if the number of active elements were less than about 20,000. The crossover point between tubes and transistors is difficult to define precisely. This is due to limited data available on radiation damage susceptibility and the fact that vulnerability varies with the type of tube or semiconductor.

Heater-less thermionic vacuum tubes in a ceramic enclosure, called TIMMS, made by General Electric, pose the greatest threat to semiconductors in a radiation environment, the Bendix analysis indicates. The TIMMS offer a significant over-all weight advantage beyond payload complexities of 100,000 active elements.




**RADIATION** in gamma ray and neutron levels is shown for unshielded 300 thermal kilowatt nuclear power source producing about 30 kwe. power, comparable to SNAP-8.

The analysis was based on locating the entire avionics payload at one end of the spacecraft with the nuclear reactor at the opposite end, using physical separation to achieve some radiation protection. Additionally, the Bendix analysis assumed the use of a truncated cone shield of lithium hydride and tungsten to reduce neutron and gamma radiation (see drawing above).

For a 3-kwe. SNAP-2-equipped spacecraft, a 15-ft. separation distance was assumed, while a separation of 33 ft. was used in calculations for a 30-60 kw. SNAP-8 and a distance of 50 ft. for the 300-kw. SNAP-50.

An urgent need exists for definitive radiation reliability data through testing and analysis, Edmond said, to determine more precise damage levels and time-to-failure for a wide variety of components.

For example, the weight of shielding required for a SNAP-8-equipped spacecraft ranges from 200 lb. to 1,200 lb., depending upon which data are used for transistor susceptibility to radiation damage. If the optimistic figure is adequate, the spacecraft could carry an additional 1,000 lb. of payload.

In other reports presented at the National Aerospace Electronics Conference, the following advances in avionics were reported:

- **Injection laser**, in which manganese

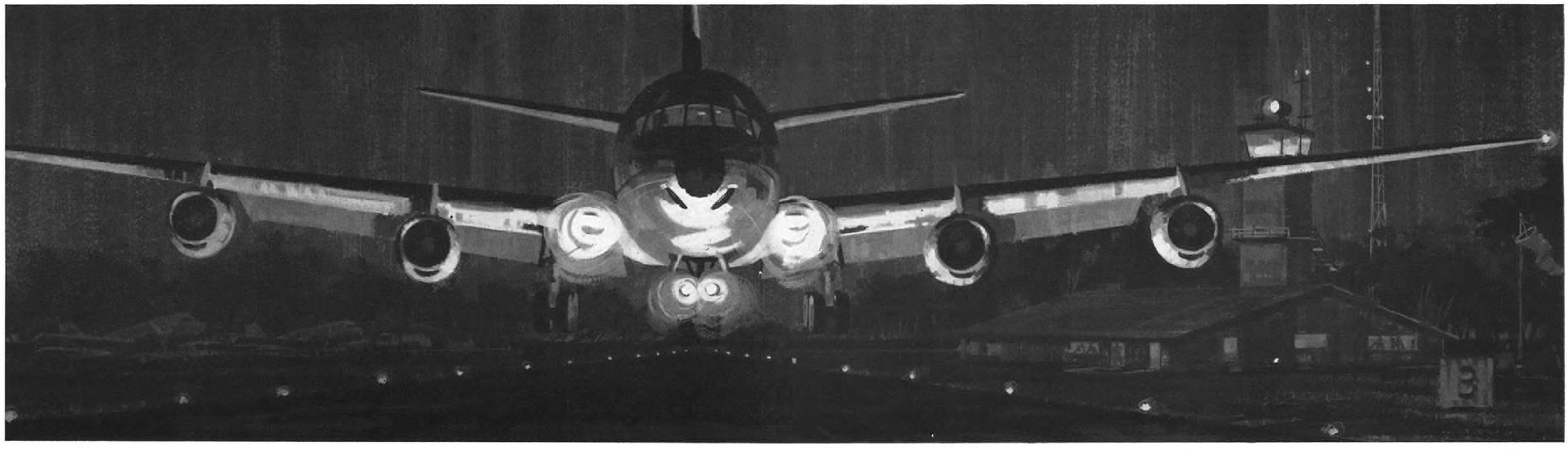
# Best <u>short</u> story of the year

*...written by a Douglas DC-8*

To how big an airport do you have to reroute a jetliner, if its scheduled landing field is locked in by fog?

If it's a DC-8 or DC-8F, not very big. The DC-8 has been approved by the F.A.A. for the shortest landing field length of any long range jetliner. It needs airports with runways no longer than those which can handle a DC-6...and that often means as small as 5,000 feet.

Credit some of this capability to a new landing gear modulated anti-skid system which continually monitors all brake pressures to maintain optimum traction. Also to the important fact that the DC-8's control at low speeds is superior to that of any other jetliner,



But even before the new landing gear system was perfected, DC-8s had landed on runways shorter than 5,000 feet. This capability is characteristic of the extra margin built into so many of the DC-8 and DC-8F systems.

And as for fog, latest Douglas transport designs already are capable of operating at weather minimums of 200 feet and ½ mile visibility. Developments will soon lower these minimums to 100 feet and ¼ mile, and may eventually achieve fully automatic landings when ceilings are zero.

**DOUGLAS BUILDS GREAT TRANSPORTS**

DOUGLAS AIRCRAFT DIVISION

TEST STAND
INSTRUMENTATION

# What's happening?

...to the temperature, to the hydrogen flow, to the neutron flux, at the nozzle and where else? Only the instrumentation knows for sure as a booster goes through its static tests . . . and what's the degree of confidence?

To get answers instead of further questions, many Prime Contractors find the optimum solution in sub-contracting the total test stand instrumentation to a single company. When that company is EG&G, the confidence curve soars.

As instrumentation contractor for the Kiwi and NERVA engine test stands, EG&G has demonstrated a competence that ranges from a high degree of innovative engineering in problem solving, to the technical and administrative capacity in depth to develop and manage complex systems of great magnitude.

Among the many specific examples that demonstrate this range of ability, are:

. . . a unique, Log-N Amplifier which compresses the 11-decade dynamic range of reactor-monitoring ion chambers to usable voltage levels, and

. . . a 2000 channel data acquisition and recording complex with complete TV-photographic coverage, site communications and environmental safety back-up.

This broad and intensive experience pays off by saving endless frustration and duplication of effort for the Prime Contractors. EG&G's trained field management and engineering specialists apply and refine the most advanced existing systems and components to the immediate problems. The Prime deals with a single manager, who is fully accountable for the total instrumentation task and has at his command an able staff of other scientists and engineers with solidly relevant experience. The result is on-time accomplishment.



*If you would like to know more about this expanding capability and EG&G's other capabilities, write us. If you would prefer to have us know more about your capability as an individual, send your resume to: Elton Harris, Dept. AW63, 160 Brookline Avenue, Boston 15, Massachusetts. EG&G is an equal opportunity employer with unequalled opportunities in our fields.*

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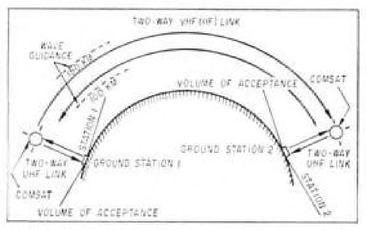
is diffused into a gallium-arsenide junction instead of the more commonly used zinc, shifting the laser output farther into the infrared region to about 9,000 Angstroms, was reported by Dr. H. T. Minden of the Sperry Rand Research Center. Minden also reported that his company is working on wide-band photo-converters having bandwidths of about 10 kmc.

• **Mode-tuning of injection laser** by varying the ambient pressure surrounding the crystal diode was reported by Dr. J. D. Axe of International Business Machines Corp. The mode-tuning effect, which also occurs when diode temperature is varied, results in shorter wavelength emission as the pressure is increased.

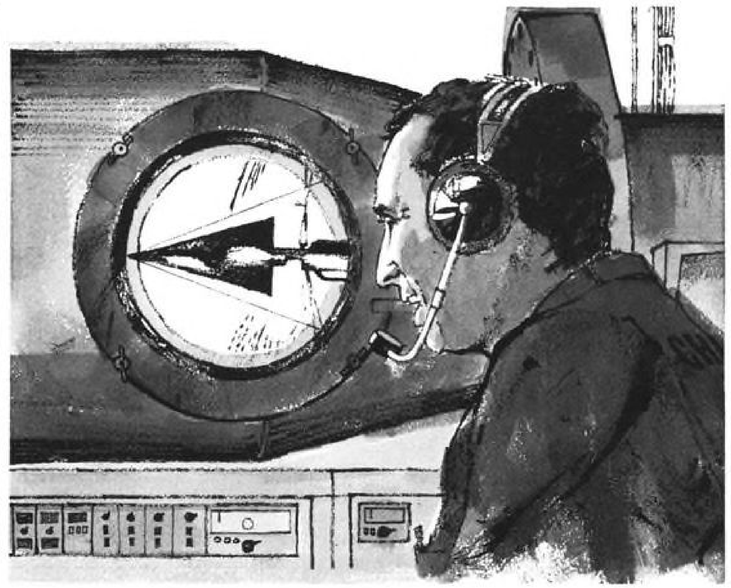
• **Greatly improved** thermoelectric cooling by operating P-N junctions in a magnetic field was predicted by John R. Sizelove of Aeronautical Systems Div.'s Electronic Technology Laboratory. In predicting increased use of thermoelectric cooling to achieve cryogenic temperatures, Sizelove cited a closed-cycle thermoelectric refrigerator built by Phillips Laboratory which cooled from room temperature of 300K down to 30K, using 1 w. of electric power to pump out 1.7 milliwatts from a cooled chamber.

• **Effort to stabilize** laser frequency against its fluorescent line shape, currently under way at Technical Research Group, Inc., is expected to yield a long-term stability of better than 1 kc., corresponding to three parts in $10^{12}$, James LaTourrette of TRG reported.

• **Strapped-down** inertial system flight tests in a DC-3 have shown that a no-gimbal system has performance comparable to conventional inertial systems using stabilized platforms, according to Joseph Levine, Ford Instrument Co. Levine said that there was no degradation in performance due to high angular rates of the aircraft and its vibration or to the high-speed incremental attitude computation required for such a system beyond what would be experienced in a conventional system using equivalent



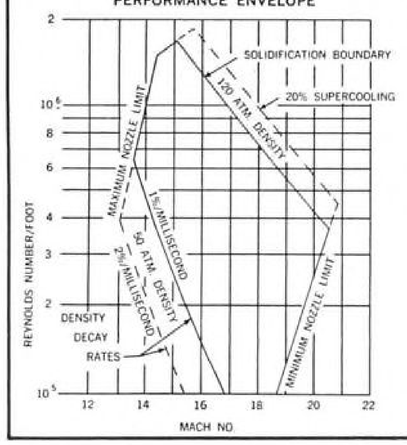

**UNCONVENTIONAL** communication satellite system under study by Raytheon would use ionosphere to transmit signal in the HF-VHF band far beyond line-of-sight range, with UHF used to relay the signal to ground terminals at either end. Communication between satellites would not require directional antennas at proposed frequencies.



## NOW... DATA AT MACH 14 TO MACH 21

Space and re-entry vehicle designers can now obtain data in the Mach 14-21 range at the extensive hypervelocity facilities of the Chance Vought Wind Tunnel Laboratories. Supporting equipment and instrumentation is available for experiments on basic aerodynamic components, heat transfer, pressure distribution, dynamic stability and jet exhaust effects. Specialized sensing instrumentation designed and fabricated by Chance Vought give a high degree of reliability. The performance envelope for the hypervelocity tunnel is shown below. ☐ This facility is one of three Chance Vought wind tunnels: low speed, high speed, and hypervelocity. Fixed costs are available for your total project. There are no extra charges involved. Write today for Bulletin PDS 60-2-3 and see how you can make use of this important space-research tool. Wind Tunnel Laboratories, Aeronautics and Missiles Division, Chance Vought Corp., P. O. Box 5907, Dallas 22, Texas.

CHANCE VOUGHT HYPERVELOCITY WIND TUNNEL PERFORMANCE ENVELOPE




| | |
|---|---|
| Mach No. | 14 to 21 |
| Reynolds No. | 1x10⁵ to 1x10⁶ /ft |
| Dyn Pressure | 0.3 to 3.0 psi |
| Temperature | 1500 to 4500° K |
| Altitude | 140,000 to 300,000 ft |
| Run Time | 40 to 80 milliseconds |
| Test Section Size | 13 inch dia |
| Max. Model Size | 2.5-in dia x 6-in length |
| Angle of Attack | −10° to 190° |

Demonstrated Testing

a. 6-component force and moment
b. Local pressure
c. Dynamic stability
d. Local Heat transfer
e. Rocket exhaust effects on vehicle stability

LTV
LEADERSHIP THROUGH VERSATILITY



Photo by Reeves Instrument Corporation
Garden City, New York

# Inland Gearless Torquers give 2-axis precision to Reeves Radar Pedestals

**Precision Radar Pedestals . . .** manufactured by Reeves Instrument Corporation, Subsidiary of Dynamics Corporation of America . . . play vital roles in major satellite and missile programs. Designed to accommodate reflectors up to 30-feet in diameter, they feature 5-second angular accuracy, azimuth load bearing ratings at 250,000 pounds and tracking rates from zero to 10 rpm in azimuth and from zero to 1/2 radian/second in elevation.

**Accurate 2-axis servo-positioning** of these Reeves Pedestals is effected by Inland Gearless Torquers ranging in torque output from 500 to 3,000 pound-feet.

**Fast, high-resolution response to servo-position error signals** is a major reason why Inland Gearless Torquers win so many missile and space-vehicle assignments. The superior performance of these direct-drive d-c torque motors comes from torque-to-inertia ratios 10 times higher than equivalent gear-train servo motors. Moreover, their compact pancake configuration meets space and weight restrictions.

**What's your problem?** If you're currently planning a servo system calling for output torque between 20 ounce-inches and 3000 pound-feet*, compare Inland Gearless Torquers with any alternative. Write for all the facts today, 347 King Street, Northampton, Massachusetts.

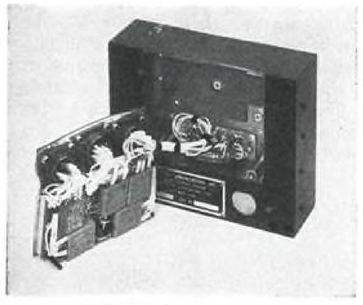
*Higher torque output levels can be provided on special order.

INLAND MOTOR CORPORATION
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components. Using gyros with a 0.1-deg./hr. drift rate, the strapped-down system demonstrated an average error of about 4.2 mi./hr. of flight, according to Levine.

• **New spacecraft** attitude control technique, which uses a combination of gravity and earth's magnetic field and eliminates the need for moving parts within the spacecraft, was described by A. G. Buckingham of Westinghouse Air Arm Div. Initial de-tumbling would be achieved through interaction with earth's magnetic field, while a subsequent erection to local vertical and orbital plane is achieved by gravitational and magnetic torques. Buckingham said that the torque levels are too low to correct for thrust-misalignment torques which might be generated by orbit position correction rockets. Spacecraft equipment would include a magnetometer and solar cells for attitude sensing and three coils for producing a magnetic field to interact with earth's field. Spacecraft attitude would be telemetered to the ground, where required control currents in each coil would be computed and telemetered back. Analysis indicates the system could maintain spacecraft earth-orientation within 2 deg. despite disturbing torques of 25 dyne-centimeters, Buckingham said.

• **Hybrid inertial-Loran-C** navigation system was proposed for use in transatlantic flights in a report by Samuel B. Claypoole of Sperry Gyroscope Co. Co-author was John J. King. By using Loran-C fixes to correct periodically an airborne inertial system, navigation errors could be reduced to a fraction of a mile, Claypoole said. Sperry is designing a Loran-C digital receiver and coordinate converter, each occupying a ½-ATR-size package, suitable for such use.



## UHF Receiver

Ultra-high frequency (UHF) command receiver recently survived a 250,000-ft. free fall from space in a high-altitude sounding rocket when a drogue chute failed to open during descent. Suffering only minor physical damage, the double-conversion superhet receiver continued to operate satisfactorily on two of its four command channels. The receiver, Model R-420, was manufactured by Advanced Communications, Chatsworth, Calif.

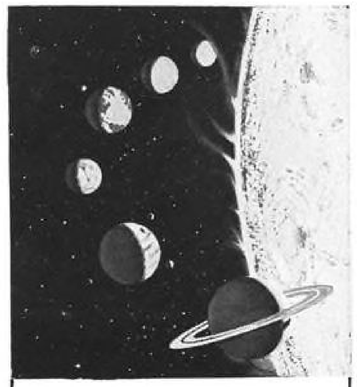
• **New type accelerometer** using the Solion principle, has an electrochemical cell containing an electrolyte whose ions respond to a change of acceleration. The new device offers a low threshold sensitivity, wide acceleration operating range and infinite resolution, Melpar's Joseph W. Paljug reported. The device has no hysteresis, is accurate to within 0.1%, has no moving parts and weighs less than 1 oz., Paljug said.

• **Plasmajet engine exhaust** strongly reflects radar energy, providing target enhancement for space rendezvous missions, Republic Aviation's Gerald Levy reported. For a pulsed plasma pinch engine of the type used in Republic measurements, the frequency and duration of the strong radar echo provides a convenient signature which enables another spacecraft to locate and identify its rendezvous target more easily.

• **Unconventional communication** satellite system, which would utilize a waveguide effect produced by different layers in the ionosphere to transmit HF-VHF signals between relay satellites with UHF frequencies used to link spacecraft to earth terminals, was suggested in a report by Dr. Mario D. Grossi of Raytheon's Space and Information Systems Div. and James I. Barker of ASD's Electromagnetic Warfare and Communications Laboratory (see drawing, p. 71). Transmissions between satellites would be in the 1-50 mc. band, eliminating the need for directional antennas and permitting the use of fewer satellites to achieve global coverage than with conventional ground-satellite-ground system configurations.

Computations by Raytheon, under ASD sponsorship, indicate that path losses at 50 mc. using the area between the E-layer and F-1 layer (between 100-150-km. altitude), would be only 120 db. over a distance of 20,500 km., or roughly half way around the earth. Grossi and Barker suggested experimental verification of the technique using two special satellites equipped with 100-w. transmitters or using satellites planned for other experiments which will carry transmitters for ionospheric sounding experiments.

• **Laser beam attenuation** while passing through shock-induced plasma similar to that encountered in orbital or lunar mission re-entry measured less than 4% during recent tests by Douglas Aircraft. This confirms theoretical studies indicating that a laser can be used for spacecraft communications during re-entry, Richard C. Sykes reported. Douglas tests, conducted in a hypervelocity wind tunnel, used a ruby laser pumped by a helical flash tube with energies up to 6,000 joules. The report was authored by Sykes, D. A. Hayler and C. L. Rudder.

# AERO-THERMODYNAMICS

North American Aviation's Space and Information Systems Division recognizes the role of research and its importance to the successful development and synthesis of manned and unmanned space vehicles of the future.

The Aero-Thermodynamics Department is an applied research division of S&ID and is engaged in advanced state-of-the-art studies associated with many interesting aerospace studies and concepts.

Employment opportunities are available to senior engineers and scientists who have the background to conduct basic and applied research and conceptual design studies in aero-thermodynamics. A broad spectrum of aero-thermodynamic facilities are available to provide engineers and scientists with experimental verification of their theoretical studies.

Experience in the following areas is desired: aero-thermochemistry, viscous gasdynamics, re-entry physics, heat transfer and ablation, rarefied gasdynamics, stability and control and aerodynamic loads.

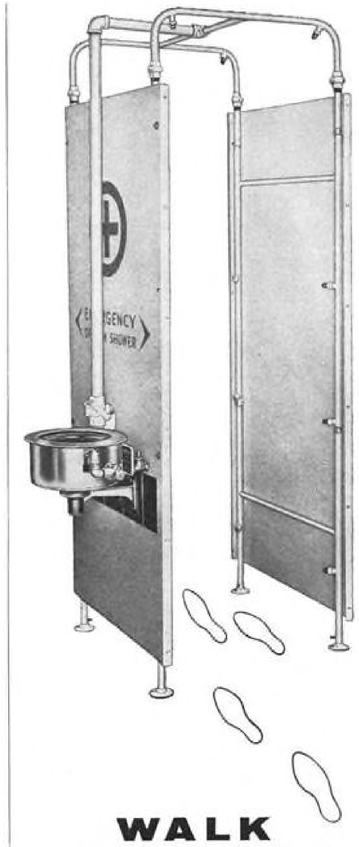
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All qualified applicants will receive consideration for employment without regard to race, creed, color, or national origin.

SPACE AND INFORMATION SYSTEMS DIVISION
North American Aviation






# WALK THROUGH to SAFETY

HAWS

**DECONTAMINATION SHOWER model 8562**

*Ready for action!* 16-FULLJET nozzles drench the body when large Push-Type instant-action ball valve is opened. Here is the *instant* first aid so vital to countering body contamination. A Haws stainless steel (Model 7900-B) eye/face-wash is mounted on paneled side to provide a complete "one-stop" safety station. Functional parts are rugged red brass. Write for detailed specs: *Haws Drinking Faucet Company, 1443 Fourth St., Berkeley 10, California.*

HAWS Since 1909
EMERGENCY EQUIPMENT




## Who's watching out for the guys on the ground?

The men in the Mohawk . . . the "elevated eyes" of the Army. The STOL Mohawk lives in the front lines with the troops. • Coming in under enemy radar at treetop level—as fast as needed—the all-weather, twin-turboprop Mohawk provides quick response to the men who are in immediate command of the in-fighting on the ground. In brushfire tactics you want intelligence now, not hours from now. • Trigger-fast responsiveness . . . sharp-eyed observation . . . that's the Grumman Mohawk. And that's what you call close support.

**GRUMMAN** AIRCRAFT ENGINEERING CORPORATION • Bethpage, N. Y.

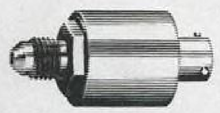
## HOW MUCH SHOULD A TRANSDUCER COST?

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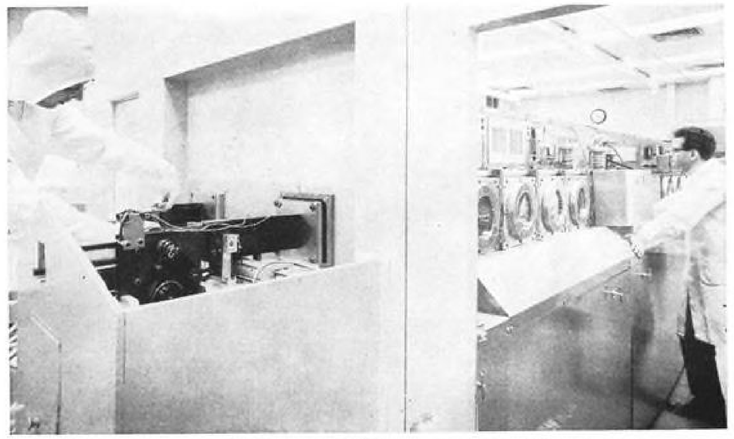
► **Laser Crystal Grown With Flat Surfaces**—New technique for growing ruby laser crystals that results in natural flat end-surfaces, whose parallelism exceeds that obtainable by cutting and polishing, has been developed by scientists at Bell Telephone Laboratories. Interferometry measurements indicate that optical length of a crystal with reflecting faces 5.5 mm. apart varies only 0.1 wavelength of red light over the entire reflecting faces, BTL says. Additionally, radiation losses through the crystal are less than 1% per pass, most of which is due to imperfect end-surface mirrors, BTL says. New rubies are produced by flux-grown process in which crystal is grown slowly at temperature far below its melting point.

► **Avionics Role in Value Analysis**—In line with current Defense Dept. emphasis on value analysis, McDonnell Aircraft Corp. is scrutinizing all avionics equipment aboard Navy's F-4B for possible weight-cost savings. For example, it is evaluating the AQU-2 horizontal situation display, which has transistor amplifiers built into indicator case as a replacement for the A24J-1 indicator, which requires separate amplifier unit with interconnecting cable. The newer AQU-2 not only weighs 40% less and costs about $1,000 less per instrument, but also eliminates interconnecting cable which is potential source of unreliability.

► **NASA Laser Tracking Test Facility**—Goddard Space Flight Center is building a nearby facility which will be used to evaluate optical-laser techniques for tracking satellites. Facility will include large, extremely precise and rigid mount for such equipment, with freedom of movement in azimuth and elevation, which is expected to weigh about 25 tons, according to Dr. Henry Plotkin, head of GSFC's optical systems branch.

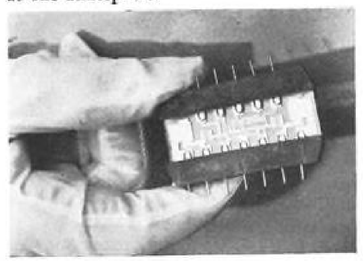
► **Wiring Diagram Preparation Mechanized**—System for mechanized preparation of electronic wiring diagrams, which eliminates tedious drafting process, has been developed by Westinghouse Electric. Company has prepared how-to-do-it manuals which it is making available to Defense Dept. for distribution to other defense contractors. System uses photographic typesetting machines, built by Harris-Intertype Corp. which permit lines, symbols and words to be placed on photographic film using machine keyboards. Technique saves 75% of time required by handdrafting, Westinghouse says. Machine operator works from sketch by design engineer.

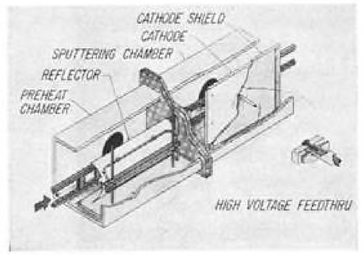




## Continuous-Process Microcircuit Production

Continuous-process thin-film microcircuit production facility, developed by Western Electric Engineering Research Center, can produce 3,000 sq. in. of tantalum film per hour. Glass or ceramic substrate mounted in slide holder (lower left photo) is placed in conveyor (at left in photo above), which transports it through 11 chambers where vacuum level increases to $10^{-6}$ mm. Hg. at third chamber. First four chambers have infrared lamps and reflectors to bake out internal gases and surface contaminants from substrate. Tantalum film is sputtered onto substrate from cathode in vertical plane (lower right photo) in film thickness of about 1,000 Angstroms (four-millionths of an inch). Mechanical probe is used to control variation in film thickness to less than 150 Angstroms on a day-to-day basis. As substrate moves to end of the line of chambers, vacuum decreases to permit exit at one atmosphere.






► **Higher-Speed Microcircuits Soon**—Watch for Sylvania to announce soon the availability of semiconductor microcircuit computer functions capable of operating at 35 mc. speeds, nearly twice the speed of devices now available.

► **New Laser Modulator Material**—New material for use in a Pockels effect laser modulator, capable of operating at microwave frequencies, has been developed by Aircraft Armaments, Inc., Cockeysville, Md. The material, hexamethylenetetramine, known as HMTA, has been operated at 1,000 mc. with a gas laser. Company says its properties are superior to previously used KDP and ADP crystals and it can be grown in similar manner. HMTA's electro-optical properties are uniform from d.c. to microwave frequencies, company says.

► **Nickel-Cadmium Battery Life Improved**—Life span of nickel-cadmium batteries is increased when cell temperature is maintained at about 75F, with shorter life at either higher or lower temperatures, according to results of life tests conducted by Cook Electric Co. under Air Force sponsorship. Tests also show that shallow discharge-charge cycles also enhance battery life. Results are contained in report entitled "Alkaline Battery Evaluation," identified AD-291-477, available for $3.50 from Office of Technical Services, Commerce Dept., Washington 25, D.C.

► **On the Corporate Checkerboard** — General Precision Equipment Corp. and Radiation, Inc., have terminated month-long negotiations toward GPE's possible acquisition of the major telemetry producer. Observers speculate that GPE still is anxious to acquire a company with telemetry-data communications capability. . . . United Aircraft Corp.'s Norden Div. will make and sell Loran-C navigation gear developed for air and sea use by Decca Navigator Co., London, under license agreement.





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## Laser Transmits Voice In Showing by IBM

New York—First voice transmission over a light beam with a gallium-arsenide injection laser using a new pulse-frequency modulation technique has been demonstrated by International Business Machines Corp.

The frequency at which pulses are emitted from the laser are modulated so that they can represent voice or other information.

Basic to the voice transmission is a special modulation circuit consisting of a delay line with a controllable charge time. When the delay line potential reaches a predetermined value, a four-layer diode at the end of the line breaks down, discharging a 0.2-microsec., 5-amp. pulse through the laser.

Charge time of the delay line, and consequently of the laser pulse frequency, is determined by the amplitude of the information signal. Pulse repetition rates from 300 cycles/sec. to 3 kc. per voice channel were demonstrated. Ten voice channels are possible on existing equipment.

Pulse repetition frequencies up to 100 kc., which would increase the number of available voice channels are, expected in the future. Frequencies of 30 kc. can now be obtained with minor modification of the modulation circuitry, IBM officials said.

Pulse-frequency modulation technique is a low-power, high-efficiency method of communications compared with existing laser systems because the former uses only 10 w. peak input power to 0.1 w. peak output power. Average power is 1/100 of each figure.

The pulse-modulation technique using a laser combines the noise suppression qualities of frequency modulation with confinement of the transmission information to a very small area in space. This area is distinct from the diffuse character of easily detectable radio transmissions.


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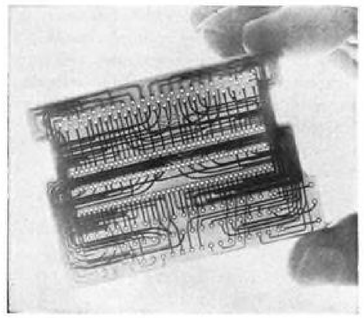
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## NEW AVIONIC PRODUCTS



• **Etched multi-layer circuit boards** are now available with up to 30 layers in a ⅛-in. thick board. Layer-to-layer interconnections are provided by plate-through holes, either conventional or landless, permitting internal crossover conductors to be metallurgically bonded to each other. Dielectric breakdown voltage between layers is more than 1,000 vc. rms., and minimum insulation resistance between layers is quoted at 1,000 megohms. Manufacturer: Globe Electrical Manufacturing Co., 1729-45 W. 134th St., Gardena, Calif.



• **Miniature rotary switch,** Model MRA-1-10, can be adjusted for 2 to 10 positions. Switch measures ¼-in.-dia., comes with phenol knob, and has non-shorting contacts with 36-deg. spacing. Manufacturer: ALCO Electronic Products, Inc., 3 Wolcott Ave., Lawrence, Mass.





# Blackburn Memo Criticizes TFX Decision

*Albert W. Blackburn handled the F-111 (TFX) tactical fighter aircraft program for Dr. Harold Brown, director of defense research and engineering from August, 1961, until he left the Pentagon Mar. 25. He established the guidelines for the aircraft and drafted the memorandum Defense Secretary Robert S. McNamara signed Sept. 1, 1961, to start the F-111 program.*

*The Senate Permanent Investigations Subcommittee, which is probing the award of the contract, has released censored copy of a memorandum for the record that Blackburn wrote Mar. 1 to Dr. Brown, detailing his F-111 role and criticisms of McNamara's decision to award the contract to General Dynamics-Grumman rather than the Boeing Co. (AW May 27, p. 32).*

*Aviation Week & Space Technology previously published McNamara's statement before the subcommittee (AW Mar. 25, p. 81) and the arguments of General Dynamics-Grumman (AW May 20, p. 104), in addition to its regular coverage of the hearings. Continuing this complete coverage, Aviation Week is publishing a major portion of the Blackburn memorandum.*

On Sept. 1, 1961 the Secretary of Defense made the decision to proceed with TFX weapon system as a joint Air Force/Navy development program with the Air Force acting as the executive agent. This decision was made after more than a year of study and analysis of the pros and cons of such a program. Neither service wished for the program to proceed as a joint development because it would deny them the privilege of autonomously developing their own weapon systems. Moreover, there was a feeling that it would be unwise to have the entire high performance spectrum for the next generation of tactical aircraft covered by a single development effort. Finally, there is a strong feeling held by many of the "old pros" in the weapon system development business that competition between the Air Force and Navy tends to generate better, more effective weapons.

### Technical Arguments

Throughout the exercise these points were never formally voiced by the services, but rather they chose to argue against the bi-service development program on the grounds of technical infeasibility. This was at a time when the Air Force was making a decision to buy into the Navy F4H program and indeed to supplant much of the F-105 scheduled production with the Navy-developed F4H. Thus, this outstanding Navy-developed aircraft will be the backbone of both Air Force and Navy tactical air power until introduction of the TFX. The question of technical infeasibility is indeed difficult to substantiate under these circumstances, particularly when one contemplates the very much greater flexibility of operations offered by the incorporation of such TFX innovations as the variable sweep wing and the afterburning turbofan engine.

In his Sept. 1, 1961, memo to the services, the secretary provided certain guidelines under which the development was to be undertaken. The Air Force SOR 183 was to be the basis for the work statement that would go to industry. On top of this SOR there were added restraints to weight, length, mold line for accommodating an adequate radar dish, bomb/missile bay capacity, conventional weapons carriage capability, and Navy mission capability. These restraints were negotiated with and approved by General LeMay and Admiral Russell prior to the final signing of the Sept. 1 memo.

On Oct. 1, 1961, a request for proposal was submitted by the Air Force to industry, which RFP incorporated the above-noted guidelines. This work statement was reviewed by ODDR&E (Office of Defense Director of Research and Engineering), and certain modifications thereto were made early in the period for proposal submissions. These changes related primarily to carrier compatibility features. Prior to the presentation by the Air Force of their evaluation of the proposals, it was recommended to Dr. (Harold) Brown that because of the potential magnitude of the TFX program and because of the inherent lack of competition, it would be a good idea to select the two top proposals and proceed through a further design refinement period wherein both of these contractors would be funded for their efforts. One precedent for this was the WS 110 (B-70) competition wherein Boeing and North American were carried on a funded basis for more than a year, during which very large and significant improvements in the design proposals were effected. This recommendation to proceed with two contractors was in fact implemented, and on Feb. 1, 1962, it was announced that Boeing and General Dynamics would be awarded a $1-million contract each and given 90 days in which to refine their respective designs . . .

### Later Proposals

The second proposals were submitted May 1, 1962, and the evaluation thereof was completed June 1, 1962. Subsequent to evaluation of these two designs, although the Air Force was satisfied, the Navy felt that its requirements could be met by neither proposal. A memo was prepared for (Navy) Secretary (Fred) Korth's signature stating that the Navy could not use the aircraft and recommending that the Air Force be allowed to proceed independently with its development for their unique use. When it was learned that such a memo was in preparation, it was pointed out to Adm. Pirie (Vice Adm. Robert B. Pirie, then deputy chief of naval operations for air) that such a position could only result in delays to

## L-T-V Studies Tactical V/STOL Designs

Dallas—Tactical V/STOL aircraft configurations, utilizing a high-bypass ratio turbofan, are under study here by Ling-Temco-Vought in a program which the company is funding.

The project, termed Adam 2 (air deflection and modulation), is a follow-on to an earlier company-funded study called Adam.

One configuration considered in the company-funded Adam 2 program calls for a two-man, tandem-seat strike aircraft, with the propulsion fans placed side-by-side in propulsion pods on either side of the fuselage. The pods would also be designed to provide aerodynamic lift.

Twin booms on the wingtips each would mount a single outboard-projecting tail surface. Flaps on the trailing edges of the wings would also be used differentially to provide roll control. Flaps normally would be used as the major means of airflow deflection for V/STOL operation.

Powerplant configuration would interconnect, or gas-couple, the power turbines to the basic generators through hot-gas ducting, with one engine driving the two outboard fans and the other the two inboard fans. This arrangement would permit shutting down either engine in flight to provide extended range, or avoid inadvertent roll due to engine failure.

In the latter situation, the remaining powerplants would continue to provide symmetrical thrust through the common ducting system.

the program since the Secretary had already decided to proceed with the joint development. Adm. Pirie then took it upon himself to get together with the Air Force and convince them that greater attention should be paid to the unique problems of Navy fleet air defense.

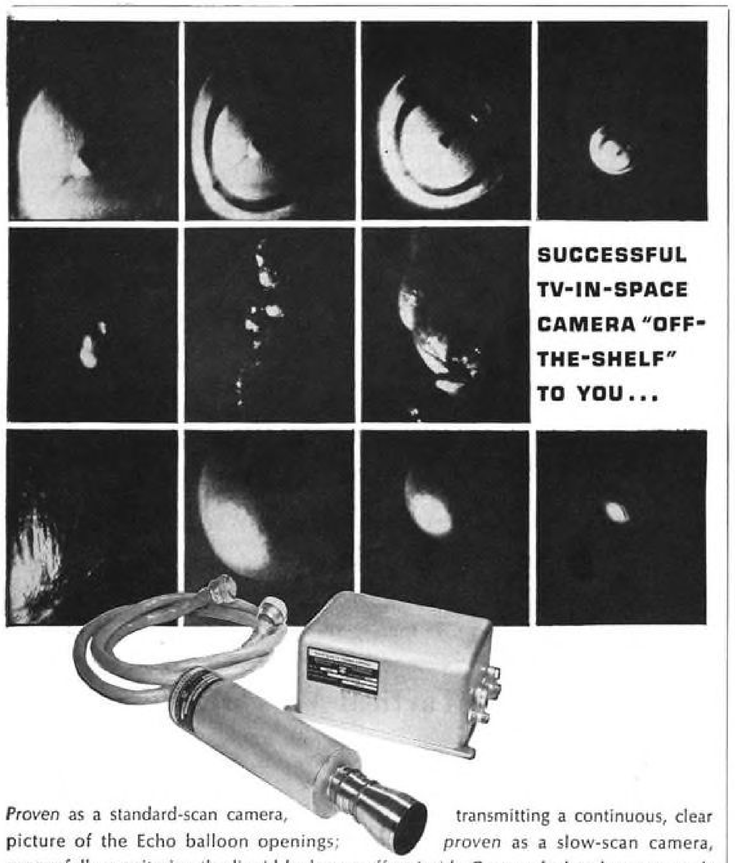
As a result, instead of the memo being signed by Mr. Korth, (Air Force) Secretary Eugene M. Zuckert requested additional time in which to attempt a satisfactory solution to the Navy's problems.

It was decided to give the contractors an additional three weeks to remedy the deficiencies in the Navy version of their design proposals.

At this point discussion of the original work statement and the Navy deficiencies is appropriate. Originally, the Navy argued very strenuously for restrictions on size and weight because of the unique requirements of carrier operations. The original guidelines were based on these very real problems. When the satisfactory goal of (blank) lbs. was established, it was done so with a view to using the GE engine, which at that time was in great favor. When the GE engine was found to have an unrealistically optimistic development program, it was eliminated from consideration and the Pratt & Whitney engine was selected for the TFX. This selection was accomplished after the first design competition. The selection of the P&W engine, which is slightly larger than GE engine and has a greater thrust rating, meant that the TFX would be a larger aircraft and the (blank) lb. weight limitation for the Navy mission could not be met using this engine. Subsequent to the second evaluation, in order to crystallize the Navy's reservation about both design proposals, there were added to the Navy performance requirement an ability to perform a (blank) maneuver at 35,000-ft. altitude, at combat design gross weight and at loiter Mach number without buffet onset. Buffet onset was further defined as a (blank) perturbation. This requirement, which is a very difficult one indeed to meet, had further impact on the weight of the aircraft. In effect, with this additional requirement, the Navy was saying "we are less concerned about weight and size per se than we are with total operational utility." The impact of this added requirement was that the Navy aircraft would require considerably greater wing area than any proposal submitted to date.

The response of the two competing contractors to the Navy deficiencies as identified in their second proposal and clarified by their additional requirements was vastly different. On June 16, 1962, their proposals were submitted to the SPO, WPAFB (Systems Project Office, Wright-Patterson AFB). General Dynamics presented its proposal in the morning, and it was clear that an atmosphere of complete panic and confusion prevailed, with the result that they presented not one but four solutions to the Navy problem out of which they selected two as being the most desirable. In one of these, the Air Force fuselage was used with a brand new Navy wing, and in the other the Air Force wing was used with a brand new Navy fuselage. Upon conclusion of this presentation, the impact on those who had received it was generally that the whole concept of a bi-service TFX development had been completely lost. It was as though the Navy had at last found and succeeded in having accepted an additional requirement that would indeed make a bi-service development technically infeasible.

That afternoon the Boeing Co. presented its answers to the Navy problem and a more workmanlike and professional approach coupled with real imagination applied to the Navy problem could not have been asked for. Not only (was) a common design preserved, but it appeared even to the most critical of Navy technical observers that

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for the first time one of the two competitors had come to terms with its problem and offered realistic solutions. What is even more interesting is the fact that not only was the Navy airplane superior to earlier design proposals given by the Boeing Co., but the Air Force airplane also profited from the proposed improvement. This gain in Air Force performance was reflected in gerater load carrying capability, shorter take-off and longer ferry range. The cost of these improvements was in a somewhat higher gross weight and greater supersonic drag.

At this point in time there was no doubt in anyone's mind as to the relative competence of the two competing companies. However, there was brought to light at this juncture a difference in procurement philosophies of the Air Force and the Navy. Although the Navy was perfectly willing to admit that Boeing represented the most acceptable source for procurement of the TFX as now defined in the work statement, it took the position that the estimated effects of the rather substantial changes to the Boeing wing, particularly with regard to the high lift devices that had been added, had not been adequately validated by analysis and test because of the very short period of time allowed the companies in correcting the Navy deficiencies.

The Navy insisted that before it would commit itself to the development of the Boeing aircraft, the company must be given time to validate its latest design proposal and the Navy must be given time to evaluate the validating data.

The Air Force on the other hand was perfectly happy to commit itself to the Boeing Co. as a source and refine the design as necessary as the development proceeded.

Thus, another impasse was reached wherein a full and free commitment by both services to the favored design could not be established. Failing to get a commitment from the Navy to this WS development, Secretary McNamara made it known that he would not permit the continuation of the program with a single contractor and elected to continue the competitive nature of the exercise for another 90 days, giving each contractor an additional $2.5 million to further refine their design proposals and validate their data. The Air Force and Navy would have 60 days to evaluate the contractor submissions. The Secretary evidently was also concerned about the large variance between contractors' cost estimates and the much higher cost estimated by the Air Force. At the start of this next round, Secretary Zuckert instructed the SPO to treat each of the competitors as though they were a prime contractor and work


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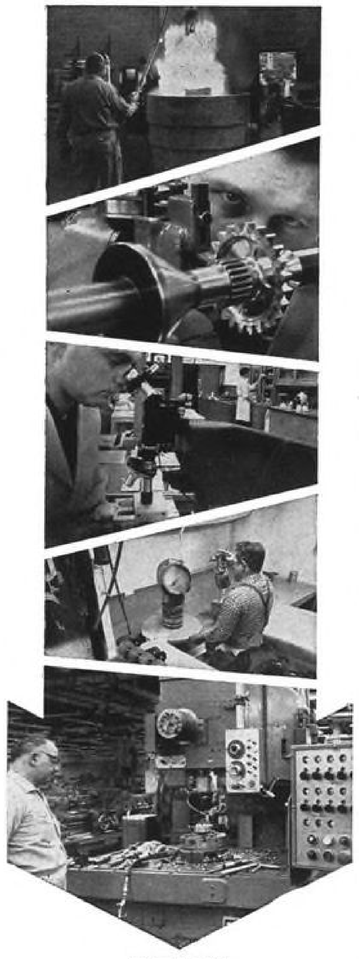
directly with them to assist in correction of their deficiencies.

As might be expected, the failure to reach a decision at this point had a severe impact on the morale of both the evaluation of the Source Selection Board and of the design teams of both contractors. In order to alleviate the morale problem, a letter to the heads of the competing companies was prepared for Mr. Gilpatric's signature which outlined the reasons for the continuation of the competition. In general, this letter stated that adequate technical validation of the Navy fixes had not been submitted, that substantiation of cost estimates was inadequate, and that satisfaction that either submission represented a truly common design was lacking.

Some comments relative to the difference between contractor and Air Force estimates of program costs should be made. The contractors' cost estimates are based on accomplishing the specified work as set forth in their proposals. They include no money for changes to these specifications and schedules, which changes invariably occur in a program of this magnitude. The Air Force estimate of the costs are historical and are based on the actual cost of similar programs, which without exception have experienced very significant changes in the total scope of the programs as they have evolved. These changes are costly, but in many cases they represent a change in scope of the program that in fact will yield a more effective weapon system as an end item.

During the 90 days following the three submissions by the contractors, two very different types of activity were taking place at Fort Worth and Seattle. The General Dynamics engineers were desperately seeking to evolve a satisfactory configuration whereas the Boeing engineers were carrying their design into detailed wind tunnel analysis for both subsonic and supersonic performance and were identifying such detailed design problems as optimum location of all the various stores, the problem of a satisfactory pitot boom location, small improvements in wave drag and the detailed aerodynamic design problems associated with handling qualities, etc.

All the imaginative aerodynamic fixes devised by Boeing in its third submission to satisfy the very difficult Navy maneuver requirements somehow found their way into the final General Dynamics design to a degree of similarity that would hardly be coincidence. With the aid of these devices, the General Dynamics design was finally brought together in a single aircraft for the Navy and Air Force, but with an empty weight approximately 2,000 lb. greater than that of the Boeing design. In their effort to refine their designs and

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to meet the Navy's often-expressed concern for weight, the Boeing engineers departed from commonality to reduce weight. However, those uncommon items could have been restored to the Navy airplane to give it the same speed envelope and same skin gages as applied to the Air Force aircraft at less than the 2,000-lb. difference between their two proposals. In fact, with the additional loiter afforded by the Boeing design, this aircraft, which would be structurally identical to its Air Force counterpart, would still have a 2,000-lb. lighter mission weight if identical missions were to be flown.

The final presentations were given to the evaluation team of the Source Selection Board on Sept. 11, 1962. The General Dynamics presentation was inspired. Histrionically, it could not have been better-paced or more interestingly presented.

The design was essentially a new one, the lines were smooth, and the data appeared to be well validated.

They did not present detailed information as to their external stores location nor such fine points as handling qualities.

The Boeing presentation followed that afternoon and was dull by comparison. The Boeing engineers had gone beyond the broad considerations of base drag, range, and maximum Mach number, and had gotten into the fine details of working on very small drag items and problems of stability and control.

There is an interesting comparison to be made here between the AH-1 aircraft which was the predecessor of the F4H and the F4H as it finally evolved. The AH-1 was a very clean and slick-appearing aircraft, whereas the F4H with all its odd bumps, cranked wing tips, saw-tooth leading edges and dropped stabilizer is a very homely and awkward appearing airplane; however, the things that were done to the AH-1 (which never was built) to arrive at the F4H configuration are the kinds of things that are necessary to evolve a useful weapon system from an aerodynamicist's design. The General Dynamics engineers were still in the early phases of their configuration evolution with lines still straight and eye appealing, whereas the Boeing designers had begun to identify the detailed problems of the final configuration resolution and were clearly much further down the line in coming to terms with the total design problem.

When the announcement was made that General Dynamics would be given the development program, it was clear to all those involved that this decision could be justified only on the basis of a broad, high-level policy of the Administration, and could not in any way be associated with the merits of the two proposals on either an operational, technical, management or cost basis. The operational commanders were the strongest in their support of the Boeing design; however, the depth of technical development of the Boeing design and its imaginative innovations such as thrust-reversers, high lift devices (later adapted by General Dynamics) and top-mounted engine inlets clearly pointed in favor of their proposal. From a cost point of view, it is a well-recognized fact that between two aircraft of generally the same performance requirements, the lighter empty weight aircraft should be the cheaper.

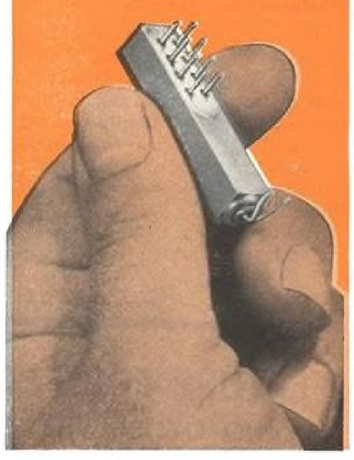
Probably one of the most critical features of the whole TFX exercise is the damage that may have been wrought on our entire design competition structure. It is difficult to imagine that several hundred top technical experts from Wright Field and the Bureau of Weapons would again, with such seriousness of purpose and over such a long period of time, including many seven-day weeks, so enthusiastically seek to accomplish the choice of the superior weapon system proposals in another such competition when the total effort expended by them, is from their point of view, completely negated by an executive decision. . . .

A final word on the protection of a common design. In 1951, the Navy decided it needed a Navy version of the F-86. This was built in prototype at the North American Los Angeles plant (Air Force) and designated the FJ-2. Production was shifted to the North American Navy plant at Columbus. Subsequently, the airplanes were re-engined and in their final configuration the FJ-4 with a Curtiss Wright J-65 engine and the F-86H with a GE J-73 engine didn't even have a common rear view mirror. The point is that if we are really concerned about retaining a maximum degree of commonality, there may be a better case for building them all at the same plant than can be made from a comparison of design proposals.

In summary, the Secretary of Defense laid out a task in the TFX which was not popular in concept with either Air Force or Navy. Nevertheless, the two services turned to with an unprecedented and very real spirit of cooperation, and carried the Secretary's desires through an agonizing year of very productive appraisal and reappraisal. The Secretary chose to make a decision on the basis of information different from that evaluated under the established ground rules. That is certainly his prerogative, but there is no real, supportable case to be made for his choice on the grounds of operational, technical, management or cost considerations. As a matter of loyalty to his own organization, a different rationale for the TFX decision should be found.


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# Higher Incentive Rewards, Penalties Due

By Katherine Johnsen

**Washington**—Defense Dept. intends to increase both rewards for good performance and penalties for poor performance under incentive-type contracts.

This is one result of a comprehensive review of incentive negotiations by the staff of Thomas D. Morris, assistant secretary of defense for installations and logistics.

Morris told the House Military Operations Subcommittee recently that the review "shows that sharing arrangements are still too conservative to achieve the benefits of superior rewards for good performance and severe penalties for poor performance."

### Performance Targets

He said that another weakness disclosed by the review is that "too little use is being made of performance targets in incentive contracts due to the inexperience of our negotiators and to the need for much closer collaboration between technical and procurement personnel in defining performance objectives."

A series of joint seminars for technical and procurement personnel is now being planned "to attack these opportunities" for more effective incentive contracting, Morris said. He told the subcommittee, headed by Rep. Chet Holifield (D.-Calif.), that actual cases of good and poor incentive contracts would be used as the basis for the seminars.

A "dramatic" and "very gratifying" shift from cost-plus-fixed-fee (CPFF) to fixed-price and incentive contracts was reported by Morris. CPFF awards dropped from 38% of the total dollar volume of Defense Dept. awards during the first nine months of Fiscal 1961 to 22.7% during the same period of Fiscal 1963.

The sharpest drop was in the Air Force. CPFF awards declined from 50.6% of the total dollar volume of USAF procurement during the first nine months of Fiscal 1961 to 31.2% of the total during the first nine months of Fiscal 1963.

Morris reported these increases in three other types of contracting during the first nine months of Fiscal 1963, as compared with the same Fiscal 1961 period:

- **Firm-fixed-price,** an increase from 30.4% to 41.3% of the total dollar volume of procurement.
- **Cost-plus-incentive-fee,** an increase from 2.7% to 10.7%.
- **Fixed-price incentive,** an increase from 9.7% to 14.8%.

Defense Dept. anticipates that more widespread application of a "program definition" phase to advanced technology projects—now under way—will also open the doors for more widespread use of fixed-price and incentive type contracts.

### DOD Directive

Dr. Harold Brown, director of defense research and engineering, reported to the Holifield subcommittee that he plans to issue a directive in June detailing policies and rules for program definition (AW May 27, p. 21).

It will be the first formal and comprehensive implementation of the policy of carefully defining major programs before "bending metal." This policy was introduced by Defense Secretary Robert S. McNamara two years ago as the middle step in his three-step plan, whose goal is to preclude vast expenditures on technically unfeasible or duplicated projects.

The first step in the McNamara plan is to acquire the "technical building blocks" to assure the feasibility of a project (AW Apr. 8, p. 33). Then, after the project has been carefully defined, the third step is to eliminate parallel projects.

Program definition has already been applied to three major programs: Titan 3, the mobile medium-range ballistic missile program, and the Lance battlefield support missile program.

From experience with these three programs, Dr. Brown issued a memorandum in January which encouraged the services to apply program definition, as a forerunner to the directive to be issued next month.

### Contract Choice

After a program definition phase results in a reasonably firm program, Dr. Brown pointed out, "the government can then specify which components and subsystems can be obtained by fixed-price contracts and which require incentive fee contracts . . . these components and subsystems can be worked into fairly precise schedules with prearranged milestones for monitoring progress. The other aspects of the job—systems engineering and systems integration, together with a few minor development talks—can be estimated much more precisely than heretofore. With these prearranged and agreed upon schedules, it is possible to remove these large systems from cost-plus-fixed-fee contracting."

Dr. Brown pointed out that Air Force was able to let 90% of the contracts and subcontracts in the Titan 3 program on a fixed-price or incentive fee basis after the program definition phase.

Defense Dept. estimates that cost overruns on CPFF contracts average 10%.

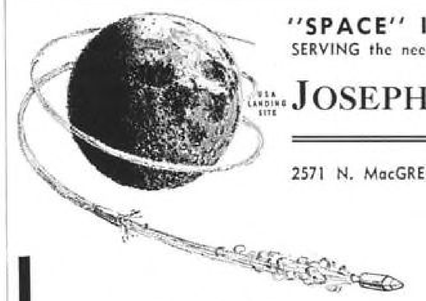
### Estimated Savings

If the Defense Dept. achieves its goal of a $5.2-billion reduction in CPFF contracts in Fiscal 1963, as compared with Fiscal 1961, Morris pointed out, it would avoid about $320 million in overruns.

Dr. Brown anticipated an additional result—a greater effort in the areas of research and exploratory development. He said that funds to finance the huge overruns on CPFF contracts for engineering and operational systems development have generally been diverted from these two areas under a "rob-Peter-to-pay-Paul" situation. This situation, he said, "is in effect eating the seed corn we should plant for tomorrow's crop . . . [It] hinders the development of the technological 'building blocks' needed for future military systems."

## TWA Reports Officer Compensation to CAB

**Trans World Airlines, Inc.**—**Ernest R. Breech,** Chairman of the Board, Director, $900 salary, $974.46 expenses; **Charles C. Tillinghast, Jr.,** President, Director, $74,794.72 salary, $4,848.70 expenses, 1,000 shares of common stock; **E. O. Cocke,** Senior Vice President-Ind. Affairs, Director, $54,849.60 salary, $7,103.35 expenses, 1,100 shares of common stock; **F. D. Hall,** Senior Vice President and System General Manager, Director, $49,402.84 salary, $11,094.53 expenses; **A. V. Leslie,** Senior Vice President-Finance and Treasurer, Director (resigned 5/16/62), $22,572.72 salary, $767.15 expenses, 90 shares of common stock; **George R. Brown,** Director, $300 salary, $77.20 expenses, 100 shares of common stock; **Charles S. Hobbs,** Director (elected 2/2/62), $900 salary, $441.16 expenses; **Raymond M. Holliday,** Director; **Clifford F. Hood,** Director, $1,100 salary, $117.27 expenses; **Barry T. Leithead,** Director, $1,000 salary, $42.54 expenses, 100 shares of common stock; **Sidney Maestre,** Director, $1,200 salary, $737.06 expenses, 332 shares of common stock; **Hughston M. McBain,** Director, $1,200 salary, $686.54 expenses, 100 shares of common stock; **Warren Lee Pierson,** Director, $700 salary, $592.85 expenses; **Ben-Fleming Sessel,** Director, $1,300 salary, $169.51, expenses; **Thomas A. Slack,** Director, $1,300 salary, $1,462.07 expenses, 300 shares of common stock; **J. R. Burch,** Assistant Vice President-Industry Assoc. Affairs, $20,038.31 salary, $7,114.58 expenses; **E. W. Barker,** Assistant Secretary, $14,659.84 salary, $562.90 expenses; **F. G. Betts,** Vice President-Purchasing, (retired 3/1/62), $6,209.32 salary, $10.85 expenses; **A. J. Brough,** Assistant Vice President-Properties and Facilities, $24,433.06 salary, $3,866.12 expenses; **E. P. Burke,** Assistant Vice President and Reg'l General Manager-Transportation, $24,892.98 salary, $2,244.81 expenses, 30 shares of common stock; **F. E. Busch,** Vice President-Equipment, Retirement, $28,423.98 salary, $1,925.20 expenses; **D. J. Crombie,** Vice President-Industrial Relations, $29,917.94 salary, $5,674.67 expenses; **R. Duckworth,** Corporate Secretary, $20,570.61 salary, $5,760.85 expenses; **S. C.**

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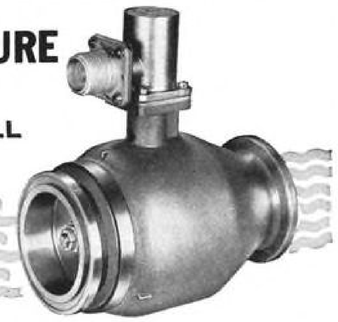
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## PROBLEMATICAL RECREATIONS 173



A man has red, gray and black flagstones for making a walk. He wants no two consecutive stones to be the same color, no consecutive pair of stones to have the same two colors in the same order, no repetition of three consecutive colors, etc. He starts out laying first a red stone, then a gray, and continues until he finishes laying the seventh stone. He then finds himself stymied and unable to use any stone for the eighth without repetition of some color pattern. What were the colors of the first seven stones?

*— Contributed*

We welcome a new member to the Components Group of Litton: Winchester Electronics, Inc. of Norwalk, Connecticut, pioneers in the development of pressurized, self-separating, and hermetically sealed connectors for missile and aerospace applications. Connectors for commercial uses, too. You'll also find Winchester Electronics on both coasts with plants in Santa Monica, California and New Milford and Oakville, Connecticut.

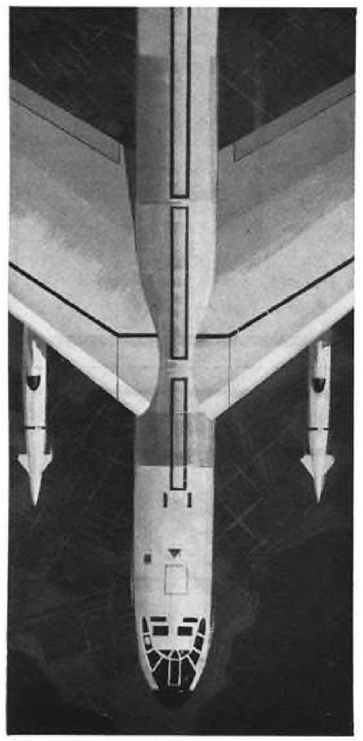
ANSWER TO LAST WEEK'S PROBLEM: Any number of the form abcabc will do, since abcabc/abc equals 1001 which equals 7 • 11 • 13.


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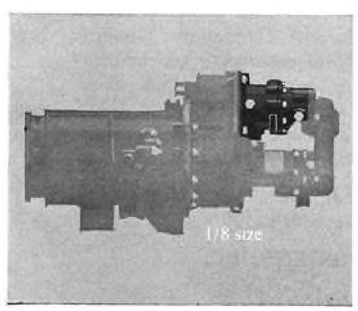
A Kellogg pump, a product of the Aerospace Division of American Brake Shoe, is an important part of the Garrett-AiResearch constant-speed drive—an efficient power source for aircraft cabin air compressors.

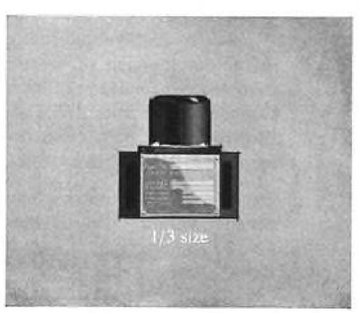


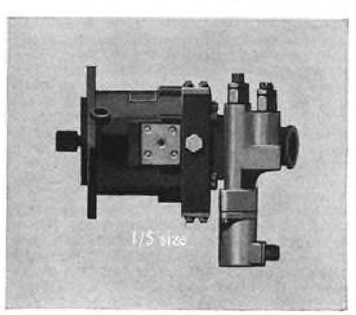
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## Beryllium Use Tested

Washington—Atlantic Research Corp. said it has successfully test-fired a large number of solid-propellant motors using beryllium as an additive to achieve faster oxidation heating, thus producing higher-energy propellants.

Because of its toxicity, the beryllium additive motors are expected to have wider potential applications for upper stages than for boosters. In the static firings conducted at the company's Pine Ridge, Va., and Coralla, N. C., facilities, the exhaust gases were filtered before being released into the atmosphere. Tests at Pine Ridge were made in a chamber at both sea-level and altitude pressures.

The ARC beryllium additive development project is being conducted under an Air Force contract, and is funded under the Advanced Research Project Agency's Principia project. Principia is a generalized study to advance the state of technology in solid, liquid and hybrid high-energy propellants.




## HOW SCIENCE GREW SUCH LONG ARMS

What's it like out there—out in the far reaches of space? ■ Man is only beginning to gratify his insatiable curiosity about the worlds beyond this world. He's looking. He's listening. And he's stretching out long arms with electronic fingers, to touch and measure: radar signals originated on earth beam outwards, then reflect back to us from the moon, the planets and the sun bearing new knowledge of their shape, direction, size and structure. ■ Before World War II—when radar first was conceived as a means of saving the lives of airmen and sailors—the effective range was a few hundred miles at best. Only a few years later, a man-made electromagnetic pulse touched the moon and returned. Man had made his first reach beyond the skies. ■ The power source for this and for all long-range radar is the modern electron power tube. Time after time, the power source bears the name Eimac, trade mark of Eitel-McCullough, Inc. ■ This California corporation has an enviable record of space-age communications achievements. An Eimac tube powered the first radar contact with the moon. Another powered the only radar in the world which could track the first man-launched satellite. An Eitel-McCullough klystron generated the signal for the first radar contact with Venus. Yet another developed the energy for the first radar pulse to touch the corona of the sun. ■ In the whole history of radar, the Eimac name has appeared on more radar tubes than that of any other electronic firm in the world. Eitel-McCullough alone, in 1938, could produce a tube which could power the U.S. Navy's first working seaborne radar. During the war which followed, Eimac radar tubes poured out by the hundreds of thousands. They flew in airborne radars to Guadalcanal, Essen and Normandy. They went ashore with the Army and the Marines, spotting mortars at Kwajalein and Iwo Jima.* For navigation, detection, ranging and fire-control they powered our radars wherever our forces went. ■ Today the Eimac name is on almost every klystron power tube in the defense communications network which connects our northern radar curtain with the U.S., Canada, Europe, the Middle East, the Pacific and Southeast Asia. ■ In its laboratories, Eitel-McCullough now has a million-dollar test instrument which will produce ten amperes of direct current at more than three hundred thousand volts, enough to power radar tubes *ten times as powerful* as today's biggest. As sophistication of the art proceeds, requirement arises for coherence, pulse shaping, controlled phase and frequency agility. These call, in turn, for developments now in progress at Eitel-McCullough: electron power tubes capable of ever higher powers, at ever higher frequencies, over ever wider bandwidths. ■ Upon the foundation of the world's largest and longest experience with radar tubes, Eitel-McCullough is far advanced today toward solution of the radar tube problems of tomorrow.

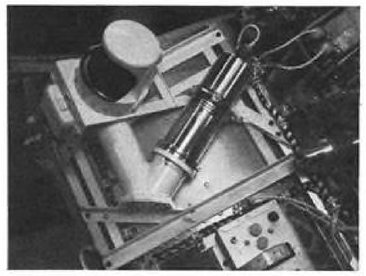
*There's an absorbing now-it-can-be-told story about this radar that "couldn't be made." It's yours for the asking. Write for "How to Build a Secret Tube."

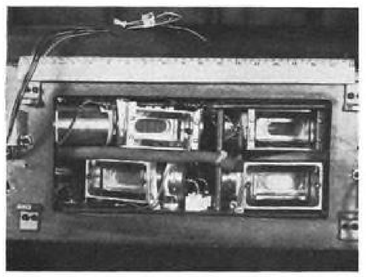
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Currently, measurements of variations on the earth's magnetic field are being made at remote islands in the Pacific Ocean, providing clues to the effect of solar activity on its shape and stability. The influence of solar wind on the geomagnetic field is also being investigated in laboratory experiments, by bombarding magnetic fields with clouds of highly ionized gases.

Scientists at Lockheed are engaged in a continuing program of designing and placing density gages, mass spectrometers, ion traps, and similar instruments on space vehicles to measure the density, composition, and temperature of matter in space. These experiments lead to a better understanding of the chemical reactions occurring in the atmosphere high above the earth.

Important investigations of the low energy x-rays emitted by stars are being carried out and interpreted to give information on the structure of stellar coronas.

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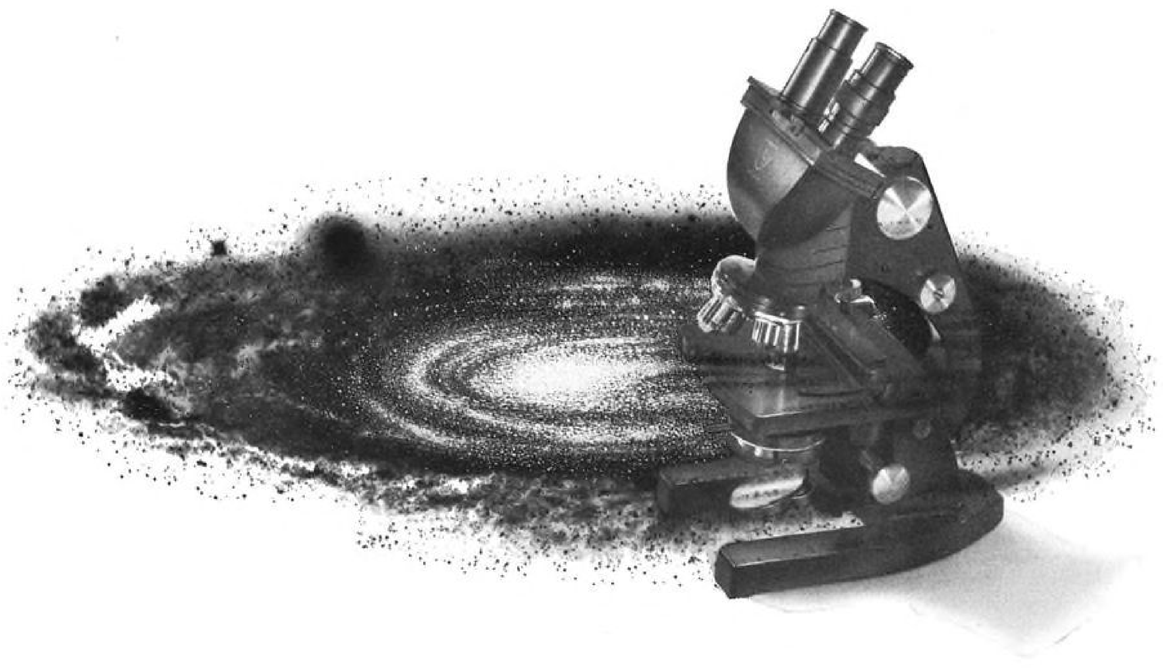
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## *LOOK AT LOCKHEED IN SPACE PHYSICS:*

***Continuing investigation of matter and forces in space***






# Small Firms Face Tight Financing Period

By Ward Wright

New York—Public disenchantment with so-called "glamor" stocks and a more cautious investor attitude point to a period of tighter money for small aerospace and avionics firms seeking financing.

One sign of this is the few new stock issues brought to the market since the May, 1962, market slump. Securities and Exchange Commission reports during the last year showed the smallest listing of public offerings in several years.

With the market virtually closed to embryonic companies—and the aerospace and avionics fields are fertile grounds for these—venture capital supply is largely limited to individuals, the few private firms specializing in risk financing, and to a relatively new source. Small Business Investment Companies (SBICs).

SBICs are licensed by the Small Business Administration (SBA) under the Small Business Investment Act of 1958 to provide promising small businesses with equity capital and long-term loans. As an inducement to investors, the federal government will match SBIC funds in a 2-to-1 ratio to provide total funds as high as $1.2 million. Thereafter federal participation tapers off. Tax advantages are also granted under the program.

### Business Loans

Since its beginning in 1959, the SBIC program has undergone definite changes in its approach to lending to small businesses. New emphasis is on a company's products and management rather than research and development. As one financial observer put it, "In the near future we won't again see an 'idea' company able to walk in and raise four million dollars."

Charles E. Salik, president of Electronics Capital Corp., San Diego, Calif., summed up the change in SBIC attitude when he told a meeting of the New York Society of Security Analysts, "We have learned to look past the nice brochure and other corporate frills to the real potential of a company . . ."

At the outset of the SBIC program, the stock market was experiencing the beginning of a wave of speculative buying and selling of comparatively low priced, untested stocks—many of them aerospace and electronics companies starting business—often companies unlisted on the stock exchange and sold in the over-the-counter market. The speculative fever was based largely on hope of quick capital gains based on experience with a few highly successful aerospace and electronics firms.

To hang a "space age stocks" label on the boom is a misnomer, however. Such words as "space," "electronics," "dynamics," or the like, in the name of a new company often were a guarantee of a sure market rise—whether or not the company really had any capability in the aerospace field.

This speculative wave was to include a surge in popularity of SBICs themselves. Backed with federal money and offering significant tax advantages to high income bracket investors, the number of new SBICs multiplied rapidly during 1959, '60 and '61 and prices of their stock rose.

SBICs were as anxious as anyone else to get the new issues, and they competed with the market for new offerings. "At that time," a president of one large SBIC said, "the question was whether we could get the new issues . . . investors felt they couldn't lose, and the market was soon glutted with 'glamor babies'."

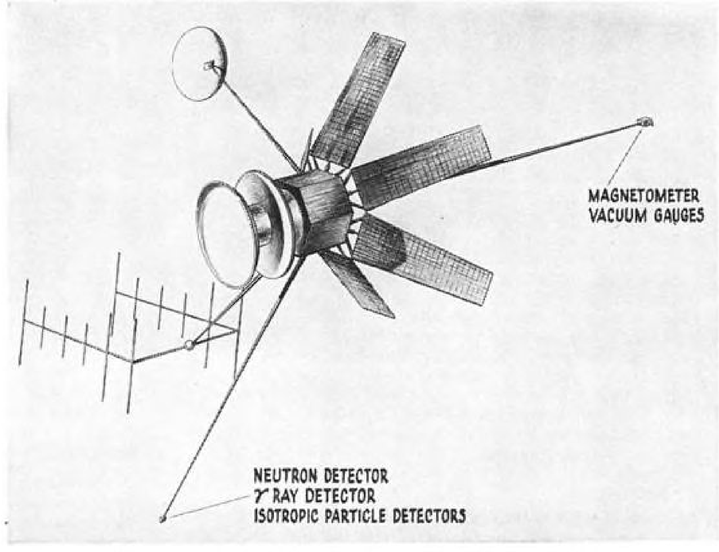
First signs of a break in the glamor stock bubble came about six months before the May, 1962, stock market slump, when some of the weaker firms began to fold and others weren't experiencing expected growth.

A spokesman for a group of SBICs characterized one cause of the decline of the growth companies as: "The bright chaps broke away from the parent companies and formed their own [companies]. They had good ideas, but were R&D oriented, used to working on budgets . . . they just never had to 'poor boy' it. It's not enough to have a good product . . . you have to be a good businessman." Salik, on the same subject said, "they had a better mousetrap . . . but no mouse."

### Investor Enthusiasm

After watching their own stocks jump to a premium in the spring of 1961, and push past their original offering prices, SBICs were caught by a mass transference of investor enthusiasm. Result was a decline in the price of public SBIC stock which took a further dip during the May, 1962, market slump.

Another factor in the decline, accord-




**Possible Solar Probe Configuration**

Possible solar probe configuration is shown in Martin Co. drawing. Martin, General Electric and Philco are studying requirements of such a probe for National Aeronautics and Space Administration (AW May 6, p. 22). Disc at top would shade the spacecraft from the sun, and the fence-like arrangement at left is the antenna system. Probe would be designed to approach within 28 million miles of the solar surface.

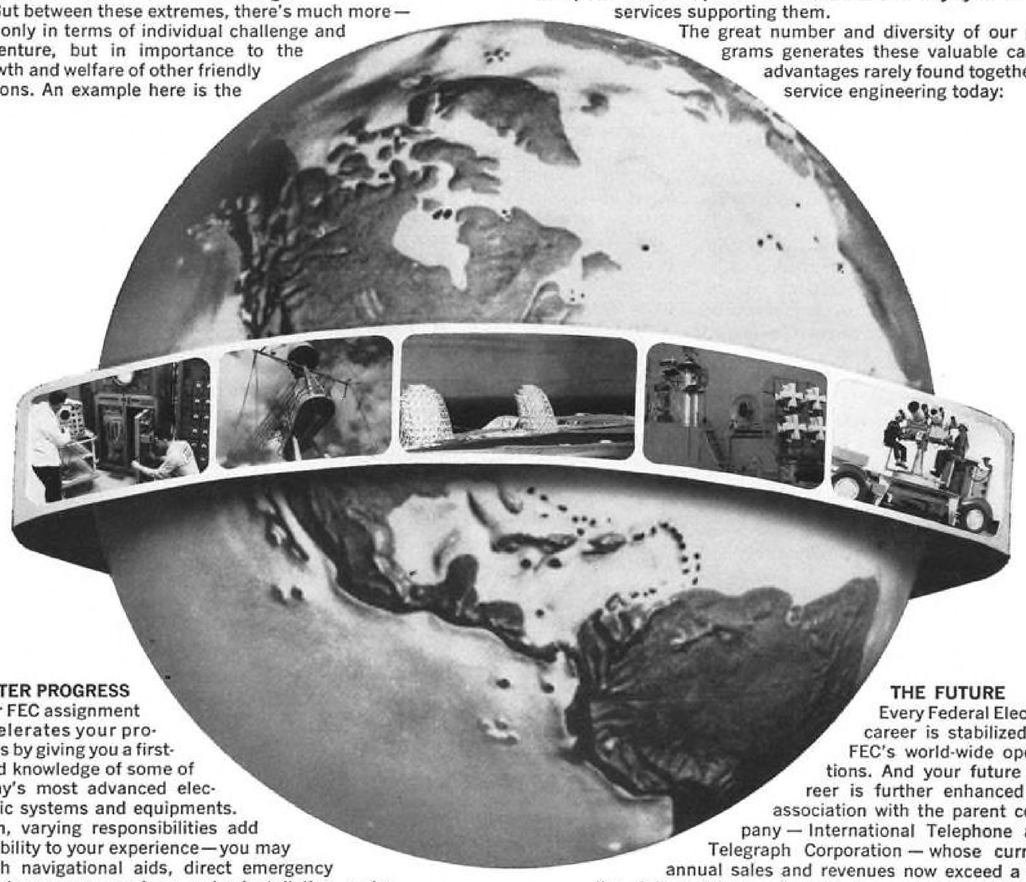
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ing to James L. Parris, deputy director of the SBA, was that SBIC stock had got into the hands of investors who didn't fully understand it. They were unmindful, Parris said, that profits depend on long-term growth of companies that SBICs have financed. Parris also said many investors believed the SBIC market was hurt by a surplus of offerings.

Effect of the May, 1962, market slump was mainly one of timing. Most SBIC operators questioned by AVIATION WEEK & SPACE TECHNOLOGY agreed that public disenchantment with glamor stocks was well under way and a decline would have come in time even without the market break.

When the slump came, many new small companies were completing the recognized 2 to 3 year period needed to iron out start-up problems and begin effective competition. These companies and the publicly held SBICs were looking to the market for a new round of financing when the bottom dropped out.

According to SBA figures, the average market price of the 47 operating publicly held SBICs dropped 55% between March and June, 1962. For the same period, market prices of stocks of companies in which SBICs held investments declined 55%. By the end of October, 1962, SBIC shares were selling at 60% of book value. Eleven of these were priced below 50% of book value. Shares of firms outside the SBIC program specializing in risk capital have also been selling at discounts.

### No Recovery Yet

Since the slump, SBIC stock has stabilized but not recovered. Privately owned SBICs are generally conceded to have weathered the decline of the glamor stock market better than the public SBICs. Principal effect was to bring the formation of new SBICs—and a new source of money for small firms—to a virtual standstill. Prior to the May slump, SBICs were being formed at a peak rate of about 70 per month. Since the slump, the rate is about five per month.

A typical SBIC makes more loans in the early days of its corporate existence, when it has a large amount of money for investment. Many firms that got these early loans now need more money for expansion. With the unfavorable market, SBICs are taking care of their old customers first and closely examining new firms approaching them for money.

Salik told the New York security analysts that Electronics Capital Corp. looked at 650 firms before investing in five, and some of these had been reviewed two or three times. Another SBIC operator said his company invested in about 1% of firms approaching it "off the street" and in about 20% of the firms referred to it by an investment banker.

Despite the new SBIC conservatism, there is still plenty of money in the SBIC program for firms which can demonstrate they have the management, technical talent, and the product line for effective competition.

According to SBA figures, 607 active SBICs reported they had invested a total of $359.9 million in small business as of Dec. 31, 1962. Total capitalization of the SBIC program is over $550 million, augmented by nearly $50 million in federal loans to SBICs. At present, there is $200-$250 million in SBIC money available to qualifying companies.

### SBIC Loans

SBA figures showed a total of 539 SBIC loans and equity financing outstanding balances totaling $59.7 million covering the aerospace and electronics industry on Dec. 31, 1962. Of these, 250 loans and equity balances worth $23.2 million were in the "electrical machinery, equipment and supplies" category. In the "professional, scientific, etc., equipment" category the 289 SBIC loans and equity balances outstanding totaled nearly $36.5 million.

Parris commented that the market slump has had both a good and bad effect on the SBIC program. The bad effect, Parris says, is the inability to sell shares on the public market, a source many SBICs had looked to for additional funds. The good effect, he says, is that with the market closed, many small companies are getting financing from SBICs otherwise obtainable.

Now, SBICs appear to be in for a period of doldrums until the public attitude toward speculative investment changes. During this period the SBIC's record of investigation of new businesses prior to investment may well prove the turning point upon which a return of public confidence hinges. Best guesses of when SBIC risk capital will loosen center around five years from now.

### Over-the-Counter Market

Tone of the over-the-counter market this spring has shown a modest improvement from the depths of the market break, but a tough SEC stand on the accuracy of registration statements—its prime means of control of stock issues—and its investigation of the securities business is still providing a damper on the market.

SEC has submitted to Congress the first segment of the Report of the Special Study of Securities Markets, compiled under the chairmanship of William L. Cary. In the transmittal letter covering the report, Carey noted that although ". . . important problems do


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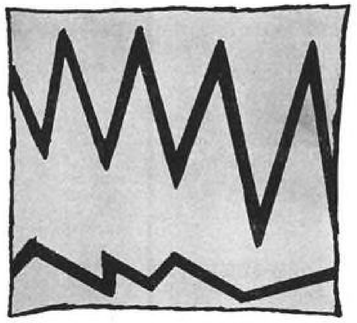
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exist, grave abuses do occur, and additional controls and improvements are needed, the picture is not one of pervasive fraudulent activity."

A section of the report dealing with the "new issue phenomenon" between 1959 and 1961 was based on an intensive examination of 22 new issues that went to a premium immediately after their offering.

By November, 1962, the report said, seven of these issues were still traded above the initial offering price, one was at the offering price, 13 were below the offering price, and one had merged with another company.

### 1961 New Issues

Analysis of a larger group of 792 unseasoned new issues offered in 1961 showed 85% traded at a premium immediately after offering. By September, 1962, only 22% of these were still being traded above the offering price. Of the issues which more than doubled in price, two-thirds were selling below their offering price in September, 1962. The report added that no price quotations were available at all in September, 1962, for 12% of the unseasoned registered stock and 48% of the "regulation A" unregistered common stock issued in 1961.

Some of the glamor stock offered publicly had only "the slimmest chance of survival," the report said, and their stock "could be sold by their underwriters only through questionable or clearly illegal techniques." The report noted that while many of the older underwriting firms exercised careful judgment on which firms were suitable for public ownership, many firms lowered their standards of quality and size, under pressure from customers and salesmen hungry for new issues. Many smaller underwriting firms were hastily organized by persons new to the securities market, the report said, for the express purpose of taking part in the new issues boom.

### Underwriters Influenced

Underwriters setting prices of new issues could not help but be influenced by the atmosphere of "excitement and expectation of profit" accompanying the new issues boom, the report said. While a high offering price might not be justified by traditional standards of value, a low price "merely assured a premium that whetted the public's appetite for the next new issue." For the careful underwriter, these conflicting phenomena posed a difficult dilemma. For others, "it was an opportunity to set low offering prices in the expectation of withholding substantial portions of the issue in the accounts of insiders to be sold out to the public at premium prices," the report added.

"Hotness" of new issues was stimulated by over-the-counter trading which began simultaneously with the effectiveness of the registration statement. "Stocks frequently were being quoted at premium prices in the after-market before all customers knew of their allotments."

Result was that before the closing, the managing underwriter would remit the proceeds of the offering to the issuer before the customers received their certificates.

The effect of this practice was to create a distorted picture of supply and demand, the report said.

### Other Practices

Other practices, some legitimate, some questionable and some manipulative, were used to limit the available supply of stock and raise after-market premiums, the report said. Some issues, already small, were further reduced by placing allotments in discretionary accounts, failing to notify customers of allotted stock, and failing to deliver stock to customers.

In other instances, the report said, participants placed shares in the accounts of firm partners and employes, relatives and persons affiliated with other firms with whom reciprocal agreements had been made. The withheld shares were later released for public sale at premium prices. Demand was further increased by active solicitation and publicity techniques calculated to cause the price to rise dramatically, the report found. With artificial limits on the stock supply, the after-market price was vulnerable even to slight changes in public demand, the report said.

Turning to the obligations of companies that issue publicly held securities, the report recommended legislation extending SEC controls on financial reporting, proxy regulation and insider trading to stocks sold over-the-counter.

It seems wholly indefensible, the report said, that investors in over-the-counter securities should be afforded less protection than those investing in listed securities.

### Random Sample

Of a random sample of 1,618 companies traded over-the-counter, 25% sent no financial information to their shareholders and much of the information supplied by the rest was deficient, the report said. Proxy solicitation was also found to be deficient. Among companies surveyed, 24% solicited no proxies at all during 1961 and a large majority of proxies did not list names of nominees for directors, only the request to vote for the present management.

Curbs on "insider trading" were recommended since many firms traded over-the-counter are "insider controlled" permitting use of confidential


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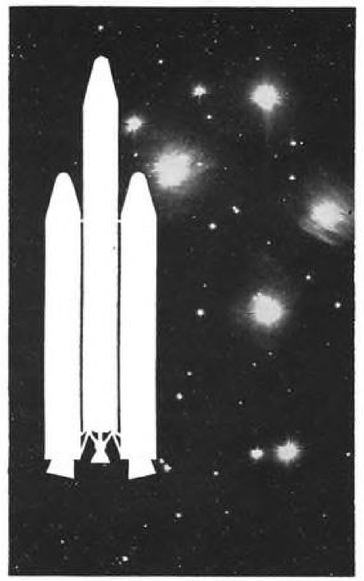
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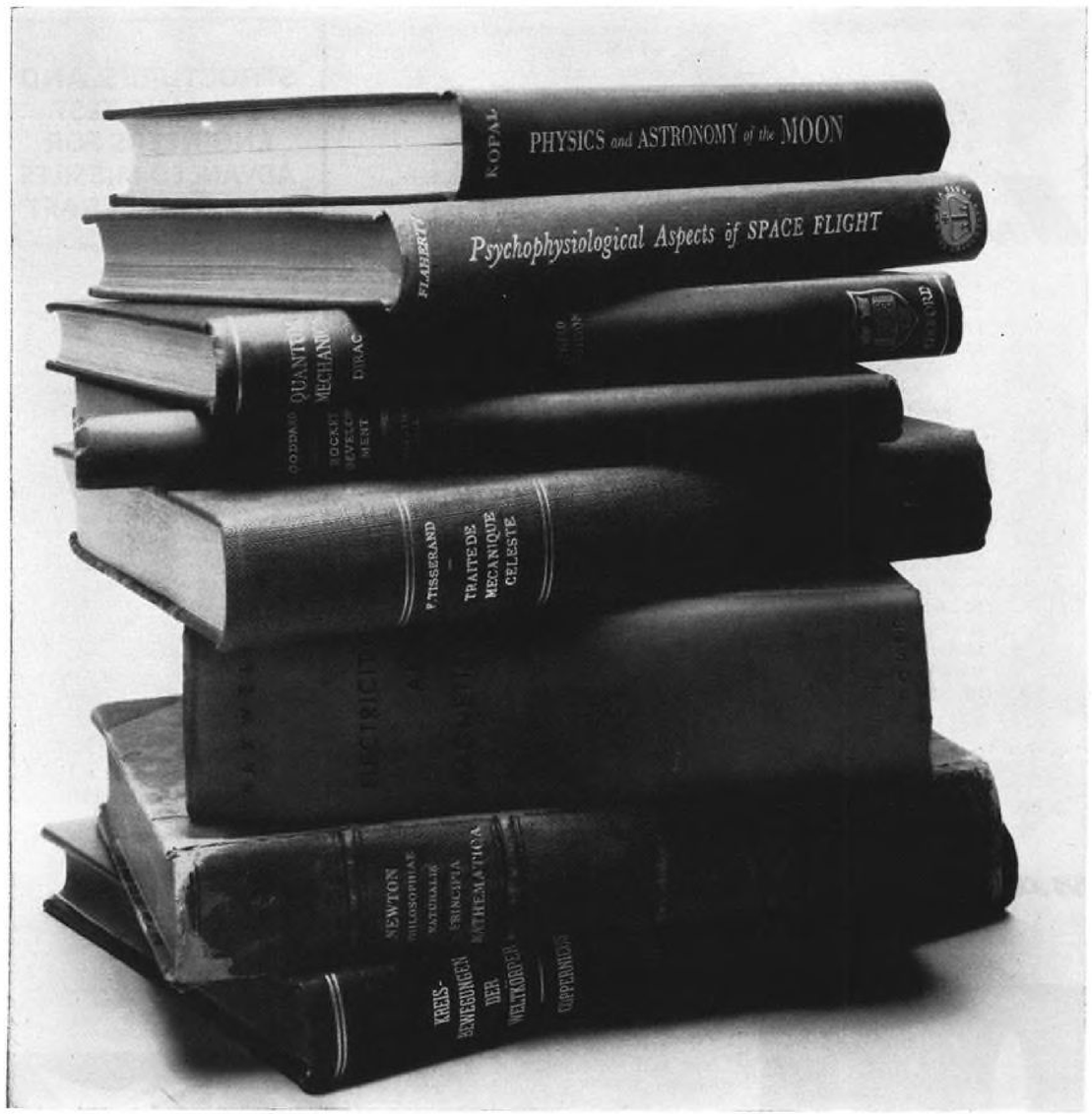
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corporate information for personal gain from trading stock in their own companies.

Lack of reliable financial information on the over-the-counter securities market makes investment advice difficult and costly, leading many investors to avoid these securities and putting the market itself at a disadvantage. Adequate disclosure, the report adds, "would tend to insure that sound companies will be the ones that will receive adequate investor's funds."

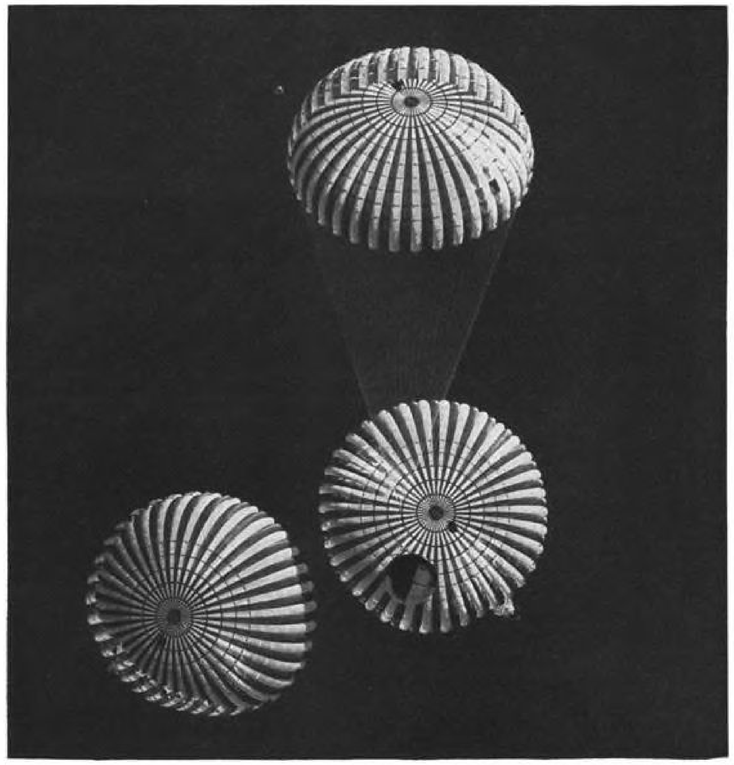
The report recommends a "phased program" for extending listed-type stock regulations to securities traded over-the-counter. To reduce the administrative burden, firms having more than 750 shareholders would be covered the first two years, those with more than 500 shareholders the following two years, and those with more than 300 shareholders thereafter.

Study of the impact of corporate publicity and public relations on the securities market indicates corrections are needed, the report said. Legislation and rule revisions should be considered to elevate the standards of management, public relations firms, financial news media, and members of the security industry regarding corporate publicity, the report added.

A survey of corporate publicity "ran the gamut from straightforward reporting of corporate affairs to . . . deliberate attempts to falsify a company's financial position and prospects," according to the report.

Much of the objectionable publicity consisted of "optimistic sales and earnings projections which seem to be based on wishful thinking, glowing descriptions of new products still in the experimental stage, and announcements of mergers and acquisitions which are only vague possibilities," the report said.

Most effective counter to irresponsible publicity, the study notes, is regular reporting and widespread circulation of reliable corporate information. The study recommended consideration of laws providing criminal sanctions and civil liability to firms deliberately spreading misleading statements and unwarranted forecasts.



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Boilerplate Apollo lunar spacecraft is lowered by three 88-ft. ringsail parachutes during ground-impact tests at El Centro, Calif. Capsule was dropped from a specially modified Douglas C-133 from 13,000 ft. System, developed by Northrop Corp.'s Ventura Div., uses 13-ft. drogue chute which would be deployed at approximately 25,000 ft. during re-entry, followed by three 10-ft. pilot chutes, which in turn are followed by the three large parachutes. These lower the Apollo at 25 fps.


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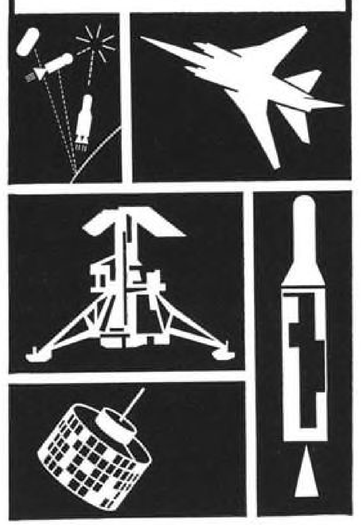
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**JULY 22, 1963**

# MANNED SPACE FLIGHT ISSUE

AVIATION WEEK & SPACE TECHNOLOGY has established an unmatched reputation for detailed coverage of technical and industry developments on the plans, operations, facilities, budgets, organization and procurement policies of the national space program. Now, a task force of editors will concentrate on both civilian and military manned space projects in an issue devoted entirely to the subject.

Theme of the issue will stress future programs from Project Apollo to manned permanent moon bases, manned orbiting space stations and interplanetary Mars and Venus flights. Editorial highlights will include:



• Major progress report on Project Apollo, its hardware and technical developments.

• Status Report on Project Gemini two-man spacecraft including joint NASA-USAF operations.

• What we learned from Project Mercury and how it built a technical foundation for future manned space flight programs.

• Technical needs of military in manned space flight, including Dyna-Soar, Aerospace Plane, maneuverable re-entry vehicles, inspector and surveillance satellites.

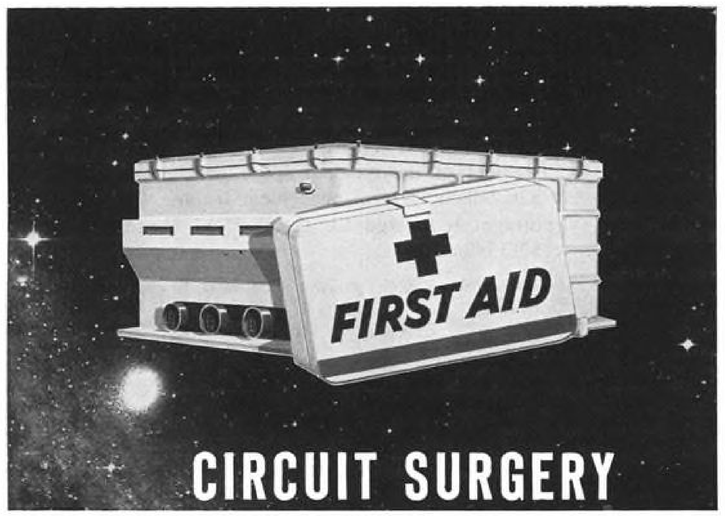
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# WHO'S WHERE

(*Continued from page 19*)

## Changes

**Dr. Leonard C. Maier, Jr.**, general manager, General Electric Co.'s Semiconductor Products Dept., Syracuse, N. Y., succeeding **H. Brainard Fancher** (AW May 13, p. 126).

**Donald W. Sharp**, operations manager, Arinc Research Corp., Washington, D. C., a subsidiary of Aeronautical Radio, Inc.

**Bert A. Foulds**, Douglas Missile & Space Systems Div. representative in Houston, Tex., and **R. L. Browning**, MSSD representative in Huntsville, Ala.

**Walter J. Downhower**, chief, Systems Design Section, California Institute of Technology Jet Propulsion Laboratory, Pasadena, Calif., and **Karl W. Linnes**, chief, Space Instrument Systems Section.

**Richard H. Holmberg**, manager-TRACE engineering, Lockheed Missiles and Space Co., Sunnyvale, Calif. **Stephen R. Warshany** succeeds Mr. Holmberg as manager-missile systems electronics, Lockheed Electronics Co., Plainfield, N. J.

**T. Guy Miller**, manager-commercial aircraft, Beech Aircraft Corp., with offices in Washington, D. C.

**Glenn T. Stebbins**, Western Region Manager, United Aircraft Corporate Systems Center, El Segundo, Calif.

**Howard A. Bond**, director of engineering-military electronics, Philco Corp.'s Communications and Electronics Div., Blue Bell, Pa.

**Dr. Jameson Dane Rigden**, group leader-gas laser research and development, Optical Maser Dept., Perkin-Elmer Corp., Norwalk, Conn.

**Joseph S. Bartos**, director, Avco Defense and Industrial Products Group Missile Management Center, Stratford, Conn.

**Col. Charles W. Gordon** (USAF, ret.), regional manager for USAF and FAA liaison, Government Products Div., Adler Electronics, Inc., with offices in Washington, D. C.

**Robert E. Miller**, an executive adviser, Northrop Nortronics' Systems Support Dept., Anaheim, Calif.

**Ronald L. Seipel**, central region military coordinator, Weston Instruments and Electronics Div., Daystrom, Inc., with offices in Dayton, Ohio.

**Dr. A. Richard Marks**, director, Planning, Research and Analysis Staff, Space Technology Laboratories, Inc., Redondo Beach, Calif., a subsidiary of Thompson Ramo Wooldridge, Inc.

**James L. Pyle**, director of marketing, California Computer Products, Inc., Anaheim, Calif.

**Ralph E. Schwartz**, manager-operations analysis group, LFE Electronics, a division of Laboratory For Electronics, Inc., Boston, Mass.

**James A. Hill**, chief of applied dynamics, Astromechanics Research Div. of Giannini Controls Corp., Berwyn, Pa.

**Dr. Nazzareno P. Cedrone**, chief engineer-defense products, Singer Metrics Div., The Singer Manufacturing Co., Bridgeport, Conn.

**Dr. Horace R. Moore**, associate manager, Fluid Physics Div., Electro-Optical Systems, Inc., Pasadena, Calif.




**Method for measuring an engineer...**

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When an engineer pays for a technical publication, it's a safe bet that that is the one he respects most.

He makes it his business to read Aviation Week and Space Technology. It keeps him abreast of up-to-the-minute events and developments in the aerospace industry and the technology to which he contributes his experience.

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CLASSIFIED ADVERTISING DIVISION
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# EMPLOYMENT OPPORTUNITIES

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The Advertisements in this section include all employment opportunities—executive, management, technical, selling, office, skilled, manual, etc. Look in the forward section of the magazine for additional Employment Opportunities advertising.

| | | |
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**Technical Public Relations Manager/Writer.** 15 years experience aerospace technologies/journalism, with top U.S. space firms. Specializing: publicity, advertising, sales promotion/corporate literature, military proposals, presentations, exhibits, films. Presently employed. Seeks position of more responsibility. Age 38. LA resident. Excellent education and references. PW-2344, Aviation Week/S.T.

**Mechanical Engineer, 12 years electronic** and areo-space industry experience. Design, field, reliability, management. $18,000 plus. Reply PW-2348, Aviation Week/S.T.

**Chief Pilot for large corporation seeks position** in airport management. Reply PW-2334, Aviation Week/S.T.

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Under Chrysler Corporation's belt is a solid decade of experience and success in research, design, development, fabrication, assembly, test and launch support of large liquid-propelled missile systems and space boosters.

Now CHRYSLER Corporation SPACE Division faces its most demanding assignment: prime contractor on the long-range SATURN I Space Program, including newly-added tasks in ADVANCE ENGINEERING and PRODUCT IMPROVEMENT.

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If you have a degree and experience in one or more of the disciplines listed on the page opposite, investigate the potential of a career with Chrysler.

Send your resume, in complete confidence, to Section A-2, Personnel Department, at the location of your choice:

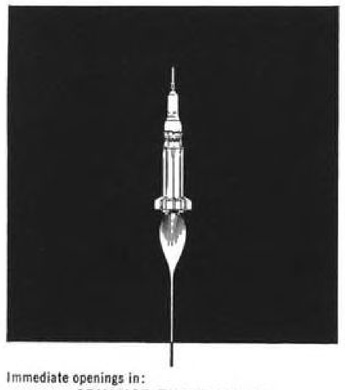
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### ELECTRICAL and ELECTRONICS

Create, design and modify complex electrical and electronic assemblies and systems; perform load studies, circuit and system analyses; and logic diagrams of switching networks. **Instrumentation, RF and Telemetry . . .** Missile flight measurements (complete and coordinate instrumentation program, define and document flight measuring instruments), design and develop telemetering and RF equipment, test controls for checkout of flight hardware and digital circuits for guidance and control, operate blockhouse telemetry panels during final countdown, evaluate test results and originate necessary changes.

### LAUNCH FACILITIES

Environmental control systems (launch facilities design including air-conditioning systems, cryogenic piping and propellant storage.) Theoretical Launch Facilities Design (feasibility and design studies of future space flight systems, earth orbital and lunar base operations.)

### MANUFACTURING

Analyze documentation, determine breakdown of assemblies, define operations, sequence and tool requirements; liaison to control product, process, tool design and inventory. **Special Equipment Design . . .** Development, design, analysis, construction and installation of special equipment; pneumatic and hydraulic, or electronic test equipment; special handling techniques in large components.

### PROGRAMMERS

Analog Computation (structural dynamics, aero and astro dynamics, control and guidance systems and closed loop hardware simulation.) Digital Computation (information retrieval, data reduction, scientific computation in trajectory analysis, aerodynamic heating, structural and vibration analysis aerodynamics.) Digital Programming to generate large-scale data processing control system.

### QUALITY CONTROL

Supervise and maintain reference of standards in mechanical systems, electrical systems, quality assurance and systems automation; evaluate instructions and test procedures and develop techniques for adapting digital computers for automatic checkout systems.

### RELIABILITY

Develop analysis methods and techniques; analysis in electrical, mechanical, electro-mechanical, structural, propulsion, systems and other areas; evaluate program; recommend engineering changes.

### STRUCTURAL, PROPULSION and RELATED ENGINEERING

Stress, structural dynamics, propulsion, cryogenics, aerodynamic loads, hydraulics, weights, materials, documentation, drafting, electro-mechanical component installation design, and development of computer solutions for all phases of structural and mechanical analyses.

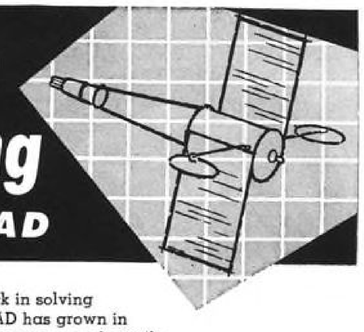
### SYSTEMS INTEGRATION

Mission planning, functional integration, design criteria and mission evaluation of space vehicle systems and subsystems and digital automatic checkout equipment.

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★ Since its first successful work in solving re-entry problems, Avco/RAD has grown in proportion to the nation's aerospace and missile requirements. Avco's leadership offers Engineers a genuine opportunity to participate in a number of here-and-now projects which demand creativity and stimulate your professional growth.

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- *Design & Development*
  - Space Telemetry & Communications
  - Solid State Circuits
  - Airborne Instrumentation
  - VHF & Microwave Telemetry Antennas
  - Advanced Arming & Fuzing Systems
  - Radar Fuzing Systems
  - Electrical Ground Support Equipment
  - Nuclear Hardened Electronics
  - Space Power Sources
- *Analytical Studies*
  - Electromagnetic Scattering Theory
  - Plasma Analysis
  - Advanced Multiflexing Techniques
  - Information Theory
  - Nuclear Radiation Effects

### STRUCTURES

- *Structural Design Methods*
- *Structural Loads*
- *Structural Analysis*
- *Dynamic Analysis*
- *Structural Testing*
- *Solid Mechanics*

### SPACE FLIGHT-TEST TECHNOLOGY

- *Thermodynamics*
- *Aerodynamics*
- *Systems Evaluation*
- *Trajectory Analysis*
- *Test-Range Technology*

### SYSTEMS ANALYSIS

- *Systems Optimization*
- *Trade-Off Definition*
- *Operations Research*
- *Game Theory*
- *Management Systems*

### RELIABILITY ANALYSIS & ENGINEERING

- *Prediction Analysis*
- *Statistical Test Design & Analysis*
- *System Evaluations*
- *Design Reviews*
- *Engineering Test Planning & Evaluation*
- *Failure Analysis*

★ The Division's facilities are located in Wilmington, Lowell and Lawrence, just north of metropolitan Boston. At Avco/RAD you are close to leading universities, cultural events and excellent recreational facilities.

***Send resume to Mr. J. Bergin, Dept OTA***

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GENERAL ELECTRIC ENGINEERING OPPORTUNITIES



# ACT NOW FOR ASSIGNMENTS ON PROJECT APOLLO

*"The requirement for the Integration and Checkout program arises from the unique characteristics . . . of Apollo . . . which distinguishes it from other projects. These include (1) the serious consequences of failure as measured in terms of national prestige, human life and cost; (2) the complexity . . . in terms of the technology required and the numbers and types of industrial contractors involved; and (3) the long period of operations in the space environment with no significant maintenance or repair possible."*

National Aeronautics and Space Administration
at the Aeronautics and Space Committee Hearings,
U.S. House of Representatives, 1963.

General Electric's Apollo Support Department has been selected to assist NASA in the integration support, checkout and reliability assessment of the Apollo system. Without doubt, it takes an unusually mature and competent man to perform under the realization that his individual work can be of significant importance to such a program.

If you are the kind of person who thrives on such responsible work, there's a place for you with General Electric. We've already put together the most impressive team ever assembled in the General Electric Company for this program . . . however, there are *many* opportunities still available to the *right* men. From the listings below you can determine your own opportunities. **Contract Programs:**

**CHECKOUT** . . . work consists of two distinct parts. First, a continuation of current engineering study efforts to provide NASA with checkout systems analysis, standardization studies, an integrated space vehicle checkout system specification, studies of test procedures, the application of advanced checkout techniques to Apollo, and system checkout engineering support at NASA field centers. Second, provision of checkout equipment to be included within the integrated launch control and checkout system.

**RELIABILITY ASSESSMENT**. . . effort includes assisting NASA in assessing overall mission reliability and safety levels, implementing a reliability and failure data system, and reviewing reliability and quality procedures and controls.

**INTEGRATION SUPPORT**. . . assist in identification and documentation of equipment and procedure interfaces within the Apollo project. Studies of integration methods and their application to Apollo including configuration control, and data handling.

**Engineering experience required in: SYSTEMS and SUB-SYSTEMS CHECKOUT and TEST PLANS, DESIGNS and OPERATIONS**

| | | | |
|---|---|---|---|
| ☐ Complex Systems Design | ☐ Logic Design | ☐ Engineering Writers | ☐ Circuitry & Circuit Design |
| ☐ Guidance Control Systems | ☐ Human Factors | ☐ Computer Engineering | ☐ Data Analysis |
| ☐ Telemetry Systems | ☐ Systems Engineering | ☐ Computer Programming | ☐ Launch Facilities Systems |
| ☐ Electronics Packaging Design | ☐ Cryogenics | ☐ Data Processing Display | ☐ Instrumentation & Simulation Systems |

**IF YOU ARE THE CALIBRE OF ENGINEER WHO CAN SHOULDER THE RESPONSIBILITIES THESE JOBS ENTAIL, WE HAVE IMMEDIATE OPENINGS IN HUNTSVILLE, ALABAMA; CAPE CANAVERAL, FLORIDA; DAYTONA BEACH, FLORIDA; AND HOUSTON, TEXAS.**

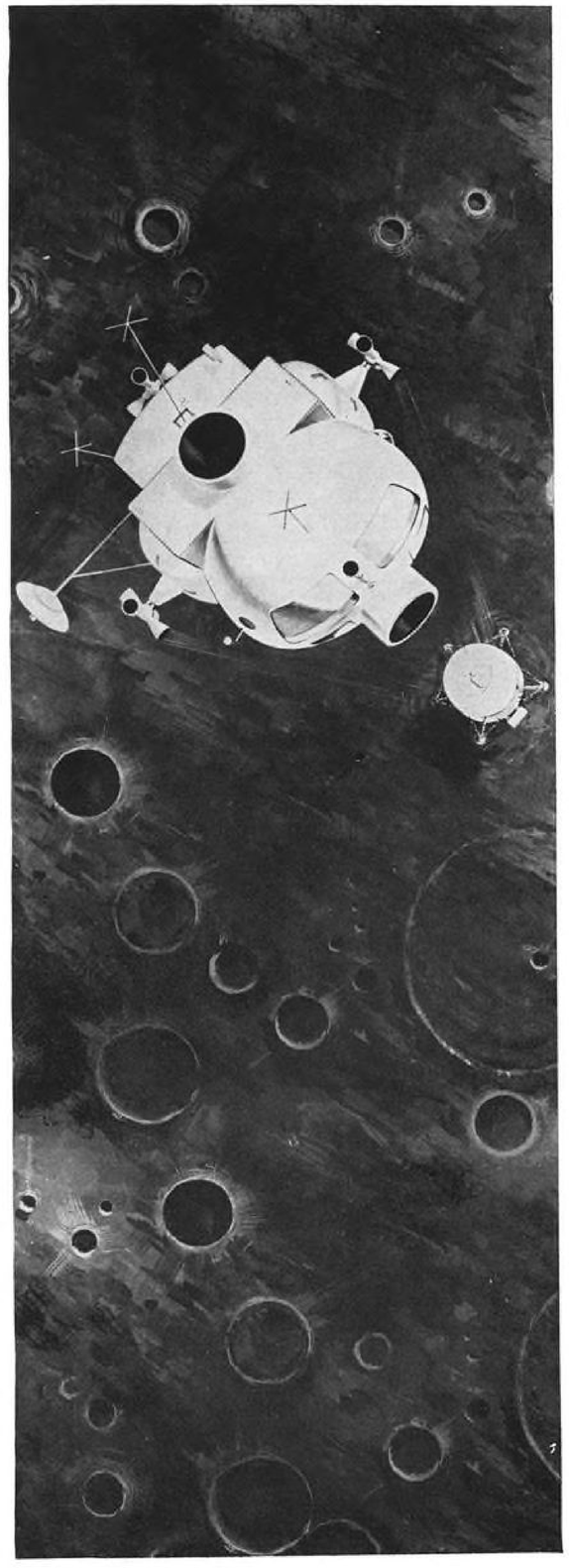
Write today to: Mr. P. W. Christos, Apollo Support Department, General Electric Co., Support Building, Room 64-G, P.O. Box 2500, Daytona Beach, Florida. (Your inquiry will be held in strict confidence. Please include your salary requirements.)

**APOLLO SUPPORT DEPARTMENT**
A Department of the Command Systems Division

**GENERAL ELECTRIC**

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# LUNAR LANDING AND RENDEZVOUS PROGRAM OFFERS ENGINEERS & SCIENTISTS THE GREATEST TECHNICAL CHALLENGE OF OUR TIMES

The selection of Grumman to design, develop and fabricate the NASA Lunar Excursion Module (LEM) which will be used to achieve the Apollo program's goal of landing astronauts on the moon, opens a new chapter in the conquest of space. Boosted by a three-stage Saturn C-5 vehicle, the Apollo spacecraft will enter lunar orbit and LEM will separate from the spacecraft to begin its epoch-making descent to the lunar surface.

Later, it will launch itself back into orbit and rendezvous with the Apollo Command and Service Modules permitting the lunar astronauts to return to earth, while the LEM is jettisoned into lunar orbit.

The Lunar Excursion Module and other space programs at Grumman are creating unprecedented professional opportunities at the company. Make 1963 a year of personal achievement in an endeavor that ranks among the greatest of all times. Current requirements are detailed on the next page. We invite your inquiry on the attached inquiry form or by personal resume to Mr. A. A. Williams, Technical Staff Engineer, Dept. GR25.

**GRUMMAN**
AIRCRAFT ENGINEERING CORPORATION
Bethpage · Long Island · New York
(An Equal Opportunity Employer)

# ENGINEERS & SCIENTISTS

***Explore these immediately available positions:***

**Structural Designers**—BS in ME, CE, AE or equivalent with a minimum of 5 years experience in layout and design. Familiarity with materials and fabrications for space vehicles, and hydrofoil boats. Ability to perform preliminary structural analyses and coordinate priority structure with manufacturing and purchasing departments. Openings also available in preliminary design for experienced creative structural designers.

**Mechanical Design Engineers**—BS in ME, CE or AE with a minimum of 5 years experience in mechanical systems design, preferably familiar with aerospace design practices. Background should cover one or more of the following areas: mechanical linkages and their motions analysis; structural design of mechanical components; determination of power requirements and selecting of power supply; shock attenuation devices; wheels, brakes, anti-skid and steering devices and interpretation of military specifications. Duties: Assist in the formation of Aerospace Alighting Gear System concept and in the detail design of the overall system and its components. Also, establish the Lunar Landing System configuration and participate in the design of the system; design for stowage, extension and erection of the system in space and lunar environment; establish test requirements for the system in space and lunar environment; study and establish landing energy absorption requirements and medium compatible with space and lunar environment.

**Aerospace Environmental Control & Life Support Systems Engineers**—BS in ME, Chemical Eng., or EE, with a minimum of 2 years fluid mechaincs and/or thermodynamics experience in analysis, design, development, testing, installation for aircraft and space vehicles in one or more of the following areas: ENVIRONMENTAL CONTROL (Cabin, Equipment, Pressure Suit-cooling, heating,pressure, humidity controls); LIFE SUPPORT (Stored, Regenerative, Ecological Systems-$CO_2$, toxic gases, odor and moisture removal); CRYOGENICS (Storage, Supply, Temperature and Pressure Controls); TESTING (Development, Qualification, Functional Pre-flight).

**Crew and Equipment Integration Design Engineers**—BS in ME, AE or CE with experience in crew design, geometry, integration of display and control philosophy; typical uses of electronics systems with the analytical approach, working with Human Factors and Systems designers to the actual hardware. Must have a working knowledge of secondary control systems and power controls; be knowledgeable in the design, layout arrangement of high density equipment installation to meet rigorous vibration, thermal, structural and accessibility requirements.

**Human Factors Engineers**—MA or PhD. degree in experimental psychology with human factors experience in systems analysis, display and control design, work station layout, and design for maintainability. Opportunity for participation in advanced systems projects in the fields of attack and reconnaisance vehicles, AEW vehicles, ASW aerospace and hydrofoil vessels.

MS or PhD. in Human Physiology with experience in aviation physiology preferred. Will participate in life support areas of aerospace programs. This work involves Research and Development and practical application of Human Factors.

**Weight Optimization Engineers**—To originate and contribute to the development of practical minimum weight design, to conduct trade-off studies for vehicle optimization and to carry out weight control during design of aerospace structures and systems. BS and 5 years aerospace experience within your specialty and general engineering competence are required.

**Electronics, Guidance & Control Test Engineers**—BS in EE or AE with 5 yrs experience in electronic systems, stable platforms, navigational and guidance electronics with background in environmental and dynamic testing to MIL spec. requirements; reliability design and statistical analysis techniques. Will set up reliability test requirements for vendors, review test plans, monitor tests, analyze and evaluate reports.

**Structures Engineers—Aerospace Frames Systems**—Structures Engineers with a minimum of 3 years experience in aircraft, missile, or space vehicle stress analysis and a BS or MS in AE, CE, ME, of Applied Mechanics or equivalent experience and education is desirable.

**Fluid Mechanics Engineers/Internal Aerodynamicists**—BS or MS with a minimum of 2 years experience applicable to analysis and test work on Reaction Jet Control Systems, Nozzle Design, Inlets, Jet Exhausts, Gas Bearings, Pressurization Systems, Thrust Vector Control, VTOL Internal Flow and Airborne Cooling Systems.

**Temperature Control Engineers**—BS or MS and 2 years experience to handle space vehicle temperature control system analysis. Should have background in radiative heat exchange and thermal coatings as applied to passive and active temperature control systems.

**Space Power Engineers**—EE or Physicist with understanding of electrical energy generation, thermodynamics and preferably some knowledge of direct conversion of electrical energy from heat and solar energy. To analyze and compare sizes, weights, efficiencies of various means of obtaining electrical energy from solar, nuclear and chemical energy; to perform preliminary design of secondary power systems for satellites and space vehicles; to participate in hardware development programs.

*Make 1963 a year of personal achievement in an endeavor that ranks among the greatest of all time. Mail the attached inquiry form to Mr. A. A. Williams, Technical Staff Engineer, Engineering Employment, Dept. GR25.*

**GRUMMAN**

**AIRCRAFT ENGINEERING CORPORATION**

**Bethpage · Long Island · New York**

(An Equal Opportunity Employer)

**PROFESSIONAL PLACEMENT INQUIRY**

Background and experience (Brief resume of experience, recent history of employment)

For your convenience and to facilitate your inquiry, please use this form. It will enable the professional staff at Grumman Aircraft to evaluate your background and experience and arrange for a mutually convenient personal interview. All inquiries will be held in strictest confidence. Enclose in an envelope and send to Mr. A. A. Williams, Technical Staff Engineer, Engineering Employment, Dept. GR25, Grumman Aircraft Engineering Corp., Bethpage, L. I., N. Y.

NAME_____

STREET ADDRESS_____

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NEAREST MAJOR CITY (IF APPLICABLE)_____

COLLEGE GRADUATE: YES__ NO__ Degree Subject Year

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Major Speciality_____ Yrs._____ Other Speciality_____ Yrs._____

Applying for position(in)(of)_____



# Responsibility:
# Total capability...in support of aerospace programs USAF

Every facet of procurement, supply, maintenance engineering and transportation in support of aerospace and weapons systems for the Air Force is now the supervisory responsibility of the Air Force Logistics Command. The implications of such a vast assignment strain conceivability.

Responsibility so widespread—coupled with needs so urgent—demand the ultimate in preparation, experience and ability from the scientists, the engineers, the people of many different disciplines who carry out this mission.

The accelerating development of technology in support of aerospace and weapons programs and the immediate application of the technology is the concern of the civilian-military team of AFLC at ten different installations in various sections of the country. Communications-electronics engineering and installation, inventory control, service engineering, a vast variety of projects relating to the total aerospace program are the business of every day at AFLC. The importance of accomplishing this business with dispatch is overwhelmingly evident.

AFLC employment benefits include patent protection for inventions, opportunity for advanced study, authorship credit on scientific papers, honorary, academic and cash awards, promotion based on merit, health and retirement benefit programs, low cost life insurance, paid vacations and sick leave.

If your qualifications are appropriate, we would be interested in discussing with you the unique career opportunities with Air Force Logistics Command.

**AIR FORCE LOGISTICS COMMAND**
has immediate openings for engineers and scientists in these areas. All positions offer full Civil Service status and benefits.

**STAFF ARCHITECT**—Will be responsible for conceptual design of facilities in which aircraft and missile components are calibrated, overhauled, repaired, assembled and tested.

**ELECTRONIC ENGINEER**—Will be responsible for solving complex engineering problems involving inertial guidance systems and stable platforms.

**ELECTRONIC ENGINEER**—Responsibility will involve the maintainability and reliability of electronic missile guidance and support systems.

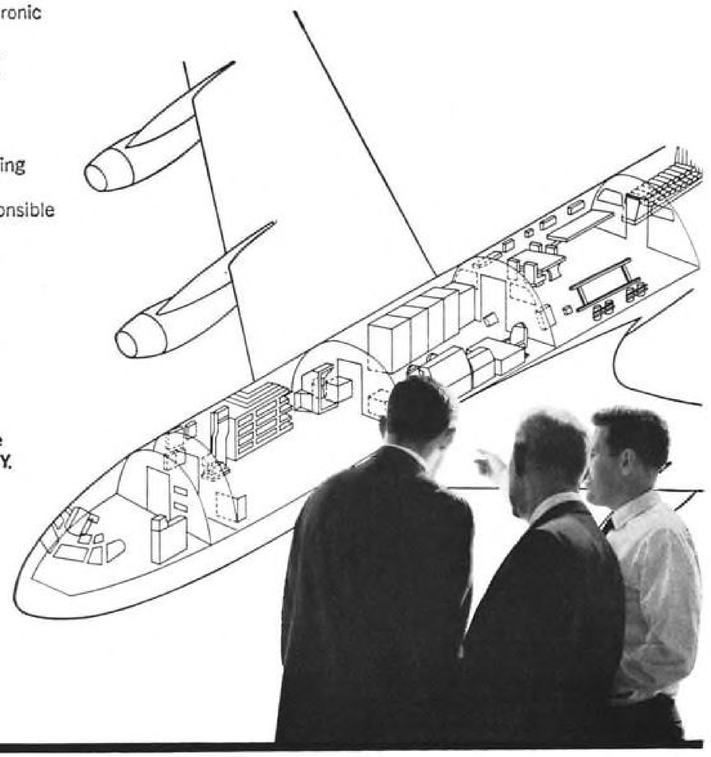
**PROFESSOR OF ELECTRICAL ENGINEERING**—Will instruct at the USAF Institute of Technology highest level courses in theoretical and experimental electronics.

**SUPERVISORY MECHANICAL ENGINEER**—Will direct staff in developing advanced packaging and materials handling systems.

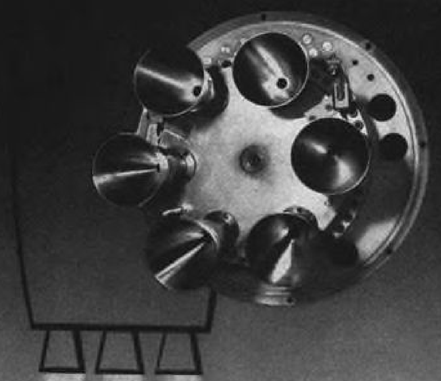
**SENIOR OPERATIONS ANALYST**—Will be responsible for carrying out difficult analyses in supply, maintenance, transportation, procurement, planning and programming.

To arrange an early interview, direct your resume or Application for Federal Employment (SF57) with geographical preference and salary requirement in strict professional confidence to:

**United States Air Force**
**AFSC-AFLC Joint Professional Placement Office**
**527 Madison Avenue, Dept. C, New York 22, N. Y.**
An Equal Opportunity Employer



# The Nose Gets Hot



## But So Does The Other End

The front-end heat transfer problems of hypersonic flight — nose cone configurations, spacecraft designs, ablative cooling methods — are studied in many laboratories. Aside from extensive programs in these well-publicized areas, however, Cornell Aeronautical Laboratory plays a leading role in solving the equally important but less understood problem at the other end of the missile: the destructive heating of the missile base.

The possible result of radiation, external burning of fuel-rich mixtures, and interaction and reverse flow of exhaust gases, base heating of rocket vehicles at high altitudes has been recognized as one of the major causes of mission failures.

Extensive Cornell Aeronautical Laboratory experience in shock tube technology has been adapted to this problem, with particular emphasis on the NASA/Marshall Space Flight Center Saturn program. CAL's researchers duplicate rocket motor operations at model scale through a pressure altitude ranging from sea level to 350,000 feet. Variations of base heating with Reynolds number have been investigated and base recovery temperatures determined. Resulting data have been highly significant in the design and subsequent successful flight testing of Saturn stages.

This applied hypersonics project is only one of the areas of research in which CAL's technical staff is leading the way.

Others include computer sciences, applied physics, electronics, operations research, aerodynamic research, flight research, applied mechanics, vehicle dynamics, life sciences, and systems research. If your experience qualifies you to join this team, we invite you to mail in the coupon below. It will bring you an interesting briefing on this community of science.

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CAREER POSITIONS

# NASA

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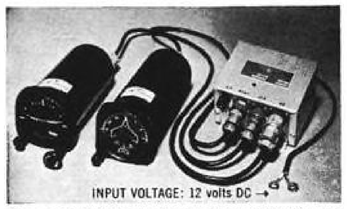
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**BID OPENING • JUNE 19, 1963**

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**Location:** FAA/SRDS
National Aviation Facilities Experimental Center
Pamona, N.J.

**Inspection Dates:** 9:00am to 4:00pm, EDST, June 3, 1963 thru June 14, 1963 except Sat. and Sun. Contact Mr. C. J. Will, Milton 1-8200, ext. 3119.

**Bid Opening:** June 19, 1963, 2:30pm EDST, at the below listed office.

For bid forms and complete details refer to bid No. 2UPS-63-349 and contact:

**GENERAL SERVICES ADMINISTRATION**
BUSINESS SERVICE CENTER
30 Church Street
New York 7, N. Y.
Tel. Digby 9-0400, Ext. 336, 337

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Your requirements will be brought promptly to the attention of the equipment dealers advertising in this section. You will receive replies directly from them.

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**GUIDANCE AND CONTROL**
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North American Aviation's Space and Information Systems Division has several assignments of exceptional scope and interest available to qualified engineers and scientists.

Tasks in the Guidance and Control Department range from actual hardware evaluation to theoretical postulation of advanced systems.

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If you are interested in associating with a company whose long experience and proven capability provides a broad perspective of past, present, and future space missions and you feel you can contribute to progress in the field of guidance and control, you are invited to investigate further by writing in confidence to:

**MR. A. F. MEDWICK**
**EMPLOYMENT SERVICES**
**12214 LAKEWOOD BLVD.**
**DOWNEY, CALIFORNIA**

All qualified applicants will receive consideration for employment without regard to race, creed, color, or national origin.

**SPACE & INFORMATION SYSTEMS DIVISION**
North American Aviation

# LETTERS

## Motorless Chopper

Referring to May 20 issue on p. 97 we note that the last line of paragraph four states, "But the chopper motor poses bearing-lubrication problems in the space environment in addition to adding to system weight and power consumption."

We have for some time been manufacturing and supplying mechanical light choppers which require no motor, have no lubrication problems and do not require a great deal of power.

It consists of a transistor-maintained tuning fork to which are attached shutters which chop the radiation.

The weight of this device is under 3 oz. and the power consumption is under .05 w. Immunity to radiation and space vacuum is high.

We believe this is an important advance in the state of the art.

Robert R. Ansell
Sales Manager
American Time Products
Div. of Bulova Watch Co., Inc.
Woodside, N. Y.

## TFX Commentary

In the weeks since the TFX hearings started, Aviation Week's attitude on McNamara's position has shifted from one of relative neutrality to one of considerable hostility. This strikes this taxpayer as unfortunate.

It would appear that Mr. McNamara's objective is to serve notice on the defense industry that the Administration and the public want certain ingrained defense R&D habits changed.

Chiefest among these habits is the practice of awarding contracts on the basis of promised breakthroughs in the state of some art that is incompletely understood at the time of bid preparation. This has usually been excused on the grounds that the need for the particular development is too pressing to permit a slower evolutionary approach.

Yet, in case after case it has turned out that the more careful approach would have succeeded faster, better and cheaper.

This is closely coupled with a second tradition, that of allowing unrealistically low bids that will obviously have to go into overruns, but dispensing with any effective penalties to the contractor later on for his poor foresight. It is not that the taxpayer objects to paying the final bill; he simply wants to be sure that the cost and time factors were understood as well as possible at the beginning so that other alternatives could have been more fairly considered.

One has only to look at the advertising in periodicals dealing with defense technology and to note how often a projected development is portrayed as an accomplished fact, an idea is called a system, or a minor advance is called a breakthrough, to see the insidious effect of such procurement practices. All normal indices by which one evaluates technical excellence and accomplishment are blurred and obscured by these practices.

The whole defense system business has gradually become such a crazy-house of complexity, misunderstanding and misrepresentation that one can only applaud Mr. McNamara's efforts to place it on a more reasonable basis. Even should it turn out on further investigation that some of the details of Mr. McNamara's arguments are questionable, still the over-all principle is correct and should be supported.

Paul E. Green, Jr.
Electronics Engineer
Weston, Mass.

Where is the "valid" detail brought out by the McClellan committee? In fact, where is the substance of the editor's colorful case on news management? So far it sounds like so much hot air from the editor's desk.

Whether intentionally or not, Mr. Hotz has made a very clear case that indeed the news services can be controlled. He brought to the reader's attention the whole pre-crisis Cuban situation when information was available and the news services failed to provide adequate coverage and analysis. Perhaps we are reminded indirectly of the lack of clear definition concerning which effective powers the people are willing to give the President and Secretary of Defense to handle critical situations, but it certainly cannot be construed as a credit or as a just injury to the news people that they were duped.

The editor's expose of the TFX investigation does nothing to preserve the "rational view." Sen. McClellan is probably gratified by the editor's praise, but no doubt would like to see the spirit of objectiveness perpetuated. A consistent reader of Aviation Week editorials would have to agree to the urgency of the President's request that the news media exercise responsible restraint on matters affecting national security. In the meantime we might ask which is apt to be the bigger mockery, freedom of the press or news management?

We are assured that henceforth the Administration would not dare conspire to run the country, we are shown that the news services cannot keep us up to date, and now we are assured that the greatest thing to happen for the taxpayer in recent months is the TFX investigation. This is no doubt so because now the taxpayer can rest assured that the military users at least cannot always form a successful collusion to serve a matter of professional pride and experience in weaponry. Mr. McNamara will certainly appreciate the editor's preference for expert opinion—"A second-best airplane is like a second-best poker hand." No matter what the crisis, the country can always rely on the matured judgment of our prominent editors and news writers to keep us informed in time.

Richard A. Dieterich
Paramus, N. J.

Your May 13 edition, in reporting on the TFX hearings (p. 29), quoted Sen. McClellan as saying: "I think the public ought to know that this thing of commonality is applicable only to less than one-sixth of the planes, or only about 200. They are making a great big noise about commonality, and that is what it amounts to."

If the senator was quoted correctly, we certainly have a vivid illustration of how a man can spend months purporting to investigate a matter and still not comprehend one of its most central features.

Even the public can deduce that the whole point of commonality in this case stems from the fact that the number of Navy planes to be built is relatively small—and that, therefore, thousands of manhours should not be poured into the design and tooling of parts which would be peculiar to this limited quantity of aircraft.

Obviously, the great part of the savings relative to the few Navy planes will come from not spending the terrific non-recurring costs which would be necessary to make them different, not from reductions somewhere within the estimated costs of the aircraft, as the senator suggested in a further display of his own commonality.

I suppose the senator's later statement that: "This is the kind of propaganda being thrown out all over the country to try to sustain this 'rough judgment' decision . . ." is the kind of thing you had in mind when you glowingly spoke, in an editorial, of Sen. McClellan's objective way of conducting the hearings.

Your own objectivity was slyly jettisoned in an adjoining article where you noted, in speaking of the F-111 case, that " . . . Fred Korth, Ft. Worth, Tex., tended to side with McNamara." Why was it important to point out Mr. Korth's former residence, if not to cast the subtle insinuation that Secretary Korth would naturally be biased toward anything favorable to General Dynamics/Ft. Worth? I didn't notice home town identifications inserted after the names of President Kennedy, Adm. Anderson, Gen. LeMay, Roger Lewis, William Allen or Harry Truman; also missing was any notation of the former home town of Governor (ex-Navy Secretary) John Connally, who was reported having sided with Adm. Anderson (against McNamara). Mr. Connally resided in Ft. Worth.

Sen. McClellan is quite correct—a "great big noise" is being generated by the TFX hearings. He is, however, completely disoriented concerning its source and content.

R. D. Maxey
Ft. Worth, Tex.

## JCS Shuffle

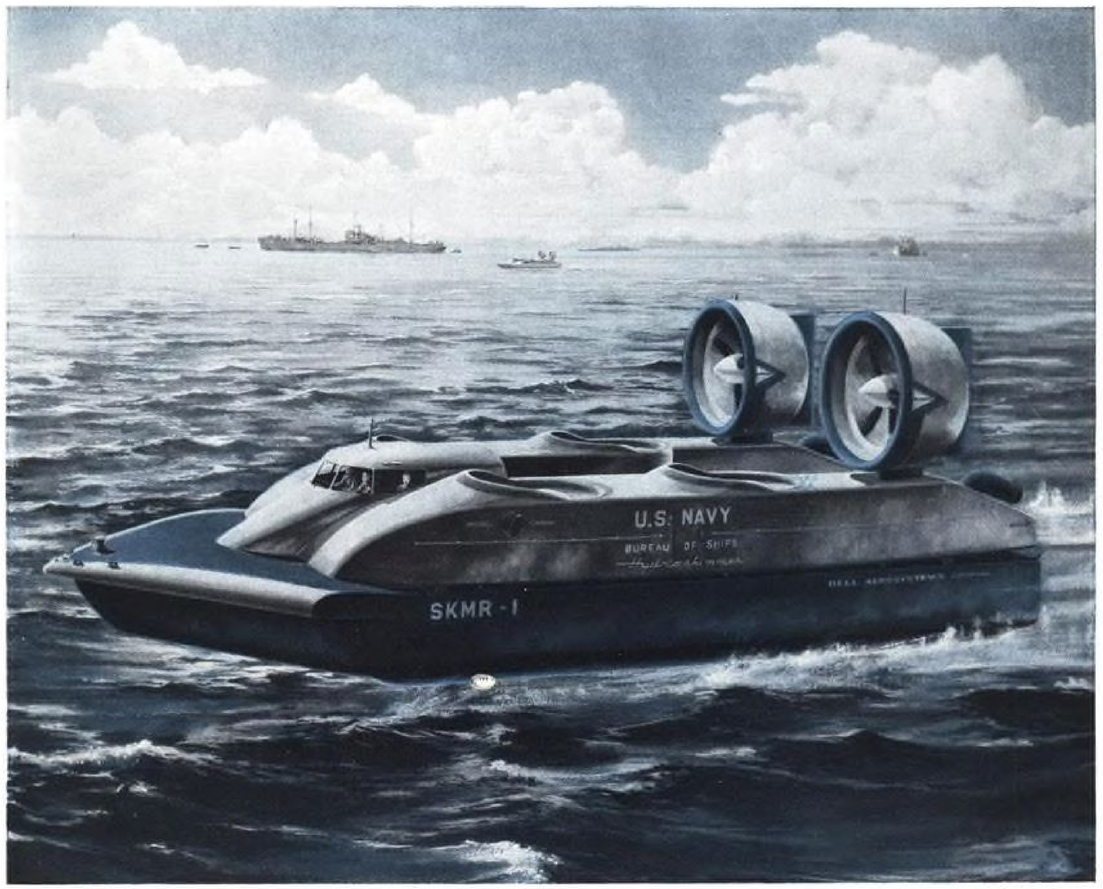
Your editorial "The Brittle Brilliance" (AW Apr. 15, p. 21) was not only brilliant in scope but also extremely timely in respect to the Anderson and LeMay "shuffle."

I only wish your magazine had broader coverage. With this in mind, I would like to obtain your approval to have this article reprinted in one or both of our local newspapers, The Schenectady Gazette and/or The Schenectady Union Star.

It is my intention, with your written approval, to suggest that the editors of our dailies reprint this important article on their editorial page.

D. W. Gifford
Scotia, N. Y.





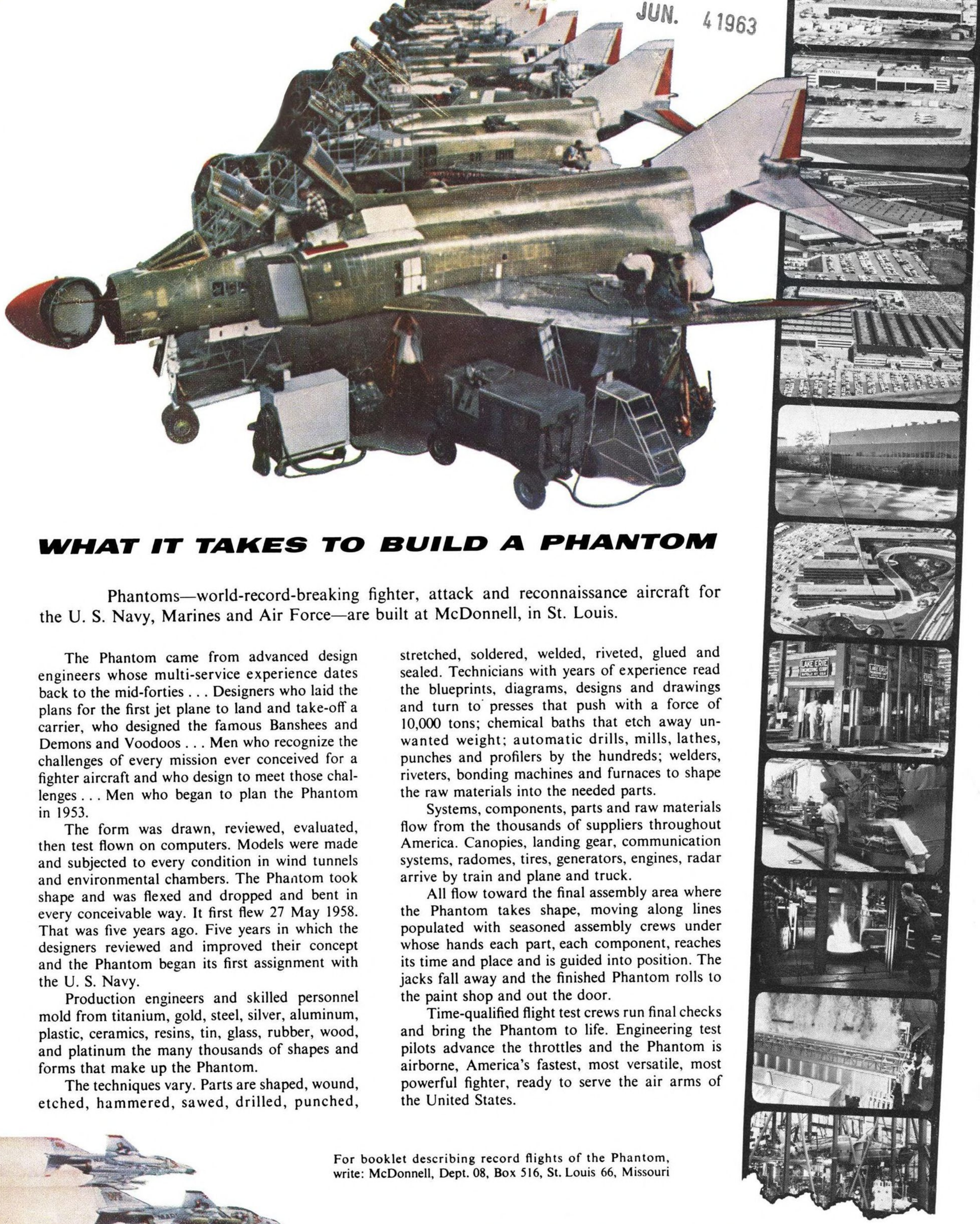

• ARTIST'S DRAWING OF THE SKMR-1

**SKMR-1 ...a new concept for the Navy**

SKMR-1 Hydroskimmer, largest air cushion craft ever built in this country, is developing its sea legs on Lake Erie. Built by Bell for the U.S. Navy Bureau of Ships, SKMR-1 overcomes many of the shortcomings of conventional craft by riding *above* the water on a cushion of air. A few of its features are high speed, zero draft and amphibious capability. Future naval missions envisioned for Hydroskimmers include ship-to-shore transport, anti-submarine warfare, patrol, rescue and reconnaissance. Vital statistics: SKMR-1 weighs 22½ tons, is 65 feet long, 27 feet wide, 23½ feet high and is designed to travel at a top speed of 70 knots or up to 50 knots in sea state 3. A two-man crew, four observers and a normal payload of five tons can be carried by SKMR-1. Additional loads can be accommodated at reduced height and speed. The Hydroskimmer is another example of Bell's creative engineering at work for the U.S. Navy.

**BELL AEROSYSTEMS** COMPANY • *Buffalo 5, N.Y.*
DIVISION OF BELL AEROSPACE CORPORATION
A textron COMPANY

JUN. 4 1963



# WHAT IT TAKES TO BUILD A PHANTOM

Phantoms—world-record-breaking fighter, attack and reconnaissance aircraft for the U. S. Navy, Marines and Air Force—are built at McDonnell, in St. Louis.

The Phantom came from advanced design engineers whose multi-service experience dates back to the mid-forties . . . Designers who laid the plans for the first jet plane to land and take-off a carrier, who designed the famous Banshees and Demons and Voodoos . . . Men who recognize the challenges of every mission ever conceived for a fighter aircraft and who design to meet those challenges . . . Men who began to plan the Phantom in 1953.

The form was drawn, reviewed, evaluated, then test flown on computers. Models were made and subjected to every condition in wind tunnels and environmental chambers. The Phantom took shape and was flexed and dropped and bent in every conceivable way. It first flew 27 May 1958. That was five years ago. Five years in which the designers reviewed and improved their concept and the Phantom began its first assignment with the U. S. Navy.

Production engineers and skilled personnel mold from titanium, gold, steel, silver, aluminum, plastic, ceramics, resins, tin, glass, rubber, wood, and platinum the many thousands of shapes and forms that make up the Phantom.

The techniques vary. Parts are shaped, wound, etched, hammered, sawed, drilled, punched, stretched, soldered, welded, riveted, glued and sealed. Technicians with years of experience read the blueprints, diagrams, designs and drawings and turn to presses that push with a force of 10,000 tons; chemical baths that etch away unwanted weight; automatic drills, mills, lathes, punches and profilers by the hundreds; welders, riveters, bonding machines and furnaces to shape the raw materials into the needed parts.

Systems, components, parts and raw materials flow from the thousands of suppliers throughout America. Canopies, landing gear, communication systems, radomes, tires, generators, engines, radar arrive by train and plane and truck.

All flow toward the final assembly area where the Phantom takes shape, moving along lines populated with seasoned assembly crews under whose hands each part, each component, reaches its time and place and is guided into position. The jacks fall away and the finished Phantom rolls to the paint shop and out the door.

Time-qualified flight test crews run final checks and bring the Phantom to life. Engineering test pilots advance the throttles and the Phantom is airborne, America's fastest, most versatile, most powerful fighter, ready to serve the air arms of the United States.



For booklet describing record flights of the Phantom, write: McDonnell, Dept. 08, Box 516, St. Louis 66, Missouri

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*Phantom II Fighter, Attack and Reconnaissance Aircraft • Electronic Systems and Equipment •*
*Talos Missile Airframes and Engines • Automation*

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