AVIATION WEEK
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Civil Airspace Allocation Blocked By Air Force



Farside Rises for Firing

ORDNANCE

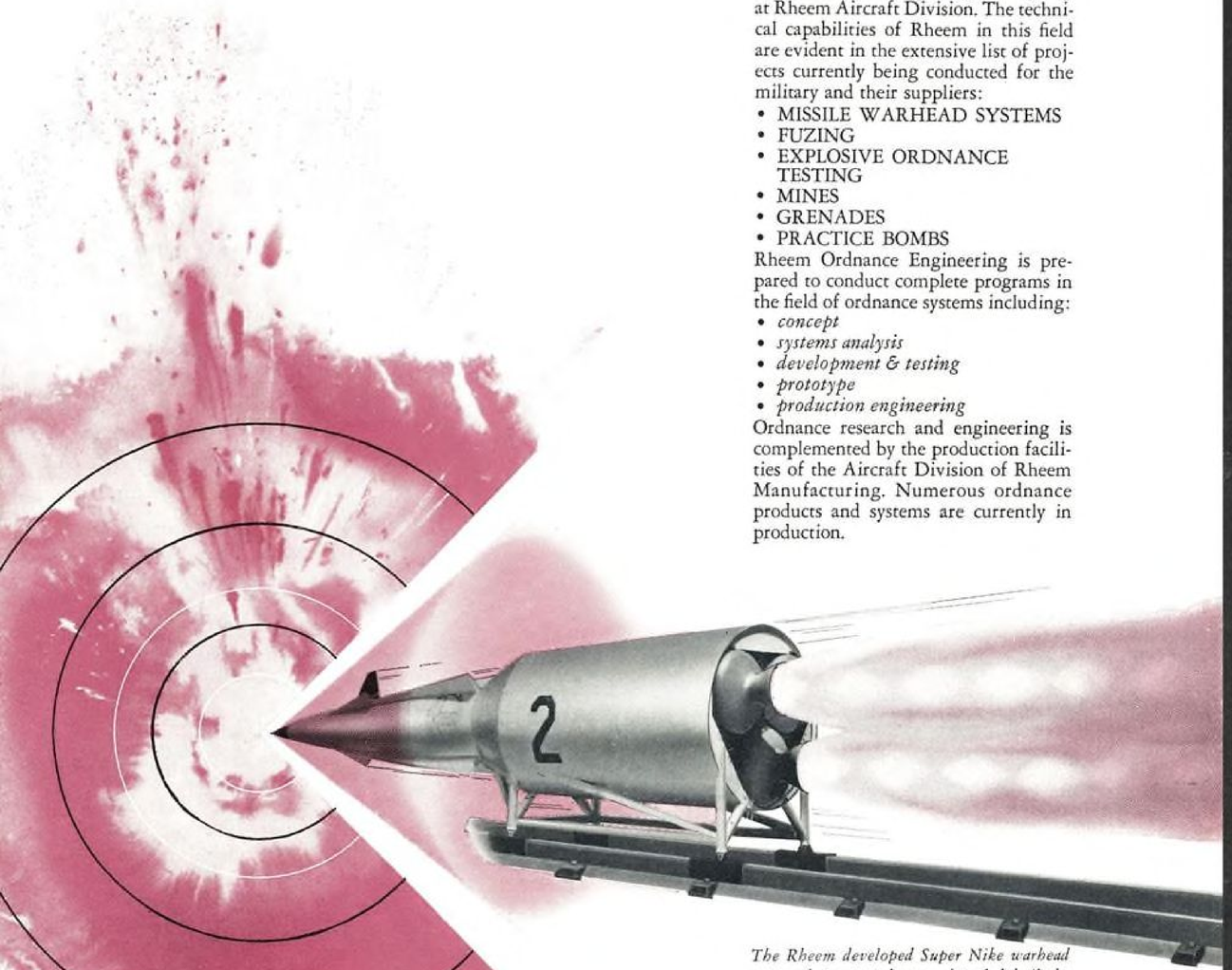
The design, development and testing of advanced ordnance products and systems is one of the principal activities of the Research and Development group at Rheem Aircraft Division. The technical capabilities of Rheem in this field are evident in the extensive list of projects currently being conducted for the military and their suppliers:

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- FUZING
- EXPLOSIVE ORDNANCE TESTING
- MINES
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- PRACTICE BOMBS

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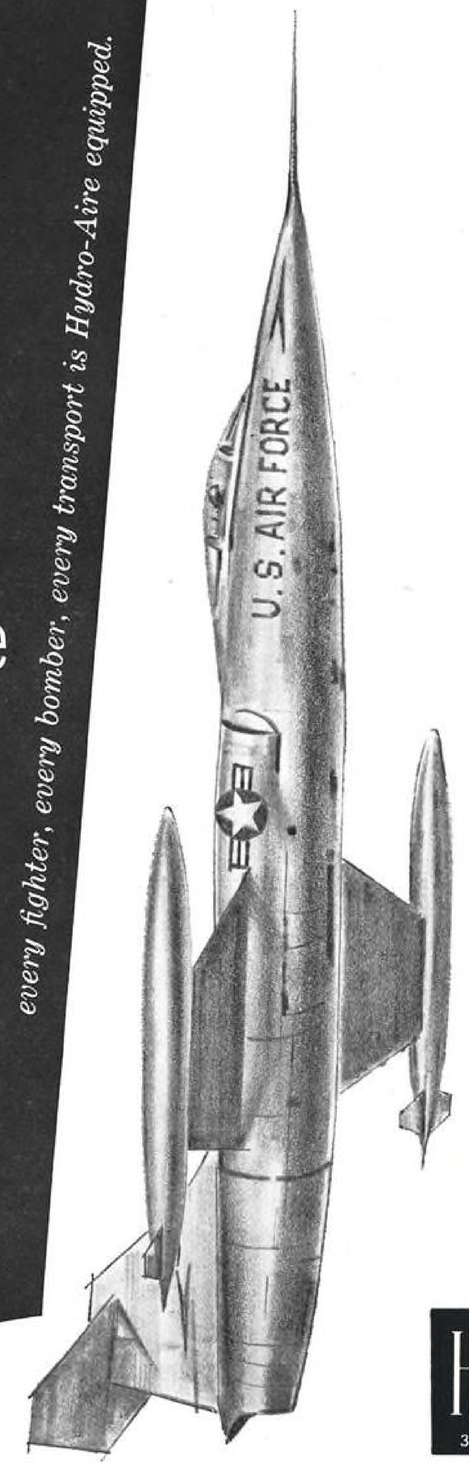
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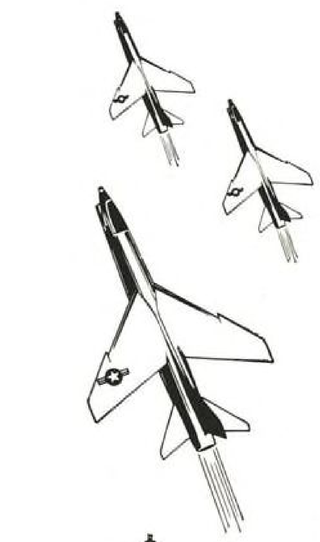
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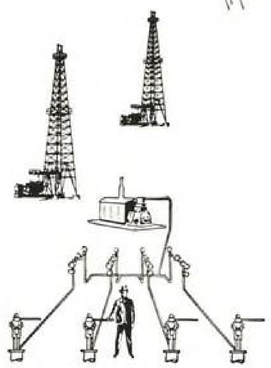


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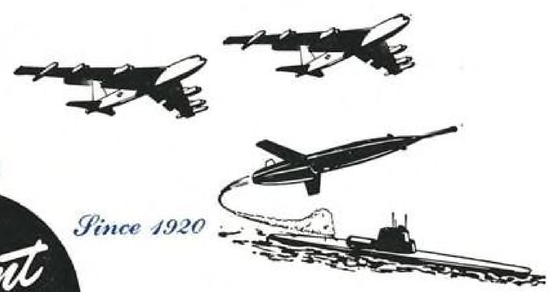
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AVIATION CALENDAR

Nov. 2-8—Second World Metallurgical Congress & 39th National Metal Exposition & Congress, Palmer House, Hotel Sherman and International Amphitheater, Chicago.

Nov. 4-8—Fourth Institute on Electronics in Management (automatic data processing system), The American University, 1901 F St., Washington 6, D. C.

Nov. 5-7—Joint Military-Industry Guided Missile, Reliability Symposium (limited to those with Secret security clearance), Naval Air Missile Test Center, Pt. Mugu, Calif.

Nov. 6-8—Third Annual Aero-Com Symposium, The Institute of Radio Engineers Professional Group on Communications Systems, Hotel Utica, N. Y.

Nov. 7-8—National Meeting, Weapons System Management, Institute of the Aeronautical Sciences, Statler-Hilton Hotel, Dallas, Tex.

Nov. 11—Plastics for Airborne Electronics, Regional Technical Conference, Society of Plastics Engineers, Hotel Ambassador, Los Angeles.

Nov. 11-13—Third, IRE Instrumentation Conference and Exhibit (Data Handling), Atlanta-Biltmore Hotel, Atlanta, Ga.

Nov. 11-15—1957 International Air Safety Seminar, Flight Safety Foundation, Palo Alto, Calif. FSF-Aviation Week Safety Awards Dinner, Nov. 14. For Details write FSF, 468 Fourth Ave., N. Y. C.

Nov. 11-15—National Electrical Manufacturers Association, Annual Convention, Traymore Hotel, Atlantic City, N. J.

Nov. 12-13—Seventh Aircraft Hydraulics Conference, Park Shelton Hotel, Detroit, sponsored by Vickers Inc. (invitation only).

Nov. 13-14—Mid-America Electronics Convention, Municipal Auditorium, Kansas City, Mo.

Nov. 13-15—The Society of Technical Writers and Editors, fifth annual convention, Hotel Statler, New York.

(*Continued on page 6*)

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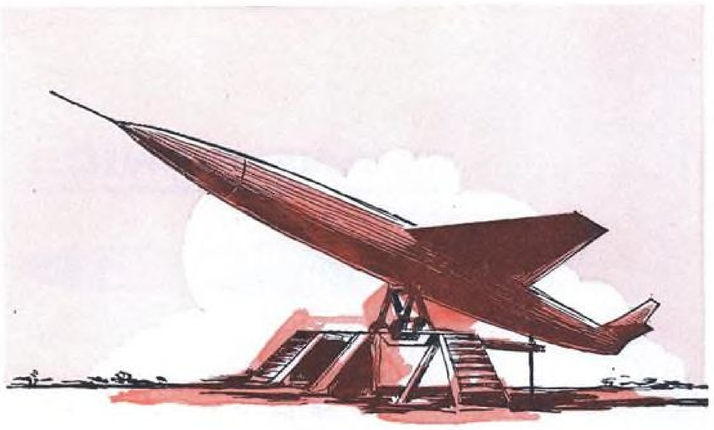
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AVIATION CALENDAR

(*Continued from page 5*)

Nov. 13-15—18th Annual Convention, National Aviation Trades Assn., Hotel Adolphus, Dallas.

Nov. 17-21—Eighth National Plastics Exposition, International Amphitheater, Chicago.

Nov. 18-22—Third Norelco Electron Microscope School, Instruments Division, Phillips Electronics, Inc., 750 S. Fulton Ave., Mt. Vernon, N. Y.

Nov. 18-26—Advisory Group for Aeronautical Research and Development, Combustion and Propulsion Panel, 12th meeting; Nov. 26-27—AGARD Aeromedical Panel, Shoreham Hotel, Washington, D. C.

Nov. 18-29—Technical Conference, International Air Transport Assn., Miami, Fla.

Nov. 20-22—30th Meeting, Aviation Distributors and Manufacturers Assn., Sheraton-Cadillac Hotel, Detroit.

Nov. 28-30—Annual Snowbird Soaring Contest, Harris Hill, Elmira, New York.

Dec. 2-6—American Rocket Society, annual meeting, Hotel Statler, New York.

Dec. 4-5—Symposium on high temperature strain gages, Aeronautical Structures Laboratory, Naval Air Materiel Center, Philadelphia 12, Pa.

Dec. 9-13—1957 Eastern Joint Computer Conference and Exhibit, Sheraton Park Hotel, Washington, D. C.

Dec. 16-18—Air Traffic Control Symposium: "The Mission and Methods of the Airways Modernization Board," sponsored by Franklin Institute, Philadelphia, Pa.

Dec. 18—Gas Turbine Development speaker: Rear Adm. S. B. Spangler, USN, Air Development & Materiel Center, at Engineers Club, Philadelphia, Pa.

Jan. 6-8—Fourth National Symposium, Electronics Reliability and Quality Control Hotel Statler, Washington, D. C.

Jan. 29-31—Fourth Annual Meeting, American Astronautical Society, N. Y. C.

Jan. 30-31—American Society for Engineering Education, 1958 College-Industry Conference, University of Michigan, Ann Arbor, Mich.

Jan. 30-31—Seventh Annual Instrument Short Course, sponsored by Southern California Meter Association and Los Angeles Harbor Junior College, at Los Angeles Harbor College, Wilmington, Calif.

Mar. 17-21—1958 Nuclear Congress, managed by American Institute of Chemical Engineers, 25 W. 45 St., New York 36, N. Y.

Mar. 17-21—Aviation Division Conference, American Society of Mechanical Engineers, Statler-Hilton Hotel, Dallas, Tex.

Apr. 17-18—RFC-RNAS Reunion, (World War I), Toronto, Canada. Contact: C. B. Stenning, Chairman, 149 South Drive, Toronto 5.

April 17-18—Institute of Environmental Engineers, Second Annual Technical Meeting, New Yorker Hotel, New York.

Apr. 22-24—1958 Electronic Components Conference; theme: "Reliable Application of Component Parts."

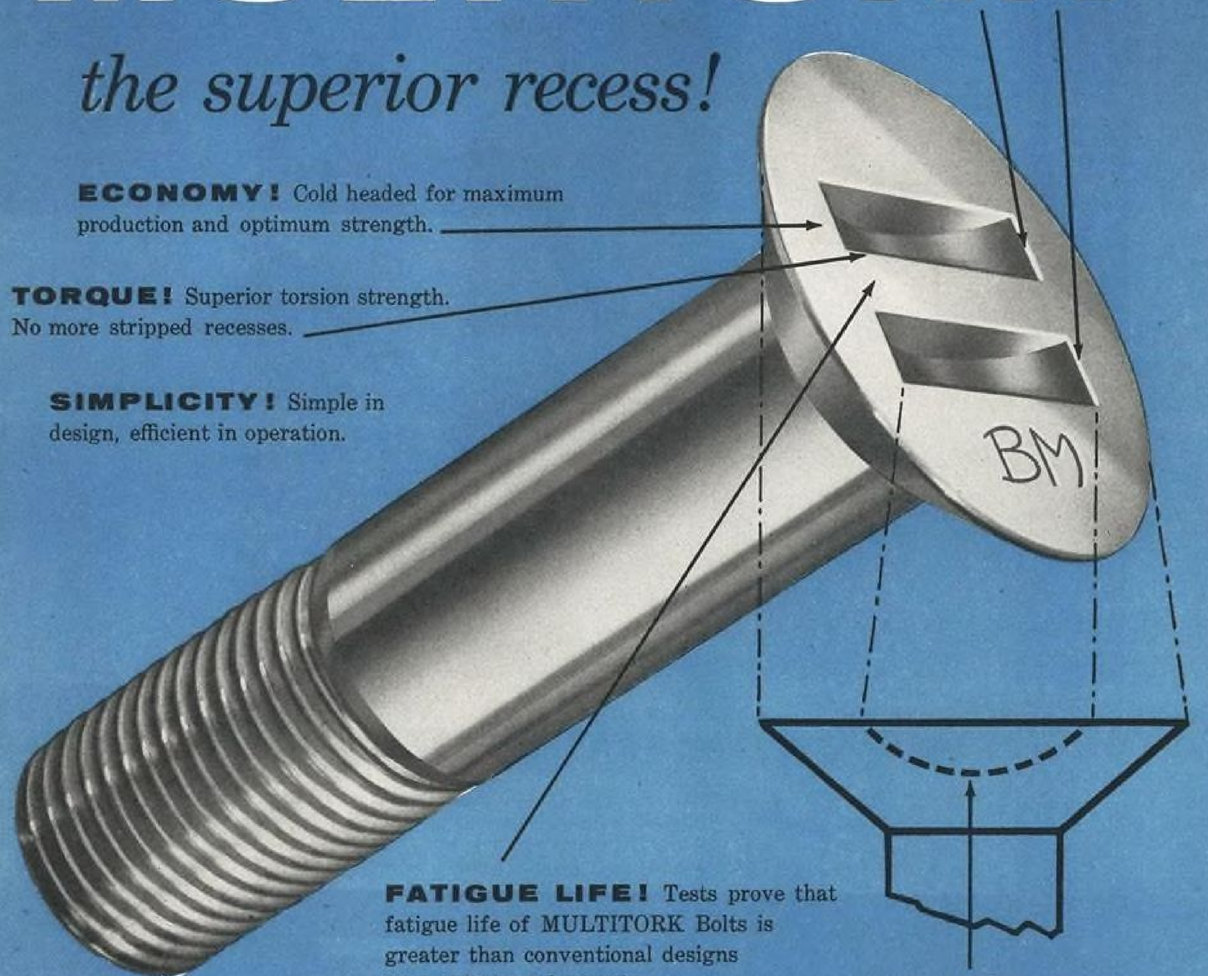
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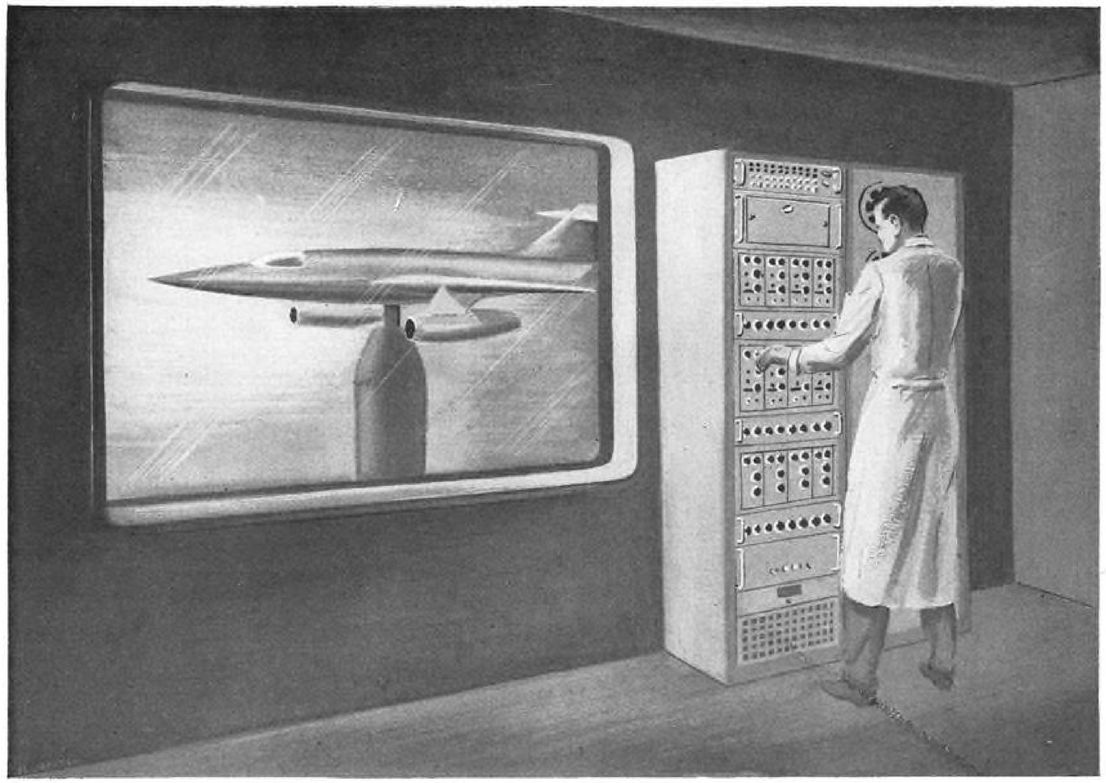
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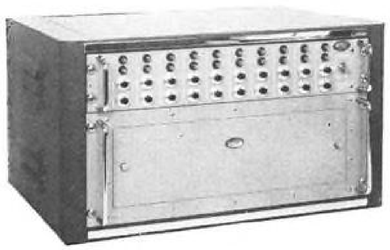
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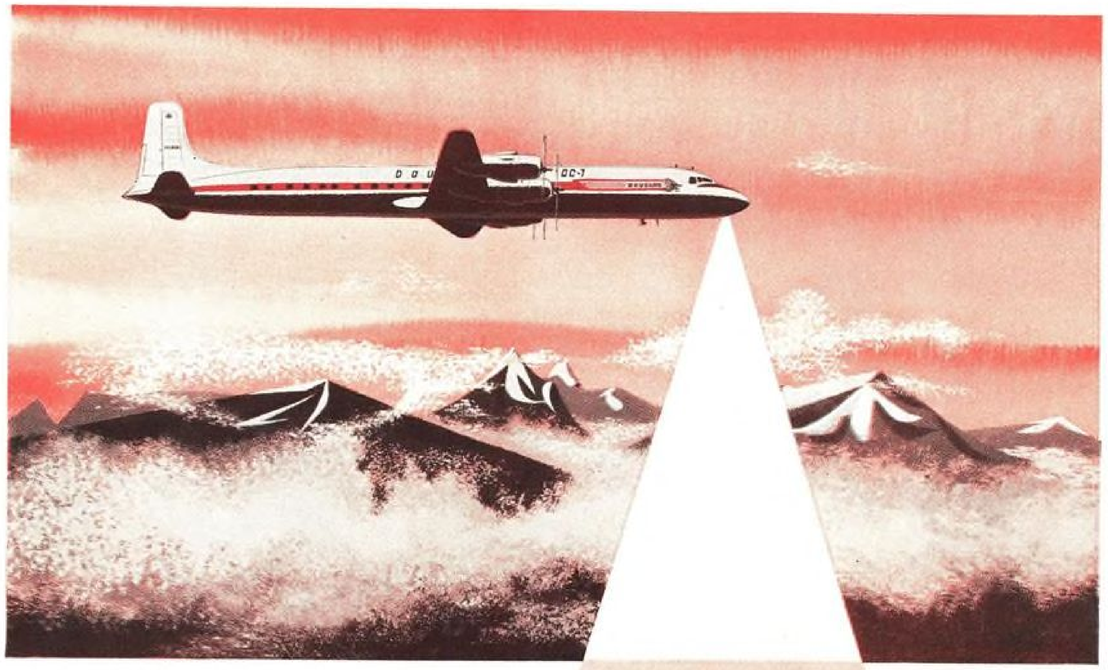
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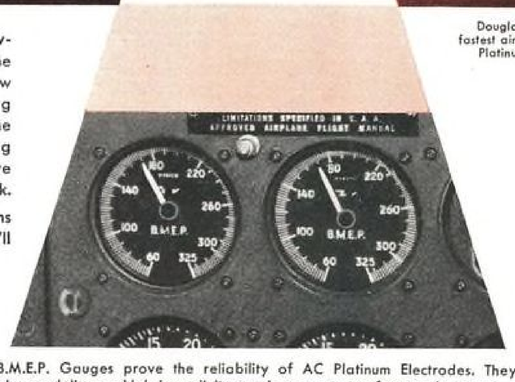
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1030 HOURS

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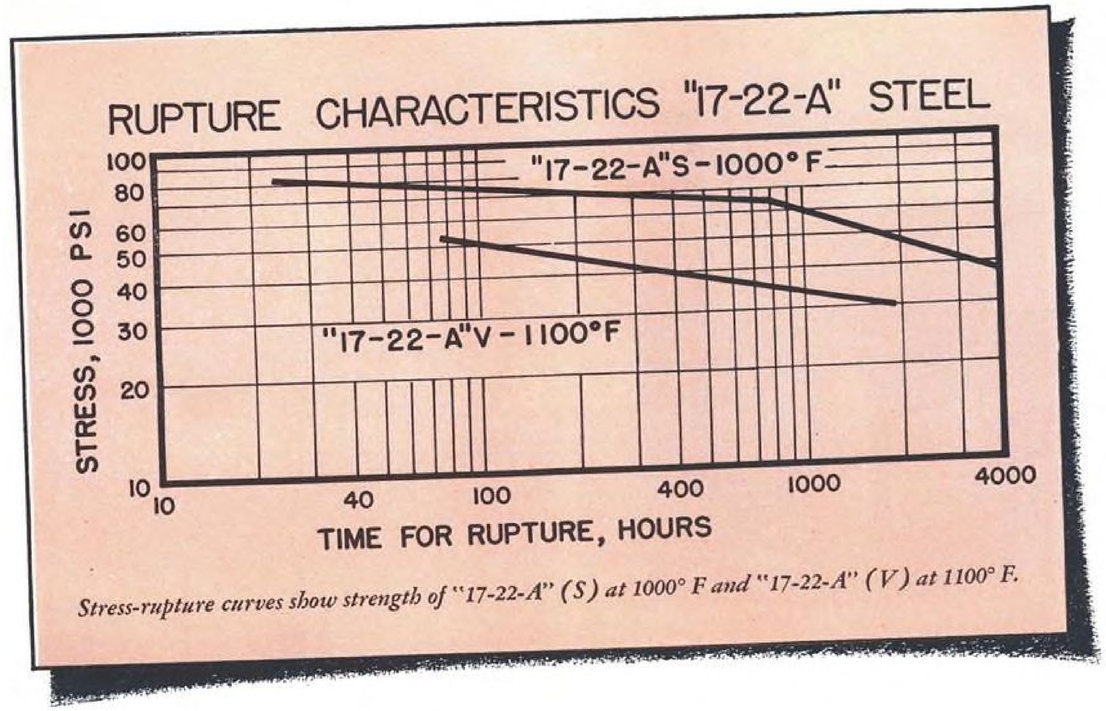
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50 amp. single pole, single throw Class A power relay.



200 amp. single pole, single throw Class B power relay with N.O. and N.C. auxiliary contacts.



25 amp. three pole, single throw Class B power relay with N.O. and N.C. auxiliary contacts.



100 amp. three pole, single throw Class B power relay.



50/25 amp. single pole, double throw Class B power relay.



25 amp. three pole, double throw reversing duty Class B power relay.

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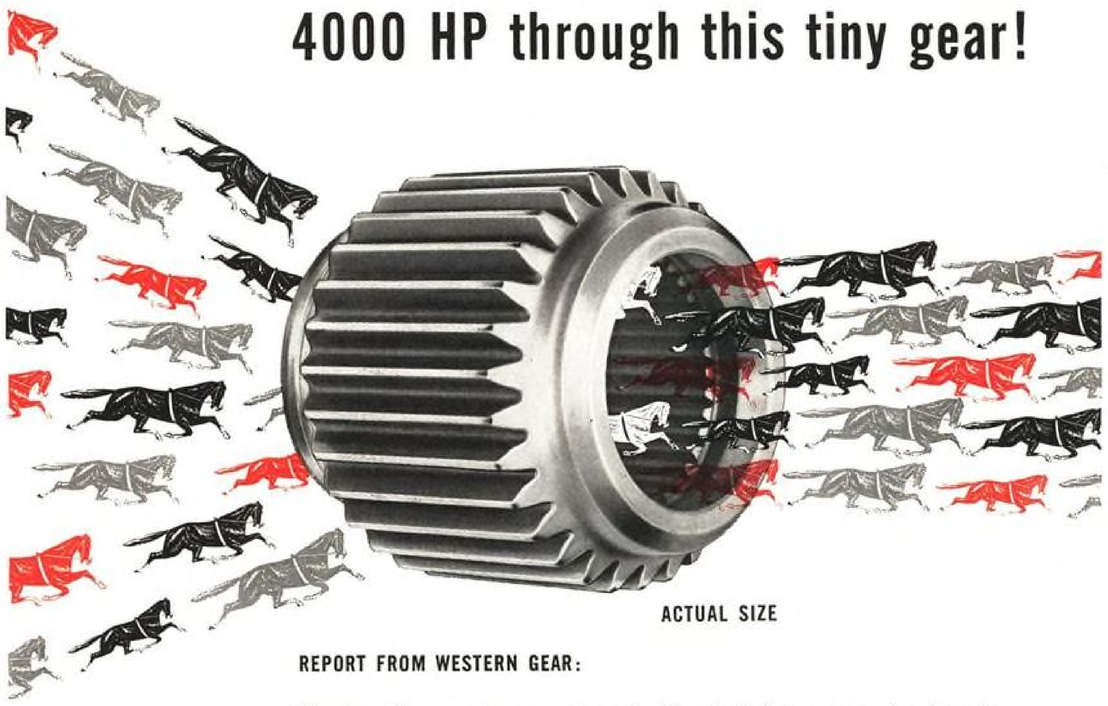
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November 4, 1957

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COVER: Air Force Farside balloon and rocket rises over Eniwetok Atoll in the Pacific. At launching altitude of 100,000 ft., rocket is fired through balloon. In tests conducted Oct. 22 (AW Oct. 28, p. 31), the Air Force rocket attained a height between 1,000 and 4,000 mi. Exact altitude could not be immediately determined, pending data computation. Prime contractor is Aeronutronic Systems Inc., a Ford Motor Co. subsidiary.

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45—Wide World; 61, 67—Sovfoto.

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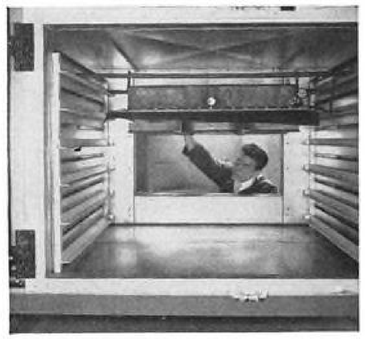
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New B. F. Goodrich laboratory is proving ground for fuel cells

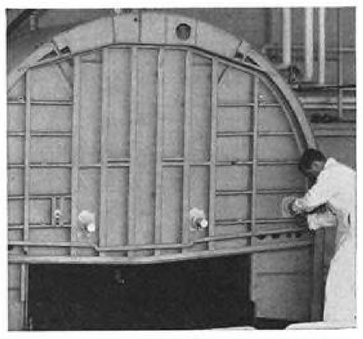


B. F. Goodrich Aviation Products' new Fuel Cell Development and Testing Laboratory at the big BFG Los Angeles plant is the last word in fuel cell research. Here, engineers maintain constant quality checks on cells being produced for many aircraft including the Lockheed 1049, T-33 and F-104, the Boeing B-52, the Douglas F4D and the Northrop T-38. In addition, fuel cell designs and materials are being developed to meet the requirements of future airplanes still on the drawing boards.

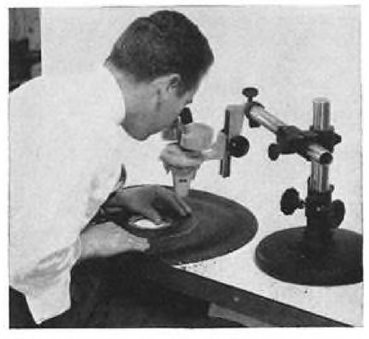
A representative sample of the laboratory's facilities is shown here. Among the specialized types of apparatus are a giant "hot and cold" room, testers for ozone, abrasion and vibration, and many, many more.



FABRIC TEST. B.F.Goodrich technician examines new fuel cell fabric that has undergone a heat aging and pressure test in 700°F. oven.



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EDITORIAL

Who Are the Real Culprits?

Readers will recall the story we published on Oct. 21, page 26, telling how the U. S. has been tapping Russian ballistic missile secrets for more than two years with scientific equipment including a giant radar located in Turkey. In an accompanying editorial entitled "Why, Mr. President?," we detailed the reasons for publishing the story at that particular time and raised the following question:

It is high time the American people asked their government why, in view of the overwhelming evidence available to it during the past two years on Soviet technical progress, it is still pursuing a policy that is slowing the pace of our military technology and sapping our future military strength?

Fulminations in Private

There has been plenty of reaction. On the one hand, the story and its accompanying editorial have stimulated daily newspaper stories and editorial reaction around the world. On page 29, we are reprinting editorial comment on this subject from leading American newspapers. We have also received similar reaction from aviation industry and military sources.

There has been another kind of reaction, too, coming primarily from President Eisenhower's personal assistants such as his press secretary, James C. Hagerty, Jr.; his foreign economic policy advisor, Clarence Randall, and Robert Cutler, his assistant for national defense matters.

All of these reactions had a curious air about them. For example, Mr. Hagerty fulminated at some length to daily newspaper reporters questioning him on the story but declined to back his comments with the use of his name or official position. They appeared in the daily press anonymously, attributed to a "top Administration official." Mr. Randall likewise made his comments of "irresponsible and indiscreet" privately. Later that week, he made a public speech referring to the Soviet Sputnik satellite as a "silly bauble." This comment drew heavy fire from such a distinguished Republican leader as Sen. Styles Bridges of New Hampshire.

What Did Cutler Say?

But even more curious is the performance of Robert Cutler on Saturday Oct. 26 at Hot Springs, Va. He was invited to speak before the Commerce Department's Business Advisory Council, which is a group of 100 leading businessmen who meet periodically to advise the government on national policy proposals. Saturday night is always a festive occasion of the council. The work has been done, and council members and their wives have played in golf and tennis tournaments. At the Saturday night affair after dinner, the awards for these tournaments are made. The job of the speaker at that affair is primarily to get everyone in a happy mood and keep them there. The reception that precedes the dinner is always an enjoyable affair.

Now we don't know what Mr. Cutler actually said that Saturday night in Hot Springs. In keeping with council tradition, there were no reporters present at the dinner. But after the dinner, several accounts of what Mr. Cutler said regarding our missile monitoring story blossomed from the dinner guests. The Cincinnati Times-Star Washington correspondent reported that, "A White House official has made a shocking attempt at censorship of a legitimate national publication by suggesting an advertising boycott. Such is the carefully checked word vaulting the mountains from Hot Springs, Va., where the Business Advisory Council of the Commerce Department has just completed a meeting.

"There Robert Cutler, special assistant to President Eisenhower for national security affairs, virtually accused a respected American trade journal's editors of treason and strongly implied the desirability of punishing the magazine by withholding advertising. His suggestion was made to members of the Council who represent the leadership of the nation's top business, industry and advertising budgets. It was made off the record at a closed session; so that there was presumably no way of countering it."

The New York Journal of Commerce reported in a similar vein on Mr. Cutler's appearance before the Council.

Cutler via Hagerty

By the middle of last week, Mr. Cutler after sober reflection had a different version of the affair. Speaking through White House Press Secretary Hagerty and dodging direct contact with reporters, Mr. Cutler denied he had mentioned "treason" or had suggested an advertising boycott. He admitted claiming that the AVIATION WEEK story was "shameful" and that the story was a violation of the law, although he would not state what law. He was also reported to be astonished that his Hot Springs remarks had reached the newspapers "because no reporters were present."

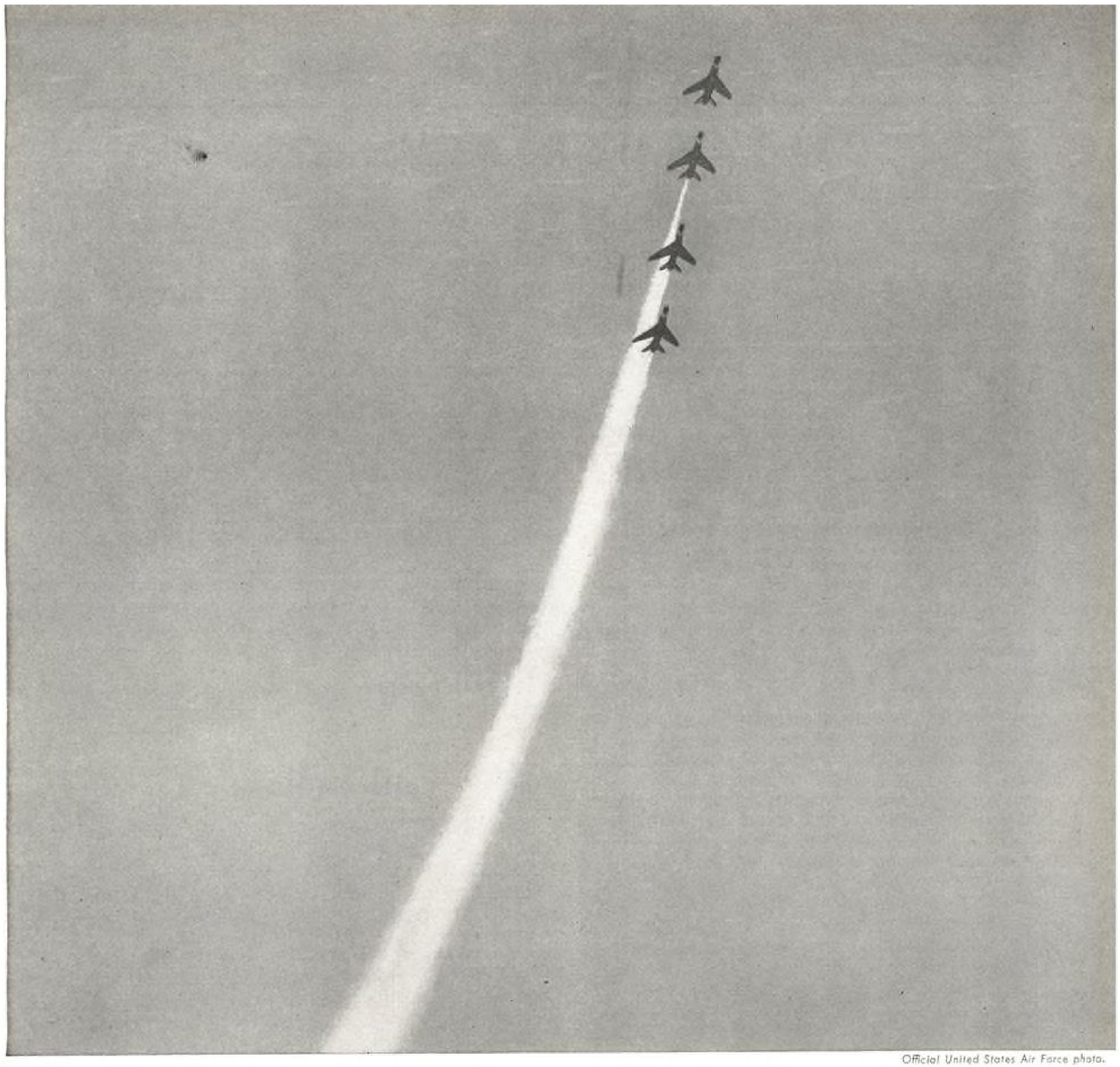
It is difficult to sift truth from evasion in the conflicting reports of Mr. Cutler's Hot Springs speech. We don't like to accept second hand reports because they are often inaccurate. But it is agreed by all parties concerned that Mr. Cutler said AVIATION WEEK's publication of the missile monitoring story was "shameful."

We would like to ask Mr. Cutler and the American people which is the really shameful act:

• **Withholding the true story** of the rapid progress on Russian missiles from the American people while at the same time cutting back our own military research, weapons development and production programs to weaken our future military strength?

• **Or telling the American people** the truth about the vital facts that were withheld from them on the phony grounds of "security" and pinning the proper label on the government officials who deliberately withheld this information?

—Robert Hotz



Official United States Air Force photo.

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Matthew J. Betley, president, Titeflex, Inc., Springfield, Mass.

David Proudlove, president, Bristol Aeroplane Company (U.S.A.) Inc., New York, N. Y.

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Robert A. Lehman, executive vice president, general manager and a director, American Electronics, Inc., Los Angeles, Calif.

Merlon F. Richards, executive vice president, Land-Air, Inc., subsidiary of California Eastern Aviation, Inc., Chicago, Ill.

Albert S. Blumenthal, executive vice president, Insuline Corporation of America, division of Van Norman Industries, Inc., Manchester, N. H.

Louis E. Fagan, senior vice president, Clifton Precision Products Co., Inc., Clifton Heights, Pa. Also: **Arnold E. Hayes, Thomas W. Shoop, Alex B. Owen** and **W. C. Richardson**, vice presidents.

Charles M. Albritton, vice president-manufacturing, Huck Manufacturing Co., Detroit, Mich.

Honors and Elections

Col. John P. Stapp, Chief of the Aero Medical Field Laboratory at Holloman AFB, has been awarded the Gorgas Medal, which is awarded for distinguished work in preventive medicine, by the Association of Military Surgeons. Dr. Stapp ". . . succeeded in exploring human tolerance to crash-type forces and in establishing that the human body can stand some shock forces better than the structure of an airplane."

Dr. Wolfgang B. Klemperer, chief of Douglas Aircraft's missiles research section, has received an honorary degree of Doctor of Technical Sciences from the Institute of Technology in Vienna (Austria) for his "pioneering and internationally recognized research work in the field of aeronautics."

Changes

Jack J. Jones, weapon system manager WS-110 program (SAC bomber), North American Aviation, Inc., Los Angeles, Calif. Also appointed engineering weapon system managers are **R. H. Kemp** on the WS-110A, and **H. E. Dale** on a long range interceptor project.

Frederick V. Ludden has joined the electronics and armament staff of the California Division of Lockheed Aircraft Corp., Burbank, Calif. Mr. Ludden will study weapon potentialities of all Lockheed military planes.

Dr. Gaelen L. Felt, Titan flight test director, Guided Missile Research Division, Ramo-Wooldridge Corp., Los Angeles, Calif.

INDUSTRY OBSERVER

► Configuration of North American Aviation's air-to-surface missile planned for the Boeing B-52 bears a strong resemblance to the XSM-64 Navaho, intermediate version of the canceled intercontinental missile project bearing the company designation G-26. Fuselage is circular in cross section, has canard surfaces and is about 40 ft. long. Wing is delta type, and canted rudders are used. Scheduled powerplant is the Pratt & Whitney J52.

► **Theory that Atlas powerplant malfunctions thus far have resulted from cavitation is being thoroughly investigated at Garrett Corp.'s AiResearch facility at Phoenix where special facilities have been established to check the theory.**

► McDonnell Aircraft is working on a three-to-four ton transport convertiplane proposal, utilizing much of the company's experience with the XV-1. There is a possibility that the design may be entered in the Army-Navy competition for a helicopter in this payload class. McDonnell also is building a smaller pressure-jet helicopter of about eight-passenger capacity. Prototype will roll out early next year. Designated the 120D, helicopter will have a single rotor 35 ft. in diameter.

► **Watch for a Royal Air Force decision within the next six months on whether a supersonic bomber will be developed to succeed the Avro Vulcan and Handley Page Victor now ticketed as the backbone of the Bomber Command's atomic and hydrogen-bomb-equipped striking force. RAF thinking has been retreating from radical "all missiles, no aircraft" position of the last British white paper on defense and is leaning heavily toward another generation of supersonic manned interceptors and bombers.**

► Proposed test vehicle for the intercontinental ballistic program combines a North American Navaho booster unit with an Aerojet Aerobee as a second stage. Range of the combination would be about 2,000 miles, and vehicle could duplicate zero gravity conditions for about 30 minutes, approximately the time required for an ICBM flight.

► **Spares requirement for F-102 stretched plexiglass hot-air anti-fogging cockpit side panels has been sliced from 30% to 5% after near-perfect results with 1,400 panels in service.**

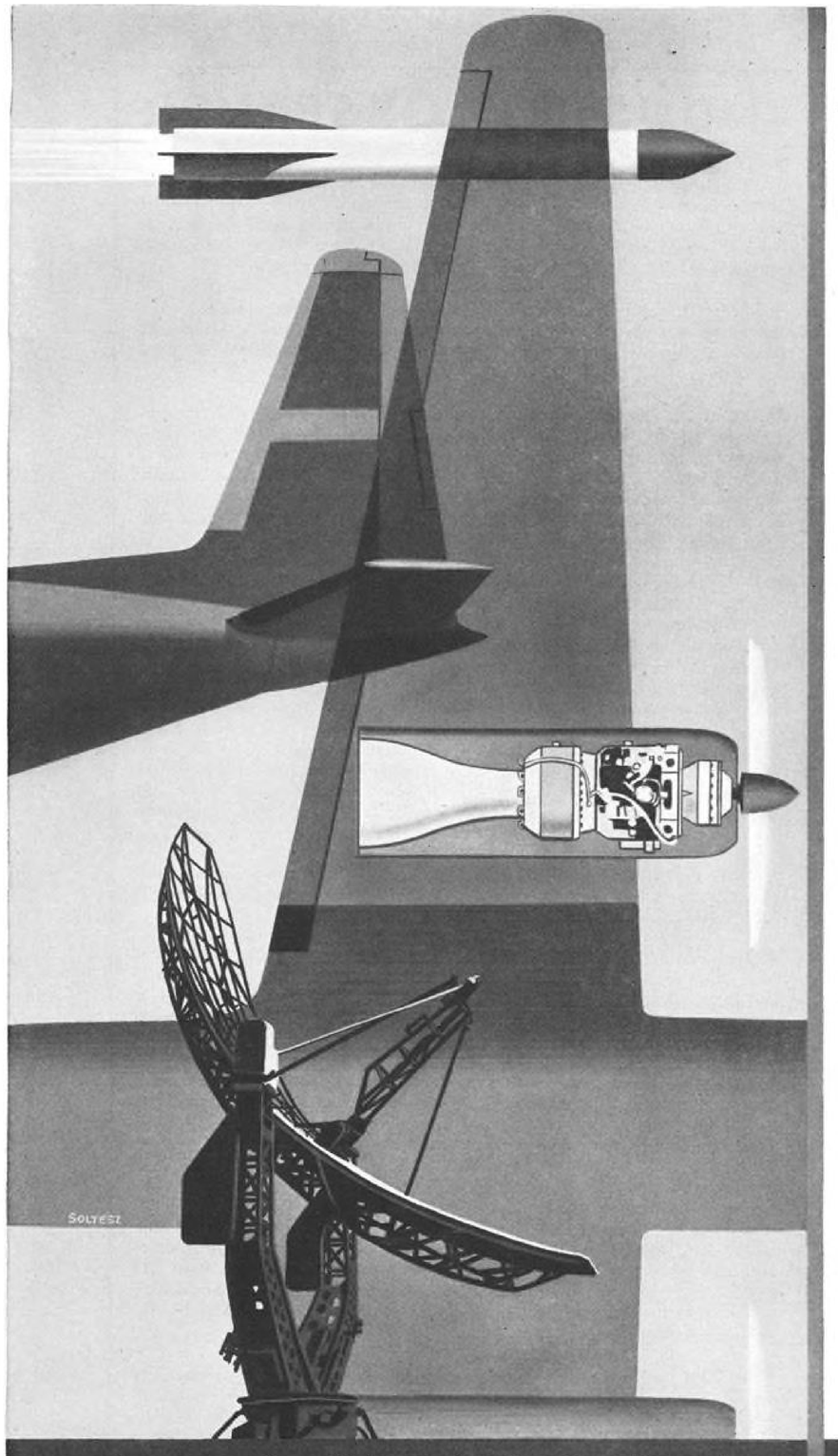
► Omega Aircraft plans to begin limited production this week of its 1,000 lb.-payload flying crane. Entire development was underwritten by the company, which spent approximately $400,000 on the project, about half of it on Civil Aeronautics Administration certification tests. Omega expects CAA certification of the helicopter within the near future.

► **Royal Air Force is counting on a major development stretch in the English Electric P.1 supersonic fighter design to fill its needs for interceptor aircraft for the future rather than any basic new designs. P.1B version of the English Electric design is now operating in the 1,200 mph. speed range.**

► Watch for a direct tie-up between Marquardt Aircraft Co. and Renee Leduc. Roy Marquardt, impressed with the technical quality of Leduc's work, visited the French firm recently and discussed means of keeping the Leduc work alive in the face of French cutbacks (see p. 50). Two possible alternatives were considered—direct financial subsidy by Marquardt of the Leduc ramjet aircraft or hiring of Leduc as a Marquardt consultant which would make his ideas available in the U. S. Leduc's current field of interest includes nuclear ramjets.

► **Army has not relaxed its determination to cut helicopter operating costs despite wide progress in last few years. Transportation Corps Supply & Maintenance Command says improved service life of helicopter components and longer periods between overhauls do not result in enough economy in view of the current austere military budget.**

► Grand Central third-stage rocket for the Vanguard satellite vehicle shows a consistent specific impulse of about 240 seconds.



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Washington Roundup

New Look at Soviets

Top scientific, industry and USAF technical brains met recently in Baltimore at a top secret meeting to take a fresh new look at the relative military airpower strength of the U.S. and the Soviet Union. Meeting was ordered by President Eisenhower and presided over by Dr. Edward Teller, known best for his contributions in developing the hydrogen bomb. Meeting's consensus was that period of maximum U.S. danger from Soviets will begin as early as late 1958 in contrast to earlier estimates that 1960 would be start of the critical period. New improvements in Soviet air defense system against subsonic bombers such as B-47 and B-52 was major factor in the new estimates. Proposals for U.S. action to regain weapons development superiority have been submitted to President Eisenhower through the Defense Department.

No 'Ball-Park' Estimates

Watch for increased USAF efforts to force contractors into supplying more accurate arithmetic. Brig. Gen. W. Austin Davis, assistant for production programming in the office of the Deputy Chief of Staff, Materiel, puts it this way:

"Comptroller functions must be realigned to give much more accurate forecasts regarding funds needed in a given month or quarter.

"These functions," Gen. Davis says, "must also be notified to show a true picture of dollars actually spent to date on a given project. We cannot accept ball-park estimates."

It is no secret that USAF has been irritated by some of the off-base figures offered recently. There were some estimated billings that were wrong by millions of dollars, thus complicating the USAF chore of splitting a limited melon.

In another aside, Gen. Davis has suggested that "industry should take the same dollar-conscious view toward developing systems for the Air Force that it takes toward private projects."

"According to reasonable estimates," the General says, "manufacturers spend upward of 40% more for a government-development program than they do when using their private capital. If pushed to it, I could give specific examples.

"Now I realize there would be a slight and reasonable additional cost due to certain procedures for coordination and security. But 5% should cover this, not 40%."

Missile Decision Hanging Fire

Possibility of a fast decision from the three-man committee studying relative merits of the Army Jupiter and USAF Thor intermediate range ballistic missiles appears remote to some Pentagon observers. Committee is composed of Maj. Gen. Bernard A. Schriever, commander of USAF's Ballistic Missile Division; Maj. Gen. John B. Medaris, chief of the Army Ballistic Missile Agency, and William H. Holaday, Special Assistant Secretary of Defense for Guided Missiles.

In effect, Holaday is sitting as a judge in the Army-Air Force controversy without any highly competent advisers to look over his shoulder. With a lack of sophistication on the subject, Holaday and staff are forced to rely on the principals for their technical information.

Possible solution for the impasse: Defense Secretary Neil H. McElroy may be forced to take over, seek advice from scientists, military experts and industry to find out which missile is best.

New Industry Probe

A House Small Business Subcommittee headed by Rep. Tom Steed (D.-Okla.) is launching an investigation of the aircraft and guided missile industries to see if small firms are receiving a proper share of defense contracts.

ANDB Demise

Air Navigation Development Board officially came to an end last week with a presidential order transferring the agency's personnel, records, projects and funds amounting to $7.2 million to the newly organized Airways Modernization Board. The President's action also approves the transfer of "certain" research and development functions from the Defense and Commerce Departments to the new board but does not effect the Civil Aeronautics Administration program for the testing, evaluation and modification of facilities and devices selected for use in the federal airways system under the CAA six-year modernization plan.

'Awaken U. S.'

All scientists with whom President Eisenhower has talked in recent weeks "agree that this problem of awakening America is one in which they believe I have a part," the President said last week. Science Advisory Committee for Office of Defense Mobilization "is preparing a plan in which they hope to lay out my part of it," the President said, and he will follow the plan if he thinks it is feasible "because I believe exactly what they said."

Committee's chief concern is not relative position of scientific advancement of U.S. and any other nation but "where we are going to be in 10 years," Eisenhower said. The President was "a bit astonished" to learn that. His part will include "awakening the United States to the importance and indeed the absolute necessity of increasing our scientific output of our colleges and universities," even if "material" federal support is necessary.

Third Pilot vs. Engineer

Air Line Pilots Assn. hopes of replacing flight engineers with a third pilot crew member on jet transports has been at least temporarily thwarted at one airline. Pan American World Airways and Flight Engineers' International Assn. last week signed an agreement which called for a flight engineer as a crew member whenever more than two crew members are required by company or Civil Aeronautics Administration regulations.

At its 1956 biennial convention, Air Line Pilots Assn. introduced a resolution that would require all members of a flight crew to be qualified as pilots. However, the Pan American agreement, which runs until June, 1960, clearly spells out the airline's intention to retain flight engineers. The agreement says: "It is the specific intention of the parties that Pan American shall not assign a pilot-engineer, as the term is understood, in place of a professional engineer to perform the engineering function."

—Washington staff

McElroy Releases Pentagon Air Funds

Two orders, revoking Wilson economy moves, restore $170 for research, $400 million for procurement.

By Claude Witze

Washington—Defense Secretary Neil H. McElroy last week revoked two economy orders inherited from his predecessor, Charles E. Wilson, assuring the aircraft industry its bills will be paid on time and partly restoring the shattered basic research program on which future U. S. airpower will depend.

Less than three weeks after taking office at the Pentagon, McElroy took these steps to help unsnarl the tangled procurement situation that has had the aircraft and related industries in a quandary for several months:

- **Restored basic research** programs of the military services to the levels authorized by Congress. This was done by reversing a Wilson order of Aug. 17 that demanded a cut of $170 million in the amount of procurement and production funds used to support research, development, testing and evaluation (AW Oct. 28, p. 28).
- **Assured contractors** that Defense Department will pay its bills when due and allow higher profit margins to those who can reduce their need for financing by the government.
- **Provided an extra** $400 million in funds that can be spent by Jan. 1, lifting the $19 billion ceiling imposed by Wilson by a little more than 2%. McElroy did not alter the Wilson-fixed goal of $38 billion for expenditures in the fiscal year ending next June 30.

USAF experts were speculating at the end of the week that the Air Force may receive as much as $300 million of the additional $400 million made available for the first half of the 1958 fiscal year. What proportion of this would be allocated to procurement and production has not been determined.

McElroy's action, a high-ranking Air Force procurement officer told AVIATION WEEK, "eases our pain" and will permit USAF to continue its current procurement schedule. This officer hastened to point out, however, that, while Wilson's ceiling of $19 billion for defense outlays up to Dec. 31 was raised to $19.4 billion, the June 30, 1958, ceiling still stood at $38 billion.

New Debt Ceiling?

In other circles, including the White House, there were strong indications that the Administration is weakening in its strong stand for a $38 billion limit on defense for the fiscal year. President Eisenhower said the figure is not sacrosanct and was proposed by the Joint Chiefs of Staff at least two years ago.

There were reports in Washington that the embarrassing shortage of money, combined with new evidence of Russian defense progress, also has made inroads on the Administration's determination to avoid asking Congress to raise the $275 billion limit on the federal debt.

Secretary of the Treasury Robert Anderson, himself a former Deputy Secretary of Defense, was rumored to have approved a program to raise the debt ceiling. This would be possible by congressional action early next year. It presumably will be necessary if expenditures stay high and early tax returns fail to ease the Treasury's debt problem.

A number of Administration officials, headed by the President, appeared to take notice of the wide feeling, particularly in the aircraft industry, that the government was in danger of becoming a poor risk as a customer.

The White House made reference to the possibility that the U. S. would stand bankrupt before the world if it did not pay its bills.

A meeting of the Commerce Department's Advisory Council of top business executives at Hot Springs, Va., received an unexpected visit from McElroy, Vice President Richard Nixon and Presidential Assistant Sherman Adams.

McElroy gave his personal assurance to the guests that their bills will be paid.

Aircraft Industry

So far as the aircraft industry is concerned, recent talk of wide stretchouts or cutbacks to meet the financial crisis last week were abandoned. It was clear that major contractors will be forced to borrow money in order to meet McElroy's request that they "support on a continuing basis a somewhat greater proportion of their inventories and work-in-progress."

A USAF spokesman said contractors have been notified that the original program of allocating sums to each company and ignoring bills beyond that level has been abandoned. Holders of cost-plus-fixed-fee contracts will face a reduction in progress payments but not until after an agreement is reached on the extent to which they will provide their own financing.

Under fixed-price contracts, progress payments already are limited to 70%. In both cases, it was clear, higher margins of profit will be allowed where justified to help the contractor meet the cost of borrowing money to finance his own inventories and work in progress.

This action also was a reversal of the doctrine under Wilson, who said at his last Pentagon press conference no exception would be made to the Armed Services Procurement Regulation banning interest as an allowable contract cost.

The Air Force emphasized that target expenditure figures will be set for each contract, and the Air Materiel Command, as well as USAF headquarters, will monitor the figures month-by-month.

Secretary McElroy said the "increases in contractor investment"—which have replaced a limit on billings as a source of relief for the Air Force—will be worked out in negotiation. "It is to be understood," he added, "that capital investment by the contractor will be taken into consideration in determining a fixed fee or allowable profit."

Protection for subcontractors, particularly small business, is stipulated in the McElroy memorandum. The Secretary said any subcontractor who feels his ability to continue production is jeopardized by the prime contractor should complain directly to the Assistant Secretary for Materiel in the proper military department.

Estimated loans that will be sought by a half-dozen big aircraft firms range from $60 million to more than $200 million. It was generally assumed that the large companies with substantial standing credit will bear the largest share of the financial burden.

Research Reversal

In the area of basic research, McElroy's reversal of the Wilson order of Aug. 17 was taken as proof that he does not agree with Wilson's traditional attitude of discounting the value of this work to the department.

Actually, a great deal of damage already has been done to the research effort of the military, and particularly the Air Force. This is because of the discontinuity forced on contractors who engage in research work, such as universities and private laboratories.

Now, however, the program is expected to grow more healthy as it returns to the level authorized by Congress. Restoration of the funds lifted by Wilson will have no effect on this year's expenditures but will bring about an improvement in the running programs, most of which will be paid for in coming fiscal years.

Fewer Signs of Fear

Generally, the aircraft industry last week showed fewer signs of fear over a possible drastic reduction in production programs. Some plants still expect to trim payrolls, but the talk is in terms of a 5% to 10% reduction, most of which can be achieved by attrition. A few weeks ago, when it looked as if the Wilson orders were going to stand, there were reports that some companies awaited a payroll slash of as much as 40%.

While a number of congressional sources indicated there will be a clamor for an over-all review of defense spending when the new year starts (see page 32), the defenders of the balanced budget and lower tax rates were clearing their guns to continue the fight.

Air Force R&D Spending

Melbourne, Fla.—Current USAF spending in the field of research and development is running at an average rate of $57 million a month, down from $60 million a month in Fiscal 1957. Comparable rate for Fiscal 1956 was $53 million a month; for Fiscal 1955, $44 million a month.

Figures disclosed here last week by Richard E. Horner, Assistant Secretary of the Air Force for Research and Development, show that USAF started this Fiscal year on July 1 spending at a rate in excess of last year's $60 million before running into the expenditure ceilings imposed by former Defense Secretary Charles E. Wilson.

Horner told the National Security Industrial Assn. that the changeover from control of the budget on the basis of obligational authority to control by expenditures has resulted in recognized hardships for contractors. This was due, he said, to the necessity for reviewing each contract.

"We had to decide whether to continue supporting it at the present level, to stretch it out, to cancel or to renew when it expired.

"Most of the review stems from analysis at the (Air Research & Development Command) centers. Here many individual judgments had to be made.

"In this transition period with new procedures being established and a whole series of decisions resulting from this critical review, much regrettable confusion has been caused."

Horner said USAF is determined to support as much research as it can, but "the basic issue is what contracts can compete successfully for dollars during any given time period."

U.S. Accelerates Moon Plans

Washington—U. S. is making an about-face and hopes to accelerate plans for an unmanned moon flight in view of Soviet advances in this field. Active in investigating feasibility of launching space projects in shortest possible time are two key agencies:

- New committee comprised of top scientific and aeronautical personnel, two of whom are James Doolittle, chairman of the National Advisory Committee for Aeronautics, and noted nuclear physicist Edward Teller. Such a group recently met in Baltimore (see New Look at Soviets, p. 25). Major companies have been requested to submit unmanned moon trip proposals. North American Aviation already has volunteered its plan to put a transmitter on the moon or direct a vehicle around it.
- Air Research and Development Command, now considering possibility of inaugurating a Phase II followup for Project Farside, recently completed under sponsorship of Air Force Office of Scientific Research in conjunction with Aeronutronic Systems Inc.

Phase II would contemplate an unmanned trip to moon or its vicinity. Phase I was aimed at reaching a 4,000-mi. altitude.

Latest data now in the hands of ARDC shows that at least one Farside rocket gave telemetered information to about 2,400 mi. and that signals recorded indicated the four-stage rocket was functioning to go the full 4,000-mi. target height.

Proposals already made contemplate that the moon program will be accomplished in less than a year's time, given reasonable financial backing. Some government circles feel period involved is too long in view of the Russian threat, but it isn't likely that too much of the year's period will be shaved.

Two general approaches are being considered for pinpointing the moon or a path in its general peripheral vicinity:

- Use of off-the-shelf rockets now in existence to minimize costs, speed program and offer no interference with ballistic missile program.
- Use of military ballistic missile rockets as boosters, coupled with other rockets as succeeding stages.

This is the plan likely to be followed in industry proposals. If adopted, project would be Gen. Bernard Schriever's Ballistic Missile Division.

Under the off-the-shelf rocket approach, propulsion units probably would include such rocket motors as Thiokol Sergeant or Aerojet-General Jupiter Senior, originally developed for Navy's Polaris fleet ballistic missile but not now being used.

These and other off-the-shelf items could qualify for combination into three- or four-stage vehicle tentatively planned to haul a 50-lb. payload to the moon or its vicinity.

Payload would include instrumentation and batteries, which would be designed to last at least five days by having transmitter sending intermittently.

In AFOSR approach, first stage would be long-burning, slow-acceleration rocket motor to avoid high heating of projectile in lower, dense atmosphere. Then, intermediate stage or stages would take over. Final stage, which might have thrust of about 50,000 lb., would impart just enough speed to take projectile out of earth's gravitational field and into moon's gravitational field, relying on the latter to draw in rocket projectile with its transmitter. Premise is that, even if direct trajectory were missed, projectile would be drawn into it in a curved path as it passed the moon.

If AFOSR is delegated by ARDC to carry out the project, Aeronutronic Systems Inc. probably will be selected as prime civilian contractors. Aeronutronic probably would act as systems manager but would share actual work on the project with some other designated contractors.

If project is specified to use military booster rockets, probably only Convair's Atlas ICBM or Douglas's Thor IRBM are in the picture. The North American Aviation liquid-propellant power-package for Atlas would include two 135,000-lb.-thrust barrels teamed with a 65,000-lb. barrel, using JP4 and liquid oxygen. Thor would have single North American 160,000-lb.-thrust barrel firing on same fuel. Army Jupiter, also using this same powerplant, conceivably also could be used, but this is not likely since the project would be under USAF cognizance.

Guidance will have to provide high accuracy. Figures advanced are that, at final stage burning cutoff, about 75 feet per second accuracy will be required in speed, along with accuracy of about one degree in angularity.

One industry combination suggested is Lockheed and North American, but North American probably would only be interested if it can take on the project alone. North American already has exact figures to substantiate its proposal.

Aerojet-General also has been alerted by its management for possible participation in the moon project.

House Probes Cutler Speech Attacking Missile Monitor Story

Washington—House Government Information Subcommittee last week began a preliminary investigation of reports that Presidential Assistant Robert Cutler referred to a story published by AVIATION WEEK as "treasonable" and suggested to a group of leading businessmen that advertisers should boycott the magazine.

The story, which appeared in the Oct. 21 issue, page 26, revealed that Russian missile firings have been tracked by the U.S. from Turkey for more than two years.

Chairman John E. Moss (D.-Calif.) has ordered the Information Subcommittee's staff to investigate Cutler's remarks. The staff has written to Cutler asking for a full explanation. The decision as to whether the subcommittee itself will hold hearings on the incident will be determined by Cutler's reply.

Cutler spoke Oct. 26 at a dinner meeting in Hot Springs, Va., following a two-day meeting of the Commerce Department's Business Advisory Council. The dinner was attended by Council members and their wives.

Council meetings are closed to the press on the theory that businessmen will advise the government more freely in private. The dinner also was closed to the press.

Cutler is Special Assistant to the President for National Security Affairs, chairman of the National Security Council's Planning Board, a member of the Security Council's Operations Coordinating Board and a member of the Council on Foreign Economic Policy.

AVIATION WEEK could not reach Cutler last week for comment, although it was in touch with his office several times.

Reply by Proxy

By late last week, his only public comment on the incident was relayed through Presidential Press Secretary James C. Hagerty in response to inquiries. Hagerty did not attend the dinner. He told AVIATION WEEK that Cutler denied accusing the magazine of treason and denied suggesting an advertising boycott.

Cutler said, according to Hagerty, that he had told the dinner meeting that publication of the Turkish radar story was "not treason but a shameful thing" and that it "probably would be a crime under law." Hagerty said he did not know what law Cutler had in mind.

Hagerty quoted Cutler as saying that "at no time in the speech" did he mention treason or advertising. Hagerty said Cutler reassured himself of this by referring back to his notes.

Other reports contradict Cutler's version of what he did, as relayed through Hagerty.

The Associated Press quoted businessmen who attend the meeting as saying Cutler "violently" condemned AVIATION WEEK, used the word "treason" three times, called the publication of the article "prosecutable" and suggested that "you advertisers" might wish to reconsider advertising policies.

Cincinnati Times-Star's Washington correspondent Douglass M. Allen wrote that "a White House official has made a shocking attempt at censorship of a legitimate national publication by suggesting an advertising boycott."

This is "the carefully-checked word vaulting the mountains from Hot Springs, Va.," the Times-Star said. Cutler said AVIATION WEEK "had committed an actionable breach of security, skirting treason," the Times-Star added.

'Advertising Boycott'

The newspaper said Cutler was asked, "If it is actionable, why don't you take it to court?" Cutler replied that the government did not want to call further attention to the story, the Times-Star said.

"But he added, in approximately these words: 'If any of you here advertises in this publication, I suggest that you search your souls before you give it further support.'"

The Journal of Commerce on Oct. 29 reported that "two versions of an incident" at the Hot Springs meeting "have Washington buzzing.

"According to persons who attended the meeting," the Journal said, "an advertising boycott of a magazine that had published a story the Administration considered dangerous to national security was suggested by President Eisenhower's Special Assistant for National Security Affairs.

"Robert Cutler, the special assistant, denied having told a dinner meeting of the council that a story published by the magazine AVIATION WEEK was 'treasonable' or that he had suggested that advertisers in the room might reexamine their advertising policies with regard to that publication."

But, the Journal added, that, according to persons who attended the meeting, Cutler "labeled the story as 'treasonable' in response to a question." He did not name AVIATION WEEK but referred to it as a weekly magazine selling for 75 cents, and "no other weekly magazine in this price category published such a story," the Journal said.

The Business Advisory Council "is made up of 60 active members plus an additional number of 'graduate' members, adding to about 100 of the nation's leading businessmen," the Journal said. "Some of the largest advertisers in the U.S., if not the largest, were present."

The Journal's account of the Cutler-to-Hagerty denial reported Hagerty as relaying that "at no time did (Cutler) mention advertising one way or another."

Albert Leman, chief press officer of the Commerce Department, attended the dinner, but he told AVIATION WEEK "everyone is dealing with memories here" and would not attempt to use his memory to try to recall what was said. Leman said he would try to answer specific questions "as to what was not said," but Cutler's remarks "were quick passing references," and no record of them was available.

Leman said his recollection of what Cutler said or did not say is "fully in accord with what Jim (Hagerty) said."

Lloyd Wright, who headed the Commission on Government Security, told reporters here that he regretted "that anyone would not think more clearly of the possibilities of assisting the enemy before publishing that type of thing" (the AVIATION WEEK story). "Mind you," Wright said, "I think a lot of the government's security classification is nonsense. On the other hand, no private citizen has the right to usurp the powers of duly constituted authorities."

Wright's commission, a group of 12 citizens appointed by the President, Vice President and Speaker of the House, recommended a 106-section bill which includes fines and imprisonment for newsmen and others who disseminate government "secrets."

Army Awards

Washington—Army last week awarded its Legion of Merit to Maj. Gen. John B. Medaris and its Exceptional Civil Service Award to Dr. Wernher von Braun for their contribution to Army's Jupiter intermediate range ballistic missile.

Awards came at the third annual meeting of the Association of the U. S. Army. Gen. Medaris commands the Army Ballistic Missile Agency at Huntsville, Ala., and Dr. von Braun is Director of the Development Operations Division of Army's Redstone Arsenal there.

Army Secretary Wilber M. Brucker, presenting the award to Dr. von Braun, called Jupiter "this nation's first intermediate range ballistic missile" and "the most advanced guided missile yet produced in the free world."

U.S. Press Endorses Missile Radar Story

Following are editorial comments from some of the nation's leading newspapers on Aviation Week's decision to publish a story on the U. S. radar base in Turkey (AW Oct. 21, p. 26):

Radar Message

Los Angeles Examiner And the Hearst Syndicate

Disclosure that United States long-range radar, based in Turkey, has been tracking Soviet missile tests since the summer of 1955 indicates appalling complacency by the Administration and the Pentagon.

Certain unnamed spokesmen for the Administration are angry at AVIATION WEEK, the magazine that broke the story, on the grounds of publishing classified information. It appears more likely the Administration anger is the fury of embarrassment.

From whom was this information classified?

On the facts of scientific detection, it is almost impossible that the Russians did not know of our radar establishment in Samsun on the Turkish Black Sea coast. Any device that emits powerful electromagnetic radiation does not remain a secret very long.

The Turks knew about it, naturally, and so did the Administration and the Pentagon. It is the American public that was "classified" out of knowing.

The Administration and the Pentagon would have done better to worry less about keeping the radar tracking secret, and worry more about its meaning.

In 1955 the radar began recording data on Soviet intermediate range missiles, fired at Russia's chief missile base at Krasnyy Yar, northeast of the Black Sea.

In 1956 the radar picked up a shift of firing pattern that indicated these missiles were in actual production.

Late in 1956 the radar picked up the first test flights of the multi-stage development of the intercontinental missile.

During this time, our satellite project continued to be separated from missile development, and missile development continued to be a matter of rancor and rivalry among the armed services.

So that radar screen in Turkey has done something more than pick up Soviet missile achievements. It reflects also the laggardness of the Administration and the Pentagon in facing up to the facts.

Maybe Sputnik has changed all that. We hope so.

Matter of Fact

By Stewart Alsop

New York Herald Tribune Washington Post and Times Herald And Herald Tribune Syndicate

CERTAIN VERY large and ugly cats have been let out of the bag in recent days. These revelations cast a new light on the Eisenhower Administration's policies in the race with the Soviet Union for superiority in ballistic missiles. And in the now inevitable full dress investigation of those policies, the cats that have been let out of the bag are going to be very hard indeed to explain away.

Cat No. 1 was the report in the authoritative technical magazine, AVIATION WEEK, that a radar tracking system in Turkey has been monitoring tests of ballistic missiles in the Soviet Union for more than two years. The report has not been denied for the simple reason that it is true—the existence of the radar system, which is of course known to the Soviets, has been common knowledge among those who interest themselves in such matters for a long time.

The meaning of this particular cat-out-of-the-bag is quite obvious. The Administration has not had to guess about Soviet progress in the missile field, or to rely on doubtful secret intelligence reports. It is known, without the slightest room for doubt, that the Soviets have tested hundreds of the shorter range strategic missiles, scores of the intermediate missiles, and this year at least eight missiles of intercontinental range.

The Administration has known, in short, that the Soviets have been rapidly outdistancing this country in the ballistic missile race, whose outcome will predictably determine the future balance of world power. And this is where cat-out-of-the-bag No. 2 comes into play.

FOR CAT NO. 2 concerns the Administration's reaction to the hard intelligence of Soviet missile progress. This cat is emerging little by little, and is not entirely out of the bag yet. The Washington Post, for example, recently reported an order by former Secretary of Defense Charles Wilson which last summer cut research and development work, largely on missiles, by some $170 million.

The order, successfully concealed for a long time, came right on the heels of the first detection by the radar monitoring system of Soviet tests of intercontinental range missiles. Other parts of the cat are also out of the bag, like the order limiting work on the American ICBM to a five-day week, with no overtime, and the heavy cuts in Air Force procurement, including procurement for the Strategic Air Command.

Some parts of the cat have yet to emerge fully, like the economy-dictated slowdown in the schedule for "Titan," the Martin Co.'s vital ICBM project, by a full 10 months. But the essential fact, which the forthcoming congressional investigation is certain to establish, is simply this: the Administration reacted to hard intelligence of Soviet technological progress, especially in the missile field, by sharply cutting back on our own efforts in that field.

A FURTHER FACT can also be established—that the Pentagon powers that be, knowing the facts, sought to conceal them. An obvious attempt to conceal the $170 million research and development cut was made. An obvious attempt to hush up information on Soviet missile development was also made.

For example, when early in July it was reported in this space that the Soviets had achieved a successful test of the ICBM, an influential senator, who is also a member of the Armed Services Committee, checked the story with the highest Pentagon authorities. He was flatly assured that it was untrue—this despite the fact that the radar tracking system had by that time recorded a number of Soviet ICBM tests.

All in all, Administration spokesmen called to testify before the investigating committee are going to have to do some tall explaining. The facts, of course, are not all on one side. The defenders of the Administration can say, with perfect justice, for example, that there was no serious missile program at all in the Truman years, which is a main reason why this country is so frighteningly far behind the Soviets in the missile race.

And yet one thing is already clear. The Sputnik as a visible symbol of the Soviet technological lead has suddenly and sharply eroded President Eisenhower's reputation for all-knowing wisdom in defense matters. This reputation has heretofore protected the Administration's

defense policies from politically effective criticism—as witness the bored yawns which greeted the sensational testimony before the Symington Airpower Committee last year.

Now, thanks to Sputnik, defense is sure to be a major political issue, and the subject of a major national debate. And that, in a democracy, is precisely as it should be.

Sputnik and Secrecy

The Hartford Courant

From time to time the American people hear pleas for freedom of information, otherwise known as the people's right to know. Naturally they are for it, but they hardly get excited about it. Mostly, no doubt, they put it down as a matter of newspapers wanting to get more stories, so that they can sell more papers.

Actually the Public's right to know is the foundation for self-government. Freedom without knowledge is no freedom at all. How can the people govern themselves if they don't know what is going on? In Sputnik, and in all that has followed about missiles and rockets and Soviet technical achievements, every one of us has had an object lesson in what it means not to know what is going on. Sputnik has changed the attitude of the world toward us and has, indeed, changed the world we live in.

* * *

Yet this shock was largely unnecessary. It wouldn't have happened if the American people had known what was going on. For years newspapers and scientists have been knocking on the doors of the Pentagon with a plea that the American people be told about their military strength, especially as regards scientific progress. But the doors have been closed. To this day we keep them closed to the point of silliness. For example, at considerable cost the government buys Russian scientific and other periodicals, which are sent to the Pentagon for translation. But, once translated, they are classified by the Pentagon—and so kept secret from the very scientists or technical magazines or others who could learn from them and so help us react with vigor.

Meanwhile the Pentagon assures us that everything is in order, that our military hardware is coming along fine. In general it acts on the premise that anyway nobody can ever overtake us. It was through the false front of complacency thus built up that Sputnik came crashing, beeping its way at 18,000 miles an hour. And now we have another in the long series of shocks that has followed. AVIATION WEEK has published the news that, for more than two years, the United States brass has known much about Soviet triumphs in developing and producing both intermediate and intercontinental missiles. We have tracked the missiles as they are fired within Soviet Russia, with an exceptionally powerful radar system set up in Turkey. In an editorial the magazine argues that this hitherto secret fact is not really a secret at all—from anybody except the American people, who are most vitally affected by it.

The Russians have known about it for some time and there is little they can do beyond what they are already doing—threaten Turkey where this radar equipment is located. We have known about it for more than a year. News of this operation can be obtained in Athens' cafes, Pentagon corridors, Los Angeles cocktail parties, and avionic professional society gatherings. Bits and pieces of the story already have appeared in public prints of several nations.

Secrecy about things that everybody knows except the American people helps explain the false sense of security in which we have been living. And in that false sense of security it has been possible for the Defense Department, day after day and week after week, to knock off one after another various items that have made up our strength—all the way from research in pure science to airplanes to infantry divisions in being.

No doubt the cutting of military expenditures has suited the national temper. We have shouted for tax cuts. We have wanted nothing so much as to be let alone in peace, to enjoy and develop still further the highest standard of living in all history. The trouble is that Khrushchev & Co. just aren't going to let us alone in peace.

* * *

And now, in the minds of the whole world, the technical leadership that once seemed ours by divine right has been snatched from us. No doubt we are far better off today than we and the rest of the world think. The trouble is we don't really know. What this situation demands is leadership—leadership that will tell us the truth, and then tell us what to do. The American people will respond.

'Security' Can Be Suicide

The Wichita Beacon

Elsewhere on this page, we reprint an editorial by Robert Hotz, editor of authoritative AVIATION WEEK magazine, which questions the wisdom of keeping secret from the American people the facts about the development of Russian missiles, satellites, etc.

We urge everyone to read it. We believe that the policy of keeping secret the dangers that threaten America can in the long run be suicidal.

All of us who write for the public prints have at times come into conflict with the brassbound brains of certain not-uncommon types of military idiots.

At the beginning of the B-29 program here during World War II, the word was "hush-hush." About a third of the adults in Wichita were helping to build the machines. The little children watched them as they flew over the city and cried, "Look at the B-29s." Presently the bombers were clobbering the enemy. And at long last the military released for publication the information that anybody could find out. Such foolishness may be excusable under the stresses of war. The censorship did not, however, serve any purpose except to gratify the vanity of the censor.

In peacetime there is something suicidal about such unreasonable censorship. It is dangerous for two reasons:

1. When secrecy concerns progress of the enemy, lack of knowledge on the part of Americans and their congressmen can create a fool's paradise. Americans have a right to know the seriousness of the dangers that threaten them.

2. When secrecy involves our own progress, lawmakers, scientists and the general public have no sources of information. They do not know whether the country is defended well or badly. They have no way of deciding whether more or less money should be devoted to defense. And scientists are often unable to obtain the results of previous research.

There are, of course, facts which must be stamped "Top Secret." Nobody has any quarrel with the concept of true military security. The danger lies in the fact that certain types of arrogant military men do not seem to realize that they are accountable to the American people and that they depend on the American people for co-operation.

An Insult to American People

The Milwaukee Journal

Certain comments of the Secretary of State in his latest news conference should not go unnoticed or unchallenged. They are an insult to the American people.

Dulles said that the Russian satellite is a useful thing if it arouses "the whole country" to the importance of the nation's missile program. He indicated that the Administration had realized all along the importance of missiles and the degree of Russian advances in the field, but that Congress and the people were generally not awake to the problem.

There is, of course, growing doubt that the Eisenhower Administration did realize the importance of missiles and the fact that the Russians were moving ahead. But of this, more in the future.

Now we would like to make the point that if the American people were not awake to missile problems the blame rests primarily with two men. One is Dwight Eisenhower. The other is John Foster Dulles.

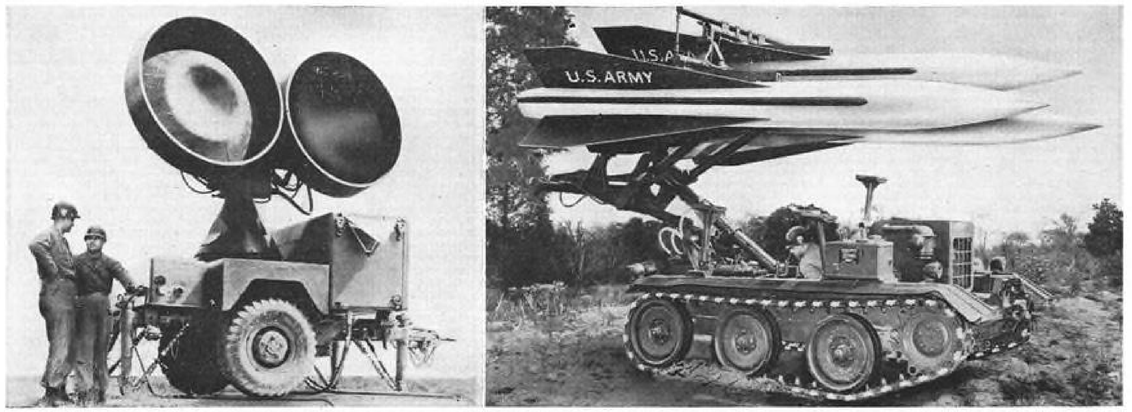
When has either advised the people as to the importance of the missile program? When has either warned that the missile program was lagging or that they needed more money to spur it? When has either tried to stir public concern by pointing out the Russian advance?

It is the terribly tragic truth that Eisenhower and Dulles, by and large, have sought to lull the American people, convince them that everything was under control, and assure them that the United States had the best of foreign policies, defense programs, weapons and leadership.

For five years, the American people have been fed little but bland assurances, pollyanna optimism, pious platitude and double talk superrefined by smooth public relations experts. Americans, along with the people of the world, have been told over and over and over again of this country's moral virtue, political rightousness, economic and cultural superiority, scientific and military genius and incomparable right to world leadership.

So is it any wonder that American people have been complacent? Is it any wonder they are shocked when they learn that the so-called "backward Russians" have overtaken them in a major scientific development? Is it any wonder that there is mounting criticism and questioning because it is not an American satellite coursing over our heads?

And how shockingly ironical that, at such a time, Secretary Dulles, of all people, should try to convey the impression that it is "the people" who are to blame for the situation in which the nation now finds itself!



Hawk Displayed on Loader

Tracking and guidance radar (left) and motor driven missile loader (right) for Army's Hawk missile. Designed for use against low flying aircraft, Hawk will supplement Nike ground-to-air missiles in this country and will also be used to defend tactical units in the field. Hawk reportedly uses Doppler radar techniques to discriminate target from ground clutter and for semi-active terminal guidance.

Sputnik Is Radiating Strong Infrared Signal

Cambridge, Mass.—Discovery that the Soviet earth satellite is radiating a relatively strong infrared "signal" is expected to focus military interest on infrared as a useful means for detecting intercontinental ballistic missiles for ICBM defense. Reason for Sputnik's strong infrared radiation is not fully understood.

Relatively crude infrared radiometry equipment, hastily applied to the task, has successfully detected the Russian satellite on a number of passes over the Boston area during the last several weeks. Simultaneous visual sightings confirm that the source of infrared radiation was the satellite.

Infrared sightings of Sputnik were made by Myron Block, head of Block Associates, an infrared consultant to Massachusetts Institute of Technology's Naval Supersonic Laboratory and to Air Force Cambridge Center. Several companies, including Baird Associates, Barnes Engineering and General Electric, reportedly are following Block's discovery and establishing detectors.

Initially, Sputnik's strong infrared radiation was attributed to reflection of infrared radiation from the sun and/or due to solar heating of the satellite shell. However, Sputnik continues to put out infrared radiation at night long after its shell presumably should have cooled and when there is no obvious source of solar energy. Radiation intensity is higher than expected from any or all known sources, prompting some scientists to suspect a heretofore unknown phenomenon, Block told AVIATION WEEK.

Clue to the source of Sputnik's radiation may come soon when Block, and others, begin to make spectral analysis of the received radiation. Radiometer used by Block employs an uncooled lead sulphide detector which is sensitive only at shorter wavelengths, out to about three microns. Use of wide-range bolometer type detector will permit more complete spectral analysis.

Radiometer used in Block's sightings has a field of view of approximately 26 deg. x 2 deg. with the long-side set at right angles to Sputnik's predicted flight path. As satellite passes through the short-side for a brief interval, its infrared radiation is recorded on an oscillograph simultaneously with a time signal from National Bureau of Standards radio station WWV.

Infrared satellite sightings are not possible, with existing equipment, when sky is overcast. The inability of infrared to penetrate heavy overcast is generally viewed as a serious handicap for early warning use, compared to radar. However, for ICBM defense, infrared detection equipment could be installed in an airborne vehicle designed to operate at high altitudes.

Sputnik May Spur Overall Defense Probe

By Katherine Johnsen

Washington—Soviet earth satellite probably will lead to congressional action far beyond the limits of prodding the satellite and missile programs. There were these developments:

• **Sen. Lyndon Johnson** (D.-Tex.), Senate majority leader and chairman of the Preparedness Subcommittee, expected to take the lead in evaluating the whys and wherefores of the Soviet triumph, declared "it may be that our whole defense structure needs a thorough overhaul from top to bottom."

• **Rep. George Mahon** (D.-Tex.), chairman of the House Appropriations Subcommittee on the Armed Services, expanded plans for a recess survey in the field of the missile program. The subcommittee will start its closed-door sessions in Los Angeles with Maj. Gen. Bernard A. Schriever, commander of USAF's Air Research and Development Command's Ballistic Missile Division, and William M. Holaday, special guided missile adviser to the Secretary of Defense.

• **Sen. Estes Kefauver** (D.-Tenn.), second ranking member of the Preparedness Subcommittee, called for a civilian cabinet-level secretary to oversee all scientific research and development. This is a recommenation that also has been made by Sen. Mike Mansfield (D.-Mont.), Senate majority whip (AW Oct. 28, p. 29).

'Sufficient Stature'

In line with the widespread congres- cabinet-level secretary to oversee all Kefauver commented: "The Navy and Air Force are vying for the top responsibility. Over these, the Secretary of Defense has been the supreme authority, but this program (missile and satellite) is not his principal responsibility and he is not chosen for his knowledge of, or interest in, basic research.

"Furthermore, the program is not purely military in nature and both the Air Force and the Navy are principally interested in military developments.

"Therefore . . . one of the first things we should do to get our program off the ground is place within the government a man of sufficient stature and position to command respect. . . ."

After West Coast conferences with guided missile contractors, Mahon's subcommittee has scheduled closed-door sessions with Secretary of Defense Neil H. McElroy and Deputy Defense Secretary Donald A. Quarles in Washington for Nov. 20 and 21.

The group will then proceed to the Redstone Arsenal.

Over the past year, Mahon has been in the forefront in the increasing congressional clamor for less competition and less dollar "waste" in the missile program (AW May 20, p. 30).

What Johnson Wants

Sen. Johnson reported the four questions he has directed the staff of his Preparedness Subcommittee to answer as the basis for public congressional hearings. They show the line the Senate inquiry will take:

• "**Could we have matched** the Soviet achievement?"

• "**Would it have been** worthwhile to match the Soviet achievement?"

• "**Does the Soviet satellite indicate** that this country has slipped behind in the development of its defenses?"

• "**If so, what do we** have to do to catch up?"

The comments of Sen. Johnson—indicative of the general congressional sentiment against increased defense expenditures—are:

"The mere fact that the Soviets can put a satellite into the sky does not alter the world balance of power. But it does mean that they are in a position to alter the balance of power. And they will do it if we remain where we are. The satellite may be little more than a scientific toy. But a nation that can produce such a toy can produce anything else that is conceivable. We must assume that the Soviet Union can produce any bomb, any rocket, any weapon that we can produce. It is only a question of time and even that may not be much of a question. . . .

"There is no point in spending more money unless we first know that the money already spent has been used wisely. And there are certainly ample grounds for suspecting that some serious errors have been made."

The missile programs, Johnson continued, "have been the subject of constant bickering among the three services. It has meant inter-agency battles fought with all the fierce intensity—although not the bloodshed—of war itself. . . .

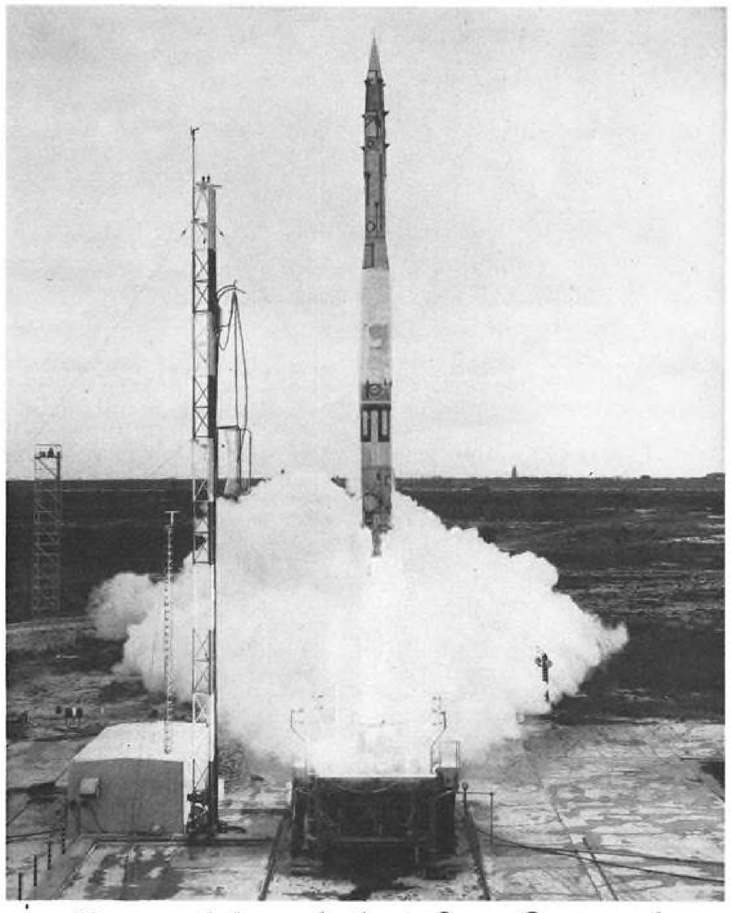
"It may be true that this country was in no race to produce the satellite. . . . But certainly the armed services were engaged in a race with each other to control the guided missile. And we cannot afford many more races like that. . . .

"The independence that was accorded the three branches was not intended to be an invitation to waste motion. And waste motion is the one consistent theme that seems to run through the missile program. . . ."

Without passing judgment on the charges and counter-charges among the services on missiles, Johnson concluded:

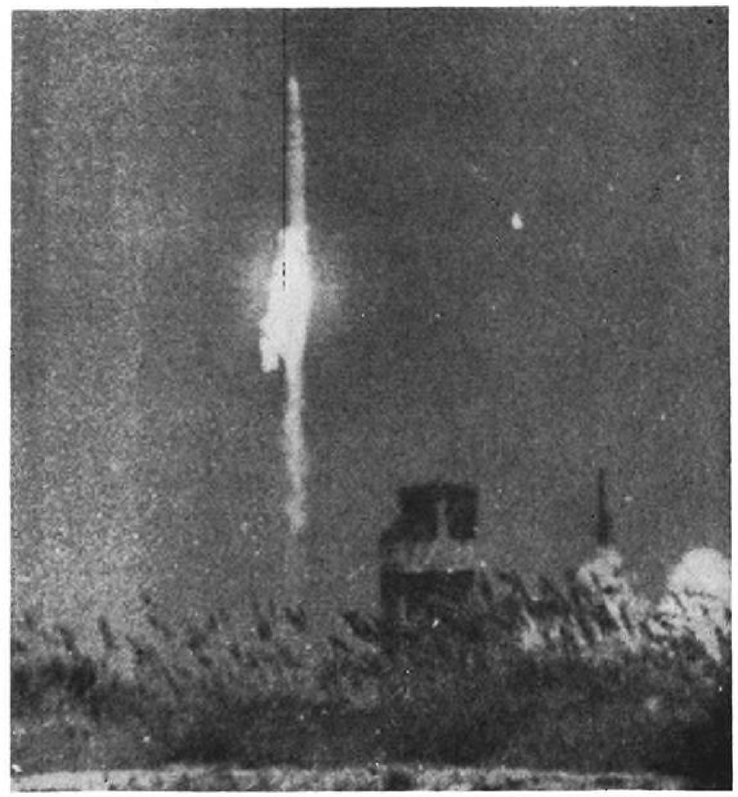
"It is clear that the people working on missiles needed introductions to each other. . . .

"We will be able to solve the problems of the satellite and the missile only if earnest men work together with cooperation as the watchword. And this represents the most important defense issue that will be before Congress in the months that lie ahead. We will have to find ways and means of bringing some unity into our weapons development program. We cannot permit this glaring gap to continue."



Vanguard Launched at Cape Canaveral

Vanguard TV-2 test vehicle is fired at Cape Canaveral, Fla., to test the General Electric first stage engine for the satellite project (AW Oct. 28, p. 25). Vehicle reached 109-mi. altitude and speed of 4,250 mph. during 140 sec. flight.



Another Thor Fired Successfully

Air Force Thor leaves launching pad at Patrick AFB, Fla., in its third successful firing. Firing of the Douglas intermediate range missile came amid a flurry of missile launchings at the Florida test site (AW Oct. 28, p. 25).

Air Force May Split Production of WS-110

Washington—Air Force contract in WS-110A chemical bomber competition between Boeing Airplane Co. and North American Aviation Inc. may be divided between the two companies. Air Force feels it shouldn't award the complete job to the winner on the theory that this would glut the winner, starve the loser.

Under this theory, the winner would have management responsibility for the weapon system along with the bulk of the project, while the loser would get a good part of the detail design and production.

Another troublesome factor bothering high Air Force officials is the question of the number of WS-110 bombers that could be put into production, since the cost of providing for high flight temperatures, advanced equipment and the burden of new manufacturing techniques may involve a price many times that of Boeing's B-52.

Both North American and Boeing WS-110 designs contain a considerable amount of high-temperature sandwich construction—North American featuring stainless steel honeycomb panels; Boeing titanium alloy sandwich.

Cost of this construction runs very high. On Convair's B-58, there are 282 stainless steel honeycomb panels totaling 1,082 sq. ft. Cost of this construction, installed, runs between $200 and $600 per sq. ft., depending upon the panel configuration, inserts, attachments, etc. Quantity of sandwich construction in WS-110 designs undoubtedly is considerably greater than the B-58. Approximately $33 million has been spent on development of stainless steel honeycomb panels, including production installations, for the B-58.

Benefits of this experience could be translated into the WS-110, but a considerable amount of sandwich development work would still be involved.

Overdesigning to take care of the potential high-temperature growth factor is another area adding to costs of new designs such as that represented by the WS-110 category. Engineers close to the picture say this temperature growth factor may never be achieved and should be minimized wherever possible to fit operating conditions which may be expected only in a reasonable span of years.

Pied Piper Propulsion

Lockheed Pied Piper advanced reconnaissance system satellite (AW Oct. 14, p. 26) is scheduled to use a Convair Atlas intercontinental ballistic missile, minus warhead, as the initial boost stage in the push to orbiting altitude.

Atlas, with its liquid propellant rocket powerplant—in effect, a two-stage arrangement of two boosters plus sustainer with all barrels firing from instant of lightoff on pad—will be teamed with a final stage rocket enclosing in the nose the instrumented satellite package carrying a television camera, optical system, radar or infrared sensor.

Firing of satellite into space would not necessarily have to await a completely operational Atlas which, in normal development, would be exhaustively tested and dependent on complex system of ground supporting equipment.



Kaman Unveils HU2K-1 Utility Helicopter

Kaman Aircraft Corp. exhibits a full-scale mockup of its first single-rotor configuration, the HU2K-1, at the company's plant in Bloomfield, Conn. The helicopter design was selected by the Navy Bureau of Aeronautics in a competition for a utility helicopter (AW Jan. 28, p. 23). The HU2K-1 will be powered by a General Electric T58 gas turbine. Vertol's HUP-4, a tandem helicopter powered by the Wright R-1300 engine, was entered as were entries by Bell and Hiller.

Polaris Begins Underwater Tests

Washington—Preliminary underwater tests of Navy's Polaris fleet ballistic missile are being conducted to determine the influence of currents and other physical phenomena affecting launching conditions from submarine or shipboard. Funding for the Polaris was recently tripled (AW Oct. 28, p. 30), and Navy hopes to fire a reasonably complete configuration within two years.

Polaris will be about 47 ft. long. It will enclose an Aerojet-General solid propellant rocket 25 to 30 ft. long, somewhere between 3½ and 4½ ft. in diameter and weighing approximately 20,000 lb. Rocket burning time will be about 35 sec. Thrust will be about 130,000 lb.

For underwater launching, a nuclear-powered submarine undoubtedly would be used. Absence of fuel tanks found in conventional submarines would permit stowage of at least a pair of the 47-ft.-long missiles. Launching procedure conceivably might involve a "torpedo pattern" launching, followed by a guided trajectory out of the water or an angled trajectory directly from the vessel.

Acceleration of the Polaris program at Lockheed Missile Systems Division's Sunnyvale and Palo Alto, Calif., plants is scheduled to boost current employment figure of about 6,000 to 10,000 by end of 1958. In addition to Polaris, the division has about 15 other missile projects, some sponsored by military and others, research and development projects, by Lockheed.

Soviets Scorn Farnborough

Moscow—Russian observers were not greatly impressed by the aircraft and missiles displayed at England's Society of British Aircraft Constructors display in September (AW Sept. 9, p. 26), according to the official U.S.S.R. Defense Ministry newspaper Red Star. In a report on the show, the Soviet publication declared:

"Overall, the Farnborough exhibit demonstrated that British industry has the potential to manufacture modern types of aviation equipment and can, under certain conditions, be a base for supplying this equipment to other capitalist countries.

"The show also indicated that the British aviation industry still lags in solving many technical problems and needs to establish business contacts with other nations."

The "other nations" obviously refers to countries in the Soviet bloc.

Red Star complained that a Russian delegation was not formally invited to Farnborough this year, although it had been in 1956. It said: "Barred from visiting the exhibit during the first four days, our engineers were only allowed to attend when it was thrown open to the general public. This situation demonstrates that the leaders of the British aviation industry are unwilling to improve the business contacts established last year through the exchange of aviation specialist delegations between the U.S.S.R. and Great Britain."

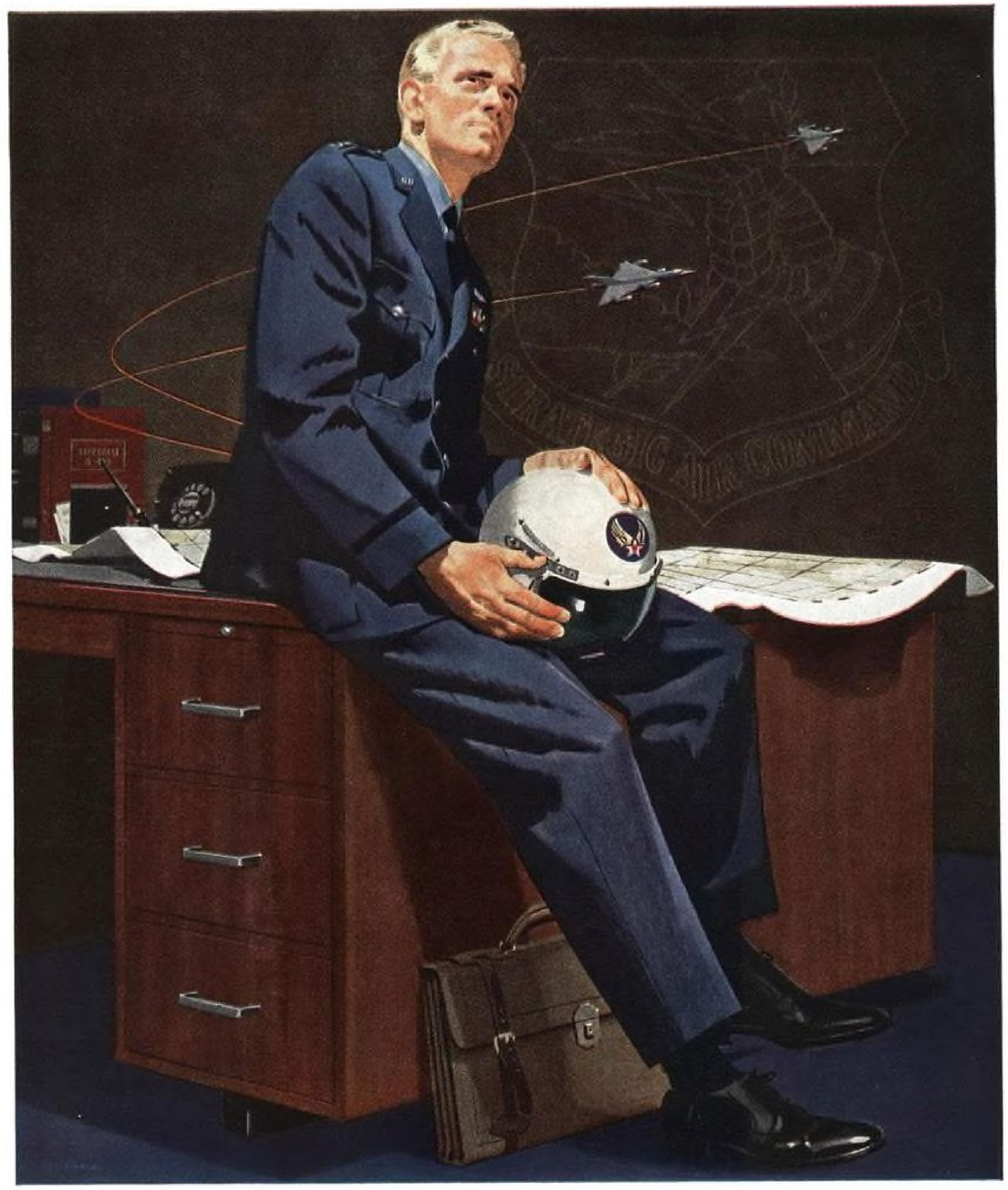
French May License English Thunderbird

Paris—Production under license in France of the English Electric Thunderbird antiaircraft missile currently is under study by the French Air Ministry.

Interest being shown by the French in the British missile, together with confirmed reports of recent French request for information on American intermediate range strategic missiles, reflects growing French fear that their nation is falling behind in missile development.

Thunderbird is in production for the British Army and Royal Air Force. The rocket powered missile is boosted off a launching device by eight boosters in four pairs. Thunderbird missile presumably would replace the French ground-air missile Parca on which the French reportedly have spent $28 million.

If the French Air Ministry decides to place an order for the Thunderbird, the missile would be built in France by Sud Aviation. Talks between this French company and English Electric already are in progress and a special mission from Sud is slated to go to England later this month.



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Defense Attacks CAB Airspace Program

Legality of plan to delegate airspace authority to CAA challenged; 'over-hasty' action is charged.

By L. L. Doty

Washington—Defense Department attack on a Civil Aeronautics Board proposal to resolve the bitter conflict between military and civil aviation over the allocation of airspace has thrown the controversial issue into a deadlock.

In a sharp criticism of the Board's plan to delegate authority to the Civil Aeronautics Administrator to assign airspace (AW Aug. 5, p. 38), the Defense Department challenged the legal right of both the CAB and CAA to control airspace allocation. It also questioned the existence of any immediate crisis in the use of airspace that would justify an "over-hasty" action.

Defense stood alone in its opposition to the plan in formal comments filed with the CAB. All other aviation segments were either warm or highly enthusiastic in their support of the Board proposal which, in effect, would empower the CAA administrator to designate restricted areas and revoke or modify present restricted areas when a "hazard to aircraft in flight exists."

Defense Charges

Here are the military's charges against the plan:

• **Proposal would** disrupt normal processes of government for handling the airspace allocation problem and "would substitute a completely unacceptable alternative."

• **Proposed ruling** would drastically depart from long-recognized principle that military aircraft must have authority to deviate from air traffic rules when it has been determined that non-compliance is required in the interest of national defense and advance notice is given to the administrator.

• **CAB and CAA are without** legal authority to adopt the proposals because they "lack statutory authorization from Congress" and because the action would "encroach on the well-recognized responsibility of the President under the Constitution." Defense argued that the plan was not in accord with the wishes of the President expressed in the 1946 executive order which established the Air Coordinating Committee. It charged that the CAB proposal was planned without "adequate consulation with Congress."

• **Proposed ruling** is not in the public interest since it would place "important military decisions in the hands of agencies without special competence" in military problems.

The issue first came to a head on July 30 when the Civil Aeronautics Board distributed a proposed rule-making that would revoke the rights of the military services to declare large areas of airspace off limits to non-military aircraft, except in the case of enemy attack or other threats to the national defense. Effect of this ruling would be to strip the Air Coordinating Committee of its power to handle airspace differences.

Public Meeting Planned

Because of the violent protests by Defense and because it was feared the issues would become bogged down in a dispute on legal technicalities, the Board will hold a public meeting on the subject Wednesday in hopes of returning the discussions to an operational level. The Board feels the deadlock can be broken once technical difficulties are ironed out.

Civil Aeronautics Board still stands firm in its opinion that its statutory authority to control airspace rests in Title VI of the Civil Aeronautics Act of 1938 which empowers the Board to promote safety of flight in air commerce by prescribing rules and regulations governing flights, navigation, protection and identification of aircraft. Title I of the Act makes no distinction between military and civil aircraft in the definition of "air commerce."

A spokesman for the Board told AVIATION WEEK that this authority is expressed in present Civil Air Regulations but has never been drawn upon since the Air Coordinating Committee has always done a satisfactory job. He added, however, that conflicts beyond ACC's capability to handle are now beginning to arise since the overcrowded conditions of U.S. airspace preclude any further distribution of space for airways or restricted areas without some give and take.

Earlier, the Board pointed out that its proposed amendments to the Civil Air Regulations were designed to clarify the "intent of the Board in providing for deviation from the air traffic rules by aircraft of the armed forces." It said the provision was originally intended to relieve military aircraft from compliance with the rules in performing certain missions and to allow complete freedom of action in the defense of the U.S. It added, however:

"It was never intended that this section would be used to justify non-compliance with air traffic rules in such operations as continuing training activities."

The Board has emphasized that the problem of diminishing airspace has become so "acute" individual users can no longer be accommodated. It said that in the past seven years, civil airway mileage has doubled and the number of airspace reservations for military purposes has increased more than 50%.

To dramatize the effect of restricted areas on the planning of high-altitude airways, the Civil Aeronautics Administration early this fall prepared a chart through the Coast and Geodetic Survey illustrating the wide sections of airspace under military control. The chart detailed an overlapping of many restricted areas and the devious routing of airways required to avoid those areas.

Defense Department countered that a large percentage of the airspace shown on the chart is "uncontrolled airspace and is open to and actually used by all aviation including civil carriers." It added that it had no desire to de-emphasize the problem and commended the CAA for attempting to present the situation in visual form.

Admitting that U.S. airspace is overcrowded, the Defense Department said facts do not call for "over-hasty" action. It declared that the "problem is not on us" at the present time and called for an orderly review of the policy changes that would be involved in making permanent organizational changes.

Precipitate Action

It cited the Curtis plan for aviation facilities (AW April 29, p. 40) as having found a settlement to the airspace controversy and added that satisfactory progress was being made until the Board and the administration took "precipitate action with which we are concerned."

Under the proposals of Edward Curtis, former presidential aide for aviation facilities, a Federal Aviation Agency would embrace all activities now undertaken by present agencies except economic regulatory powers of the Board. Since it will be at least three years before the new agency is formed, the Air Transport Assn. has argued that the Curtis proposals fail to solve the immediate airspace conflicts that already are threatening to retard airline transition to jets (AW July 15, p. 38).

The Defense Department, in its crit-



Britannia 312 Returns to New York

Britannia lays over at New York International Airport after return from Miami where plane had landed on two engines following compressor trouble encountered in turbulent conditions en route (AW Oct. 7, p. 39). The British Overseas Airways Corp. 312 model of the Bristol turboprop is scheduled for further proving flights before entering BOAC service. Its four replacement engines incorporate compressor blade modification. Bristol reports in London that prema nent solution to earlier icing difficulty with Proteus engine has been ground tested successfully, involves bleeding off air from engine's compressor and feeding it into air intake duct bend. Technique is designed to prevent ice building up at critical point in duct. Leading edges of fin and stabilizer were under repair. De-icing system, involving a sprayed-on electrical conductor had shorted.

icism of the Board's proposed ruling, praised the Air Coordinating Committee for the work it had done in resolving airspace differences and added that during the period from Jan. 1, 1956 to Aug. 31, 1957, only four cases did not reach unanimous agreement within the Airspace Panel out of 5,642 cases handled. It charged that military members of the Panel were agreed that any delays incurred in the settling of airspace conflicts were due to lack of CAA coordination with users.

The military group said the existing mechanism of the Air Coordinating Committee can be geared to cope successfully with the airspace problem and added bluntly that giving the job to the Civil Aeronautics Administration is no solution.

On the legal question, the Defense Department argued that there is no language in the Civil Aeronautics Act of 1938 that in any way attributes to the Board specific authority to establish airspace reservations or restricted areas.

It called attention to the Air Commerce Act of 1926 which authorizes the President to issue an executive order for the "setting apart and the protection of airspace reservations in the United States for national defense or other governmental purposes."

The Department concluded that any authority the Board derives from the Act is derived by "implication" and is "conceptually" different from the authority of the President. It added:

"If Congress had given the CAB statutory authority to make a final determination as to national defense airspace requirements and to allocate airspace to meet those requirements, without giving the President a decisive voice in the matter, there would be a grave question as to the constitutionality of such a statute on grounds of interference with his responsibilities as Commander in Chief."

The Defense Department said there was no doubt as to Congress' intent to give the President powers to establish airspace reservations and warned that since the President had usually left airspace problems to government elements, the Board would be "unwise to put the conflict of its authority and that of the President to test."

IATA Members Agree On New Rate Pattern

International Air Transport Association members agreed during their traffic conferences last month in Miami on a new rate pattern involving increases in fares on some routes and a hike of about 5% in cargo rates on a number of routes.

Shelved until a Nov. 19 meeting scheduled in Paris was further discussion of the stalemated issue of how the new low-fare transatlantic rate is to be worked out next year.

Most of the fare increases were in first class traffic. Changes are:

- **Some minor adjustments** to fares within and between the Americas. New tourist and excursion fares are to be introduced, chiefly a discount for eight or more persons traveling together.
- **First class fares** between Central America and Europe to go up $20, tourist fares to remain unchanged.
- **Increase of 3%** in first class and tourist fares between South America and Europe. Introduction of emigrant fares from some European countries on the route.
- **Individual increases** up to 5% in Europe, Middle East and Africa region. Continuation of present promotional excursion program and addition of some new items.
- **Little or no change** in fares between Europe and India. Tourist increases of 4-5% and first class increases of 6-7% between Europe and the Far East and Australia. No increase in direct Europe-Australia fare.
- **Some increases** mostly first class, in Asia, Australia and Pacific region.
- **No change** in fare on North Pacific and mid-Pacific routes. A 5% increase in first class fares on South Pacific route.
- **No change** in round the world or polar route fares.

Caribbean carriers voted to add new tourist services within their area, but failed to agree on fare levels over most sectors in the region. Current resolutions expire next March 31.

If the governments involved approve the new fares adopted by the conference, they will become effective next April 1. The new cargo rates will go into effect next February.

Conference members also agreed to fight their no-show problem by experimenting with ticketing time limits and reconfirmation procedures. These will apply to passengers booking space on international flights out of Canada, Cuba, Mexico and the U.S., and on return trips from gateway points in Europe. Regulation is to become effective March 1.

New heads of the three IATA traffic conference areas for the next year are W. Gordon Wood, Trans-Canada Air Lines; Philip Lawton, British European Airways and Roberto Lim, Philippine Air Lines.

Equipment Pitfalls Detailed by Financiers

Washington—Domestic airlines may fail to meet their commitments for new equipment unless they are permitted to improve their earning power, leading New York financial experts warned the Civil Aeronautics Board last week.

The financiers said there is a limited amount of investable funds available, and this money is going into industries and companies which have the best credit strength.

The financial problem of the nation's domestic airlines was outlined in the written testimony of investors and economic experts submitted as exhibits in the General Passenger Fare Investigation by the Air Transport Assn. Generally, all agreed that a moderate increase in fares will help restore needed earning power and financial confidence in the industry. The major financial problem facing the airlines today is how to finance the jet and turboprop aircraft which airlines must buy between now and 1961 in order to remain competitive, according to T. Carl Wedel, vice president of the transportation department of the First National City Bank of New York. He estimated the overall cost to the major trunk airlines for the aircraft now on order at more than $2 billion in addition to the money required for ground facilities.

Sources for Finance

Airlines can obtain the large sum of money necessary from only the following sources, he said:

- **Internal cash generation**—which is the sum of retained earnings—i.e., net income less cash dividends—plus depreciation.
- **Cash proceeds from sale** of excess or obsolete equipment.
- **Outside financing**—borrowed money or the sale for cash of equity securities.

Wedel said the amount of money obtainable from the sale of surplus equipment is an imponderable since no one can predict the future selling price of current equipment. Therefore, he added, the airlines should base their financial programs on internal cash generation and outside financing.

"The airline industry is a part of our free enterprise and economy and must, therefore, compete in the capital markets of the nation for this outside financing with all other industries in that economy," Wedel said. "The airline industry must come into this capital market with credit strength at least equal to that of other industries if it is successfully to obtain the outside financing it requires on satisfactory terms."

He said the measure of credit strength most widely used by lenders of money is what is known as the debt-equity ratio. This is the relationship between the amount of borrowed money and the owner's money, commonly known as equity capital, in the business. He added:

"Even the stable electric utility industry, which does not face the competitive problems hanging over the airlines' immediate future, has today a composite debt-equity ratio very close to one to one. It is our opinion that the investment community will not be willing to provide debt money to airlines on any much more liberal basis."

Wedel pointed out that at the end of 1956, the total book net worth of the major U. S. domestic trunk airlines was $563 million. Simple arithmetic, he said, shows that, if the entire $1.5 billion of outside financing required by the airlines through 1960 were in the form of debt, a debt-equity ratio of close to three to one would result.

Financing 'Conditional'

He said financing already arranged by the industry is conditional. "By this," he added, "I mean that the ability of an airline to actually borrow the money available to it under its credit agreement depends upon its meeting the required debt-equity ratio test, and in my opinion, no airline today has sufficient equity to meet this test for the full amount of its commitments from banks and insurance companies.

"Therefore, the belief that many airlines have already successfully arranged for the money they will need to pay for their jet airplanes is fallacious since they have only arranged for it if they acquire during the years of 1958 through 1960 substantial additional equity capital.

"Today, primarily as a result of the sharply declining earnings of the industry, the market price of virtually all airline common stocks is well below their book value. In view of the airline industry's vital need for additional equity to maintain its financial health, this fact is of grave concern to a commercial bank committed to lend substantial sums to that industry. I am convinced, however, that the problem can, in the final analysis, be solved only by permitting the airlines to increase substantially their earning power as soon as possible."

Similar opinions were expressed by Albert H. Gordon, senior partner of Kidder, Peabody & Co., one of the largest underwriters and distributors of investment securities in the United States.

Gordon said the investor views the air transport industry as one in which there has been no comparable growth in net earnings, although total operating revenues have grown impressively. On the contrary, he added, 1957 net earnings in the face of expanding business activity will be substantially below those for 1956. Dividend payments, which for most airlines have never been substantial, are being curtailed to conserve cash. He added:

"Increased inter-line competition, higher costs and the apparent ceiling on passenger fares presage lower net earnings, even if there is no general business recession. To add further complications, the industry is entering a period of acquiring major new equipment, the introduction of which may, at least temporarily, have an adverse effect on net earnings."

He said it is obvious there is a flight of capital from the airlines. The common stock of the 12 trunk lines, Gordon pointed out, are now selling at 64% of their book values as contrasted with airline stocks that were trading at 122% of their book values in 1956, 128% in 1953 and 324% in 1946. Even in the dark days of the industry —1947—they were selling at 155% of their asset values, he said.

Earnings Decline

When leading insurance companies during the last three years agreed to loan substantial sums to several large airlines on a long term basis for purchase of new equipment, Gordon said the earnings outlook was bright and the loans appeared to be well secured.

He added, however, that it is doubtful that the insurance companies would have made the arrangements had they realized that the net earnings trend would shortly turn downward and that the sale of equity securities would become increasingly difficult.

"I believe," he said "a more constructive regulatory climate toward the airlines is a must if the industry is to begin to attract the capital it requires. In this connection, a fare increase for the airlines is clearly indicated.

"The fare structure must begin to match the increases in operating costs if the squeeze on profit margins is to be corrected. Moreover, air travel growth will not suffer as the public appears to be willing and able to accept a moderate increase in the price of its tickets as it knows that the cost of everything it buys has gone up sharply.

Also included in ATA's exhibits was the written testimony of Percy S. Young, Jr., investment manager of the bond department, Prudential Insurance Company of America, one of the major investors in long-term airline securities.

"A healthy industry," Young said,

"should retain some portion of its earnings for growth and in our more recent loan agreements, we have insisted on a retention of a percentage of earnings for this purpose. Ability to sell equity type securities is another test of a healthy company or industry, and one of the factors which induced the Prudential to lend to certain airlines was their proven ability to raise additional equity.

"However," he added, "it is obvious from the stock market record of the last 18 months that equity investors are disturbed by the failure of earning power to follow the continued increase in traffic, to the extent that, at present, the climate for raising additional equity is not at all favorable. Should the ability to raise this equity be lost because of investor discouragement, the industry would be gravely weakened."

Others submitting testimony along similar lines include James P. Mitchell, Chase Manhattan Bank vice president and Frederick F. Robinson, president of the National Aviation Corp., an investment company.

American Airlines Needs Fare Hike To Cover Additional Jet Purchases

By Glenn Garrison

New York—American Airlines wants to buy 40 additional jets to provide an almost all-turbine service by 1961, but will need a 15% fare increase to handle the financing, according to C. R. Smith, president.

Fifteen more long-range and 25 medium jetliners would cost $200 million with related ground equipment, Smith said, and the program will depend on annual earnings of $25 million. To accomplish this, the airline needs a rate of return of about 12% on its indicated investment in 1959. For additional financial security, American's operating costs as a percentage of operating revenues must be held to 93% or less after taxes.

American's program and problems were described by Smith in testimony filed last week with the Civil Aeronautics Board in the passenger fare increase investigation case (AW Oct. 7, p. 38) and were amplified by him at a press conference here last Monday.

Urgent need for further large amounts of capital, a seller's market in money, declining airline earnings and a downward trend in the general economy make a fare increase mandatory if airlines are to meet their jet age obligations to the public, Smith said.

Borrowed $135 Million

The airline already has borrowed $135 million to finance its previously-ordered turbine fleet of 30 long-range Boeing 707s and 35 Lockheed Electra turboprops.

No decision has been made on which jets would be bought for the expanded fleet, Smith said, "But I would guess that the 15 long range planes will be additional Boeings." For the medium range jets, choice appears to be between the Convair 880 and Boeing 717, he added.

With straight jets and turboprops serving all but the shortest route segments and cities where turbine service would be economically or operationally impossible, American's only remaining piston equipment by the end of 1961 would be some 15 DC-6s.

Reasons for Increase

By then the public, exposed to jet service on main route segments and turboprop service on even short local service carrier hops, will regard piston equipment as obsolete, in Smith's view. American's present turbine orders will not be able to satisfy the public demand, he pointed out, because:

- **Total system capacity** of 12.7 billion seat-miles will be required by American by the end of 1961.
- **Segments of 500 mi.** or longer will require 9 billion seat-miles of capacity, and over 6 billion of this will be on over-800-mi. segments.
- **Boeings now on order** will produce less than 5 billion annual seat-miles. If these jets were used only on segments over 800 mi. they would fail to meet the requirements for these runs and further, would provide no jet service to such competitive markets under 800 mi. as New York-Chicago and New York-Detroit.

With the fleet now on order, Smith said, American could provide straight jet service to only 10 cities on its system. With the additional jets, such service can be extended to a total of 25 cities by the end of 1961.

Full requirements for that time were not provided for in initial jet orders, Smith said, because the intermediate range jet had not been developed when the orders were placed. American planned to use its Electras on intermediate segments, shifting them to shorter-haul service later when the medium jets became available.

But development of the new planes proceeded more rapidly than expected, narrowing the time interval between the first and second phases of American's equipment modernization program.

The second phase cannot be put into effect, however, unless the airline can find means to finance it, Smith said.

"We do not have that money," he told the CAB. "Our total net worth at the end of 1956 was only $128 million and it will be very little more as of the end of 1957. At present fare levels, we will suffer a loss in 1958 after payment of interest. Our cash flow through 1960—again at present fare levels, and even without deposits on additional equipment orders—would bring us to perilously low points. By the end of 1959, current liabilities will actually exceed current assets, resulting in a negative working capital position.

"The tests of our condition all point to one obvious conclusion: our financial position is poor to put it mildly. How are we to find the money necessary to provide us with $200 million of new aircraft and ground facilities by the end of 1961?"

The ground facilities, Smith estimated at the press conference, would account for about $25 million of the total.

Regarding financing of the current turbine orders, he said $135 million was borrowed through two loans, one in 1955 from Metropolitan Life Insurance Co. and another in 1956 divided between Metropolitan and Prudential Life. The loans were made after determination that it would be impossible to raise more than a small portion of the money through equity financing.

American's situation at the time of the first loan, Smith said, was that its debt represented about 20% of its total capital, earnings had been relatively good for several years, CAB "had not disturbed a rate of depreciation . . . which . . . was sound," and the airline had a good record of stockholder-retained earnings.

Cash Cushions

Estimated depreciation throw-off funds and deferred income tax payments funds were important cash cushions in allowing for contingencies that might require additional funds to complete the initial program, Smith pointed out.

At that time, "conservative assumptions" indicated annual net earnings after taxes and interest of $18-20 million through 1960 or 1961, with annual retained earnings of about $12 million.

On the basis of American's present position, its ratio of debt to total capital will stand at over 60% when the insurance company money has been completely drawn. Interest charges, which in 1956 were $860,000, will be $6,362,000 annually in 1960, and when payments on principal of the loans begin in 1967, annual required payment with interest will be over $10 million.

Air France Borrows in U. S. for Jets

Paris—Air France will get help in financing its Boeing 707 jet purchase from Boeing Airplane Co. and United Aircraft Corp. in addition to the Export Import Bank and three New York banks. Arrangement marks the first time the French state airline, has borrowed money in the U. S. for aircraft.

Carrier ordered 10 long range Boeings in 1956 and seven more last March. Total cost plus spares amounts to $104.7 million. The dollar-short French government wasn't in a position to help out its airline, yet Air France had to find the money or lose its delivery position for the jetliners.

Air France now plans to pay for the 17 planes by borrowing $46 million from the Export Import Bank and $15 million from the private banks, at interest of 5.5% with the loans to be paid off within seven years. Boeing and United Aircraft, the engine builder, have agreed that Air France may postpone payment of $17.5 million due them on delivery of aircraft. Air France will put up $26.2 million to make up the total.

Loan charges plus interest and fixed charges on expanded ground facilities such as terminal buildings and maintenance bases will total $16 million in 1960.

The carrier's present DC-7 fleet poses a substantial financial risk, Smith said. If these aircraft were depreciated uniformly over seven years with 10% residual, unrecovered costs by the end of 1961 would total $30.3 million "at a time when they have become completely obsolete."

Entire segments of the airlines' existing fleets and finally their whole piston fleets "will become suddenly obsolete and will glut the secondhand market in a way which will make the mediocre secondhand market of 1949 seem a bonanza," Smith predicted.

American has adopted a depreciation policy which adheres to the seven-year life for the earlier DC-7s, but depreciates those DC-7s acquired later on a five and a four year basis, Smith said. Even so, according to American's figures, their total residual value remaining on the airline's books by the end of 1961 will be $11.2 million.

Poor earnings position of the airlines which makes the attraction of capital so difficult is due to rising costs and falling load factors, Smith said. More important is the load factor situation, which itself is due to slackening of the general economy and to increasing route competition.

Trouble with the general economy, Smith told reporters at the conference, is something more than a "weekend crisis." All business is likely to encounter a "trying period" for a while.

Asked if airports at cities American will serve with its jets are ready for them, Smith said facilities will be "in pretty good shape" for the airline's first-phase jet operation. Runway situation generally is better than terminal facilities, he added. For example, American's passenger terminal building at New York International Airport may not be ready in early 1959.

Regarding noise at Idlewild—where the jet is persona non grata at present sound levels—Smith said the manufacturers had spent a lot of money on suppressors and had proved that noise could be reduced. Question remained, he added, as to how much power reduction would be entailed in suppressor use.

Smith said he felt sure noise would be down to "operable" levels by 1959, although he couldn't be sure "operable" levels means the same thing to American that it does to Port of New York Authority Executive Director Austin Tobin.

The American official said that if CAB didn't grant the fare increase, the airline would probably have to tailor its program to what resources it had. But he said he thought the Board will be reasonable.

His airline's program would not ordinarily have been disclosed until the last possible moment for competitive reasons, Smith said. But it was being made public because there was no other way of bringing to CAB the fullest realization of American's financing problem.

Stanley Gewirtz Resigns National Vice Presidency

Miami, Fla.—Resignation of Stanley Gewirtz as vice president of National Airlines was announced last week by G. T. Baker, president and board chairman.

Gewirtz is a former vice president of Air Transport Assn. and executive assistant to two chairman of the Civil Aeronautics Board. He told AVIATION WEEK his future plans will be announced at a later date.

Russia Suggests U. S. Bilateral

Washington—Soviet Union last week announced that it is ready to negotiate a bilateral air agreement with the U. S. for direct airline service between Russia and the U. S.

Gorgi N. Zaroubin, the Soviet ambassador made this proposal here during negotiations with State Department Special Assistant William S. B. Lacy on the expansion of exchanges of ideas and information between the two countries. In a prepared statement, Zaroubin said:

"The Soviet side is also ready to reach agreement in principle on the establishment of direct air communications between the U. S. S. R. and the U. S. A. on the basis of reciprocity."

Indications that Russia would soon seek a bilateral agreement with the U. S. were disclosed in an AVIATION WEEK interview in Moscow last year with Major Gen. Beletsky, operations chief for the Soviet-owned airline Aeroflot, and Col. Victor Danielitiev, chief of the carrier's foreign division (AW July 9, p. 26.)

At that time, Gen. Beletsky told AVIATION WEEK that Aeroflot would enter transatlantic competition in about two years when either the Tu-110 four-jet transport or a large turboprop became available. It is possible that the Zaroubin announcement was timed as a prelude to Russia's new, 170-passenger, long-range turboprop Rossiya transport (see p. 34).

In August, 1956, a Pan American World Airways contingent visited Aeroflot officials in Moscow in response to an invitation to discuss Moscow operating rights for PanAm (AW Aug. 27, p. 25). Negotiations were halted and have not been resumed.

Gen. Beletsky explained during the AVIATION WEEK interview that Aeroflot's bilateral policy is based on reciprocity. He said the Soviet airline expects to fly to any country to which it grants traffic rights. The long-range program envisioned routes to North America, Western Europe and Asia.

East German Transport

Medium range jet transport conceived, developed and built by East Germans will be completed by next May. The transport, reportedly designated the Baade/Bonin B-152, will be made in both 40 and 70 seat versions.

The aircraft will cruise at 500 mph. and have a 1,500 mi. range. It has four jet engines developing a total of more than 27,000 lb. of thrust. This places the East German B-152 in roughly the same class as the Sud Caravelle. The B-152 has about the same passenger capacity with more thrust and a higher claimed cruise speed.

Most striking claim made for the B-152 by its designers is a take-off run of only 2,620 ft. with a full load. Other aircraft of similar weight and power need in the neighborhood of 4,000 ft.

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Airline Revenue Regulations Denounced

By Ford Eastman

Washington—Federal regulation of revenue in an industry with the economic characteristics of U. S. domestic airlines is not in the public interest, according to a study made by Herbert B. Dorau, New York University School of Commerce economics professor.

The conclusion was drawn from an analysis of economic standards applicable to various types of enterprises. The analysis was filed with the Civil Aeronautics Board as an exhibit by Eastern Air Lines in the General Passenger Fare Investigation.

The exhibit is more of a course in business economics than the type argument usually presented in a CAB rate case. In this case, however, several airlines are filing testimony on similar lines. The analysis explains certain characteristics associated with one type of business as compared with another and why different methods of determining a fair rate of return must be used in order to attract the "all-important investor."

Dorau's Conclusions

On the basis of the comparative analysis, Dorau concluded that:

• **There is no need for federal** regulation of fares to protect the public against exorbitant rates, primarily because of the leveling effect of competition between carriers and between airlines and other modes of transportation.

• **So long as fares** are regulated and a ceiling placed on rates, it is in the public interest to determine airlines' revenue requirements by the "margin of return" formula instead of the "rate of return"—profit as a percent of total investment—method now used.

Dorau said the airline industry itself appears to have made the initial move in seeking economic regulation because prior to and at the time of the Civil Aeronautics Act of 1938, the industry's revenues were wholly inadequate. The economic provisions of the act, he said, were intended almost solely as a means of strengthening the airline industry through the prevention of destructive competition, wasteful duplication of service and through subsidization.

Besides the highly competitive situation of the airlines, Dorau said there are other factors involved which make it unnecessary to control fares. They are:

• **Rapid rate** of capital turnover, where revenues quickly equal total investment, is one of the characteristics of the airline industry and is ordinarily accompanied by a small margin of return. Thus, only a slight increase in prices, without corresponding increase in expenses, produces a substantial percent of increase in the "margin of return" and a substantial increase in the "rate of return."

• **Although air transportation** is an increasingly important element in the nation's economy, passengers and shippers of freight generally can choose other means of transportation. Therefore, the product is not considered highly essential to the public at large in terms of the intensity of need, on one hand, and the proportion of the people for whom the need is intensive on the other.

Control of Utilities

Dorau said desirability of revenue regulation of the non-transportation utilities, including electric, gas, water and telephone companies, is generally accepted.

Reasons for this, he said, are that the characteristics of these utilities are the opposite of those in the air transportation industry—exclusive legal control of the market, the degree of essentiality of service and the general unavailability of alternate means of getting a substitute service.

The non-transportation utilities provide indispensable service under conditions which make exclusive control of the market socially most economical, Dorau said. Competition between two of these industries occurs only within very limited spheres of activity. The public is dependent upon the service and, in the absence of competition and rate regulation, an opportunity to uneconomic prices would exist.

In addition, he said, the non-transportation utilities have a low capital turnover and operate on a wide "margin of return." Therefore it would take a much greater rate increase to increase margin or rate of return by only a small percent.

Must Consider Formula

If federal regulation of fares continue, according to the analysis, it will be in the public interest to consider a formula to determine the revenue requirements of the air transport industry from the standpoint of the consumer, investor and the airlines.

Unless airlines receive a sufficient return on their investment, Dorau said, consumer interest will be prejudiced for want of the better or more extensive service that such capital would provide.

The "rate of return" approach, Dorau explained, assumes that the return should bear an appropriate relationship to the amount of capital employed, while the "margin of return" approach assumes that the return should bear an appropriate relationship to the expenses invested. Although capital employed and annual expenses are both investments, capital employed is the longer term investment. Annual expenses is the shorter term or annual reinvestment.

Base of reference which is the more important, useful and reliable, Dorau said, depends upon the nature and characteristics of the class or type of enterprise.

Both the capital investment and the annual investment reflect the extent of the hazard assumed by the investor, but Dorau says their relative importance varies with the rate of capital turnover, or the number of dollars of capitalized investment required to produce a dollar of revenue.

"In general," he said, "the economic principle is that the more rapid the rate of turnover, the more important the risk associated with the annual outlay of operating expenses and, similarly, the slower the rate of capital turnover, the more important the risks and uncertainties associated with the long term capital outlay or investment."

Safe Margin

It follows, Dorau added, that the use of a rate of return approach for slow capital turnover utility industries, when non-competitive, is logical and consistent.

On the other hand, the margin of return approach is more appropriately used when revenue levels of the more rapid capital turnover industries are appraised.

The economic ends of both approaches are basically the same—to afford a means of appraising the return requirements of enterprise so that enterprise will be encouraged, capital attracted on favorable terms without prejudice to the past investment, the credit maintained and the investor and consumers fairly treated, Dorau said. Therefore, he believes it is important to allow an enterprise revenues that will produce both a fair rate of return and a reasonably wide margin of return.

In an industry with a very slow rate of capital turnover, the analysis said, even a conservatively low rate of return will produce a safely high margin of return.

Dorau said that in the electric utility industry the average capital turnover, based on 1946-1955 statistics, is about .30% and the average margin of return is about 19%. In comparison, the trunk airlines' 1946-1955 average capital turn-



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over was 1.66. The average margin of return was 3.1%.

With an average margin of return of 3.1%, a 3% decrease in revenues or a 3% increase in expenses would reduce the margin and rate of return close to zero. Dorau says such a large degree of risk coupled with a ceiling on fares seriously interferes with the industry's ability to attract investment at reasonably low cost.

On the other hand, he added, non-transportation utilities with a wide margin of return tend to be less volatile because earnings usually remain fairly stable in the face of any given change in revenues or expenses. To the investor, he said, their relative apparent safety substantially counterbalances the fact that revenue regulation makes the chance of gain relative improbable. Investors who feel fairly assured of a continued return within conservative limits and who feel confident that they will not lose their capital investment do not demand unlimited upward possibilities in their return, Dorau said.

Los Angeles Terminal to Expand

New passenger terminal complex provided for in expansion plans for Los Angeles International Airport consists of 13 buildings of major proportions in the 200-acre area. Ticketing buildings are located around the perimeter of a 5,000-car parking section. Located on the ramp, and reached by underground channels, are the satellite buildings where passengers will enplane and deplane.

Each of these buildings will measure 300 x 170 ft., large enough to cover a football playing field and each will have a waiting room, coffee shop, news and gift stand. Satellite buildings also will have 10 plane loading positions suitable for the coming big jet transports.

Each will have another level and a mezzanine above ground.

Plans for a center complex have not been settled, but arrangements for the general scheme likely to be followed are progressing. Center complex will contain a restaurant, cocktail lounge, coffee shop, employes cafeteria and commercial shops. Spiders leading from central complex to buildings around perimeter are elevated walkways over the parking lot, which is one story below the field level.

First story of ticketing buildings around perimeter are flush with the parking lot; second story is flush with the field level. In the first quarter of 1958, work will begin on underground construction, under apron and on paving of apron. After this, work will commence on ticketing buildings and satellite structures.

Next will come the central area which includes the main buildings and parking.

Pereira and Luckman are coordinating architects in a joint venture which also includes architects Welton Becket and Associates and Paul R. Williams.

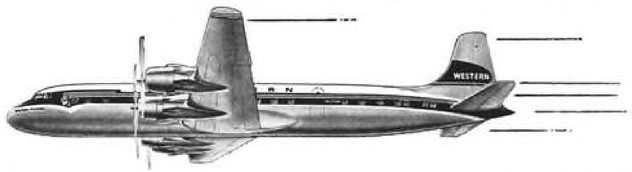


Boeing Stratoliner Rolls From Plant

Number one Boeing 707 Stratoliner jet passenger liner is rolled out of Renton, Wash., Transport Division plant, near Seattle, on Oct. 28. Photo at right shows the 80-180 passenger aircraft shortly before rollout date. The structurally complete plane will undergo final functional testing before being flight tested. This plane will be delivered to Pan American World Airways; delivery is scheduled for late 1958 (AW Oct. 28, p. 125). The 707 is expected to have a nonstop range of 5,000 mi. and speed in excess of 600 mph.

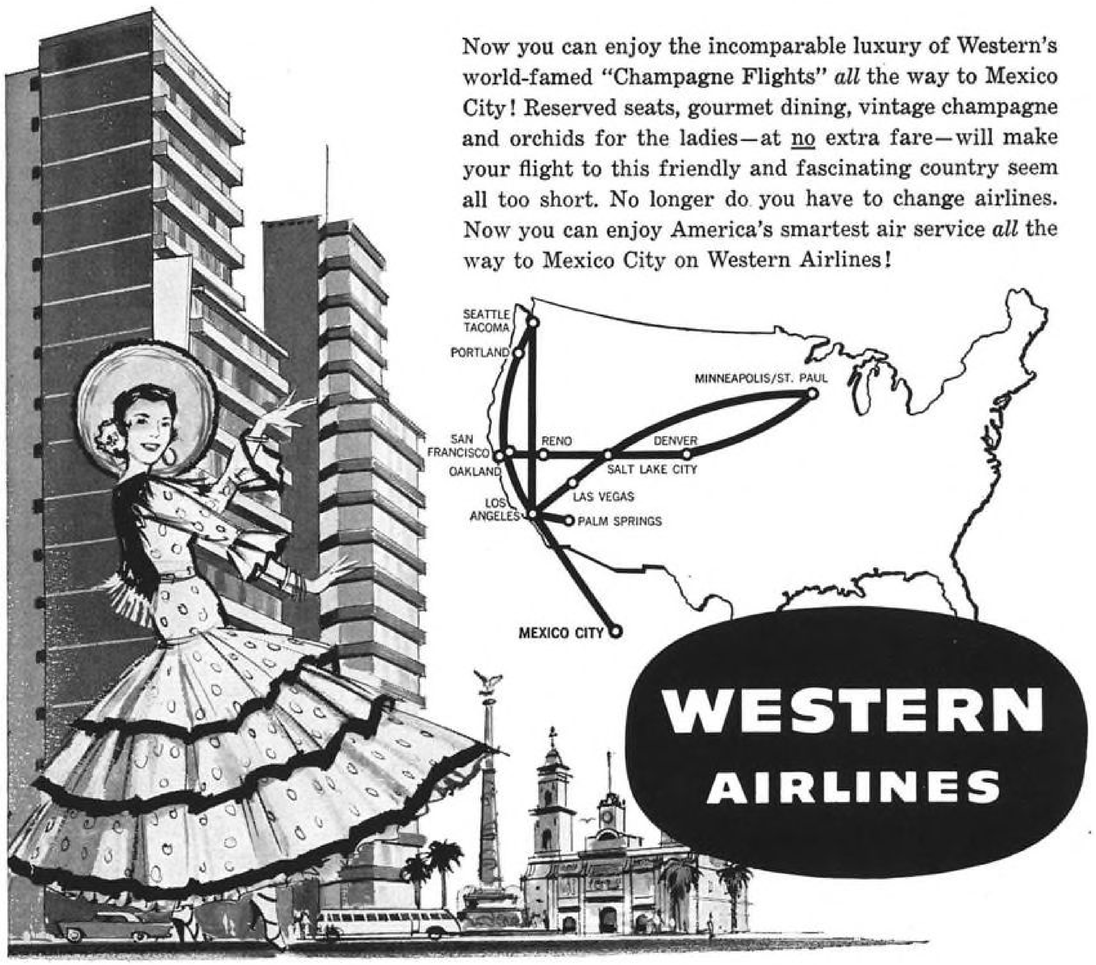


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SHORTLINES

► **United Air Lines** will begin daily Douglas DC-7 air coach service from Boston to Chicago and Los Angeles on Nov. 12. The new flights, called "Custom Coach" service, are scheduled to leave Boston at 9:45 A.M. EST, and arrive at Los Angeles at 5:25 P.M. PST, with an en route stop at Chicago. The return "Custom Coach" flight, scheduled to leave Los Angeles at 11:50 A.M. PST, will arrive in Boston at 12:54 A.M. EST, flying by way of Chicago and New York.

► **Continental Air Lines** has doubled its Douglas DC-7B air coach service at Kansas City on the Chicago-Los Angeles route. On the new schedules, the airline's "Club Coach" Flight Five is scheduled to leave Chicago daily except Wednesday at 2:30 P.M. CST, adding Kansas City to the flight, arriving there at 4:15 P.M. CST and continuing on to Denver and Los Angeles. Returning to Chicago, Flight Six will stop daily except Tuesday at Kansas City at 6:20 P.M. CST, continue on to Chicago, arriving there at 8:25 P.M. The new Kansas City service is in addition to the daily stops to that city on Flight One Westbound and Flight Four Eastbound.

► **KLM, Royal Dutch Airlines,** has increased its cargo operations to Europe, the Middle East and Asia. KLM now has 10 weekly flights to London, seven to major cities in Germany, five to Paris and five to Brussels. KLM also has extra cargo capacity of up to 55,000 lb. a day in its air-freighters, plus twice a day departures in combination cargo/passenger aircraft.

► **Pan American World Airways** is completing the purchase of a 20% interest in Philippine Airlines. The purchase was made, subject to Civil Aeronautics Board approval, at the invitation of Philippine Airlines president Col. Andres Soriano, who asked Pan American to become associated with Philippine Airlines through a purchase of part of his holdings. Pan American acquired approximately 4% of PAL's stock last August.

► **Flying Tiger Line** reports a net income from operations for the third quarter of 1957 at $497,443 as compared with a deficit of $116,834 for the same period last year. Net income and special items for the third quarter were $1,001,515. Gross revenue for the period was $9,466,631 over $5,150,538 resulting from introduction of the new Lockheed Super-H Constellations on Flying Tiger's routes last June.

AIRLINE OBSERVER

► Convair is assessing local service airline interest in a turboprop conversion of its C-240-340-440 series. Most local service carriers are determined to shift to turboprop power when they change from the DC-3 and the manufacturer hopes to retain its hold on the short-haul market through the conversion. Northwest Airlines already is considering piston engine version of the 440 as a possible replacement for its fleet of DC-4s.

► **Aeronaves de Mexico's first Britannia, which arrived in Miami last week, by-passed New York International Airport to avoid the 3% New York City sales tax. Price of the plane is about $3.5 million. Second Britannia is due in Miami in two weeks.**

► Airline stocks doggedly continued to lag within a few points of 1957 lows despite the recent one-day upsurge of market prices. However, as the market slipped back to lower levels last week, turnover of airline stock was slight and new lows for the year were avoided.

► **Russia's new, long-range Rossiya turboprop transport scheduled for unveiling in the near future is expected to make sharp inroads in trans-Siberian rail travel. Soviet Air Force Major Gen. A. Maksimov says a 170-passenger Rossiya, operating only 100 hr. a month on the Moscow-Vladivostok route, will be able to replace 10 trans-Siberian passenger trains.**

► Trans World Airlines' pilots have been given a new voice in operational matters under a policy introduced by President Carter Burgess, now feel they are given a fair chance to participate in company decisions on flight time schedules.

► **Lack of senior analysts has forced Civil Aeronautics Board to go against its own wishes and defer the local service Rate of Return Case. The Board denied an earlier bureau counsel request for deferment on grounds that the carriers had spent much time and money in the presentation of their cases and that a further delay might render the records "stale." However, bureau counsel's plea that its senior analyst who was to be the chief witness has left the Board's employ and that the number of senior analysts has decreased from six to two in less than a year leaves the CAB with no alternative but to postpone procedural dates.**

► Northeast Airlines hopes to expand its operations through interchange of equipment agreements with other airlines. Prior to the Civil Aeronautics Board denial of National Airlines' petition to discontinue the National-Capital interchange agreement, Northeast told the Board it would be willing to enter such a pact on its Washington-Miami route it the National-Capital agreement were dissolved.

► **Iberia, Air Lines of Spain, and Swissair feel their Convair Metropolitan 440 flights are having an effect on competitive British European Airways' Viscount flights over European routes. Both airlines are experiencing a marked rise in load factors on the Convair flights after a prolonged and discouraging introductory period of low traffic levels.**

► Pan American World Airways' plans for jet transport operations include streamlining of in-flight service based on a long-term test program. Plans call for the meal service of 180 passengers in 18 minutes with another 18 minutes for clean-up. The airline has been testing and modifying galley equipment for the past several years as part of the program. Quick-freeze techniques are being further developed. The airline plans to key its in-flight service to an "international hospitality" theme and is expanding its bilingual requirement for in-flight personnel. About 75% of its flight service personnel are now in this group.

► **Northeast Airlines has been forced to move all four-engine equipment flights from the LaGuardia domestic terminal to the Marine Base at the New York Airport because of overcrowded conditions in loading areas at the former terminal and lack of gate space. All two-engine flights will continue to operate from the LaGuardia terminal which means the airline is required to maintain duplicate ticket counter and passenger-service facilities for its New York operations.**



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SUB-MINIATURE BASIC SWITCHES
(E4-100 Series)

STANDARD – (Model E4-103) Sub-miniature basic switch with ambient temperature of –65° to + 250° F. (See other operating characteristics at bottom of page.)

HIGH TEMPERATURE – (Model E4-107) Ambient temperature of –65° to + 350° F. (Diallyll Phthalate cases with high arc resistance; high impact strength.)

HIGH CURRENT CAPACITY–(Model E4-114) 5 amps. @ 30V., DC, Ind. Elec. life rating: 25,000 ops.

ADJUSTABLE MOVEMENT DIFFERENTIAL–(Model E4-507) mov. diff. can be adjusted from .002" to .0005", approx.; operating force from 200 to 100 grams, approx. Also adj. contact gap. Amb. temp –65° to + 350° F.

Actual Size:
25/32" x 1/4" x 23/64"



ENVIRONMENT-FREE SUB-MINIATURE BASIC SWITCHES
(EF Series)

SEALED BASIC SWITCH–Approved on QPL–Mil. S. 6743 in accordance with dwg. Ms 25085-1.

STANDARD – (Model EF-3) sealed against dust, dirt, heat, humidity and cold. Shock and vibration resistant. Amb. temp.: –65° to + 180° F.

HIGH TEMPERATURE–(Model EF-7) ambient temp. of –65° to + 325° F. Internal switch case of Diallyll Phthalate with high arc resistance; high impact strength.

Actual Size:
15/16" x 11/32" x 19/32"

(Standard switch has 12" leads)



SUB-MINIATURE BASIC SWITCHES
(Slightly larger than E4-100 Series)

LOW DEADBREAK – (Model E4-58) features low deadbreak of .0005" max. Amb. temp. –65° to + 250° F.

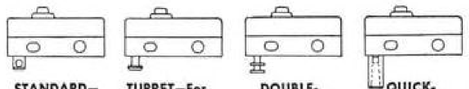
LOW MOVEMENT DIFFERENTIAL – (Model E4-31) Mov. diff. of .0005" max. Amb. temp.: –65° to + 350° F.

LOW OPERATING FORCE–(Model E4-41) for applications where low oper. force is desired: 135 grams ± 5 grams. Mov. diff. .002" ± .0005". Amb. temp.: –65° to + 350° F.

Actual Size:
27/32" x .260" x 23/64"



TERMINAL CONFIGURATIONS
(Available for all models)



STANDARD– Cross drilled for solder wiring

TURRET–For wrap-around solder wiring

DOUBLE-TURRET–For multiple lead-in soldering

QUICK-DISCONNECT– Female tubular for std. AMP male dis-connect term. connections

Choice of case material and oper. characteristics available with any terminal type.

BASIC OPERATING CHARACTERISTICS
(Sub-miniature Switches—E4-100 Series)

Weight—.004 lbs.
Mech. life rating—150,000 ops.
Elec. Life ratings—
150,000 ops. @ 125/250 V., AC—2:5 amps.
100,000 ops. @ 125/250 V., AC—5.0 amps.
50,000 ops. @ 30 V., DC—2.5 amps.
50,000 ops. @ 30 V., DC—4.0 amps., res.

Approved on QPL, Mil. S. 6743 in accordance with dwg. MS 25085-1. UL Approved.

TOGGLES
Maintained or Momentary with variations for Single-Pole to Triple-Pole

	Maintained	Momentary
Single-Pole	A3-20	A3-14
Double-Pole	A3-8	A3-15
Triple-Pole (shown)	A3-27	.....

Bushing size, above models: 1/4" x 40 (Also available in 15/32" x 32 bushing)



27/32" x .830" x 1 23/64"

ROTARY-ACTUATED, GANGED, SUB-MINIATURE
6-Pole assembly A9-7 (shown) Also available in a wide range of other pole arrangements.



ACTUATORS for Sealed, Environment-free Sub-miniature Switches

TOGGLES	Maintained	Momentary
Single-Pole	A3-37	A3-38
Double-Pole (shown)	A3-30	A3-36

Bushing size, above models: 1/4" x 40 (Also available in 15/32" x 32 bushing)



61/64" x .747" x 1 3/64"

PUSHBUTTONS

Single-Pole	A4-18
Double-Pole	A4-7
Triple-Pole (shown)	A4-14

Bushing size, above models: 15/32" x 32. (Also available in 1/4" x 40 bushing.)

Wide Range of Pushbutton Actuators for All Applications.



27/32" x 7/8" x 1 3/64"

OVER 500 PRECISION-ENGINEERED STANDARD ACTUATORS for Sub-Miniature Switches

BALL-BEARING PUSHBUTTONS

Single-Pole	A4-44
Double-Pole (shown)	A4-58



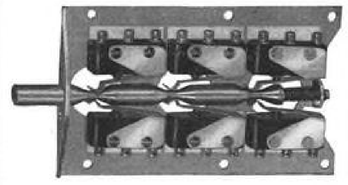
15/16" x 1 1/16" x 1 3/4"

LEAF
(Standard, Stainless Steel)

	Single-Pole	Double-Pole
Short Leaf	A5-8	A5-54
Extended Leaf	A5-9	.....
Roller Leaf (shown)	A5-10	A5-22



GANGED INTERLOCKS
Sub-miniature switches can be ganged in virtually unlimited arrangements for specific applications.



LEAF
(Standard, Stainless Steel)

	Single-Pole	Double-Pole
Short Leaf	.....	A5-59
Roller Leaf	A5-103	A5-57



A5-59 shown

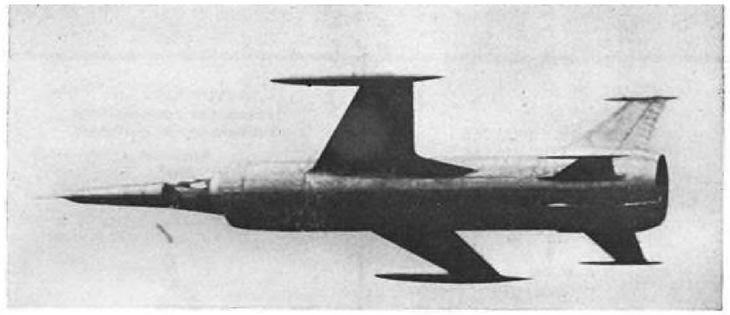
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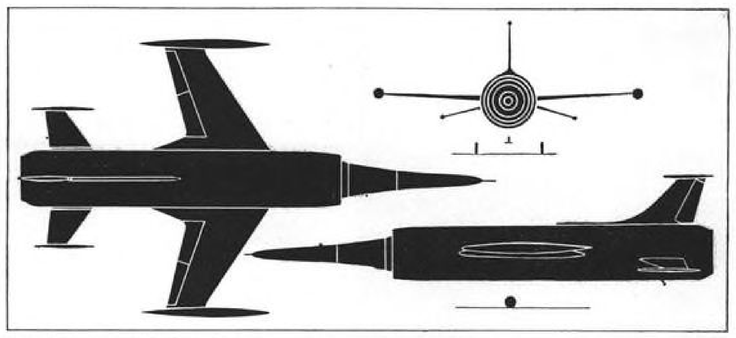


Standard Basic Switches | Double-Pole Basic Switches | Triple-Pole Basic Switches | Single-Pole Basic Switches | Heavy Duty (40 amp.) Basic Switches | Industrial Diecast Switches | Hermetically Sealed Switches

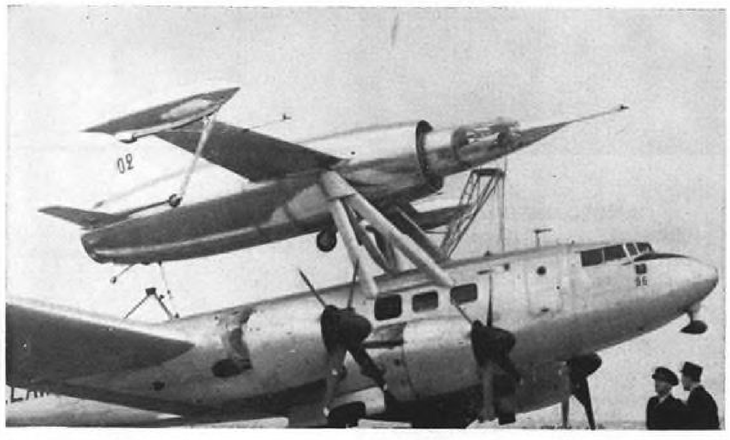
ELECTRO SNAP

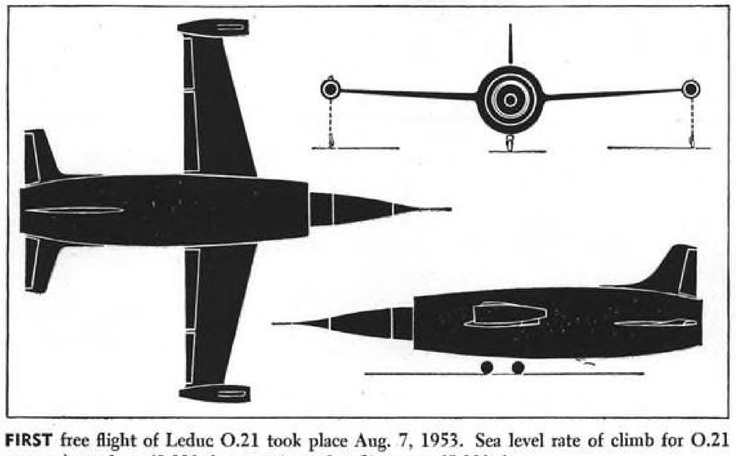
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DIMENSIONS of Leduc O.22 ramjet interceptor now flying are overall length, 57.7 ft.; height 17 ft.; wingspan, 32.8 ft. Approximate total wing area is 253 sq. ft.





FIRST free flight of Leduc O.21 took place Aug. 7, 1953. Sea level rate of climb for O.21 was estimated at 40,000 fpm.; estimated ceiling was 65,000 ft.

Leduc Ramjet

By David A. Anderton

Argenteuil, France—Work on the second prototype Leduc O.22 ramjet-powered interceptor, nearing completion and scheduled to fly early next year, faces a threatened cancellation by an economy-minded French government.

In spite of the magnitude of the technical contribution made by the relatively small Leduc organization, plans are under way to eliminate the O.22 along with some other promising prototypes from the lists of government-supported projects (AW Oct. 7, p. 31).

This proposed review of the French industry is similar to the British White Paper of last spring, which hurried the British industry into the missile business in spite of itself.

But in view of the often-stated French military requirement for an interceptor, it seems strange to technical observers that the Leduc work should be cut back.

This second prototype O.22 is the seventh in a series of man-carrying ramjet-powered aircraft developed and built by the firm of René Leduc et Fils. It is the first of the projects designed with a military requirement in mind although it is not yet matched to any specific armament system nor can it be considered as a part of a weapon system at this stage.

The second prototype is similar to the first O.22 now on flight status at the government test center in Istres in the south of France.

Sophisticated Brute

The Leduc O.22 now flying is a brute of a machine compared to the almost delicate appearance of the early experimental aircraft. The huge cylindrical fuselage, with nose spike thrust far forward, dominates the layout. The thin swept wings and tail surfaces seem added as afterthoughts.

Overall length is about 57.7 ft.; height is about 17 ft. The wings span 10 meters, or 32.8 ft., and are mounted on the fuselage centerline. Approximate total wing area is 253 sq. ft. Plain flaps and ailerons are about 25% of the chord. Large fillets at the intersection of the wing trailing edge and the fuselage serve to house the retracted landing gear. The wingtips carry streamlined tanks of high fineness ratio which probably double as a means of getting the neutral axis forward and cutting down any tendency of the 5% wing surface to flutter.

Interceptor Project Faces Cancellation

The tail surfaces are also distinguished by tip fairings, also probably serving as anti-flutter devices. Thickness of the tail surfaces is 5%. The horizontal tail is mounted just below the fuselage centerline with considerable anhedral. This surface is a slab tail and is powered by irreversible hydraulic controls developed by Jacottet-Leduc.

Standard tricycle landing gear is used, and there is a fourth wheel serving as a tail bumper.

Flying Powerplant

Essentially the O.22 is a flying powerplant with lifting and control surfaces, a cockpit and landing gear added. Almost every possible design concession has been made to get optimum engine performance.

The engine begins actually at the sharp point of the nose spike that generates the first bow shock wave in supersonic flight. This spike stretches far enough ahead so that at high supersonic speeds the rest of the airplane lies completely inside the Mach cone. Two-thirds of the way along the spike there is a contour change for the cockpit. Just forward of the inlet is a small annular scoop which is the boundary-layer bleed.

The lip of this scoop generates a second inclined shock wave which, over the design speed range of the O.22, first impinges on the main cowl lip and then moves down-stream as speed increases. Inside the cowl the air slows further to a Mach number around 1.2 at the minimum cross-section just downstream of the inlet. The central body, near the throat section, is porous for flow control. The normal shock occurs in the diverging portion of the cross-sectional area and subsonic diffusion follows.

Mounted in the center of the fuselage is a single Snecma Atar D3 turbojet engine. Its thrust is used for the slow-speed portions of the O.22 flight profile—takeoff, landing, cruise and acceleration to ignition speed. Starting at its exhaust nozzle and continuing outward along a conical surface are the rings of annular burners of the ramjet engine. They have a maximum diameter of approximately 5.4 ft., and the fuselage diameter is 6.56 ft.

The ramjet exhausts through a convergent nozzle.

Structural Composition

The structure of the Leduc O.22 is not tremendously complicated, for the simple reason that almost everything in the airplane has to be capable of being built in the Leduc facility. For this reason, forgings and other high-production components just aren't used.

Because of the desire to get maximum engine-plus-aerodynamic performance out of the plane, Leduc engineers have not been able to get much in the line of off-the-shelf components.

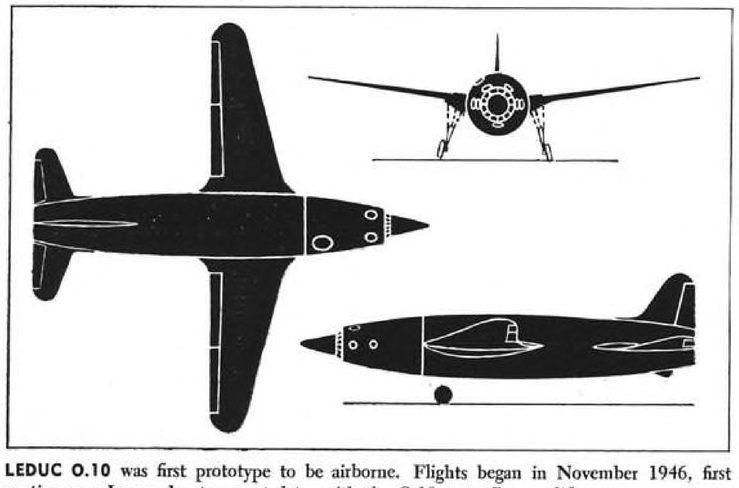
The small wheels and brakes didn't exist, ramjet engine controls hadn't been built anywhere in France, engine instruments were for turbojets and piston engines, not for measuring the fuel flows through a line that dwarfed previous fuel conduits. So Leduc's staff designed, and his competent shop built, a complete assortment of components.

With the exception of some instruments, the tires, fittings, plugs, rivets and such small parts, everything on this airplane and the ones before it has come out of the Leduc shops. This is probably unique in contemporary aircraft design.

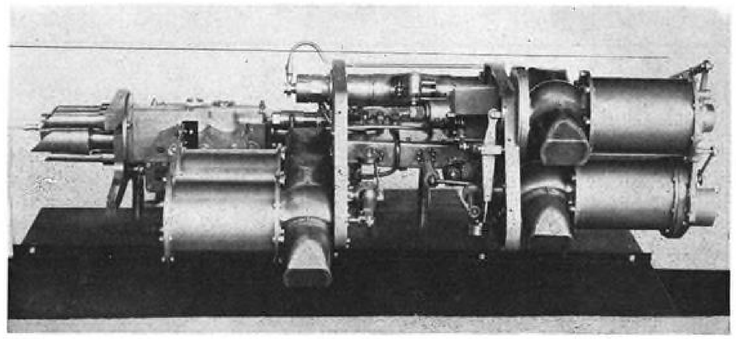
Integral Stiffening

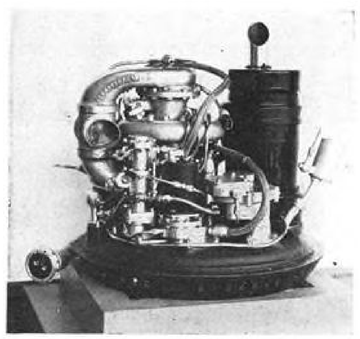
Wings of the O.22 are milled from alloy slab and integrally stiffened. This comparatively new practice has been a feature of all the Leduc experimental airplanes including the first O.10, which means that Leduc has been building integrally stiffened wing skins for a dec-





LEDUC O.10 was first prototype to be airborne. Flights began in November 1946, first captive on a Languedoc transport, later with the O.10 cast off as a glider.





FUEL control system for the Leduc O.21 (left) was designed, built by firm's technical staff. Accessory package for O.21 is at right.

ade, several years longer than most everybody else.

The wings are made in upper and lower halves on a huge Swiss-built La Rigide horizontal miller designed according to Leduc's requirements. The miller is being used by Leduc on some subcontract work for other firms in the French industry; the machine was bought for him by the French Air Ministry.

The miller is the pride of the Leduc shop, which is not over-equipped by U.S. or even French standards. The shop most resembles an experimental shop anywhere in the United States during the war. There is a small number of competent technicians and mechanics who have been in the business long enough to make or duplicate any part by hand or with elementary tooling, there are specialist machinists who fabricate the high-tolerance parts for engine control systems, there are riveters, welders and assembly hands. Parts and tools are everywhere.

In one corner stands the gaunt skeleton of the second prototype O.22, just beginning to take recognizable shape. Off diagonally in the other corner is the cylindrical outer shell of the ramjet engine for the same ship. Near it is a cockpit mockup and a scaled-down model of the airplane that was used to flight-test the escape system.

Wind Tunnel

Across the street and through a storage yard is a building which houses Leduc's supersonic wind tunnel. It's a suckdown type, discharging from atmospheric inlet to a battery of vacuum bottles.

Size of the test section is about 11 in. square; there are fixed nozzle blocks for Mach numbers 1.5, 1.75, 2.0 and 3.9.

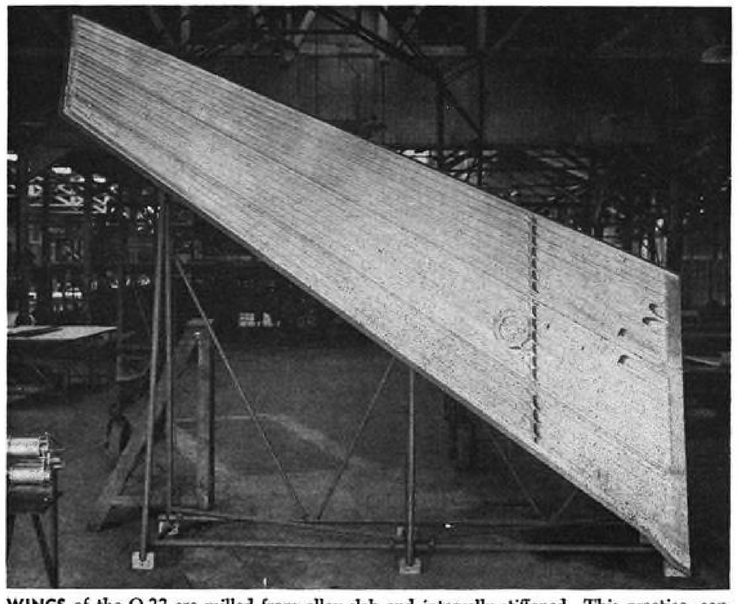
Three motor-driven suction pumps have the capacity to evacuate the vacuum tanks for a run every half-hour.

Test data includes standard force measurements—lift, drag and pitching moment—plus pressure distributions and schlieren observation or photography.

I saw a test run on the diffuser inlet at Mach 2.0; flow in the test section was very uniform and there was no indication of spurious shocklets caused by manufacturing errors or design inaccuracies.

The home-built schlieren system produced a rock-steady, high-quality picture.

As with the Leduc airplanes, almost every part of the tunnel has been designed and built by the staff, including the balance systems, manometer board and the schlieren.



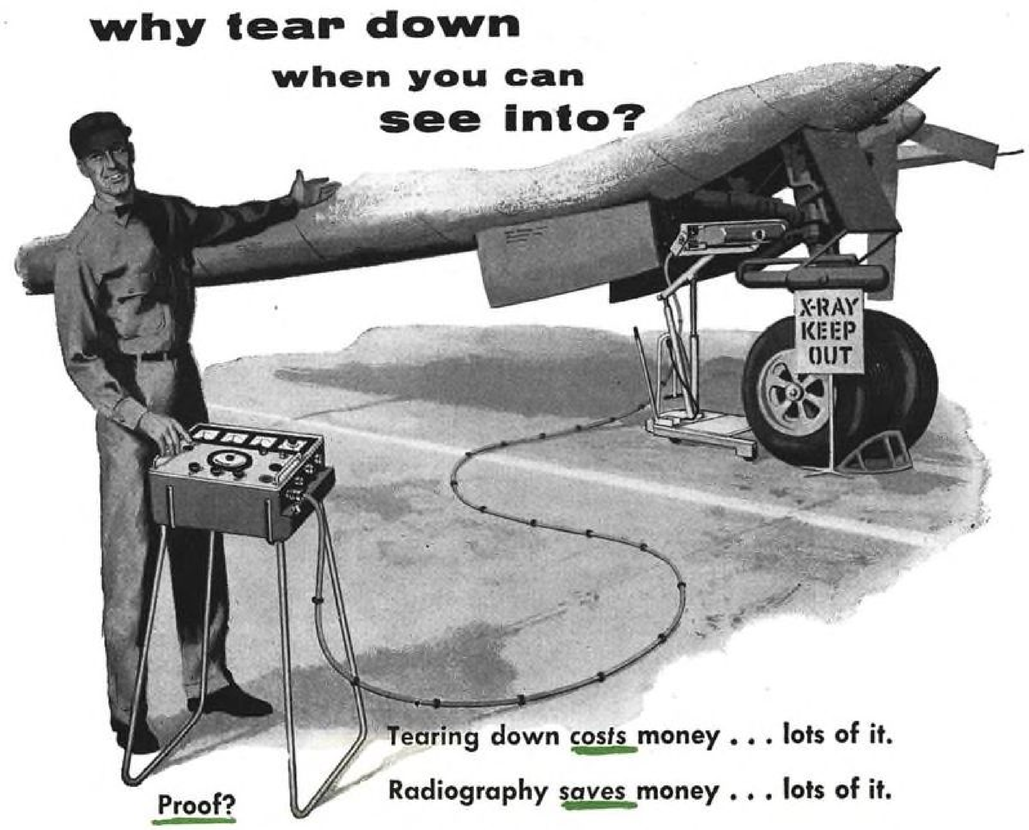
WINGS of the O.22 are milled from alloy slab and integrally stiffened. This practice, considered comparatively new, has been used by Leduc for a decade.

Lengthy Career

More than 24 years have separated René Leduc's early studies from the achievements of his current airplanes. Starting in the depths of a world-wide depression, his work has outlasted a war, an invasion, an occupation and its puppet government, postwar reconstruction and a subsequent inflation that has driven development costs in the aircraft business almost out of sight.

Leduc's first serious proposal for a ramjet-powered aircraft was made in 1933, with a basic design almost identical to the first prototype airplane flown years later. His preliminary studies of the ramjet began in 1934, with theoretical analyses supplemented by tests made in a near-sonic airstream with a tiny engine. The following year Leduc was able to measure a positive thrust for the first time in his development work, but the combustion of the engine was irregular and pulsating.

Specific studies made by Leduc in 1935 included overall ramjet analyses, work on combustion and design calcula-



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Maximum Leakage—5 c.c./min standard air
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Overall Dimensions—6.85 x 3.5 x 3.4 inches
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Endurance tested for 100,000 cycles. Integral bleed-down feature releases outlet pressure when inlet pressure is removed.

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Here's just one example of the many types available!

tions for a series of inlet diffusers.

In 1936 he continued the theoretical work, extending his studies to a sonic-speed ramjet and calculating performance of a series of diffusers in which the cross-section varied as a function of a constant times the wetted area times the quantity one minus Mach number squared.

Parallel to these studies he continued engine testing.

This first phase of test work ended in June 1936, by which time Leduc had achieved stable combustion and had completed an official test on the engine witnessed by engineers of the French aviation technical service. These runs were made with an engine of 1.2 in. inlet diameter and 1.5 in. exit diameter. Free-stream Mach number was 0.965. The recorded thrust was 8.4 lb. and the fuel consumption was measured at 2.85 lb./lb. thrust/hr.

Official Recognition

The following year the French Air Ministry gave Leduc the order to build and test his prototype aircraft, essentially approving the long-range program he had laid out for a series of steps leading to manned supersonic flight in a military interceptor. Leduc was assigned available space in a Breguet plant and moved in.

Serious construction and test work on the first prototype O.10 began in 1938. Complete model tests of the plane were made in the Eiffel laboratories, paralleling the detailed design of fuselage lines, lifting and control surfaces on the drawing boards. A one-fifth scale combustion chamber was built and tested over its expected operating range. Wing profiles of 6.25% and 12.5% were tunnel-tested at Mach numbers of 1.6 and 2.35. Diffuser tests began again in 1939 aimed at defining specific lines for the prototype aircraft.

About this time, Leduc and his engineers began another unusual program: they started development of a gas turbine to drive the pumps and accessories for the engine and airplane. The state of the gas turbine art at that time was very sketchy. The Germans, first to build and fly an aircraft gas turbine, had several months to go before getting into the air. Frank Whittle in England was deep in development testing and proof of his designs. In Italy, Campini was working toward a 1940 flight date of a rudimentary ducted-fan engine.

That, plus the experience of builders of large heavy gas turbines for stationary powerplants, was about it. Leduc dove into this problem and in 1940 had his gas turbine running and driving accessories.

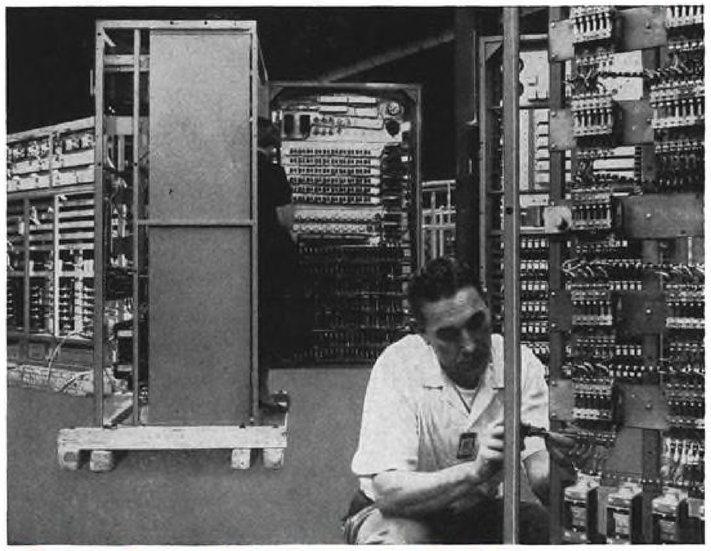
The six weeks' war caught Leduc with completed engine, combustion

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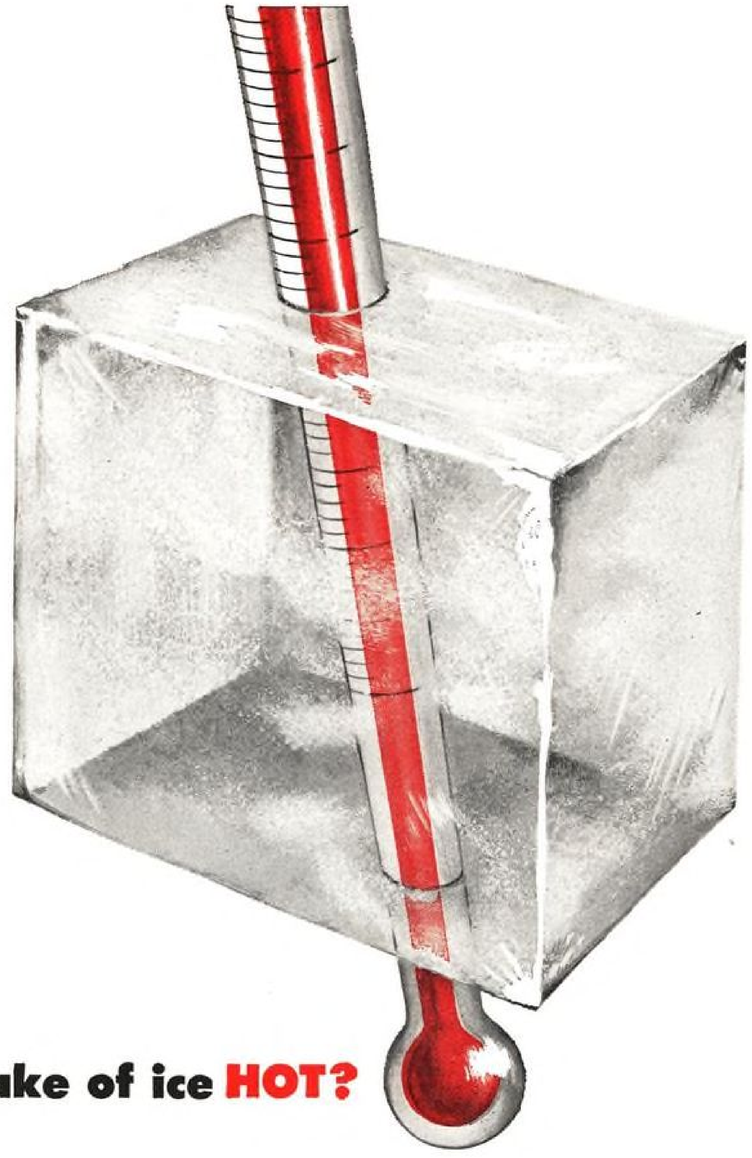
Power Control Distribution for SAGE



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chamber and gas turbine and no particular desire to hand them over to the invading forces. With a few of his staff, Leduc took off for Toulouse, taking his unfinished hardware, drawings and technical data with him.

He might not have gotten away with it, had the Germans been impressed with the caliber of his work. But postwar interviews with some of the propulsion specialists in Germany showed that they knew of Leduc and his efforts, but considered him crazy and his work of no value.

Work Continues

Leduc kept after the Vichy government during the occupation and succeeded in getting a green light from them in 1943 to continue work. But his plant was bombed in 1944 and critical portions of the work were destroyed.

In August that year he started again on the O.10 and completed the airplane the following year in a freer atmosphere. Preliminary ground checks took more time, so that the airplane did not get into the air until 1946. Since its only engine was the ramjet, which was ineffective until a moderate speed had been reached, Leduc decided to air-launch the plane from a trusswork structure on top of a Languedoc four-engined transport designed before the war by Marcel Bloch (now Dassault) and ordered into production in 1941 by Vichy for the Germans.

Flight tests began in November 1946, first captive on the Languedoc and later with the O.10 cast off as a glider during a shallow dive of the carrier plane. Many flights proved the separation system and the controllability and flight parameters of the Leduc craft.

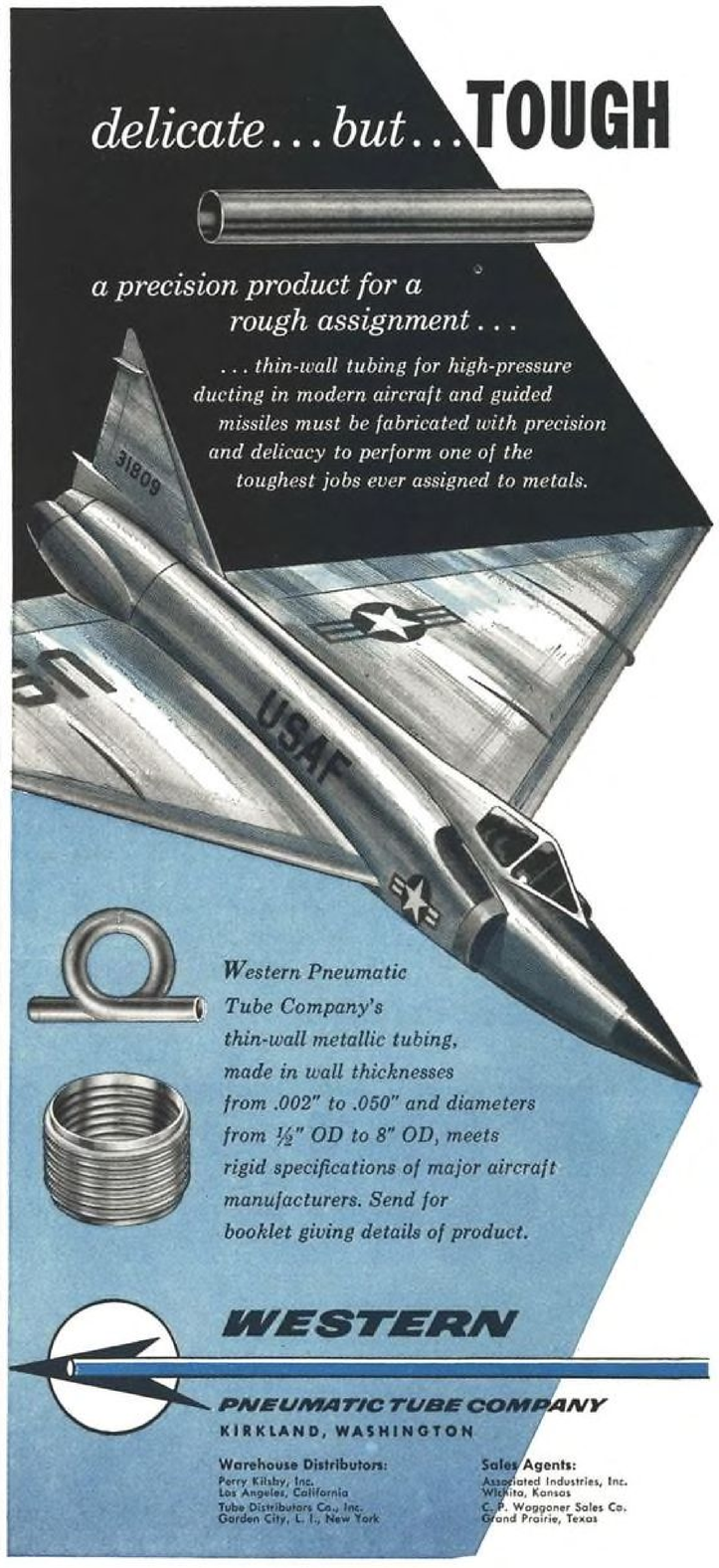
First Flight

Then on April 21, 1949, Jean Gonord climbed the ladder from the Languedoc wing to the tiny circular cockpit entrance of the Leduc O.10 and squeezed in. The four piston engines of the carrier bellowed and the composite craft lurched from its hardstand to the taxiway.

At 13,000 ft., Col. Perrin, now on the Leduc staff, dropped the nose of the Languedoc below the horizon and began the shallow dive for separation. Gonord in the O.10 talked to Perrin, told him he was ready to light the engine and cut loose.

Above the Languedoc, the huge ramjet engine came to life with a roar, its bright yellow flame tinting the metallic surfaces of the carrier. The roar was steady, the flame short, the airspeed right.

Perrin and Gonord checked instruments once more, spoke briefly over the radio link between the planes. "Allez!"; the planes separated, the O.10





military . . .

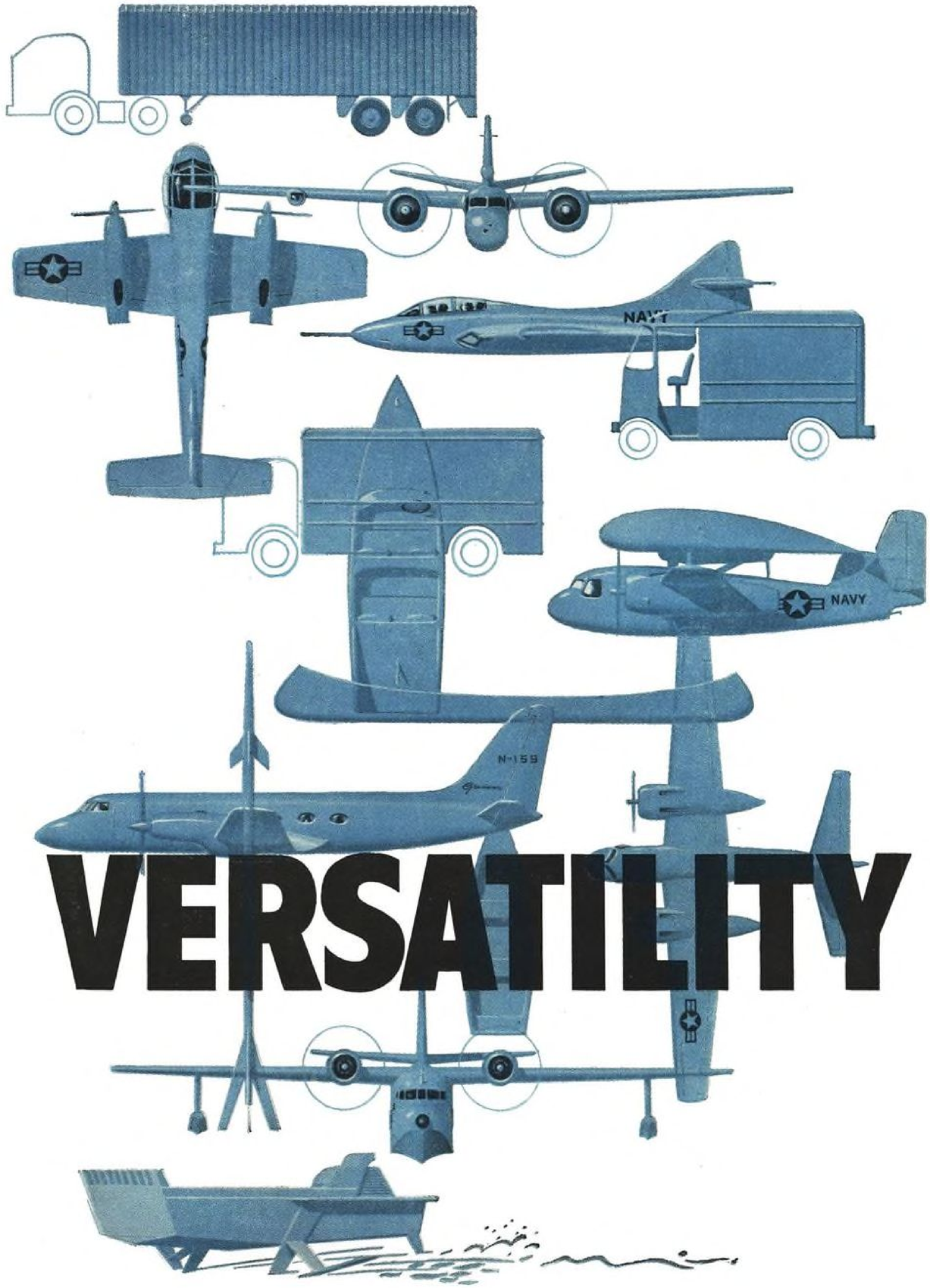
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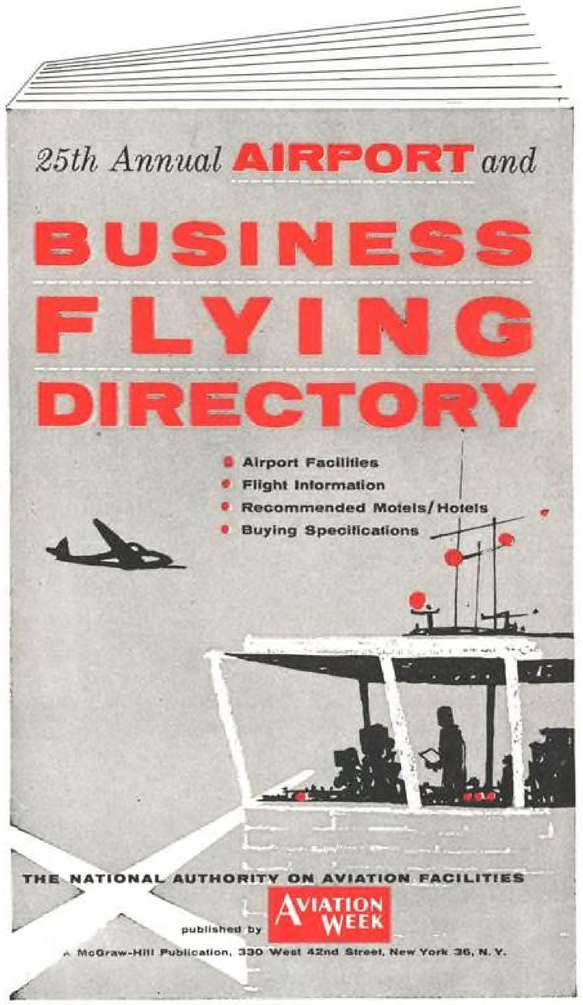
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AW1



Soviet Short-Haul Plane

Soviet An-14 Pchelka (Little Bee) was designed by O. K. Antonov for short-haul airline service (AW Aug. 19, p. 39). Six-passenger, two-engine plane can carry mail, light cargo and perform aerial photography, rescue missions, other tasks. Aircraft cruises at 125-145 mph., is reported to be able to fly on one engine. Pchelka can land on a small field, road or any open area 40-60 yd. long. Plane is equipped with instruments for blind flying or night flights, has relatively high ceiling. Aircraft will be invaluable for operation into Russia's primitive airfields.

lifting and the Languedoc dropping like a stone.

Gonord pulled up and away to the left, with the engine a steady blast behind him. On this first flight he took it easy, turning on one set of burners after another and accelerating to 450 mph. Nine minutes later he wheeled the O.10 around into a glide and returned silently to base.

On later flights with the same plane, Gonord reached 36,000 ft., touching Mach 0.84 in the climb at 26,000 ft. His rate-of-climb indicator was still showing 40 meters per second, which converts to just under 7,900 ft./min. Fuel consumption was 3.25 lb./lb. thrust/hr. at Mach 0.84.

This was about the maximum performance of the first prototype.

Next Prototypes

The first two prototype O.10 aircraft, which were essentially identical externally and internally, were followed by the Leduc O.16. This was basically the same as the O.10 twins, but a pair of Turbomeca Marbore 1 turbojets were fitted at the wingtips by request of the pilots.

These were used during the flight test program, but later abandoned and replaced by tiptanks. This version was cleared for flight early in 1951.

Construction of a pair of O.21 prototypes was Leduc's next project. These were larger aircraft; their engine diameters were 4.75 ft. compared to the 3-ft. figure of the O.10. The first prototype, finished at the beginning of 1953, began its captive flight tests in May that year. The faithful Languedoc was still the carrier.

First free flight of the O.21 took place on Aug. 7, 1953. The second prototype O.21 flew under its own power the following March 1.

During this series of flight tests, Leduc test pilot Ivan Littolff recorded speeds of Mach 0.91 and a maximum altitude of 46,000 ft. The climb performance of the aircraft was astounding. The sea-level rate was estimated at 40,000 fpm., and a measured figure at a test altitude of 16,400 ft. showed the plane to be climbing at 15,700 fpm. Estimated ceiling of the plane was 65,000 ft.

Air Ministry Support

The French Air Ministry has supported Leduc's work in what is probably the longest single airplane development program in history. Barring a brief hiatus during the occupation, development funds have continually been forthcoming for the Leduc effort.

Nobody can deny this is a long-term project; but some observers have questioned whether or not it has been too long a term. They cite the fact that France has now several airplanes flying with Mach 2 potential and that Leduc has therefore lost the technical lead he obviously had.

The answer to this criticism lies in the ramjet powerplant itself. Light in weight, producing enormous thrusts for low drag, and capable of operating on a variety of fuels from low-grade oils to exotic chemically synthesized propellants, the ramjet engine furnishes a powerplant of extreme versatility. It has one major drawback: it has to be boosted to some speed sufficient to light off. It produces no static thrust, cannot be used for takeoff in a conventional manner.

Booster Problem Solved

But combined with an internal turbojet, the ramjet takes on new life. Thrust-weight ratios are still very favorable, and the booster problem is solved. Furthermore, the fuel consumption of the combination still shows advantages over a rocket-powered craft of comparable weight or cost or complexity. This spells range, or loiter time, in a target area.

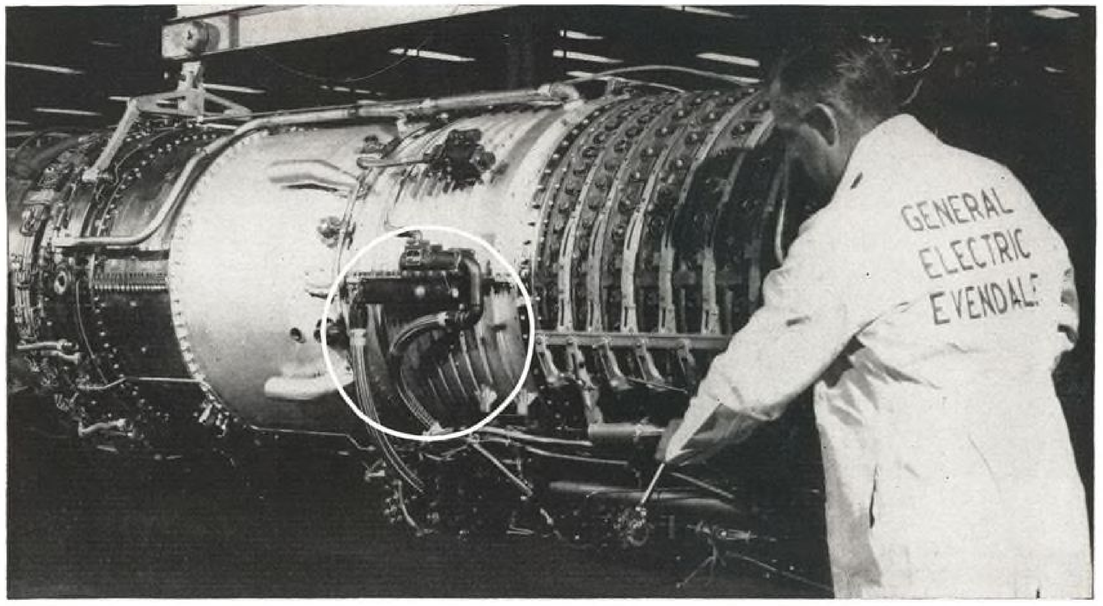
These factors all add up to one generalization: the ramjet-turbojet combination is an excellent powerplant for an interceptor.

France's obvious defense need is an interceptor. Current indications (AW Oct. 7, p. 31) are that the need will be solved first with the Dassault Mirage 3,

T2V, WV-2 Cutbacks

Washington—Immediate reduction of 300-400 Lockheed Aircraft Corp. employes will result from cutbacks in production of T2V-1 and WV-2 aircraft ordered by Navy.

Cutbacks will reduce Navy spending by $21 million in Fiscal 1958. They eliminate 15 WV-2 radar early warning aircraft due for delivery next year and 100 T2V-1 SeaStar jet trainers, 81 of which were to be delivered this year.

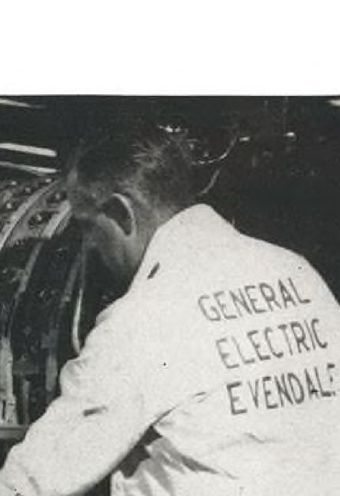


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Carrier's Bulk Dwarfs Demon

Huge bulk of USS Saratoga (CVA-60) dwarfs a McDonnell F3H that has just been catapulted from the deck of the aircraft carrier. Photo was taken during carrier qualification operations near Guantanamo Bay, Cuba.

a delta-winged plane with a powerplant combining a large turbojet with afterburning plus a smaller liquid rocket engine.

Next step in the solution could be an advanced Sud Aviation Trident (AW Oct. 7, p. 31). Or the next step could be a weaponized Leduc 0.22. Or it could be a missile, although even the most biased proponents of pilotless aircraft are beginning to back off on availability dates of operational weapons.

Long years ago, the French Air Ministry technical experts recognized the future potential of Leduc's ideas. Their continued backing has been the result of engineering respect, not political pork-barreling. They saw then the possibilities of manned flight interceptors with climb speeds above Mach 2. After the war, in the long-needed axing of projects, Leduc's work was spared for technical reasons. It has survived until today solely on that basis.

Increased Magnesium Use Forecast

New York—Magnesium's relatively high heat transfer characteristics and ease of manufacture will make it competitive for an increasing number of aircraft and missile parts despite the higher temperatures of supersonic flight, according to speakers at the Magnesium Association's annual convention here.

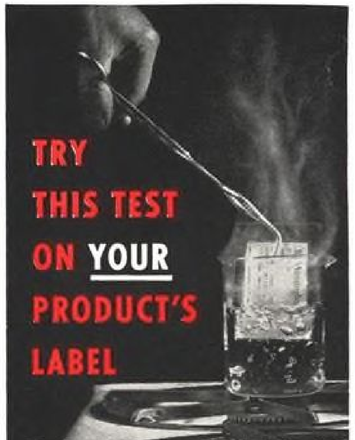
Value of high heat transfer rate has made it more attractive for Marquardt Aircraft Co., Van Nuys, Calif., to use magnesium alloys covered with heat resistant paints for their Bomarc ramjet inlets than some of the stainless steels. A spokesman for Marquardt told AVIATION WEEK that it may be possible to use magnesium alloys even for extensions of the Bomarc which Boeing is said to be planning, such as Mach 4.0 bomber-carried missiles and even ICBM interceptors. Skin temperatures in these applications will near 900F.

According to another materials engineer at the meeting, steel conductivity is too low to carry away its own heat, if the part is of a certain size, while magnesium with suitable surface protection can readily be cooled from the inside.

A paper by John H. Rizley and Robert E. Mihalco, two Convair engineers, warned the conference, however, that unless magnesium developments are able to keep pace with progress in other materials, the slight advantage which magnesium alloys now hold on a strength-to-weight and stiffness ratio basis in the 300-700F range may be lost. At present, magnesium is most attractive for parts such as electronic chassis which must be both light and able to carry heat away, according to these engineers.

Recent manufacturing developments which make magnesium attractive discussed at the meeting were:

• **New 13,200 ton** German-built extrusion press now being operated by the



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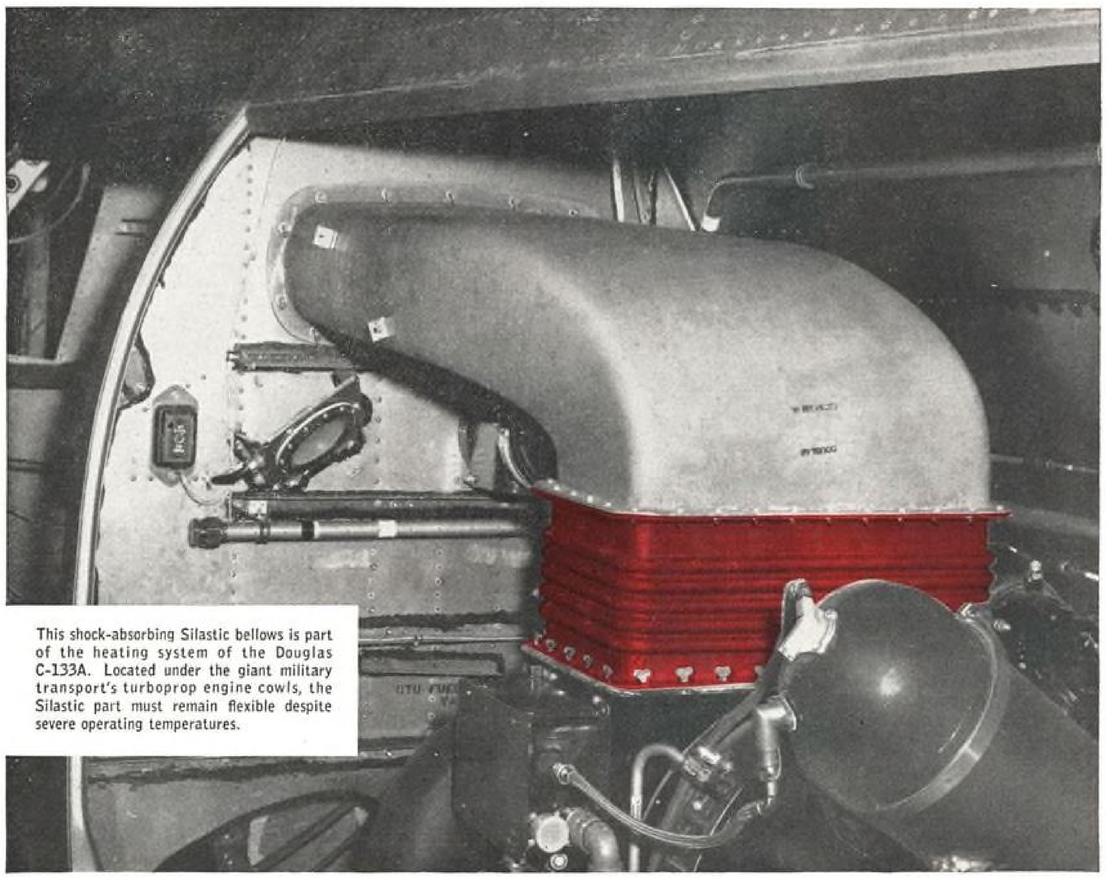
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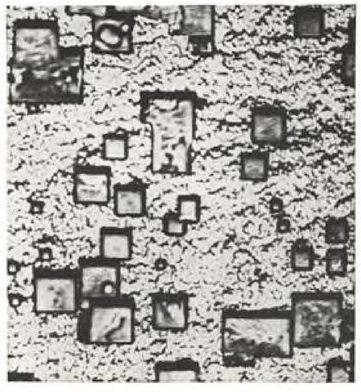
Dow Chemical Co. at Madison, Ill. Dow says they are able to use as large as 2,500-lb. ingots to produce magnesium extrusions up to 93 ft. long or 18 in. diameter. When used in missile and aircraft wings and bodies, these extrusions will reduce both the finish machining time and the structure weight.

• **Precision casting** of magnesium by firms like the Osbrink Corp., Los Angeles, was claimed by L. H. McCreery of Chance-Vought Aircraft, Inc., Dallas, Tex., to have saved his company at least $3,500 per missile when used on an outer wing panel.

• **Pressed forging** at McDonnell Aircraft Co., St. Louis, Mo., which consists of placing a heated pre-trimmed blank into one-half of a 650-850F heated mating die, bringing down the other die half, and then applying sufficient pressure to make the metal flow. Magnesium and aluminum can be pressed. Pressure is inversely proportional to web thickness with minimum webs requiring 40 tons/sq. in. compared to 20 tons/sq. in. for average forgings.

One distinct advantage of the pressed forging technique is that no draft allowances need be made and McDonnell has been able to make 3-in.-high ribs as thin as 0.090 in.

Other production techniques discussed at the meeting were chemical milling, large forging presses and dip brazing and high-rate machinings.



Material Simplifies Electrical Products

Westinghouse Electric Corp. has developed a new type of cube-oriented magnetic core material which can be magnetized in four directions, freeing electrical equipment designers from the necessity of building core laminations up from many separate punchings, with the resultant heavier parts and flux loss across the joints. As the etched magnification illustrates, the cube-oriented crystals are lined up in the same direction. Therefore all their axes of easy magnetization coincide.

Civilian Test Pilots Form Flight Council

Civilian test pilots at the Air Force Missile Development Center, Holloman Air Force Base, N. M., have formed a test pilots council for the purpose of achieving and maintaining sound and effective procedures for both flight safety and flight tests. The council is currently supporting a flying safety program initiated by Gen. L. I. Davis, commander of the missile development center.

Membership includes engineering and experimental test pilots from Hughes Aircraft Co., Convair, Bell Aircraft Corp., Douglas Aircraft Co., Goodyear Aircraft Corp., McDonnell Aircraft Corp., Lockheed Aircraft Corp. and Northrop Aircraft, Inc.

Officers of the test pilots council are: John F. Brumfield, Northrop, chairman; William Mable, Bell, secretary; Raymond Hunt, McDonnell, treasurer; Richard Kutchins, Lockheed, vice chairman; Dean Mitchell, Goodyear, assistant secretary, and Roger Oglesbee, Lockheed, assistant treasurer.



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Canadians Study ICBM Exit, Re-Entry

Montreal, Canada—Intercontinental ballistic missile exit and re-entry problems, and design details of higher performance turbojets, were among the subjects covered at a joint Canadian Aeronautical Institute and Institute of Aeronautical Sciences meeting held recently at Montreal, Canada.

Gap between ICBM performance and development test equipment was described by G. V. Bull, K. R. Enkenhus and G. H. Tidy of the Canadian Armament Research and Development Establishment (CARDE). In enumerating present methods for ground simulation of ICBM flights, the authors described their work with the CARDE aero-ballistic range, showing how this could be used for problems such as stage separation during ICBM boost out of the atmosphere.

In the CARDE design a light gas gun using a hydrogen-oxygen mixture and with hydrogen as the working fluid is used to launch ¼ in. diameter models into an evacuated range. A dump chamber is used to trap the heated hydrogen gas following the projectile and to duct it outside the laboratory. The range is 2 ft. in diameter and 60 ft. long. It is instrumented with two-dimensional spark photographic stations to measure the trajectory.

Gas Controlled

Gas inside the range can be controlled in pressure, temperature and content.

Although the firing range is readily calibrated, the authors said that observation and measuring problems are extremely difficult. Moreover, the types of models are limited by the large launching loads. Models in the order of a few grams can be launched at velocities up to 20,000 ft./sec. (about Mach 20), but heavy models (weighing in the order of a few pounds) can only be fired at Mach numbers as high as 10 by using a heavy gas atmosphere such as freon.

Summing up the present lack of fully developed ICBM test methods, the authors concluded that current ICBM aero-ballistic problems will continue to be mainly solved by expensive test firing techniques.

Concrete suggestions for designers of efficient engines with high specific thrust, low frontal area, were offered by two National Advisory Committee for Aeronautics researchers and an engineer from Orenda Engines, Ltd., Canada. Future turbojets, according to these authorities, may well contain the following:

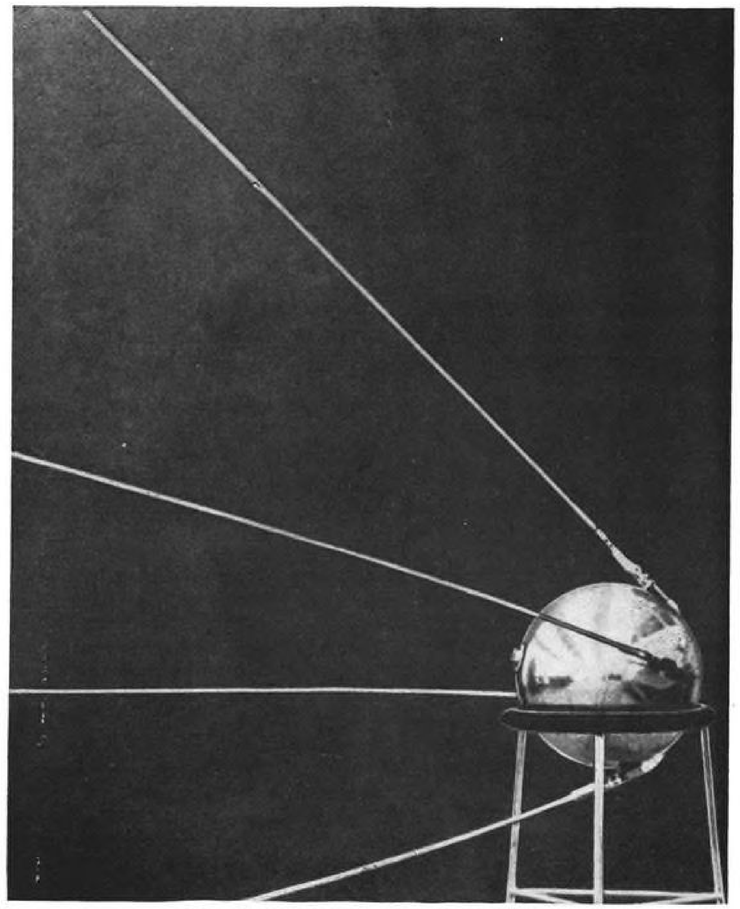
- **Transonic compressors.**
- **High flow combustors.**
- **High workload turbines.**

W. H. Robbins and H. W. Plohr of the Lewis Flight Propulsion Laboratory, Cleveland, O., said NACA has run a transonic compressor which achieved 1.48 pressure ratio per stage with a mass flow of 30 lb./sec./sq. ft. and a peak efficiency of 0.9 Relative Mach number at the blade tips was 1.1. This, they said, was an airflow increase of 20% over that for conventional subsonic compressors or, in other words, one transonic compressor stage could do the work of two conventional subsonic compressor stages.

The transonic compressor represents a major advance in the compressor field, according to NACA, as it will enable the designer to increase the airflow capacity and stage pressure ratio simultaneously without sacrificing either efficiency or range. The majority of transonic blading employed by NACA was selected from a family of double-circular-arc airfoils. The high Mach blading differed from conventional airfoils in that the leading edge of the blade is thin and the position of maximum thickness is shifted toward the trailing edge.

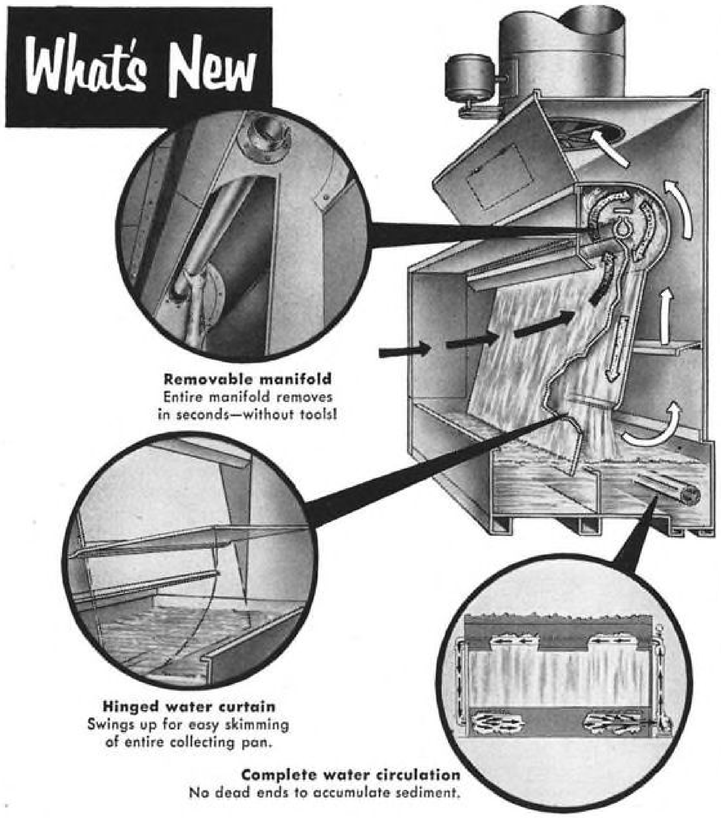
Ramjet Approach Used

Use of ramjet combustion techniques now giving inlet flow velocities up to 200-400 ft./sec. was predicted for turbojets by F. D. M. Williams, Orenda Engines, Ltd. In ramjet-type combustors, primary zones will offer less obstruction to the airflow, stabili-



Model of Soviet Satellite

Model of Sputnik displayed in Moscow shows location of Russian satellite's four antennas. Sphere, which weighs 184.3 lb., measures 23 in. in diameter, is made of aluminum alloys (AW Oct. 14, p. 27). Sputnik is reported to have reached peak altitude of 580 mi.



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zation will be done in the wake of gutter-type bluff bodies and a more discreet type of piloting will be used, Williams said.

Problems Will Increase

Structural problems of designing combustors for supersonic turbojets will increase many-fold because not only will compressor delivery air be over 1,000F and make the cooling of the sheet metal parts difficult, but the demands for light overall engine weight will (as has been already evidenced on Orenda's Iroquois) demand that the engine envelope be a continuous monocoque structure.

This will make it impossible to continue the easy accessibility of present combustor systems where the cans can often be removed from the engine in a few minutes. The combustion systems for these advanced engines will have to be able to operate reliably for 25-50 hr. right at the outset of the engine test development program, Williams said. The usual fixes to the combustors during development will be out of the question and for this and other reasons the combustion system will have to be tackled more seriously in the early phases of a new engine.

Turbine Work

Conventional turbine design techniques, according to Robbins and Plohr of NACA, result in severe penalties in efficiency under the high work-output conditions required for supersonic turbojets.

However, these losses can be minimized by careful attention to the aerodynamic loading on the turbine blade and the turbine can be "forced" to even higher outputs without efficiency drop.

NACA has re-designed turbine blades to avoid the usual extreme velocity peak over the suction surface when the blade is being overloaded. They have found that with new velocity distribution they have been able to design turbines apparently suitable for driving transonic compressors.

Focke-Wulfe Flight Tests License-Built Piaggio P-149

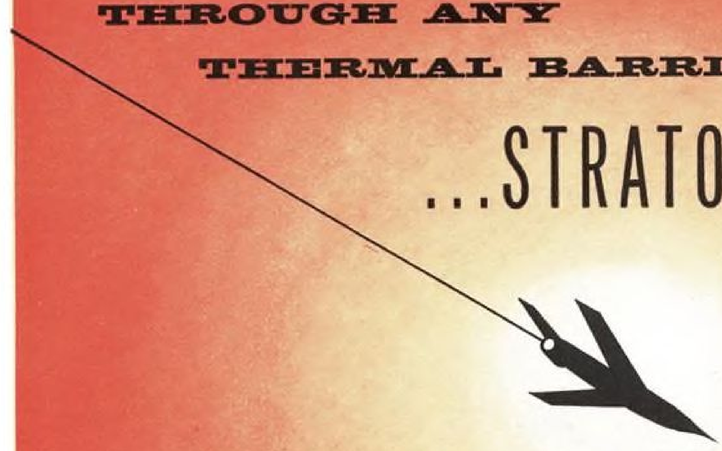
Focke-Wulfe, Bremen, is carrying out trial flights of its first Piaggio P-149 built under license.

German Defense Ministry has ordered a total of 190 of this type from Focke-Wulfe to be delivered within the next four years. Price per plane is between $25,000 and $28,000.

Piaggio is the first of three foreign planes being built under license for the German Air Force to reach completion. The others are the Noratlas and the Fouga-Magister.

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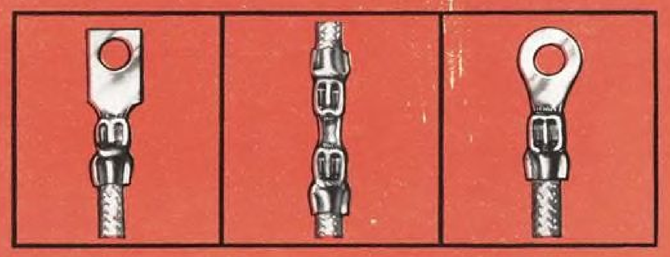


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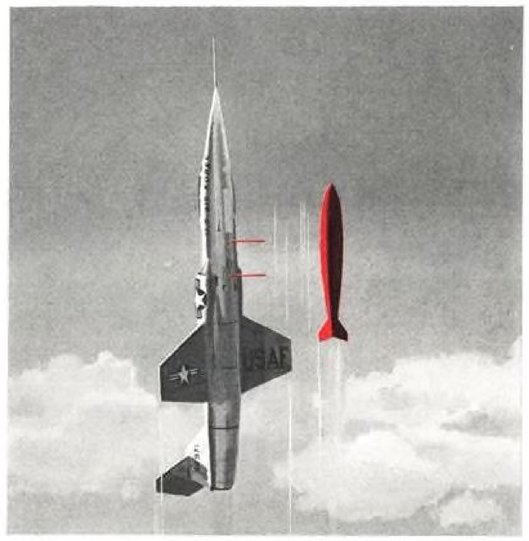
BOHANAN, *still first in force ejection*



Members of the BOHANAN force ejection team are shown studying a component of a new BOHANAN force ejection system.



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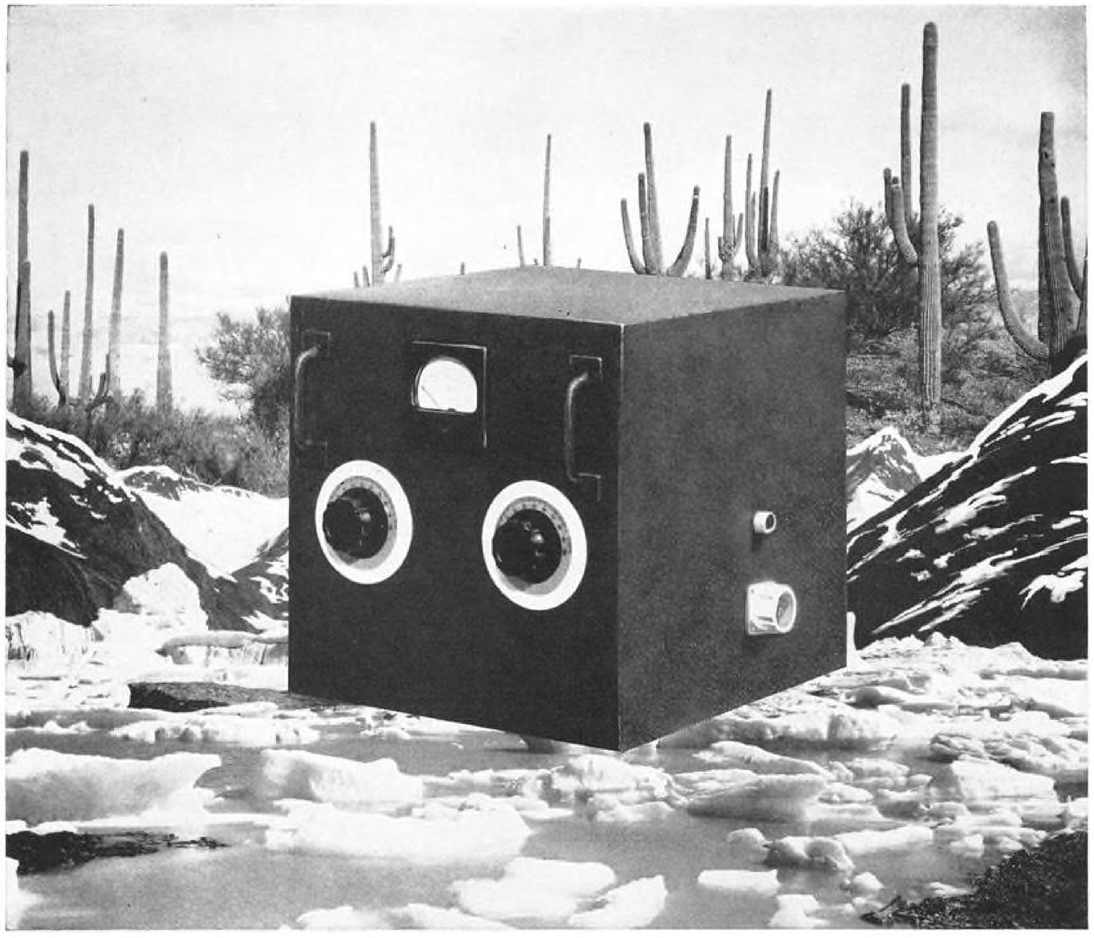


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NACA Studies Ways to Soften Jet Noise

By J. S. Butz, Jr.

Cleveland, Ohio—Three basic approaches to bringing turbojet noise down to piston-engine levels are being investigated by the National Advisory Committee for Aeronautics at the Lewis Flight Propulsion Laboratory here. Considerable progress is reported even though no definite solution has been reached and each noise reduction method has its disadvantages.

The general areas of study are:

- **Mechanical suppressors** (various nozzle shapes, etc.).
- **Engine design.**
- **Climb procedures.**

This NACA work is devoted solely to decreasing noise during takeoff and much of it involves the study and extension of ideas originating with various manufacturers and research groups here and abroad.

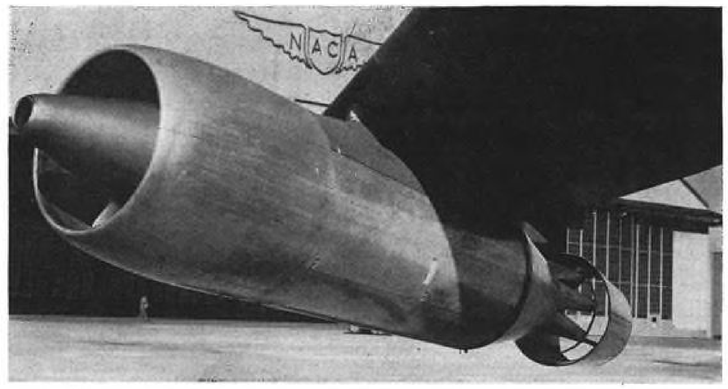
Main Drawback

Many types of mechanical supressors have been tried and their main drawback has been that they reduce engine thrust while cutting noise. To the airlines this could mean a revenue loss through reduced passenger loads.

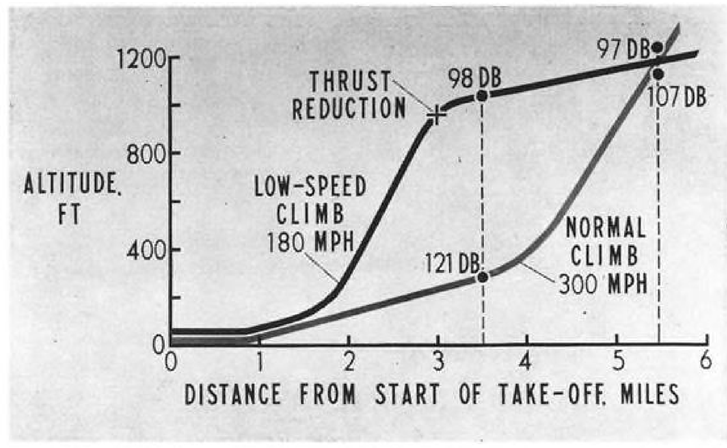
However, the NACA has a nozzle-ejector combination that reduces noise to the required level without the customary thrust losses. The only drawback of this installation is that the ejector will increase the drag of the aircraft and cut its range down.

The whole project is in the experimental stage and efforts are now being made to make the ejector both retractable and light.

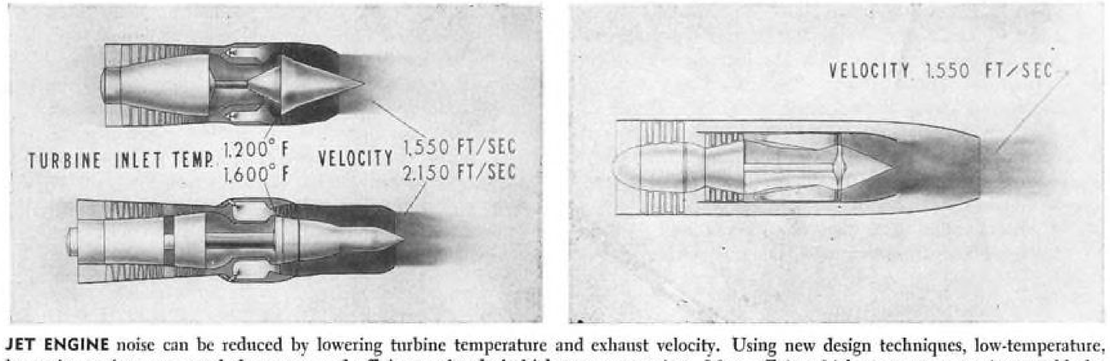
Current study of this nozzle-ejector has given the NACA considerable hope that a workable answer to the noise situation will be reached through a relatively simple mechanical device. Much



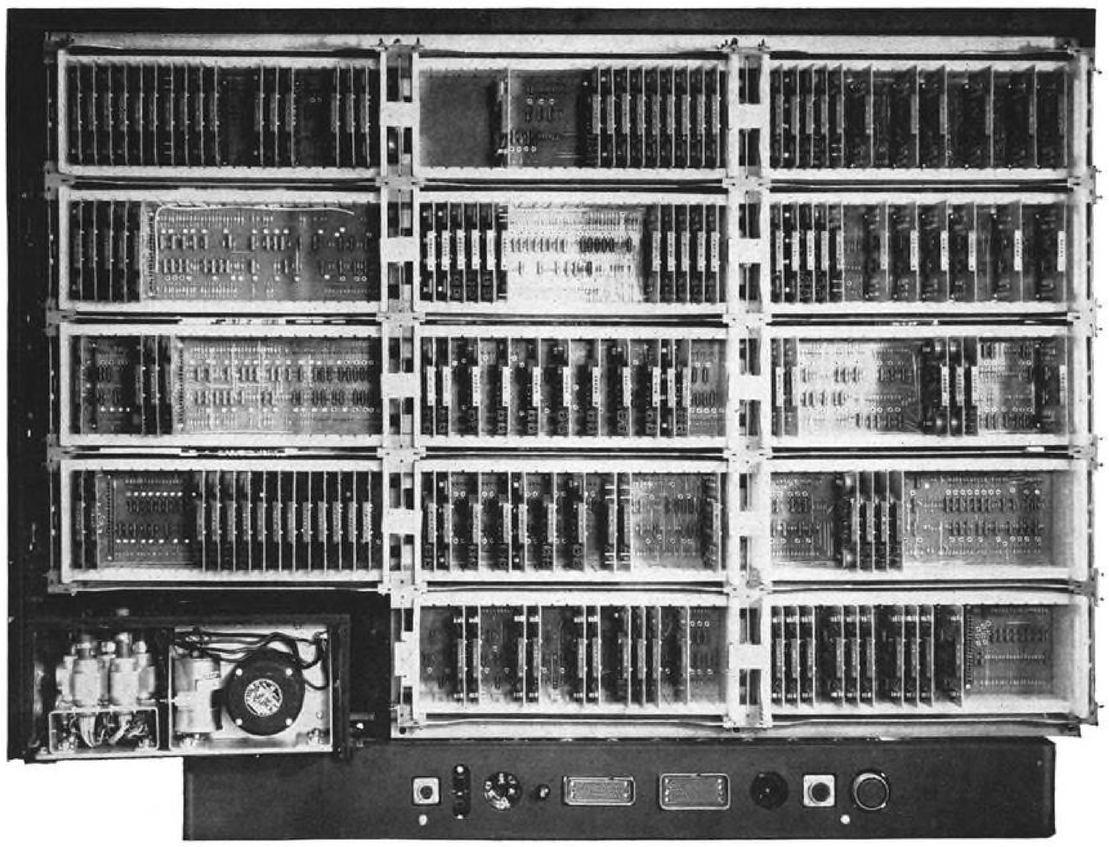
CORRUGATED nozzle in combination with annular sheet metal ejector is most promising noise suppressor being studied by the NACA. Ejector eliminates thrust loss due to the corrugated nozzle, but it has a large drag which would lower aircraft range.



TAKEOFF and climbing procedures especially tailored for each airport and its surrounding communities can do much to lower jet noise in populated areas. Typical climb procedure and the noise it creates on the ground (in decibels) is compared to a proposed low-speed, low-noise climb.



JET ENGINE noise can be reduced by lowering turbine temperature and exhaust velocity. Using new design techniques, low-temperature, low-noise engines can equal the power and efficiency of today's high-temperature jets. More efficient high-temperature engines could also be built with the new design methods. Exhaust velocity and noise of by-pass engine (right) is reduced by low energy by-pass flow. By-pass engine has about same noise level as the low temperature engine (above, left).



The Role of

PRODUCT ENGINEERING

in Systems Work

It has become characteristic of modern weapons systems that they are required to operate under severe environmental conditions, as well as to meet stringent weight and space limitations. Moreover, the complexity of many of these systems poses additional difficult reliability problems, while at the same time the increasingly critical consequences that depend on the proper functioning of the typical system logically call for a *higher* degree of reliability than previously achieved. The same is true of certain electronic systems for industrial applications, such as the Ramo-Wooldridge digital control computer, some of whose design features are shown above.

Meeting all of these requirements is in large part the responsibility of product engineering. Generally speaking, product engineering starts with a system or subsystem at the breadboard stage and transforms it into the final product, which in addition to meeting all of the requirements previously stated, must be practical to manufacture and to maintain. Such creative productizing requires the development of ingenious mechanical design features, a thorough knowledge of circuit design and component reliability, and a broad familiarity with materials and manufacturing processes.

At Ramo-Wooldridge, the product engineer is an essential member of the research and development team which has the full responsibility for creating new systems, from the initial theoretical studies on into the manufacturing stage. Engineers experienced in product engineering are invited to explore the variety of openings which exist at Ramo-Wooldridge in such fields as airborne electronic and control systems, communications and navigation systems, digital computers and control systems, and electronic instrumentation and test equipment.

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work still remains before this practical device is achieved.

These mechanical suppressors are designed to alleviate the two conditions in the high velocity exhaust of a jet engine which are the primary causes of its noise. First are the turbulent eddies which are created as the high speed exhaust mixes with the low speed outside air. These eddies produce fluctuating pressures which radiate sound waves.

The second major source of noise is the shear at the edge of the jet blast which results from the steady components of the exhaust velocity. This velocity shear greatly amplifies the acoustic output of the turbulent eddies in the jet blast.

Suppressor Method

Mechanical suppressors all attempt to reduce the intensity of these two noise sources by:

- **Increasing downstream mixing** of the jet to attenuate the strength of the eddies.
- **Increasing contact area** of the jet blast with the outside air to reduce velocity shear.

Many nozzle shapes have been studied. One is the "organ pipe" type which passes the engine exhaust through a number of small pipes. Another nozzle uses deeply folded convolutions or corrugations to spread the exhaust. Parallel slots have also been tried on nozzles.

All of these types can produce the required jet noise reduction of 15 decibels to bring a four jet transport passing directly overhead at 100 ft. with full power to the noise level of a plane with four piston engines under the same conditions.

They are all faced with the same serious disadvantage however; they build up back pressure on the engine and slow its exhaust velocity, causing a thrust loss.

Ejector Reduces Loss

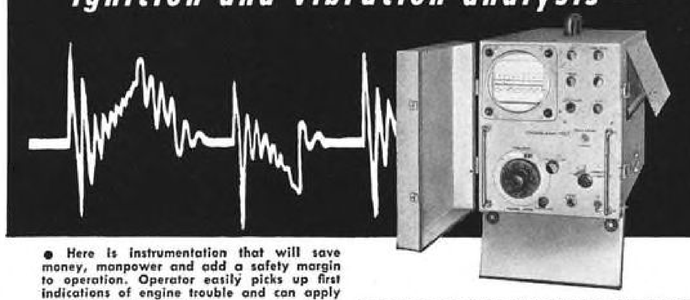
This back pressure and thrust loss can be eliminated while achieving the required sound reduction by surrounding a corrugated nozzle with an ejector, according to the NACA. The ejector is a form of jet pump. High velocity engine exhaust air passing through the ejector pulls low speed secondary air around the jet blast. This reduces pressure in the jet stream and gives the velocity shear gradient surrounding it a more gradual character. As mentioned previously, this promising unit is being developed further to decrease its weight and the drag of the ejector.

Another basic approach to the noise problem is a change in turbojet design so that engine exhaust velocities could be efficiently reduced. Lowered jet velocities would have added benefits because the engine would run cooler,

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Power Requirements (total) — 250 watts.

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The INFLIGHT 136 incorporates the vibration selector switch into the switching module. This reduces the number of individual units and cabling required for a complete system.

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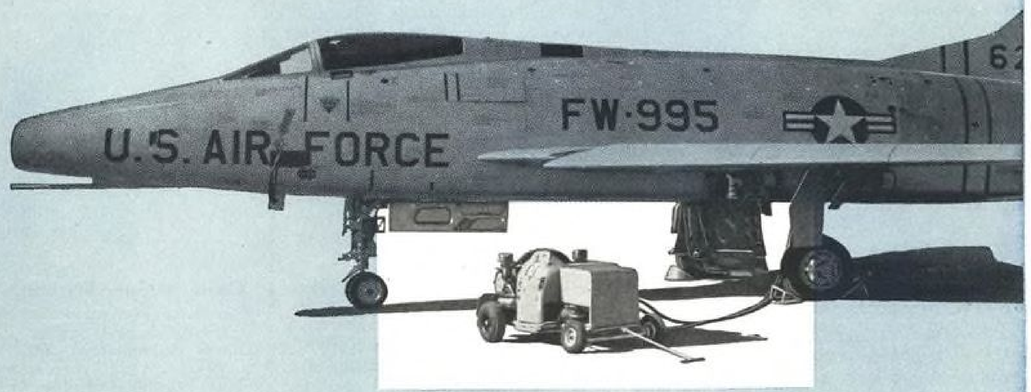
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As a part of its jet engine hydraulic starting system evaluation program, Vickers Incorporated recently demonstrated the ability of its starter package to start Century Series fighters. Acceleration to ground idle speed of the J-57 turbojet engine, installed in a production North American F-100D Super Sabre, was accomplished in times comparable to other known starting means . . . using only 50 horsepower, prime mover power.

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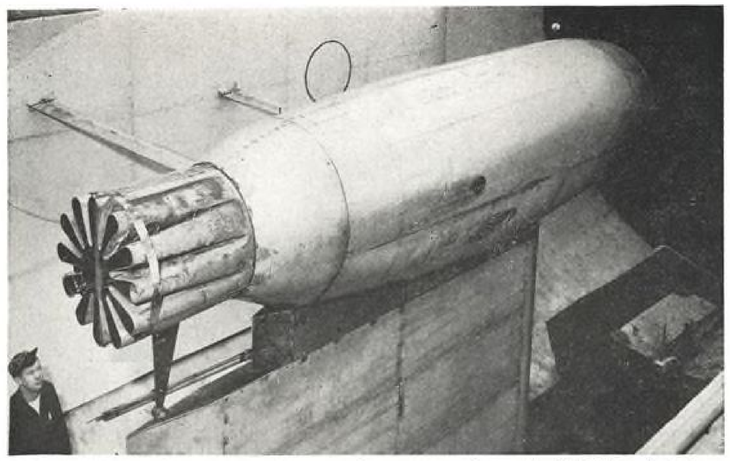
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ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921



EXPERIMENTAL noise suppressor is mounted on a test engine at the NACA Lewis Laboratory. Nozzle design lowers noise level effectively but also reduces engine thrust.

with longer life and greater safety.

Current transport engines which are based on military designs require high turbine temperatures and exhaust velocities to operate efficiently. Improved design techniques developed since these engines entered production make it possible to build low temperature, low jet velocity engines which are as efficient as today's jet transport powerplants. These engines would result in about a nine decibel sound reduction which is a large step in the right direction.

Quiet vs. Efficiency

Main arguing point against such low temperature engines is the fact that the improved design techniques could be used to produce a more efficient engine with no reduction in noise. The low temperature engine is also slightly larger then its noisier counterpart and would thereby tend to increase aircraft drag in some installations.

One current type of turbojet, which is as efficient and as quiet as the low temperature engine, is the by-pass engine. Noise reduction on this powerplant is achieved in much the same manner as the nozzle-ejector combination except that the mixing of the low energy secondary flow with the high speed jet exhaust takes place within the engine. The air which is ducted around the combustion chamber, turbine and part of the compressor on the by-pass engine is mixed with the main jet in the tail pipe. This gives the resultant jet exhaust a lower velocity and less noise. Velocity is especially reduced in the shear area between the jet and the outside air.

The third method that the NACA is considering for reducing noise is by varying the aircraft flight technique. Chart on page 73 shows the normal climbing procedure for a jet transport and its associated noise. It also shows one of the recommended flights paths resulting from NACA test.

Noise Reduction Technique

The normal technique is to take off in the jet transport, hold it down until it accelerates to about 300 kt. and then begin the climb. This is the best climbing speed and gives the minimum time to climb to altitude.

The alternate procedure, which results in less noise for people on the ground, is to take off and begin climbing almost at once at an airspeed of only 180 kt. This climb is maintained at maximum power until an altitude of 1,000 ft. is reached. Then the pilot throttles back to 50% power and brings the nose down to the point that will allow him to maintain 180 kt. speed. As shown on the chart, this procedure makes it possible to reduce the sound on the ground by 23 decibels at a point 3.5 mi. from take off.

It is impossible to make any hard and fast rules about how such climbing techniques will reduce noise in communities. Local conditions vary too much for this, but it is probable that each separate airport can devise its own take off rules to greatly reduce the noise in neighboring populated areas.

There is the further possibility of combining all three of these general approaches to the noise problem to achieve a single, economical solution. Cost, thrust losses and weight are all factors of the greatest importance when considering devices and procedures to be used by commercial airlines. While effective noise reduction methods may be presently available they require much more development before they will be acceptable to the airlines.



PUMP PRIMERS

by
Arthur A. Nichols

Low weight, high performance and unusual adaptability to space and geometry of housing structure make Gerotor pumps ideal for gearbox lube and scavenge service.

Engineers concerned with drives, auxiliary power sources, gear boxes and various transmission design problems involving pressure lubrication have found Gerotor type pumps extremely useful in their attempts to hold weight down and achieve maximum compactness with high service reliability.



Fig. 1 Integral Transmission Pump

Several helicopter firms and their gear suppliers, for example, are using our pumps because they combine so many useful advantages of importance in aircraft design. The Gerotor pump is a positive displacement type, delivering a predetermined amount of fluid in direct proportion to speed. It is a form of internal gear pump — simple and compact in basic design, (has only two moving parts). It is lightweight, valveless, provides exceptional performance and has low wear over a long service life. It is balanced and extremely quiet in operation.

Unlike conventional gear pumps the Gerotor needs only a single shaft. Both elements are substantially concentric to it and are mated to provide continuous, fluid-tight engagement without the crescent structure necessary in other internal gear pumps. Porting and plumbing are completely flexible in location. Further, Gerotor elements can be stacked along a single shaft and mounted on a single AN pad to perform multiple pump functions: lube, scavenge, boost, etc. *(fig. 1)*. Such compactness allows pump configuration to be adapted to the gear box

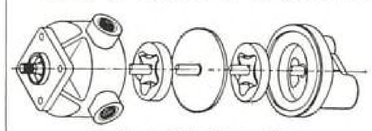


Fig. 2 Multiple Element Pump

geometry. It can be "submerged" in a sump which frequently may be part of the pump housing, *(fig. 2)*.

Valveless design insures absence of mechanical troubles and wear problems inherent in valve construction.

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ARMED reconnaissance helicopter rises to fire 2.75 in. rockets at target. Helicopter then drops quickly behind covering trees.

Army Evaluates Armed Helicopter Units

Ft. Rucker, Ala.—Experimental exercises with armed helicopters here at the Army Aviation Center will be reviewed soon to establish tactical doctrine and equipment requirements for operational flying cavalry units.

These proposed helicopter units will be self-contained and able to support themselves for three or four days in the field with their own maintenance, resupply and evacuation of battle casualties.

Their function will be to provide:

- **Close reconnaissance** over wide areas separating major units on an atomic battlefield.
- **A means** of rapidly mounting strong infantry attacks against enemy troop concentrations, supply and maintenance groups that reconnaissance shows to be forming.

To accomplish this mission, flying cavalry units will have reconnaissance elements equipped with small two-man helicopters, troop carrier groups with much larger equipment, weapon sections of large helicopters with their whole payload devoted to missile and machine gun armament, and resupply and evacuation groups of large helicopters.



BELL H-13 reconnaissance helicopter armed with four 30 cal. machine guns approaches a target at high speed under cover of a stream bed.

Patrol Function

Initial tactical procedure of a flying cavalry unit will be to keep reconnaissance groups operating in constant patrols over its assigned sector. These reconnaissance groups would vary from single elements of two helicopters to several elements functioning together. They would be able to cover more territory more thoroughly in a single morning than motorized cavalry could in several days (depending on the terrain).

Enemy concentrations too small to warrant an atomic or full-scale airborne attack and too distant for engagement by motorized troops would be attacked by the flying cavalry. Troop carriers would move by a sheltered route to a line of departure where they would meet the weapon helicopters. Weapon section would then precede the troop carriers to a landing area close to the enemy concentration.

Area-saturation fire with missiles and machine guns by the weapon section would keep the enemy down and suppress its fire while carriers discharged infantry and withdrew. Helicopters of the weapon and reconnaissance sections would then be available to deliver suppressor fire against any target that the disembarked infantry indicated.

Limited to Area Fire

At the moment, only area fire is possible from helicopters, but as their stability increases it is believed that they will be effective against point targets such as tanks.

Helicopters are able to take advantage of terrain and cover. In wooded and gently rolling country of the type surrounding Ft. Rucker, large groups of helicopters can move rapidly with little possibility of hostile observation from the ground except from very high vantage points. They fly down stream beds, sunken roads, etc., always a few feet off the ground or above the trees. Their attack on simulated targets is sudden and devastating. A small number of armed helicopters can saturate a large area with effective fire for several minutes.

The helicopter is, of course, vulnerable to automatic weapon fire from the ground. But this will probably only be effective in open flat country with little cover, or if the helicopter is at point blank range. This will probably lead to ambushes covering possible routes of helicopter approach to stop flying cavalry patrols and attack groups before they reach their objective.

Scouting Role

Function of the cavalry scout has always been to locate the enemy, and this usually results in drawing enemy fire. The scout in the small helicopter will probably not fare any better or any worse than his motorized and mounted predecessors. The helicopter will give him a maneuverable and rapid vehicle for his work, as has been demonstrated at Ft. Rucker.

All helicopters in flying cavalry units will have some type of armament for their own defense and for ground attack. The reconnaissance craft will have machine gun and/or rocket installations. Troop carriers will have detachable machine guns which can be fired in flight and then removed for ground use. They will also have portholes so that infantrymen in the helicopter will be able to assist in returning any ground fire that might be encountered. Resupply and evacuation craft will have similar capability.

Predictions are already being made that another element will have to be added to the flying cavalry units. This would be an anti-helicopter section with the specific task of protecting



VERTOL H-25 weapon helicopter fires salvo of 1.5 in. aerial rockets. Complete payload of such weapon ships is devoted to missile and machine gun armament.



APPROACH is made by Sikorsky H-19 weapon helicopter (above) before attack (below). A few of these can saturate a target with continuous fire for several minutes.



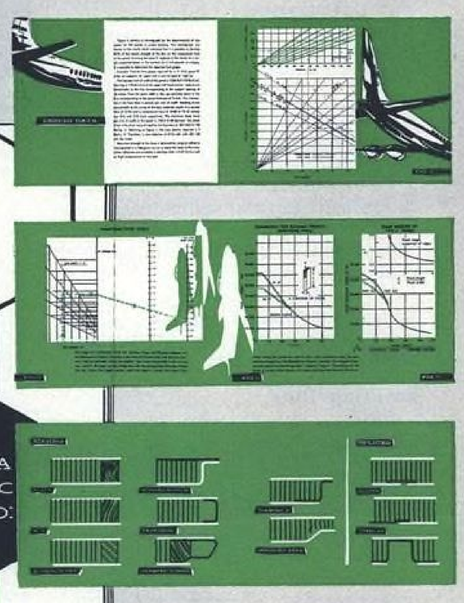
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other craft in the unit and disembarked infantry from attack by hostile helicopters. It is generally believed that the only flying machine which will be effective against a helicopter will be another helicopter.

Gen. Howze's Description

Maj. Gen. Hamilton H. Howze described the army's study of the feasibility of aerial cavalry as follows:

In June 1956, when Brig. Gen. Carl I. Hutton was commandant, a small group of volunteer pilots and enlisted assistants were assembled at the Army Aviation School and aerial cavalry tests were begun, using reconnaissance helicopters as test beds.

Four functional categories of aircraft were considered:

- **Reconnaissance vehicle** (H-13, H-23 class).
- **Squad carriers** (H-21, H-34 class).
- **Antitank vehicle** (all classes).

Following weapons were studied for possible application:

- **Aerial machine guns**—.30 and .50 cal.
- **Various fixed** fin aerial rockets.
- **Various folding** fin aerial rockets.
- **Recoilless** rifles.
- **Ordnance** and chemical bombs.

Test program was divided into three phases:

- **Feasibility studies** and experiments.
- **Tactical employment** tests of platoon- and company-sized units of armed helicopters.
- **Organizational studies** based on first two phases.

First phase is, and will be, a continuing series of experiments as different weapons are tested for the roles indicated.

Some Capabilities Known

Known capabilities are:

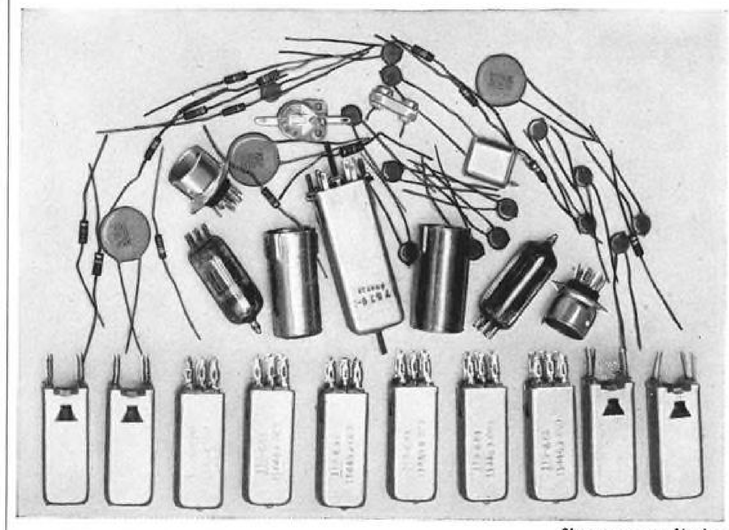
- **Reconnaissance helicopter**—As one or more machine guns were believed to be required, tests were made to determine a maximum machine gun capability of the light helicopter.

This was determined to be two AN M-2 .50 cal. aerial machine guns (600 rd. per gun per min.) or six AN M-2 .30 cal. machine guns (1,200 rd. per gun per min.). Fixed fin 80 mm. aerial rockets were successfully test fired from a light launcher. Also feasible were 3.5 in. tubed rockets. All weapons were fired electrically and adjusted with an aircraft optical reflecting sight.

- **Squad carrier** (H-21, H-34)—Suppression fire capabilities have determined that the ship can fire two or more fixed aerial machine guns forward. It can carry eight or more fixed fin 80 mm. rockets forward. The H-21 can handle a twin .50 cal. machine gun turret forward of the nose wheel. Machine guns (.30 cal.) can be fired from side doors

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as waist guns. Rifles can be fired from each port.

• **Weapon ship (H-19, H-25)**—These ships can fire their maximum cargo lift capacity in the form of aerial rockets. Number of rockets depends upon weight and configuration of individual rocket and its launchers. This is about eight in the 5-in. class and up to 160 or more rockets in the 1.5-in. class.

• **Antitank vehicle** (all classes)—This study is still being conducted and results are not ready for release.

Some basic characteristics of armed helicopters have been observed. These are indicated by type:

• **Reconnaissance**—This is a light ship and therefore reacts more readily to the recoil reaction of weapons. Ship can be rotated rapidly by rudder pressures so weapon traverse may not be essential. Elevation and depression of weapon and sighting system is essential to compensate for the vertical angle along pitch axis with different load conditions and at speeds between the hover and V-max. It has a built-in vibration which results in aim wander or tracking error of about 7-8 mi. (including pilot techniques). Payload is limited by rated gross weight. Sighting, from a hover to cruise speed, is not a serious problem.

• **Squad carrier**—This is a larger, heavier ship and appears to offer much a more stable firing platform than the reconnaissance helicopter. As its tactical function precludes excessive rudder traverse or deviation from course when in formation, both elevation and traverse of weapons is indicated. Tandem rotor configuration appears to offer more stability along the pitch axis. Sighting straight ahead is simple. Deflection firing introduces problems common to all aircraft with flexible guns.

• **Weapon ship**—Stability of the utility class helicopter appears to be between the squad ship and the reconnaissance ship. Elevation and depression of weapons appears to be essential. Traverse of forward firing weapons appears to be desirable but may not be essential unless the ship is to be fired from tight formations. Target tracking accuracy results are promising.

• **Antitank ship**—All lessons learned from other tests are being applied to this study as experiments continue.

Improvements Anticipated

Improved engineering designs of proposed helicopters will greatly increase the armament and speed capabilities of the helicopter as well as provide a much more rugged and dependable structure.

The armed helicopter, at the immediate disposal of the unit commander, represents an effective means of delivering concentrated suppressive fire power on short notice. It is not intended that this weapon replace the fighter bomber, the armored vehicle or tank. It is believed, however, that it does have the capability of effectively filling the gap between the time troops must be deployed and the time self-propelled weapons can be moved into position.

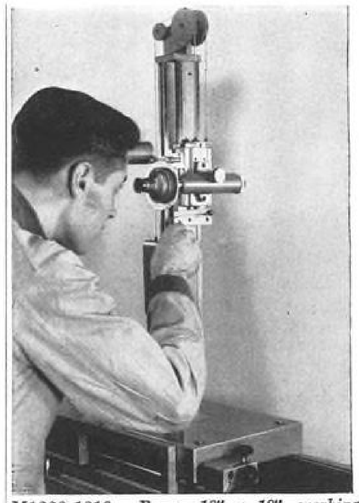
Extensive testing is yet to be conducted to determine the full extent of the helicopter's capability as a firing platform. Vulnerability factors must be arrived at, and dependability must be established. It is apparent that the helicopter has a great potential in the highly mobile tactical situation envisioned in any future conflict.

Evaluation of this aircraft in future field maneuvers will be beneficial in determining the full extent of this potential.



15 Years Makes a Difference

Sikorsky R-4 (foreground) emerged 15 years ago as the world's first production helicopter. Behind it is an S-56, largest Sikorsky aircraft in production.



M1238-1818 — *Range 18" x 18", working distance 9" to infinity. Reads to 0.001" up to 24" working distance. Protractor ocular reads to 3 minutes of arc. Image is erect.*

Cut inspection time in half

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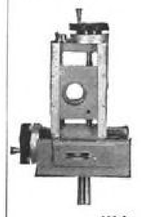
These convenient, reliable optical instruments permit making precise coordinate measurements in a vertical plane. The two dimensions are measured with one setting, object does not have to be rotated. Inspection time is cut in half and resetting errors eliminated.

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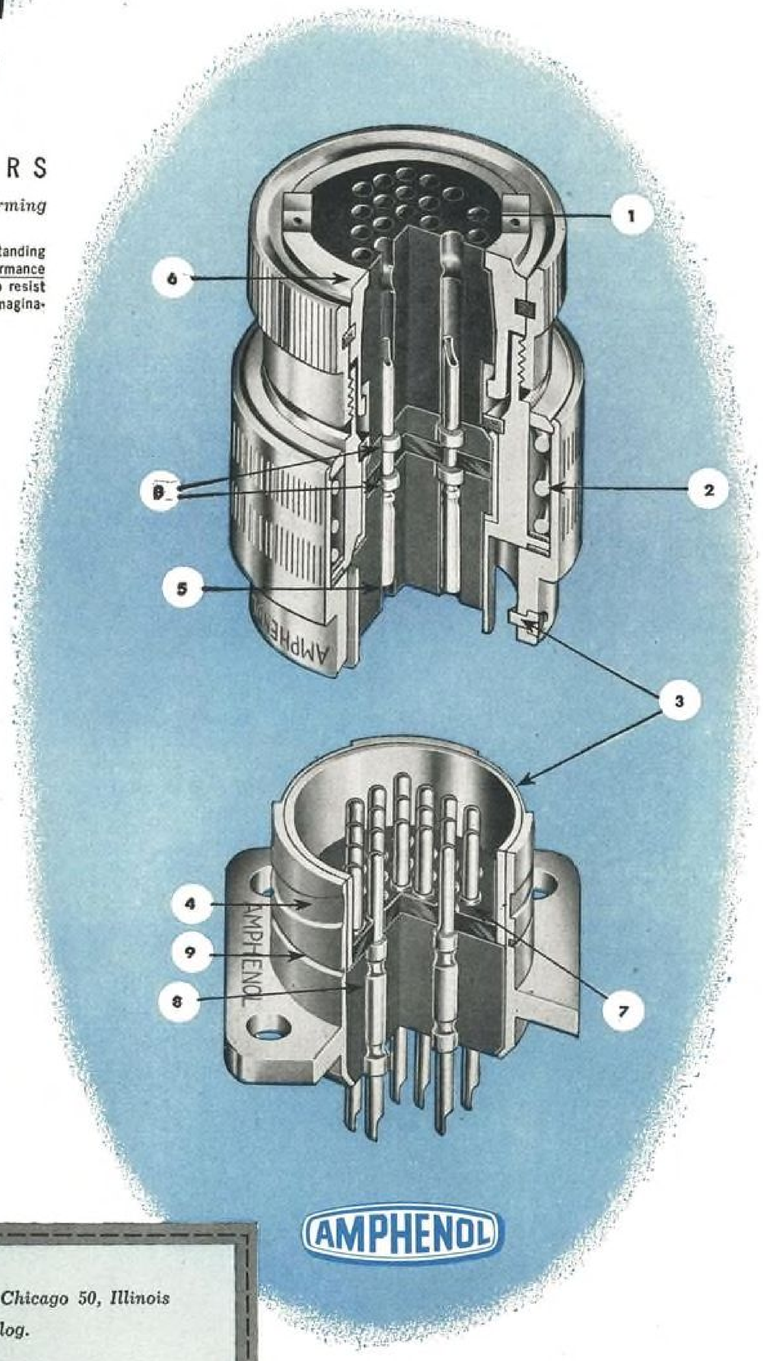
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FEATURES

1. Environmentally sealed with unitized back end grommet. (Also available with provision for potting.) Either grommet seal or potted seal meets moisture resistance requirement of MIL-C-5015C, Paragraph 4.5.21.
2. Spring-loaded coupling ring provides a positive locking action in the bayonet slot, and a constant compensating force which eliminates the effects of resilient face seal compression set.
3. Stainless steel bayonet slots and pins reduce wear and frictional characteristics. The three pin bayonet coupling minimizes the rocking action of the mated plug and receptacle.
4. Flattened incline angle of bayonet slots reduces mating force requirement.
5. Hooded contacts resist test prod damage as defined in Paragraph 4.5.14 of Amphenol Specification 340-43-2108.
6. Unitized grommet seal; clamp and grommet form a single unit for ease of assembly and maintenance.
7. Face seal gasket with individual barriers to isolate each contact.
8. Hard insert dielectric (plus resilient face seal) positively retains contacts with no possibility of contacts being pushed out of the insert.
9. A visual full engagement indicator is included in the design to insure the user that he has fully engaged the connectors. The indicator is an orange line around the receptacle shell.

- When using mated sealed connectors, no derating for altitude is necessary at 70,000 feet.
- Test voltage 1,500 volts RMS 70,000 feet on sealed connectors.
- Vibration per Method 204 of MIL-Std-202A. 10 to 2,000 cps at 20 g's.
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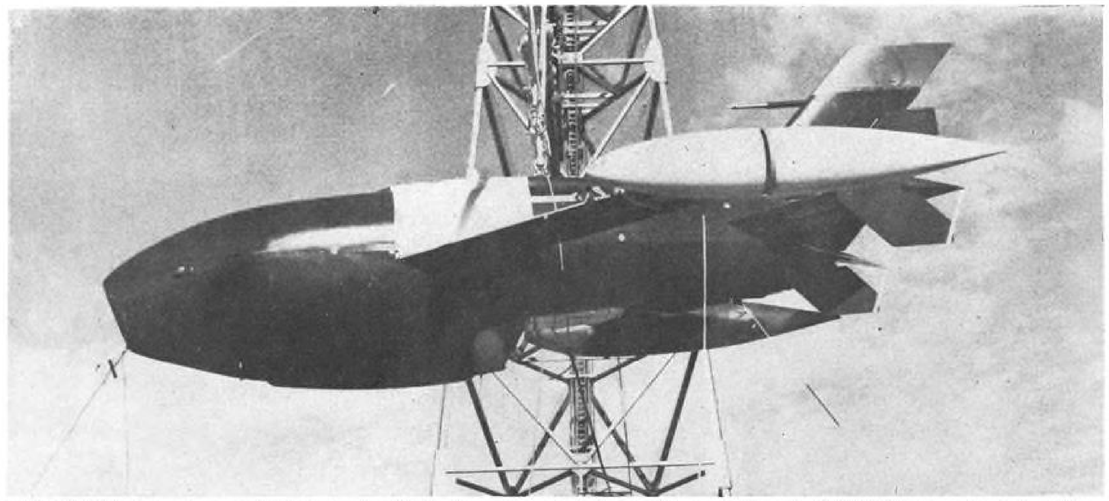
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FIREBEE Q-2A drone is suspended between two 300-ft. towers (one in background) as rocket target. PARAMI transponder is in pod.

System Measures Near-Miss Distance

Missile miss-distances are being evaluated for the Air Force by Ryan Aeronautical Co. with its near-sonic Firebee jet drone.

Ryan is using two methods to measure the distance by which missile misses the target:

- **Parsons** Active Ring-Around Miss Indicator (PARAMI) system.
- **Wide angle** lens camera mounted in Firebee wingtip pod.

Inflight tests are scheduled in the near future at Air Force Missile Development Center, Holloman AFB, N. M.

Meanwhile, a series of tests have already been run at Randsburg Wash facility, Naval Ordnance Test Station, China Lake, Calif., where the Firebee Q-2A drone was suspended between towers as a target for firings by high velocity aircraft rockets (HVAR). These tests will assist in calibrating results obtained by both the PARAMI and single-camera scoring systems with corresponding distances obtained from camera instrumentation of known accuracy, using range timing for correlation.

PARAMI Systems Utilized

Ralph M. Parsons Co., Pasadena, Calif., is supplying five of the PARAMI systems to Ryan. One system already has been used in the Randsburg Wash initial tests; the remaining four PARAMI systems will be used in Holloman tests.

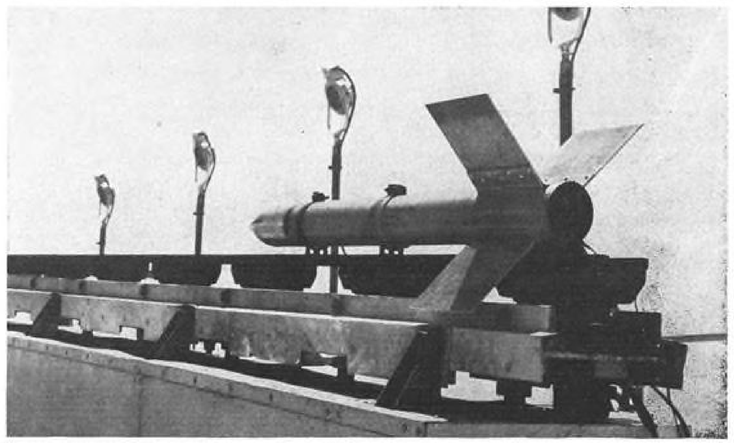
PARAMI system includes target transponder (mounted in Firebee), missile transponder, and receiving and recording equipment with direct decimal read-out of missile-target distance versus time.

For Randsburg Wash tests, Parsons modified 10 HVAR rocket warheads and installed antennas, wiring and a mounting plate for the missile transponder.

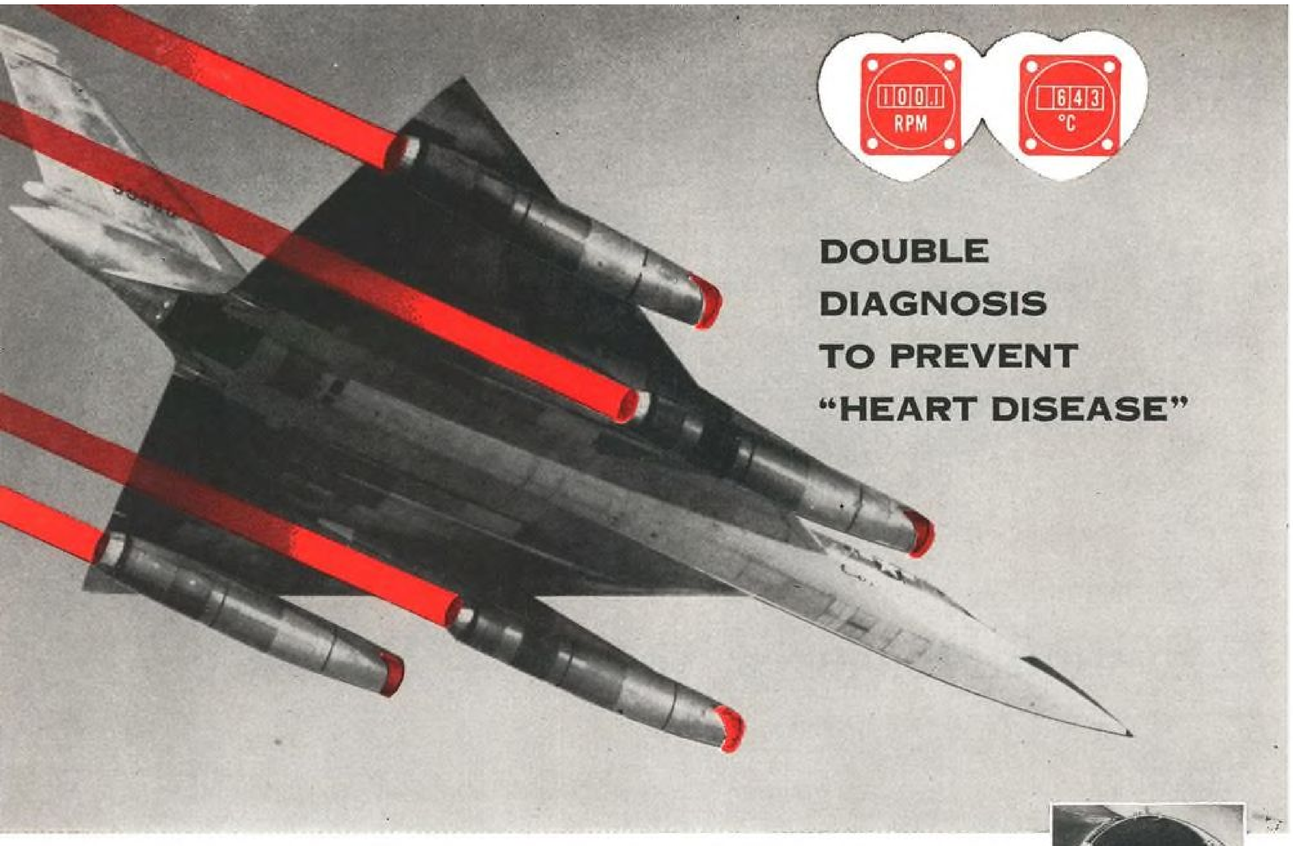
Transponders in the Firebee and rocket each transmit a signal pulse at a different frequency which is received by and triggers the other transponder, thus forming a "ring-around" loop. "Ringing frequency" is reduced by a delay built into the Firebee transponder, with frequency shift corresponding to separation of target and missile antennas.

Ringing frequency is monitored by





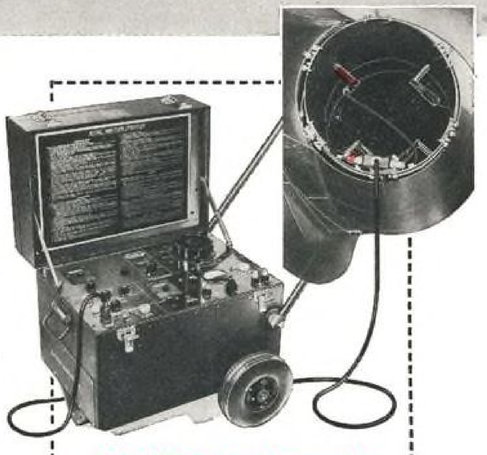
LAUNCH tower has rail launcher 70 ft. long (left); rocket (right) has equipment for missile transponder in place of warhead.



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Two of the most important factors that affect jet engine life, efficiency, and safe operation are *Exhaust Gas Temperature (EGT)* and *Engine Speed (RPM)*. Excess heat will reduce "bucket" life as much as 50% and low EGT materially reduces efficiency and thrust. Any of such conditions will make operation of the aircraft both costly and dangerous. The *JETCAL Analyzer pre*determines accuracy of the EGT and (interrelatedly) Tachometer systems and isolates errors if they exist.



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(functionally, without running the engine)

Tests RPM Accuracy to 10 RPM in 10,000 RPM (±0.1%)

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ground station, computer corrects for calibrated time delays in target and missile transponders, and miss-distance, in feet, is recorded on paper tape together with timing pulses.

Tower Launching

In Randsburg Wash tests, HVAR rockets were fired from top of a 150-ft.-high mobile launching tower which has a slotted rail launcher 70 ft. long, and is adjustable both in elevation and azimuth.

Firebee drone was suspended 150 ft. above ground between two 300-ft.-high towers located 2,800 ft. downrange from the end of the launcher rail.

For additional data on miss-distance, Ryan engineers designed a wingtip pod containing a Traid 500 camera equipped with a 165-deg. wide-angle lens facing to the beam.

Camera was remotely triggered at instant the rocket was fired from the launching platform. By measuring missile image size, distance of the rocket from target as it passed Firebee could be estimated.

Three Bowen CZR-1 cameras provided photographic coverage of the tests. Located at various stages along route, they collected data on the missile's velocity, acceleration and trajectory.

Fairchild Orders Up

Fairchild Engine Div., Fairchild Engine and Airplane Corp., Deer Park, N. Y., said that a recent $1,300,000 order for its 1,000-lb. thrust J44 turbojet has increased its total dollar volume of orders for the small engine to more than $7,000,000 during the last nine months.

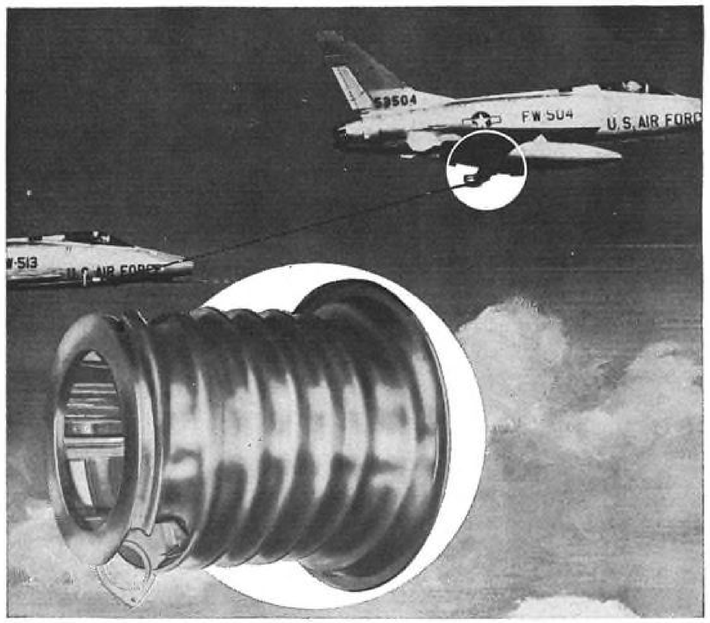
Production volume called for by these orders is somewhat over 200 engines. A small portion of the contracts will go for continued product improvement of the 10-yr.-old engine which now costs between $20,000-$22,000.

Most of the current orders are either for the Navy version of the Ryan Firebee target drone or wingtip thrust assist powerplants for USAF Arctic-based C-123s.

AVIATION WEEK has learned that both the J44-powered Navy Firebees and the Continental Aviation J69-powered USAF Firebees have been running away from the F9F and F-86 type chase planes at 50,000-ft. altitudes.

At this height the small drone's lightness, especially after its fuel runs low, makes it able to outperform the heavier aircraft.

A Fairchild spokesman said that even though the J44 is a relatively outmoded design, its demonstrated reliability and suitability for drone and takeoff assist applications are expected to extend its production life at least another five years.



critical assemblies for critical operations

Erco Fabricates Unique Airborne Hose Drum for Flight Refueling, Inc.

Erco's proven ability in sheet metal fabrication manifested itself recently in the fabrication of a special hose spool for in-flight refueling.

Flight Refueling, Inc. supplied the blueprint designs and Erco engineers and sheet metal craftsmen constructed an extremely workable unit which incorporated a dual combination of fabricating techniques and abilities. Chief design features of this unit emphasize no slippage and sound performance under extreme stresses and speeds plus rigidness in operation and ruggedness in lightweight construction.

Erco subcontracting facilities embrace over a quarter of a million square feet — under one roof — with the finest in both production and precision metal working machinery available.

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LAST MONTH RUSSIA SURPRISED, perhaps shocked, the world by launching the first man-made satellite.

This month, however, after calm appraisal of all factors involved, Sputnik seems more a victory of propaganda than a triumph of practical science. The moon is still a long way off. We have every intention, and the capability of planting the Stars and Stripes there first.

On the record of the years,

In America's proved electronic achievement and know-how,

In the vastness of our enormous national resources —both in manpower and material,

In the firm and far-sighted policy of our government,

In the devotion to duty of the many thousands in government charged with our national security,

In the very history of our unflinching acceptance of every challenge,

In the singleness of purpose to achieve our goals for peace and the welfare of all humanity . . .

You may feel very confident, indeed, of America's future.

Yes, we can be confident that America already has in its laboratories and testing grounds the means, the men and the machines unequalled anywhere in the world. And we can take pride in the fact that America's achievement in rocketry, avionics and electronic communications is the accomplishment of free men living in a free society.

Yet, what we have, what we have done, is nothing to what America in its unbounded reserve capacity can do. As the speed up of progress accelerates, we will take it in stride without sacrificing human needs.

The future, like the present, will be in America's control, which is a very fortunate thing for a free world. It is our job, and the job of every citizen to keep it that way.

Loral Electronics Corporation

Leon Alpert

LEON ALPERT,
President,

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Contributing to America's vital first line of defense and to its future scientific progress through electronic research and development.

Plant Choice Keyed to Vibration Level

By Philip J. Klass

Clearwater, Fla.—New $4½ million facility for developing and producing inertial guidance systems and components, called "world's most jiggle-proof plant," has been opened here by Minneapolis-Honeywell on Florida's west coast, near St. Petersburg.

One corner of the 98,000 sq. ft. facility is located at 27° 53′ 26.1″ N. Lat. and 84° 43′ 25.6″ Long. which defines its position to within 10 ft.—a necessity for precision alignment by celestial means of inertial platforms under test.

One of the major reasons for selecting the Clearwater location over 20 other sites was its relative isolation from natural and man-made vibration —a requirement for testing gyroscopes that have drift rates of the order of 0.001 deg. per hour. Honeywell engineers measured the vibrations caused by tides from the Gulf of Mexico, 10 mi. away. They also measured earth tidal effects—the periodic shifts in earth's crust caused by sun and moon gravitational pull.

Soil Samples

Soil samples were taken down to depths of 60 ft. to test compressive characteristics of sub-soil because infinitesimal shifts in plant floor level can introduce appreciable errors in inertial component tests.

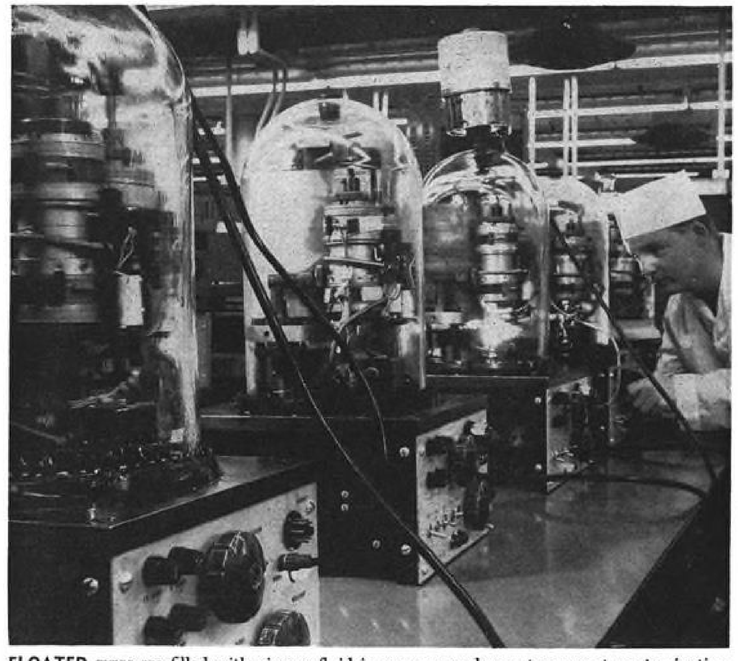
Honeywell says that vertical vibration in its gyro assembly and test area is less than 10 millionths of an inch, and as low as four micro-inches on special test pedestals. Horizontal vibration is only one micro-inch.

To achieve this degree of isolation the company went to great lengths. The plant is built on pre-stressed concrete pilings, 30-35 ft. deep. To minimize the effects of moisture, the plant floor is constructed 2½ ft. above ground level and the building is surrounded by a large moat, extending three feet below normal ground level. Asphalt apron runs from building to the moat to carry off rain water and the moat is continuously pumped dry.

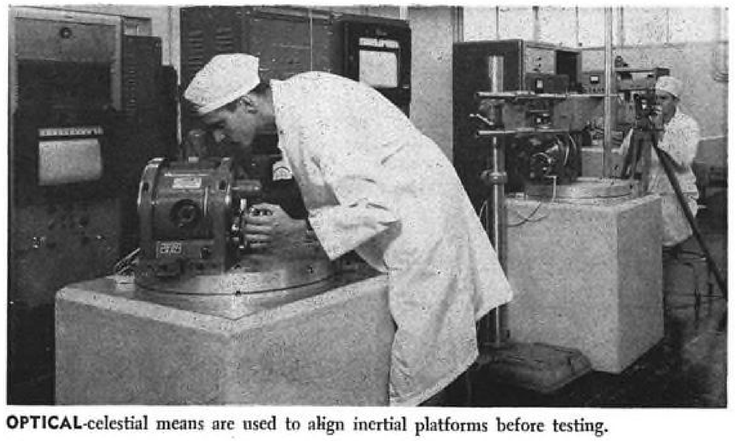
Gyro rooms are built on 18-in. slabs of concrete and are isolated from remainder of the building. Gyros and stabilized platforms are tested on 10-ft. concrete pedestals to isolate them further from vibration. All heavy, vibrating machines, such as air conditioning, compressors, and special power generators are mounted on springs and rubber pads and located in a penthouse ad-



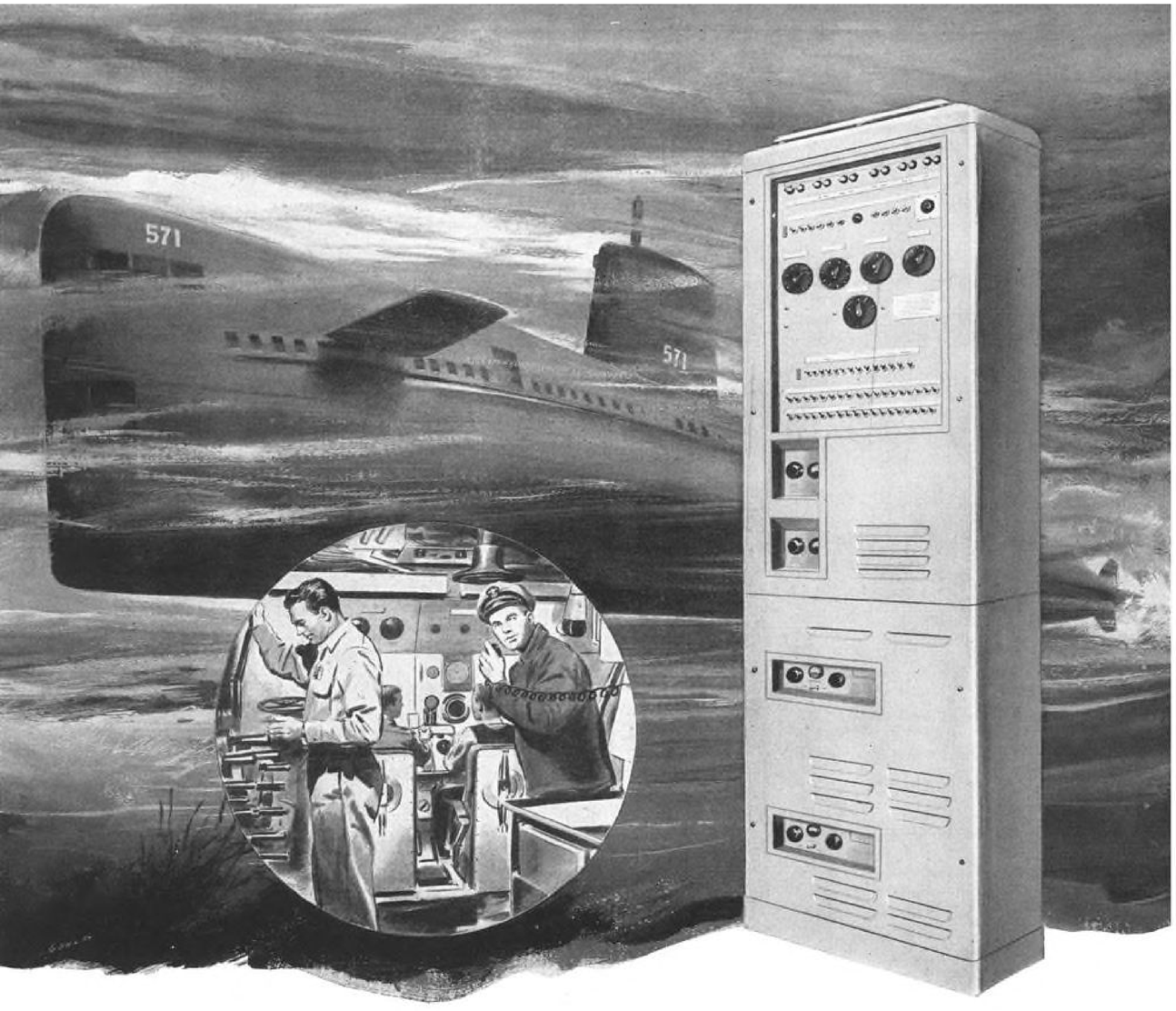
HONEYWELL'S new Florida facility will develop and build inertial systems and components.



FLOATED gyros are filled with viscous fluid in vacuum enclosure to prevent contamination.



OPTICAL-celestial means are used to align inertial platforms before testing.



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Similar equipments also serve the land and air arms of our country's military forces and give evidence of equal dependability under the special conditions for which they were designed.

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A DIVISION OF GENERAL DYNAMICS CORPORATION
General Offices and Factories at Rochester, N. Y.—West Coast plants at San Diego and Los Angeles, Calif.

Cyrogenic Gyroscope

Minneapolis-Honeywell, like several other companies, is investigating feasibility of building gyroscopes that employ spinning electrons at near-absolute zero temperatures instead of conventional spinning flywheel, according to a company official. Program is in the research stage.

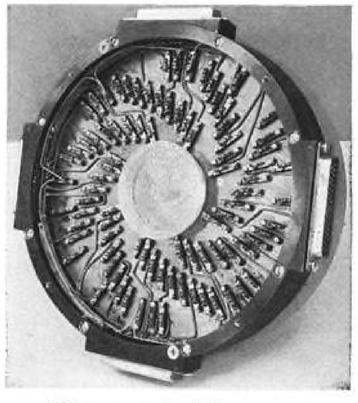
joining the plant. Penthouse steel girders are enclosed in concrete to provide further vibration damping.

Current Programs

Existing plant is primarily an engineering and pilot production facility which can turn out about 60 inertial systems per year. Plans are ready for a 110,000 sq. ft. manufacturing facility addition when business level requires, according to Melvin P. Fedders, vice president and general manager of the new operation.

Current programs at the new plant total about $3 million, including development of "a new type of inertial guidance system," for Air Force's Wright Air Development Center under a $1.8 million contract. Honeywell also is building a three-gyro (integrating) stabilized platform and associated attitude programmer for use in the Titan and Thor ballistic missiles. These reportedly are similar to the ones the company developed for Project Vanguard earth satellite program.

Honeywell also is developing digital computers here with company funds for use in inertial systems. Digital computers are expected to reduce size, weight and improve computational accuracy over analog computers presently used by Honeywell.



Compact Memory

Eighty-eight recording heads on an eight-inch diameter magnetic disc memory unit provide high density data storage on North American Autonetics Division's portable general purpose digital computer (RECOMP). Memory units have operated more than 1,300 hours in the field without maintenance, company reports.

Current employment here is around 450 of whom about 200 are professional engineers. Total employment is expected to reach 600 by end of the year with an annual payroll of about $3.5 million.

Honeywell reports that it has made significant gains in both the accuracy and reliability of integrating (HIG) gyros which form the cornerstone of the firm's inertial systems work. Company officials say that the new facility is producing HIG gyros with drift rates in the order of 0.001 deg. per hour.

This is roughly 100 times better than the early HIG gyros, and approximately 1,000 times the accuracy of early postwar gyros.

Honeywell's Minneapolis facility will continue to make low-cost HIG gyros with moderate drift rates for use in fire control systems, while inertial quality gyros will be developed and built here in Florida.

Another indication of gyro progress was the report of significant reduction in the number of parts used in HIG gyros. Honeywell's first (non-inertial quality) HIG-5 gyro was constructed from 425 individual parts, according to John W. Anderson, manager of engineering here. In a subsequent HIG-4 model, the number of parts was cut to only 225. One of the current inertial-quality HIGs now under design has only 90 parts.

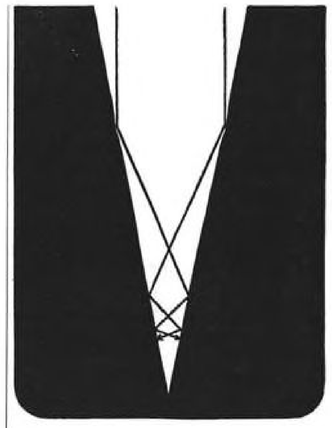
Anderson also reported that company's new MIG (miniature integrating gyro), originally expected to have a drift rate of 0.5 deg./hour is exhibiting drift rates of only 0.1 deg./hour, equal to the accuracy of the much larger HIG-6. New MIG gyro is used in Army's Sergeant missile, Anderson said.

But these gains in gyro accuracy have reached the point, Anderson said, where gyro designers must now concern themselves with the oscillatory nature and internal damping of molecules of the materials from which gyros are fabricated.

Effect of Errors

Critical effect of small gyro, accelerometer and alignment errors on overall navigation accuracy of an inertial system was pointed out by George Rusler, head of systems engineering here. If a Schuler-tuned inertial system used in a Mach 1 airplane is to have an accumulated error of no more than one nautical mile after one hour's operation, individual elements of the system must meet the following requirements:

- **Gyro drift rate** must be less than 0.008 deg./hr.
- **Accelerometer error** in measuring



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Infrared sources are typical of the integrated line of OptiTherm components available from Barnes Engineering. OptiTherm Sources are universally recognized as precise black body standards for testing and calibrating infrared detectors, systems and instruments. Most of the calibration sources for the SIDEWINDER program are made by Barnes Engineering.

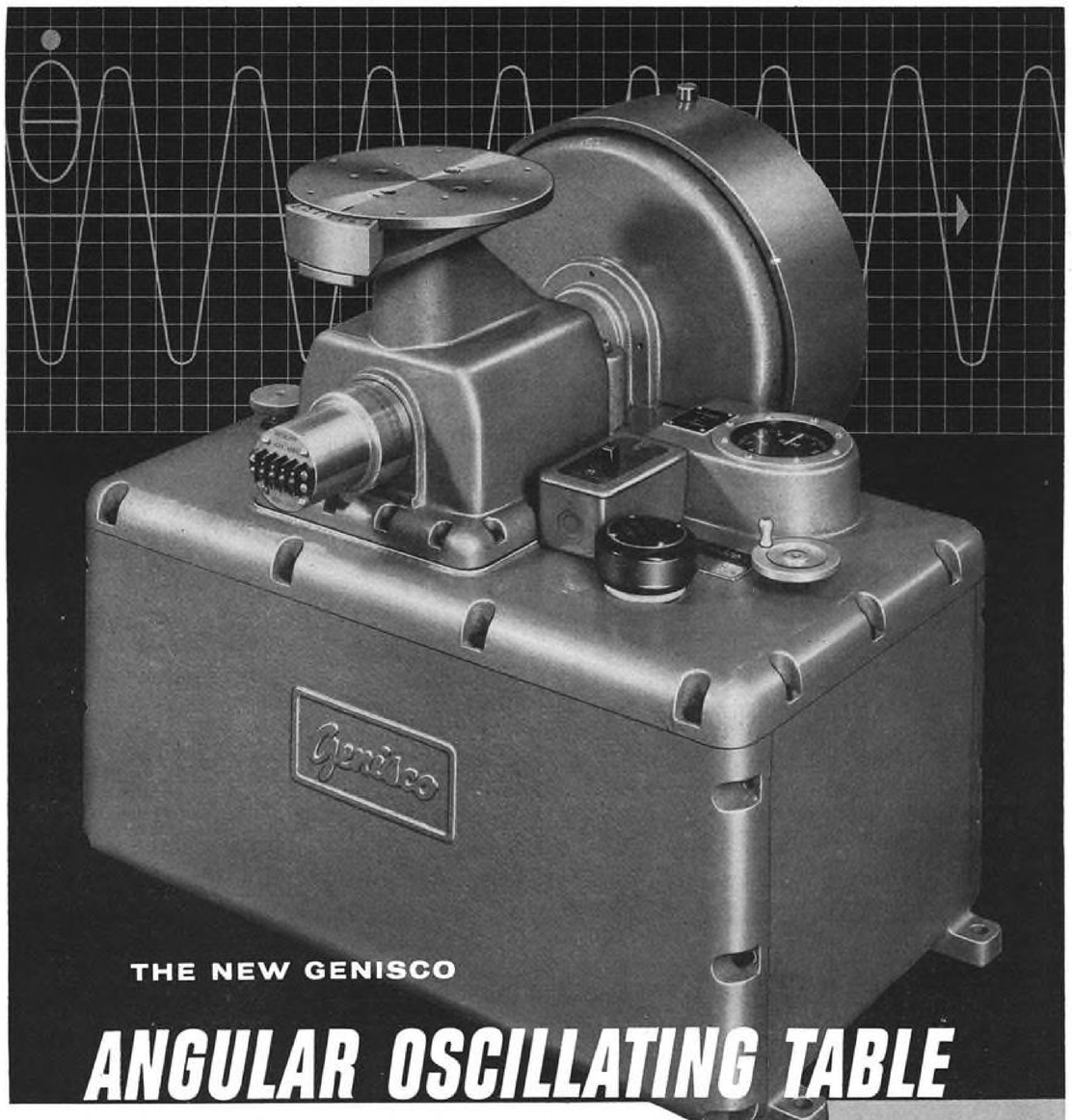
You will find five models of OptiTherm Sources to choose from, with controlled temperature ranges up to 600°C. Four laboratory units with .5" cavity openings are available, and one model for field use has a 12" x 12" reference surface. All models are compact, yet ruggedly built, and are readily coordinated with other components in infrared systems.

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ANGULAR OSCILLATING TABLE

Generates a precise sinusoidal function accurate to within 0.1% at excursions up to ±2°, 0.5% up to ±10°, and 1% up to ±15°.

This newest Genisco machine utilizes a unique conical crank mechanism to generate an angular oscillation which closely corresponds to a theoretical sinusoidal waveform. A precision sine-cosine resolver coupled to the crankshaft can be used to bring a test instrument output signal and the oscillating table output signal into coincidence for direct reading of phase lag angle.

The extreme accuracy of the Model B386 Oscillating Table makes it particularly suited for evaluating the damping and response characteristics of angular accelerometers and rate gyros. The Model B386 can also be used for calibrating peak angular velocities and peak accelerations to the accuracy of the known angular excursion and frequency. Within its range, the machine can double as an environmental angular shake table.

For complete information and performance specifications, write to–

Brief specifications

Angular Excursion: Infinitely adjustable from zero to ±15°.

Frequency Range: Continuously variable from 0.02 to 3 cps in the low range; 0.2 to 30 cps in the high range.

Accuracy:
Angular Excursion—within 10 minutes of arc.
Frequency Indication—within 1% with tachometer; within 0.1% with stroboscope.

Payload Capacity: 100 lb. deadweight; 750 lb.-in. under dynamic conditions. Protected against dynamic overload by replaceable shear pins.

Vibration Isolation:
Vertical Displacement—0.003" max. at any frequency
Lateral Displacement—0.001" max. at any frequency.

Platform Diameter: 8".

Approx. Weight: 400 lb.

Genisco INCORPORATED

2233 FEDERAL AVE., LOS ANGELES 64, CALIFORNIA

acceleration must be less than 0.00015 G.

This is the equivalent of an acceleration so small that it would require an automobile accelerating at this rate from a dead stop a total of 2½ hours to reach 30 mph., Rusler said.

• **Azimuth alignment error** of platform at start of mission must be less than 0.048 deg. This is equivalent to one inch displacement in 100 ft.

• **Final integrator error** (drift) must be less than 0.04%.

Cleanliness

Assembly of gyros and other inertial components is carried out in familiar dust-free rooms, with an important assist from the state of Florida which itself provides a relatively dust-free environment, Fedders says. By means of filtering and electrostatic precipitation, the dust count in the gyro rooms is maintained at less than 15,000 particles (one micron or larger) per cubic foot. The count often is down to 5,000 per cubic foot, Fedders says.

Expansions, Changes In Avionics Industry

Fairchild Semi-Conductors Corp., Palo Alto, Calif., is name of new firm organized by Fairchild Camera & Instrument Corp. around nucleus of scientists recently employed at Beckman Instruments' Shockley Semiconductor Laboratory.

New company, which will develop and produce semiconductor devices, is headed by H. E. Hale, vice president of Fairchild Controls Corp. Dr. Robert Noyce heads new company's research group.

Other recently announced expansions, changes and mergers in the avionics field include:

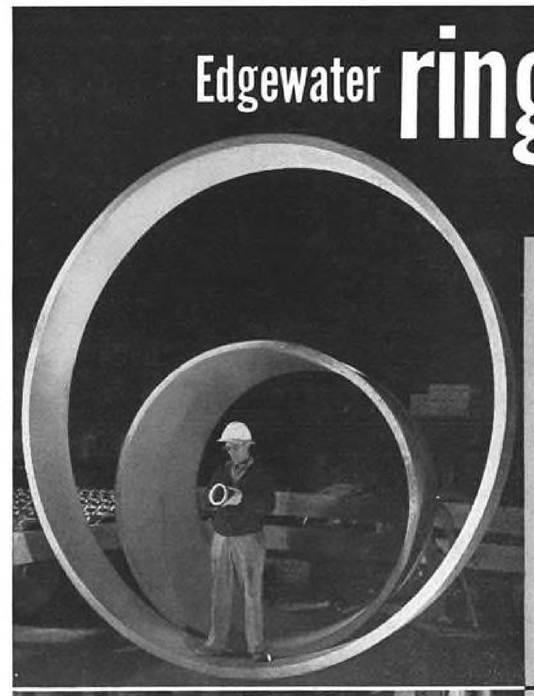
• **Temco Aircraft Corp.,** Garland, Tex., has completed $59,000 antenna research laboratory for testing performance of antenna systems.

• **Booz, Allen Applied Research, Inc.,** is new name of the former Applied Research Inc. Company's new address is 430 Green Bay Road, Kenilworth, Ill.

• **General Electric's Computer Dept.,** Phoenix, Ariz., has opened new Computer Applications Laboratory, staffed by more than 70 specialists, to handle business, scientific, engineering problems for outside companies. Dr. Herbert R. J. Grosch heads new laboratory.

• **Sperry Gyroscope Co.** has opened new liaison office in Dayton, in Monument Bldg., which will be staffed by representatives of company's Aeronautical Equipment, Air Armament, Microwave

Edgewater **rings**



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RINGS



Write for bulletins and complete data.

Uniform, dependable, accurately made Edgewater Rings are furnished in a wide variety of cross-section shapes, and in diameters from 5 to 145 inches. They meet the most critical specifications and standards of quality.

Representative applications include bearing races, jet engine parts, parts for missiles and rockets, gears, grinding rings.

Edgewater Steel Company

P. O. Box 478 • PITTSBURGH 30, PENNA.



World's First Unmanned 'Copter

The successful maiden flight of Kaman's pilotless helicopter has added a new concept to military strategy. Flown entirely by remote control, the variety of missions possible with these ships is almost limitless. Using the Kaman robot as a flying TV or motion picture camera, complete battlefield surveillance and target marking are available without hazard to personnel. Also possible is the entry of the robot helicopter into contaminated or hazardous areas.

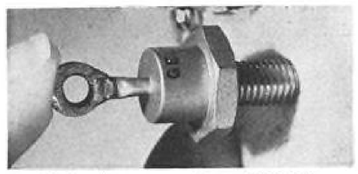
The control station is portable and can be operated from the ground or in air to air operations. Mission equipment such as cameras, weapons, target markers and detonators can be actuated at the control station.

Kaman is proud of this forward step which has been taken in behalf of our National Defense effort.



KAMAN

THE KAMAN AIRCRAFT CORPORATION
Bloomfield, Connecticut



20 Amps At 200C

Miniature silicon rectifiers, rated 20 amps at 200C, with peak one-cycle surge rating of 300 amps, maximum leakage current of 5 ma., are now in production at General Electric's Semiconductor Products Dept., Clyde, N. Y. New rectifier comes in four types: 1N1301, 1N1302, 1N1304 and 1N1306, with peak inverse voltage ratings of 50, 100, 200 and 300 volts, respectively.

Electronics and Electronic Tube divisions.

• **Gulton Industries, Inc.,** Metuchen, N. J., has acquired **Titania Electric Corp. of Canada, Ltd.,** Gananoque, Ontario, through stock exchange. New acquisition will produce electronic instruments and components of parent company.

• **Laboratory For Electronics,** Boston, has formed new Computer Products Division to develop and market data processing devices. New division was formed from personnel previously engaged in developing data processing systems for bank use after company decided to withdraw from the complete data processing systems field.

FILTER CENTER

►**Semiconductor Decade Switch**—Bell Telephone Laboratories has developed, but not yet officially unveiled, new semiconductor equivalent of the beam switching tube which makes it possible to construct 10-stage switching counter in a device about ½ in. long. Load (output) currents of 20 ma. may be possible from each stage.

►**Micro-Miniature Magnets**—Permanent magnets as small in diameter as a human hair have been made from Cunife (60% copper, 20% nickel and 20% iron) at National Bureau of Standards. Material has several interesting properties. It can be cold drawn instead of requiring casting or sintering into desired shape. Cunife can be cold worked to point where its magnetic properties are adversely affected but initial magnetism can be restored by simple heat treatment, Bureau of Standards says.

►**Major Gain in Telemetry**—Watch for Radiation, Inc., to reveal a new FM/FM telemetry receiver design technique which reportedly will provide at least a 10 db. gain over existing receivers without modification of airborne transmitters.

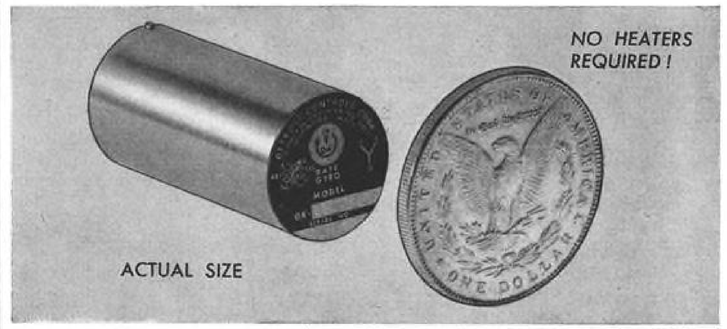
►**Transistor Sales Continue Climb**—Semiconductor manufacturers sold 15.6 million transistors during first eight months of 1957, more than double the 6.9 million sold in the same period a year ago. Dollar volume was $42 million compared to $19.7 million last year. Figures were released by Electronic Industries Assn., formerly Radio Electronic Television Manufacturers Assn. (RETMA).

►**New Lightweight Nav/Com Package**—Lear soon will unveil its new lightweight integrated navigation-communication package for business aircraft. Basic system, weighing about 21 lb., will include VHF receiver, transmitter and omnirange navigation provisions. More complete package, weighing about 37 lb., will include the foregoing plus marker beacon, glide slope receivers and automatic direction finder.

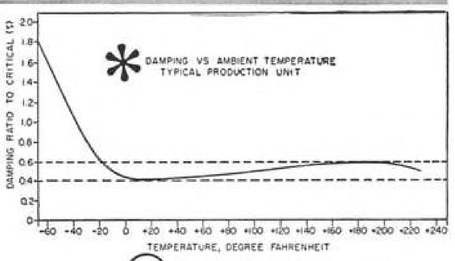
►**Microwaves, Anyone?**—The 1958 National Symposium on Microwave Theory & Techniques has been scheduled for May 5-7 at Stanford University. Prospective authors should submit 100-

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With Constant Damping Over A Wide Temperature Range*



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7. Wide variety of sensing ranges (from 0.5 radians/sec to 20 radians/sec, full scale)
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100 Morse Street, Norwood, Massachusetts

word abstract and 500-word summary of paper before Jan. 15 to: Dr. Kiyo Tomiyasu, 601 California Ave., Palo Alto, Calif.

▶ **Datamation With French Accent**—France now ranks second only to the United States in the manufacture of electronic data processing machines, according to publication France Actuelle. France exports more than $3 million annually, publication reports.

▶ **Signed on Dotted Line**—Several avionics manufacturers report following new business:

• **Cubic Corp.**, San Diego, has received $1.1 million Air Force contract extension for production and installation of its Secor systems for missile tracking and ranging.

• **Technical Research Group, Inc.**, New York City, reports a $155,000 Signal Corps contract for study and design of an atomic clock which will be sufficiently rugged to operate in a missile and withstand launching shock.

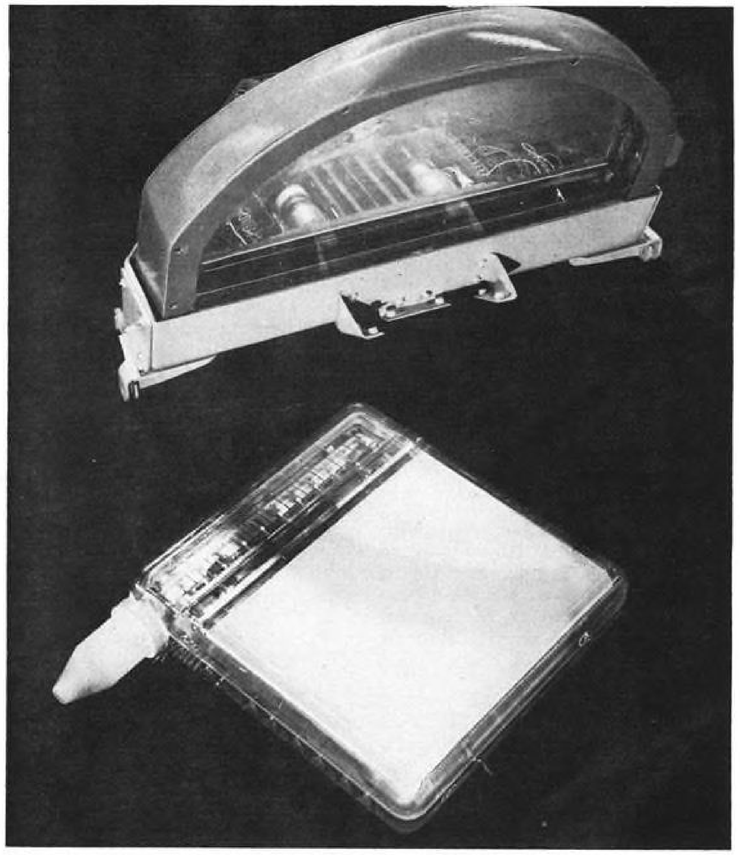
• **Electronic Communications, Inc.**, (Formerly Air Associates) St. Petersburg, Fla., has received $12 million contract from Hughes Aircraft for airborne communications and data link equipment to be used in Hughes' fire control systems for the F-102 and F-106.

• **Topp Manufacturing Co.**, Los Angeles, has received $1.1 million contract from Civil Aeronautics Administration for 65 omnirange transmitters.

▶ **Private VORs**—Civil Aeronautics Administration has established requirements for installation, performance and maintenance of privately-owned (non-federal) very high frequency omnidirectional radio ranges (VORs) in CAA Technical Standard Order N27. Purpose of N27 is to obtain standardization of VORs such as are operated by state aviation organizations with those installed, operated and maintained by the CAA.

▶ **Bendix to South Africa**—Seven new Vickers Viscount transports of South African Airways will be equipped with airborne weather radar systems to be delivered by Bendix Aviation before the end of the year.

▶ **Army Missile Components**—Army recently disclosed that General Electric's Missile and Ordnance Systems Department has been working on arming and fuzing systems for five Army missiles—Honest John, Little John, Corporal and Lacrosse surface-to-surface-missiles and the Nike-Hercules surface-to-air missile.

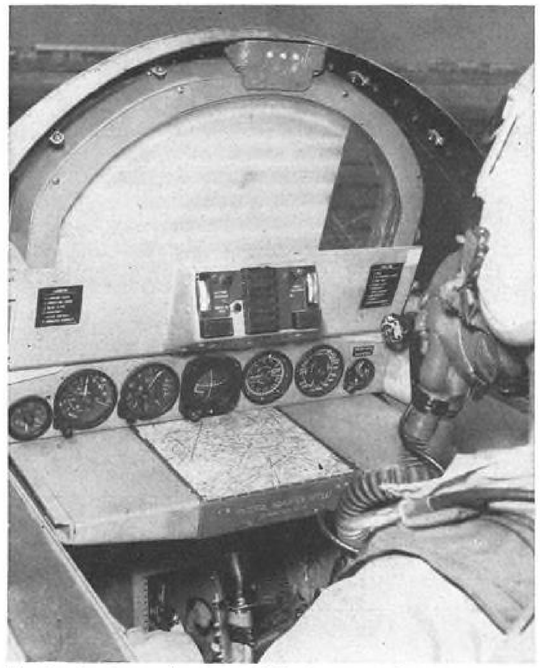


Kaiser-Aiken flat cathode ray tubes, one using newly developed transparent phosphors (above) and the other conventional translucent phosphors (below) are key elements in new Army-Navy cockpit display undergoing flight tests in T2V-1 (AW Oct. 21, p. 34).

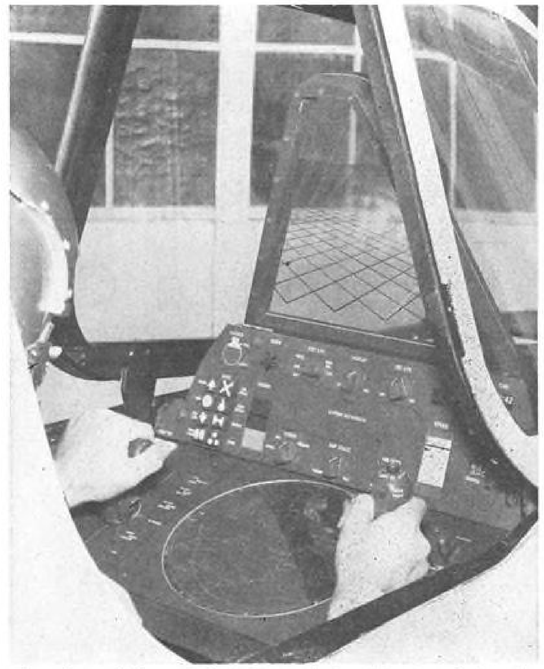
Flat, Transparent Cathode Ray Tube Tested in Army-Navy Cockpit Display



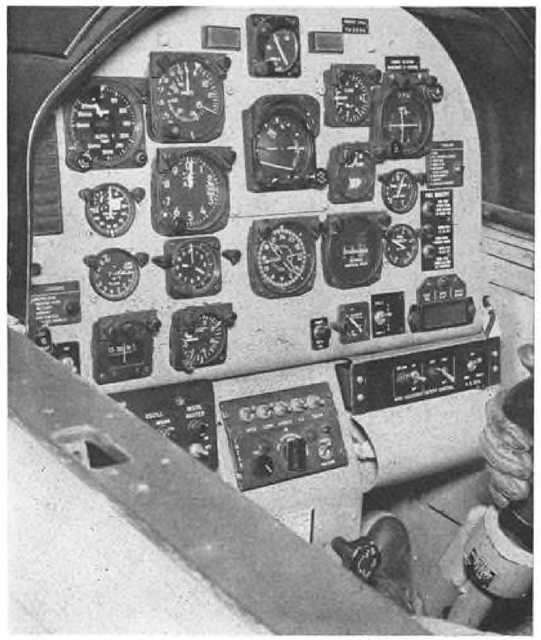
Transparent flat tube permits pilot to view through it for contact flight. Development of flat tube was first revealed by Aviation Week three years ago (Sept. 20, 1954, p. 10).



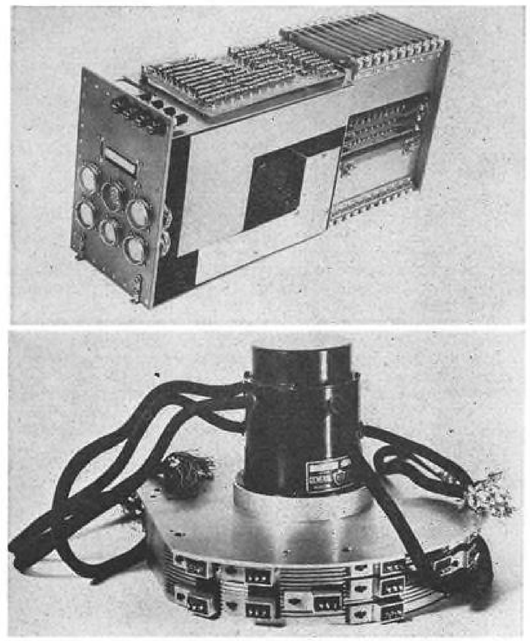
Simulated picture of contact flight is presented on transparent flat tube mounted behind windshield of T2V-1. Lightweight digital computer, developed by Litton Industries, and an analog generator, developed by DuMont, provide signals which create pictorial presentation on flat tube intended to simulate what pilot would see under contact (VFR) flight conditions. In ultimate version . . .



Flat tubes will be used both for vertical and horizontal situation displays as shown in mock-up. Small flight control "joystick" is operated by right hand, new type throttle control is operated by left hand. Douglas Aircraft Co., prime contractor on the program, designed the layout for future aircraft application. Simplicity of cockpit instrumentation is in marked contrast to . . .



Conventional instrument panel, in rear cockpit of the T2V-1, using latest of conventional aircraft instruments, points up greatly reduced complexity of proposed new Army-Navy display. New instrumentation has been demonstrated to nation's airlines.



Central control computer (above) and magnetic storage drum (below) will perform all required computation of flight and navigation data, eliminating analog type computers now employed. Models shown are interim equipments to be replaced by improved models.

S.S.White

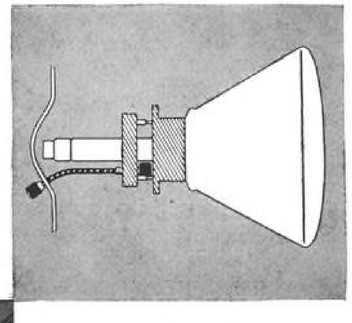
Flexible Shafts Make Operations Easier!



The manufacturer of this hue control for a color TV set uses a standard S.S. WHITE FLEXIBLE SHAFT to cope with a 90° turn. The shaft needs no alignment . . . can be quickly and easily installed. Costs are lower . . . manufacturing is simpler . . . assembly operations are easier, faster.

You can often reduce a complex system of gearing, universals and other parts to ONE FLEXIBLE SHAFT! Flexible shafts also make better designs possible . . . allowing new freedom in locating connected members to save space and facilitate operation and servicing.

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USEFUL DATA on how to select and apply flexible shafts. Write for Bulletin 5601.

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S. S. White Industrial Division, Dept AW 10 East 40th St., New York 16, N. Y. Western Office: 1839 West Pico Blvd., Los Angeles 6, Calif.

New Turbojet Test Cell Can Be Airlifted

Ontario, Calif.—Completely portable three-unit test cell system has been designed to accommodate turbojet engines up to 35,000-lb.-thrust capacity. System was demonstrated successfully in runs with a J79 powerplant to a group of about 25 military representatives from Air Materiel Command, Wright Air Development Center, Oklahoma City Air Materiel Area, Tactical Air Command and Strategic Air Command.

In simulation of a run from time of unloading from aircraft—including set-up of three test cell units, installation of J79 on dolly and engine light-off—elapsed time was 1 hr. 55 min. for six men and two supervisors.

Developed jointly by General Electric Co.'s Production Engineering Dept., Evendale, O., and company's Aircraft Apparatus Service Shop, Ontario, Calif., the new portable field-test facility includes:

- Engine dolly.
- Control trailer.
- Fuel trailer.

Designed for Airlifting

Total weight of the three units is less than 15,000 lb. Each is designed to be completely portable by air, and can be towed on land at 25 mph. to meet basic military requirements.

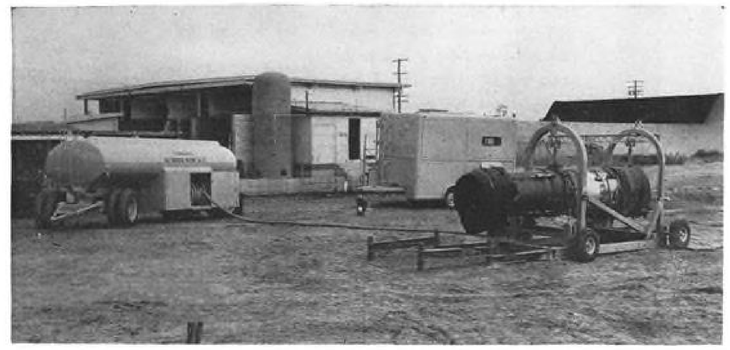
General Electric so far has built only one prototype portable test cell system, which was used in the military demonstration, and is also scheduled for use by General Electric as its own property in its activities at Dallas, Tex., in support of the Air Force-Convair B-58 bomber program.

No price tag has been set for the portable test cell system but it is likely to be in the neighborhood of $50,000. High degree of commercially available items have been used by General Electric in manufacture of the test cell system.

70-Day Development

General Electric says that only 70 days elapsed from the time specifications for the test cell were firmed until initial demonstration.

While projected to meet Air Force requirements for a portable test cell, General Electric specially tailored the prototype system for its J79 turbojet. But the company says the system can be modified with adaptors and instrument changes to handle any jet engine in existence or currently projected, since the dolly's design limitation is 35,000 lb. thrust.



PORTABLE test cell system is set up for a check of J79 turbojet. Note how test cell dolly is restrained by four earth screws which extend about 5 ft. into soil.



CONTROL trailer has storage area forward, control section aft. Panels give easy access to instrumentation. Operator's window is over main instrument panel.

System also has potential in the commercial market where relatively inexpensive engine test facilities are required, for example, at overseas or temporary bases or for use during transition to permanent fixed cells for jet transport engine testing.

Anchored to Ground

Restraining mechanism for the engine dolly consists of four earth screws or augers for anchoring the dolly on a soil base for field testing. Each auger has a 23,000-lb. shear test capacity. Two rear augers are connected to the two front augers by steel beams. Front augers are tied to the rear of the engine test dolly.

Engine dolly wheels are mechanically retracted so that dolly's chassis rests on ground.

Thrust restraint is translated through dolly's members to the thrust sensing element.

Nylon tarpaulin with steel perimeter is placed on the ground under and forward of the engine inlet to prevent suck-up of loose earth or other debris.

Dolly also can be adapted to concrete pads by fastening rear of its base frame to anchors.

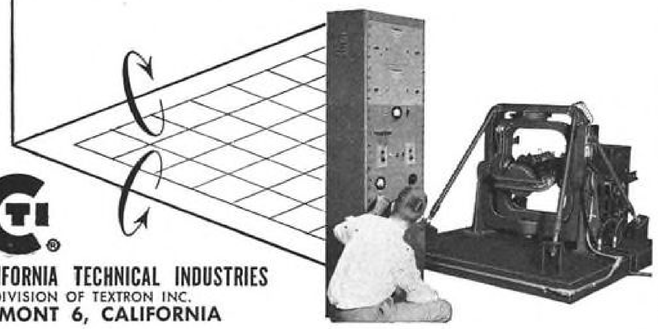
Minus tongue and with wheels re-

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FLIGHT SIMULATOR

Providing a flight table which can be continuously oriented in space with respect to three mutually-perpendicular reference axes, the CTI Dynamic Flight Simulator can be programmed directly from the output of a computer. Operating smoothly with no gearing, the instrument accepts independent voltage signals in each of the 3 axes and converts these vector analogs into a position corresponding to the defined space vector.

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Every manufacturer, design and production man should have this valuable data. Sent upon request.

PA STURTEVANT CO.
ADDISON (QUALITY) ILLINOIS

tracted, dolly is 95 in. wide, 172 in. long and 108 in. high.

Control trailer has forward storage section to accommodate adaptors, bellmouth, debris screen, nose fairing, control cables, harnesses and other items. Trailer is designed for integral power unit (gas turbine or diesel) but prototype uses standard 220-volt, 3-phase line power.

Trailer's control section, about 5 x 6 ft., accommodates test operator and inspector, contains main and auxiliary control panels, fire blanket, extinguisher and first aid kit. Insulation drops the sound level in the booth to about 60 db. during J79 runs.

General Electric based instrument placement in the trailer on the experience of four operators, each having about 10 years of test cell operation. Main panel accommodates standard engine parameter instruments. On the right is a load panel, and on left a panel for vernier exhaust gas temperatures and exact rpm. Instrumentation is standard to make calibrating simple, and is within 1% or better accuracy. All pressure sensing is remote and fail-safe. If main power is interrupted to control trailer, fuel flow is immediately shut off, remaining closed until the switch is thrown. No fuel passes through the control trailer.

Designed for Comfort

Trailer is temperature controlled, has a viewing window. Except for cable lead-in box, trailer is normally closed to cut noise level. Access is easily accomplished through panels on trailer exterior.

Control trailer is 93 in. wide, 224 in. long, 120 in. high.

Fuel trailer has 2,000-gal. capacity, provides maximum flow of 65,000 lb. per hr. at 60 psi., has 5-micron filter. Towed, it will carry a 22,000-lb load at 25 mph.

All controls are explosion-proof. In addition to pumping system, the unit contains flowmeter, high-speed electrical shutoff valve, plus emergency manual valve. Tire surface loading is low to promote portability through sand, snow or mud. Tanker is 88 in. wide, 239 in. long and 87 in. high.

During test run, distance between dolly, control trailer and tank is 40 ft.

Pan American Jet Seats Emphasize Safety Angle

All seats for Pan American World Airways Boeing 707 jet transports, both first class and tourist, will be manufactured by Aerotherm Corp. Company says special design emphasis will be placed on safety features in accordance with recommendations made by the National Advisory Committee for Aeronautics.

REPORT FROM RYAN

Ryan's Diversification Creates Wide Opportunity for Engineers





More Orders for Ryan Firebees

San Diego—Nearly $20 million worth of Ryan Firebee jet drone missiles have been ordered by the Air Force and Navy in 1957. In operational use, the Firebee is the nation's most realistic "enemy" target for evaluating the performance of air-to-air and ground-to-air missiles. It possesses the high speed, altitude, maneuverability and extended duration needed to simulate "enemy" intercept problems.

America's number-one jet drone, the Firebee is another example of Ryan's skill in blending aerodynamic, jet propulsion and electronics knowledge to meet a challenging problem... answer a vital military need.

X-13 Vertijet Adds New Punch to Airpower

Washington—Unveiled in an unprecedented flight at the Pentagon, the Ryan X-13 Vertijet gave military officials a glimpse of the future of airpower. Like a huge bat, the Vertijet unhooked itself from its nose cable, hovered vertically, then whipped over into horizontal flight and roared out of sight.

World's first jet VTOL aircraft, the Vertijet combines the flashing performance of jet power with the mobility of missile launching. It frees supersonic airpower from runways and airports. Without landing gear, flaps, actuators, the X-13 concept means less weight—more performance in speed and climb.

In the words of a top Air Force General, "The Vertijet has provided military planners with a new capability for manned aircraft of the future."

Achieved in close cooperation with the Air Force and Navy, the Vertijet is based upon Ryan's unsurpassed 2¼ million manhours of research, development, and test in VTOL aircraft.

Navy, Army to Use New Ryan Navigator

San Diego—Navy aircraft—piston engine, jets and helicopters will soon be equipped with Ryan lightweight automatic navigators and ground velocity indicators. Lightest, simplest, most reliable, most compact of their type, these systems are self-contained and based on continuous-wave radar.

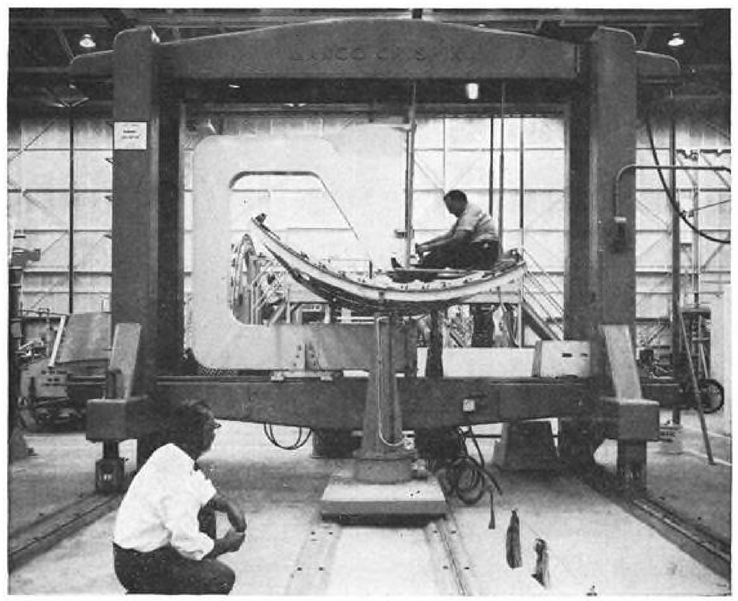
The navigators provide pilots with required data such as latitude, longitude, ground speed and track, drift angle, wind speed and direction, ground miles covered and course and distance to destination. Ryan is also developing guidance systems for supersonic missiles.

Ryan has immediate career openings for engineers

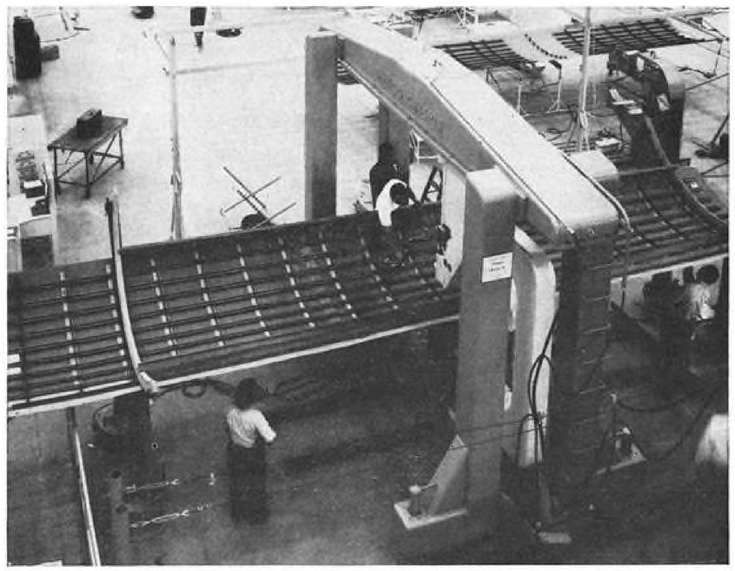
Look to the future. Look to Ryan . . . where you can grow with an aggressive, forward-looking company. You'll find a variety of stimulating projects. Ryan engages in all three elements of modern flight—airframes, engines and electronic systems.

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THREE-POINT sensing unit keeps curved panel (above) properly positioned.



GANTRY moves around panel, riveting the panel and shaving excess rivet material.

Mobile Unit Speeds DC-8 Riveting

New gantry riveter speeding production on Douglas DC-8 jetliner is essentially a large mobile unit in which yoke containing riveting equipment free-wheels over the panel. It is triggered into approximate working position by an operator using air motors.

Known as Manco-Crispin riveter, principal feature of the machine is that it brings the riveting operation to the work, instead of moving work to a stationary riveting location, Douglas points out. Rivet-by-rivet longitudinal mass work is eliminated, as is the need for extra floor space to accommodate panel movement under a stationary riveting location, Douglas maintains.

Only space necessary is for the length of the part.

Yoke containing the riveting and shaving tools is easily hand-positioned over riveting location. Immediate riveting area of the panel is automatically maintained 90 deg. to the axis of riveting anvil by a sensing unit.

Automatic cycle starts with bottom cylinder containing a pressure foot rising to the work, exerting a clamp force to squeeze panel upward against rivet head.

Rising within lower cylinder, rivet gun upsets rivet against anvil, then retracts. This is followed by shaving mechanism that removes excess rivet metal to close tolerance. After shaver retracts, yoke is hand-positioned to next rivet location and cycle is repeated.

Riveting system was conceived by T. S. Crispin, tooling administrator of Douglas Santa Monica Division. Machines are manufactured under license by Manco Mfg. Co., Bradley, Ill.

Five of the riveters are in operation at Douglas aircraft's Long Beach Division.

W. Germans Negotiate Powerplant Licenses

Bonn BMW Triebwerkbau (Munich), a subsidiary of Bayerische Motorenwerke (Munich), is negotiating a license agreement for Lycoming aircraft engines, another agreement with Orenda Engines Co. for servicing the Mk. 5 and Mk. 6 of the German Air Force, and a cooperation agreement with Rolls-Royce on joint technical development of some unidentified projects which the German Defense Ministry is expected to order in the near future.

Ultrasonic Detector Finds Metal Defects

Ultrasonic inspection equipment to detect flaws in metal plate, taper skins, forgings, rolled and extruded bars and other shapes of titanium, aluminum and steel has been installed by Republic Aviation Corp.

Installation consists of an ultrasonic immersion tank with mechanized search-unit positioning equipment, electronic flaw detection equipment and a bridge crane for material handling.

High frequency pulse waves indicate on an oscilloscope whether there are any defects in the metal being inspected, and the location and extent of any flaw.

Equipment features an alarm system which warns the operator by flashing light or ringing bell when a defect has been located. Electronic machine transmits waves at frequencies ranging from 200 kc. to 25 mc.

Republic says that the equipment,

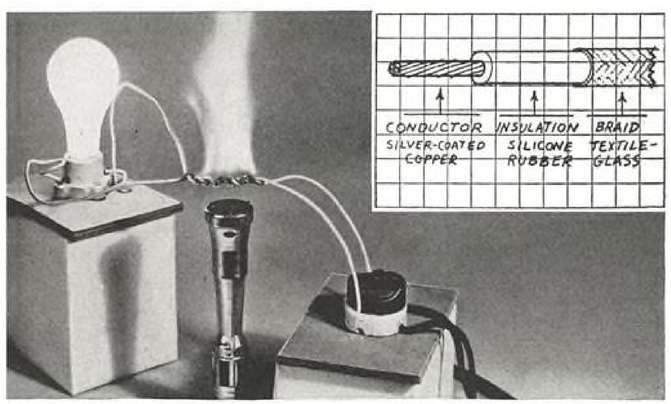
HOW TO SOLVE AIRCRAFT AND COMPONENTS DESIGN PROBLEMS WITH

GE SILICONE IDEAS

AIRCRAFT WIRE

HIGH STRENGTH RUBBER PARTS

HYDRAULIC FLUID



Problem: *Find a high-temperature aircraft wire that protects itself—and the crew.*

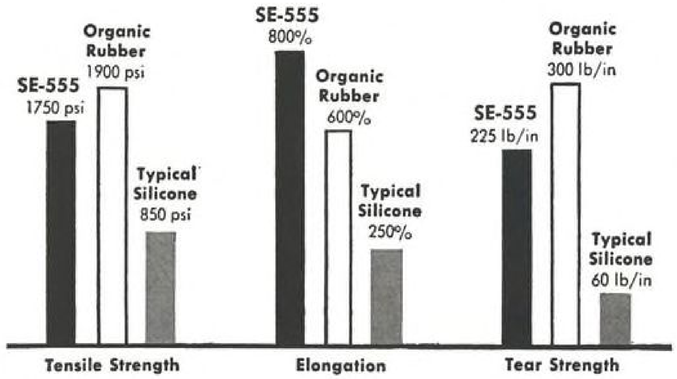
Solution: Wire made with G-E silicone rubber insulation.

Exposed to an 1800°F flame for hours, G-E silicone rubber insulation still insulates, forming an ash of silicon dioxide, an excellent non-conductor. No toxic fumes are released, nor will it shrink and expose the wiring, as the laboratory experiment on the left shows. Silicone rubber has superior dielectric strength at high temperatures and keeps it for years. It stands up well to oil and fuel splashes, has low water absorption. It is highly flexible down to −75°F.

Check into the specifications for silicone rubber aircraft and ignition wire, for it costs little more than standard wire, and much less than other high temperature wire. Technical literature and names of qualified wire and cable manufacturers are available on request.

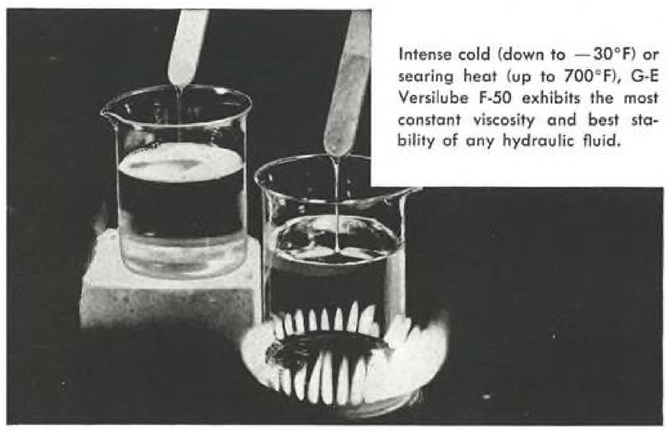
Problem: *Organic rubber parts failing because of temperature extremes and ozone. High tear and tensile strength cannot be sacrificed.*

Solution: Replace with SE-555—silicone rubber with tear and tensile strength comparable to organic rubber.



SE-555 is a new silicone rubber with tear and tensile strength double that of ordinary silicone rubber (see comparative typical values at left). Whenever maximum resistance to weather and temperature extremes (minus 150°F to 500°F) is required, combined with high tear and tensile strength, specify SE-555. This is the only material available to rubber fabricators that meets AMS 3345 requirements for tear and tensile strength, elongation, heat resistance, compression set and low temperature flexibility. SE-555 can be fabricated in practically any color, including white.

You can order high strength silicone rubber parts immediately because SE-555 is available from stock for shipment to your fabricator. For more information and a list of qualified fabricators, mail the coupon below.



Intense cold (down to −30°F) or searing heat (up to 700°F), G-E Versilube F-50 exhibits the most constant viscosity and best stability of any hydraulic fluid.

Problem: *Find a hydraulic fluid that functions over the −30°F to 700°F range needed for future aircraft.*

Solution: *Versilube F-50*, General Electric's new silicone fluid, with the best performance over this range of any hydraulic fluid now available.

Over the −30°F to 700°F *range*, only General Electric's new silicone fluid, Versilube F-50, provides adequate performance in all these areas: thermal stability, lubricity, viscosity-temperature coefficient, oxidative stability, oxidation threshold temperature and hydrolytic stability.

No other serviceable hydraulic fluid matches the thermal stability of G-E Versilube F-50—up to 600°F and for many applications, up to 700°F. Its lubricity is unequalled at temperatures as high as 700°F and comparable to other hydraulic fluids in the moderate ranges. Versilube F-50 also maintains a more nearly constant viscosity than other hydraulic fluids over the −30°F to 700°F.

For more information about Versilube F-50 and other G-E silicone fluids, send the coupon below.

Write for more information . . .

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Silicone Products Department, Waterford, New York

Section D7J11, Silicone Products Dept.
General Electric Company, Waterford, N. Y.

Please see that I receive all available information, plus names of manufacturers, of: ☐ aircraft wire ☐ hot air ducts ☐ silicone fluids for mechanical applications. ☐ I also want data on:

Name _____ Position _____

Company _____

Address _____

City _____ Zone _____ State _____



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made by Sperry Products Co. of Danbury, Conn., helps substantially in quality control of material for major structural components and results in considerable savings in time and cost by rejecting defective raw stock before expensive, time-consuming machining is begun.

Decision Handed Down In Electrofilm Suit

Law suit filed by Electrofilm Corp. in Superior Court of California charging Therm-O-Lab Corp. with appropriating the rights to a missile heating unit (AW July 2, 1956 p. 32; Nov. 5, 1956, p. 34) has been settled. In a decision handed down recently. Judge Leon Yankwich, chief federal judge of the 9th Circuit, held the Electrofilm dry lubricant patent in issue invalid in all claims.

Amphibious Helicopter Finishes Flight Tests

Flight tests of the research Vertol HUP-2 helicopter which was recently amphibianized by Edo Corp. (AW Oct. 21, p. 32) have been completed at the Flushing Bay, N. Y., test site. Machine is now waiting delivery to Patuxent Naval Air Station for further test work.

During the flight checks, the helicopter was landed in water at sink rates up to 8 ft./sec., double the sink rate required by the Navy's BuAer. Forward speed during this test was 5 kt.

Although amphibianization added a total of 350 lb. to the helicopter's maximum gross weight of 6,100 lb., 69 lb. of emergency flotation gear previously carried was removed. Result is a net weight increase of 280 lb.

Company Will Make Explosive Devices

Design, development, manufacturing and test services of packaged explosive power devices and related electronic equipment will be provided by a new engineering and production company, Holex, Inc., Hollister, Calif.

Products will include igniters for solid and liquid rocket engines, pressure cartridges, explosive trains, electrically operated initiators, and thread-in type glass-to-metal seals.

Mechanical and electronic parts and assemblies to integrate these components will also be designed and manufactured. Ernest J. Stecker, formerly in charge of facilities planning for Convair's Guided Missile Division, is president of Holex.

Hiller research is now directed into three broad categories: helicopters, ducted fan aircraft, and tilt-wing propelloplanes.

The Army's Flying Platform





The Air Force X - 18, now under construction



The Marines' XROE - 1 collapsible Rotorcycle

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Never before in history has mobility meant so much to military planning and tactics. No wonder all the services, particularly the U. S. Army, look to the air—and VTO*—for the only road to revolutionary progress. * Vertical Take Off

Hiller Helicopters has one objective in its many research programs for the Army, Navy and Air Force: to transform ideas for better VTO aircraft, capable of widespread practical applications, from dreams to reality in the shortest time possible.

Engineers: write for opportunities with an industry leader in an ideal California locale.

HILLER HELICOPTERS
PALO ALTO, CALIFORNIA



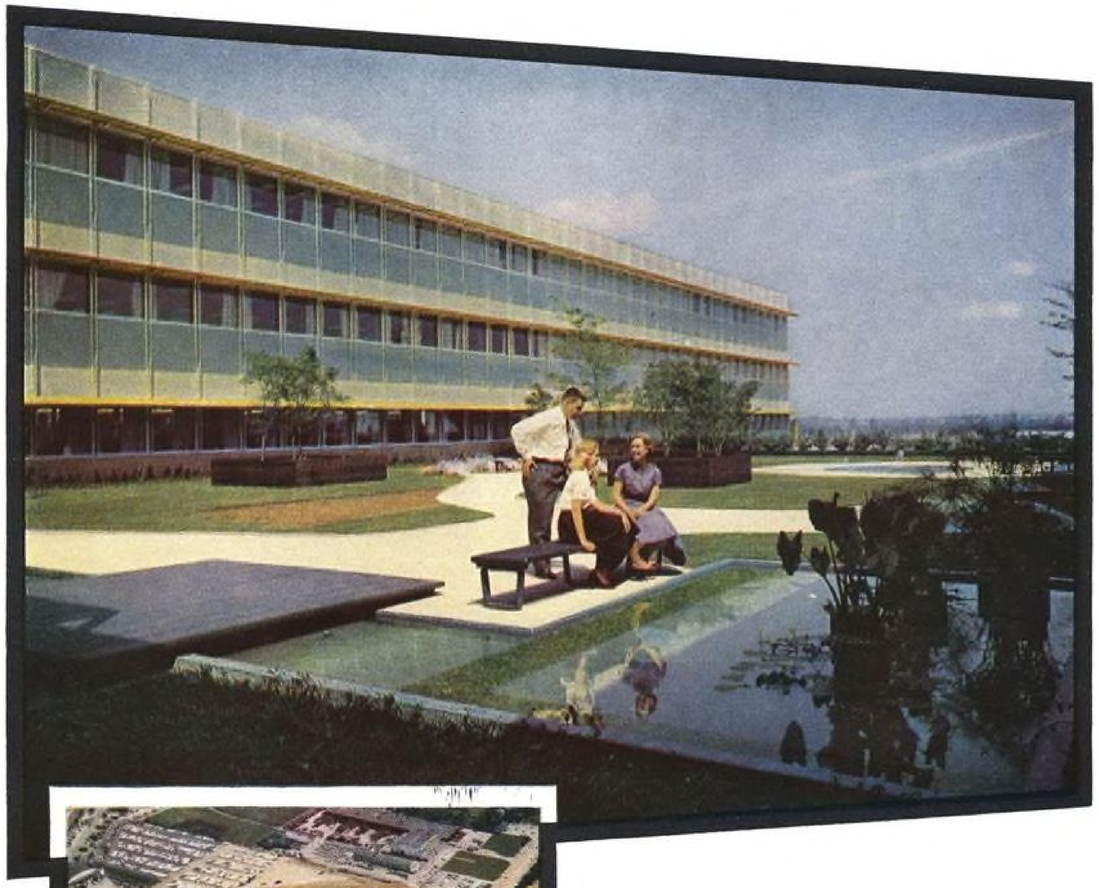
Who said it can't be cut? This internal helical gear for the Sikorsky S-58 helicopter transmission is cut on a production basis at Indiana Gear Works although the material is 50 Rockwell C and the tolerances for involute, spacing and helix angle are those of a master gear.

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Helicopter Simulator Is Research Tool

By Craig Lewis

Ft. Worth—Unique helicopter simulator has been developed by Bell Aircraft Corp. as part of a long range program to design an ideal helicopter instrument flight system.

Simulator employs a contact analog to simulate contact helicopter flight and will be mounted on a dynamic platform to duplicate actual flight motions.

Basic simulator cockpit is now in operation at the Bell plant here.

Bell developed the simulator as part of the Army-Navy instrument program it shares with Douglas Aircraft Co. under the supervision of Office of Naval Research (AW Oct. 21, p. 34). Bell is prime contractor in a program aimed at development of an optimum helicopter instrument system, and Douglas runs a similar program for fixed wing aircraft.

Psychological Tests

Bell's contact analog could eventually form the basis for an actual instrument flight system, but right now its primary use is in the simulator system. Simulator will be used for psychological tests of various displays to determine the optimum display system for simple, efficient helicopter operation.

Current simulator system is built around a closed sheet-metal cabin equipped with a seat, flight controls and a contact analog display. The display presents two pictures to the pilot—one represents a view straight ahead and the other a view downward at a 45 deg. angle.

These pictures are presented on two 17 in. cathode ray tubes, and the system will be able to use flat tubes when they become available.

The display can indicate pitch, roll, yaw, altitude changes and forward and lateral velocity. The display depicts contact flight in terms of a field of squares. The forward view shows this grid pattern diminishing to a distant horizon, while the downward view is filled with a grid pattern.

Grid Simulates Motion

In flight simulation, the grid pattern moves just as terrain would appear to move in reference to the pilot in actual contact flight. The squares increase or diminish in size to simulate altitude changes, the horizon moves to indicate roll or pitch. And other motions show the pilot how fast he is moving over the simulated terrain and in what direction.

The simulator system is run by an analog computer through a display generator.

A test program is set up in the computer, and signals are sent to the generator. Bell is using an electromechanical generator now, but an electronic generator being developed by DuMont Laboratories will replace it around the first of the year, and the new generator will give the system smoother, more precise displays.

Two television cameras pick up the grid pattern from the generator and display it on the two cathode ray tubes in the simulator cockpit. In the future, Bell may shift to a random dot pattern to replace the grid now in use.

The pilot closes the loop in the system when he moves the simulator controls in response to the display. These movements go to recorders and also to the computer where they become signals for adjustment of the display.

Early next year, a dynamic platform developed by Franklin Institute will be added to the system. It will be driven by hydraulic servos and will add motion to the simulation process.

When the DuMont generator is available, Bell will be able to fly the contact analog system in an HTL-7 helicopter. An HTL-7 cockpit will then be installed on the simulator platform to compare the system's reactions under flight conditions and under simulation.

This will give a precise test of the fidelity of simulation achieved.

Testing Program

Bell will use both the present cockpit and the HTL-7 cockpit for the testing program. The HTL-7 cockpit is more sophisticated since it provides the standard set of helicopter instruments and controls, and the test subject can simulate such things as engine starts.

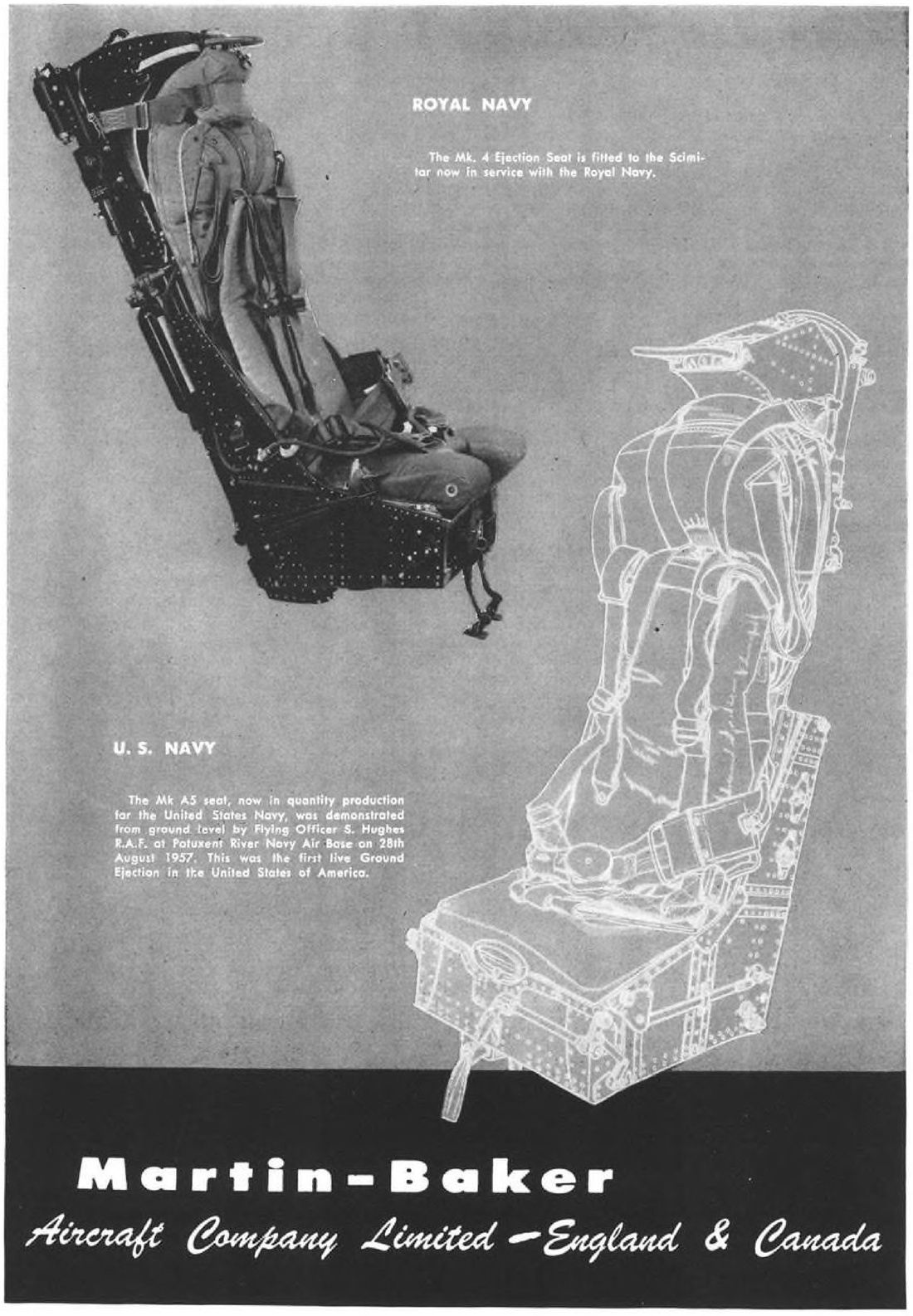
The testing program is starting out with very simple flight equations, although the computer and system can





Fairey Ultra Light Helicopter Goes to Sea

Tip-jet helicopter developed by Fairey Aviation Co., Ltd., of England, is carried on platform at stern of H.M.S. Grenville in the English Channel during evaluation tests of the aircraft's ability to operate at sea. Helicopter is powered by a Blackburn-Turbomeca Palouste turbo-generator which supplies compressed air to pressure-jet units at rotor tips (AW April 8, p. 34).



handle such complicated equations as those for the H-40 turbine helicopter. First tests will use fixed-wing equations and involve only level flight. The Bell testers want to concentrate on display problems and eliminate helicopter control problems for the time being.

Subject Source

Subjects for the testing program will be drawn from Bell's factory population, although students in local colleges may be used later.

All subjects will be male and should be as naive about flying as possible. Testers will use subjects who have never flown an airplane, and as many as possible will be persons who have never ridden in one.

Bell's simulator work is part of its long range quest for an ideal helicopter cockpit under the Army-Navy program. Bell program, called ideal-man-helicopter-engineering project, started two years ago, about a year and a half after Douglas launched its fixed-wing program.

Bell's program is keyed to the fact that the services, and especially the Army, need a helicopter that can fly at low altitudes in bad weather without ground aids. And the instrument system should be so simple that the average helicopter pilot can fly it without extensive special training.

Since most helicopter instrumentation is actually fixed-wing aircraft equipment and not very efficient for helicopter operation, Bell is starting from scratch to design and develop instrumentation specifically for helicopters.

Human Engineering Program

Such a project starts with the pilot who must use the instruments, and Bell has launched a substantial human engineering program to determine what information a pilot really needs to operate a helicopter. Courtney and Associates has completed a study for Bell on pilot information requirements for each mode of flights.

Bell will take this information and determine which flight data are most important, what cues are necessary for various flight modes, etc. The simulator will be valuable in this phase to test pilot reaction to various combinations of information. When Bell settles on what data should be presented, the next problem is how to present it, and the simulator can be used to test various types of data display. While this exploratory work is going on, Bell can anticipate certain hardware needs.

Development of an airborne computer has been ordered, and feasibility studies have been subcontracted for such basic instruments as altimeters, airspeed indicators and obstacle detectors. Work is also being done on high resolution radar.

OFF THE LINE

Wyle Laboratories, El Segundo, Calif., is constructing a high-flow liquid and gaseous oxygen facility for testing missile components and systems, as well as for cleaning and packaging components for operational use. Technical assistance for the project will be provided by Linde Co., a division of Union Carbide Corp.

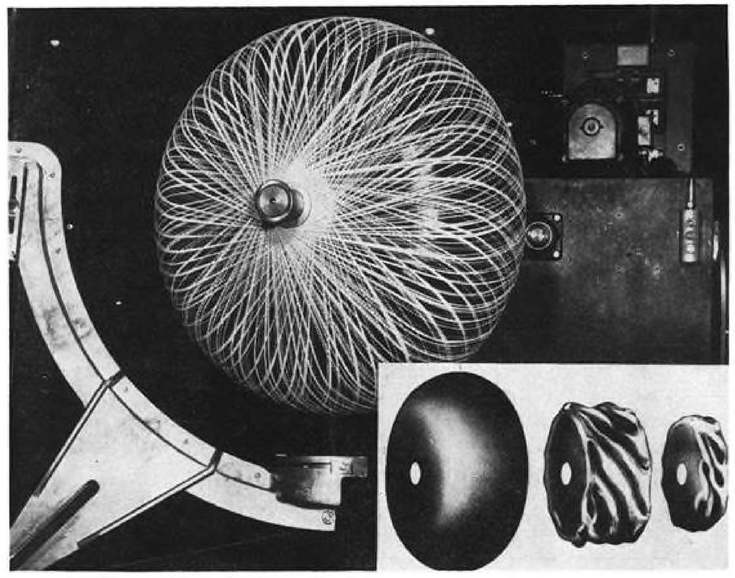
Perkin-Elmer Corp. registered annual sales of $12,753,563 for the fiscal year ending July 31, 54% ahead of last year. Net income was $509,985, equivalent to $1.15 a share compared to 33¢ a share last year. Company's backlog of orders at the end of the fiscal year was $8,400,000 and working capital reached $4,596,759.

Perkin-Elmer's expenditures for research and development for the current year were $746,741, almost double the $481,307 spent the previous year. Company is expanding its headquarters at Norwalk, Conn., and is establishing subsidiaries in Canada and England.

New aircraft engine accessory repair depot, called Airengines, Inc., has been established at 660 Rockaway Turnpike, Lawrence, N. Y. Company receives engines as removed from aircraft, strips them of cowling and accessories and subcontracts overhaul. Accessories are overhauled by Airengines and cowling and sheet metal are repaired as necessary. When engines return after overhaul, company builds them up and returns them to the aircraft owner. Airengines, which is a division of Airponents, Inc., says it has received response from such carriers as Varig and Swissair.

Northeast Airlines recently moved its Florida-bound four-engine flights from Gate 11 to the Marine Terminal at LaGuardia Airport. Twin-engine Florida flights moved to the Marine Terminal two months ago. Twin- and four-engine flights to New England will continue to use Gate 11.

Vickers Viscounts propellers, first turboprops to operate commercially, have passed the three-million propeller/hour mark.



Folding Tire Developed

New type of aircraft landing gear, based on use of a folding tire, is being developed under a research program by Fairchild Aircraft Division. Program has entered the second, or prototype phase. New tire and gear system is expected to solve many operating problems of short takeoff and landing (STOL) aircraft on unimproved fields. Inset shows (left to right) fully inflated tire, partial deflation, and folded tire one-eighth the size of fully inflated unit. Features of the tire include continuous, high tensile nylon cord wound around the tire body (main picture) to provide reinforcement at points where highest stress is expected, and an automatic vent system for deflating and folding the tire so that it can be stored in space of a standard tire. Added advantage of the valve is that it allows the tire to be a high pressure unit for operation on paved surfaces and a low pressure tire when plane rolls on rough, unprepared fields. Folding feature does away with large size problem of conventional low pressure tires.

PERFORMANCE PROVES CAPABILITY

INERTIAL GUIDANCE



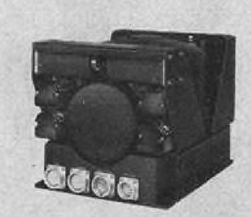
KEARFOTT has been engaged in the development, production and flight testing of Inertial Systems and their components for over 7 years. Their leadership in the field of lightweight, high precision Inertial Guidance Systems for aircraft and missiles has been proved by performance. The instrument shown here is a typical KEARFOTT inertial platform.

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Based on this 3 gyro, 3 gimbal stable platform weighing only 25 pounds, precise vertical reference (2 milliradians) under all dynamic conditions is guaranteed. This system also serves as an all-latitude compass system with 1° per hour random drift rate. Its performance is substantiated by the hundreds of systems in operation today.

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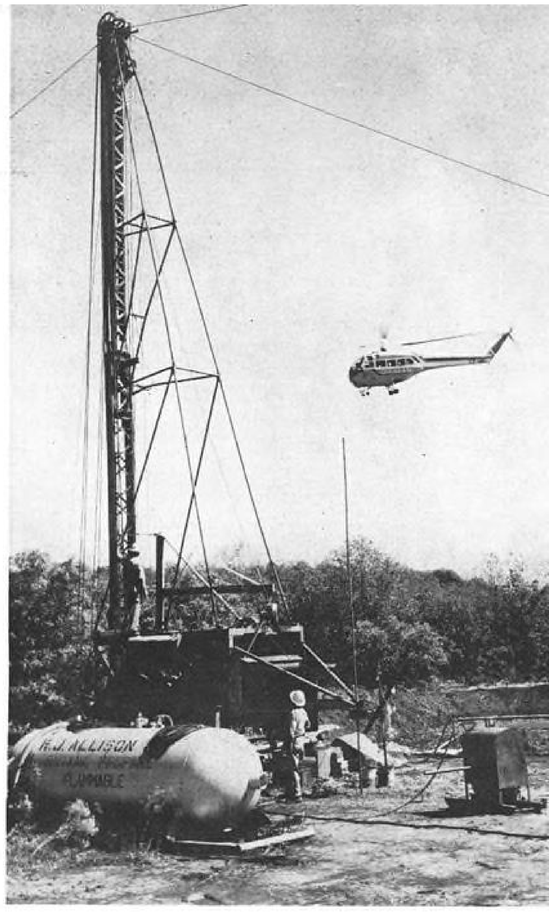
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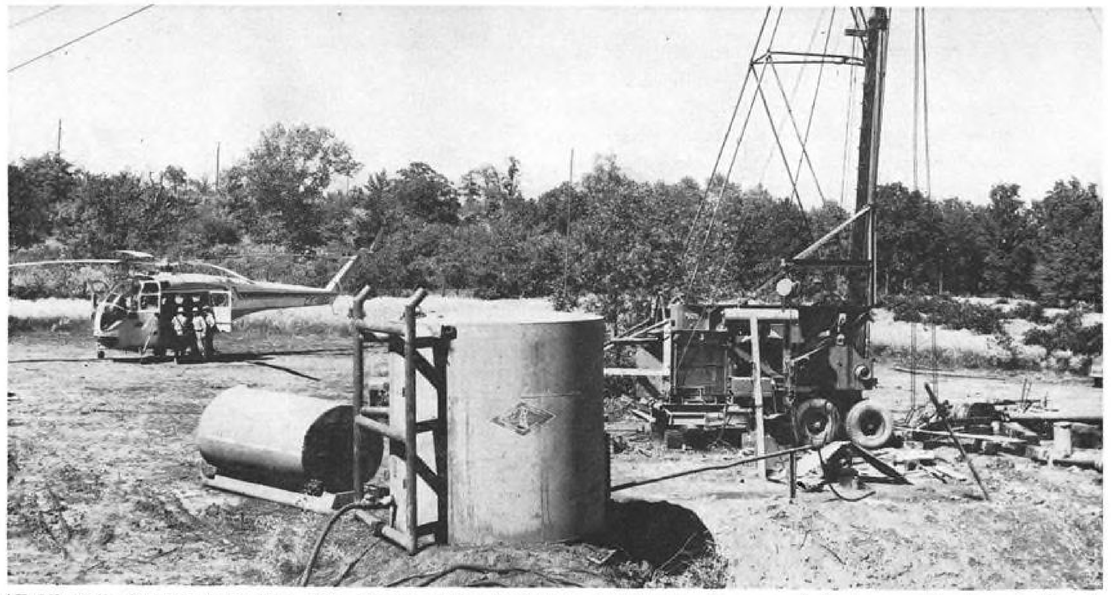




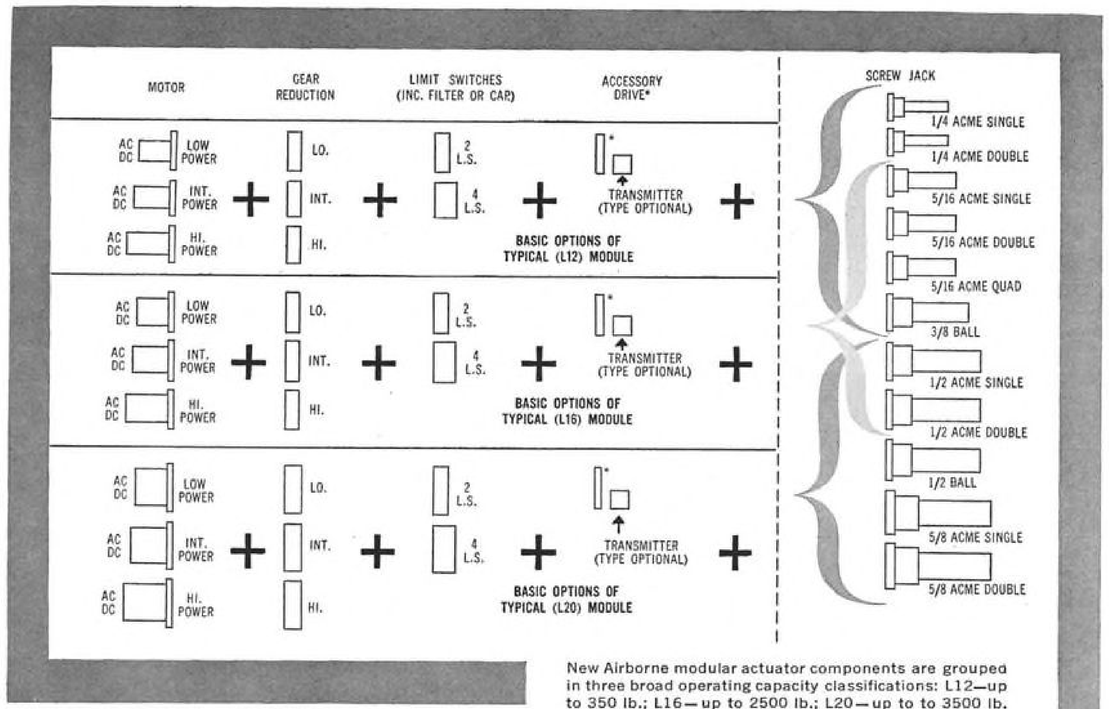
PUMPING UNIT CRANK weighing 1,000 lb. (above) is loaded into Doman LZ-5 at an oil field supply plant for flight to a well head. LZ-5 arrives (right) at a drilling rig located in deep brush country. An engine is loaded into the helicopter (below) at the oil field. LZ-5 made some 50 demonstration flights in Louisiana, Texas, Oklahoma.



Doman LZ-5 Gets Oil Field Check-Out



AT OIL DRILLING RIG in Cushing, Okla., Doman LZ-5 unloads some needed parts. In course of about a month's demonstrations in Southwest oil producing areas, the helicopter carried 238 passengers in addition to cargo. LZ-5's fuel consumption averaged 18.3 gph.



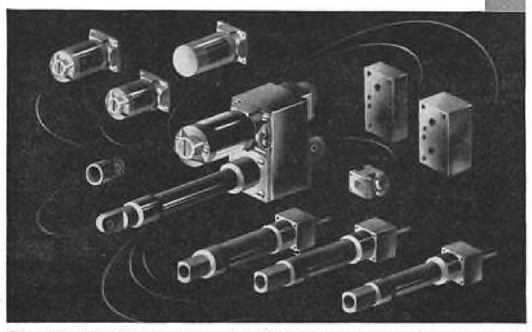
New Airborne modular actuator components are grouped in three broad operating capacity classifications: L12—up to 350 lb.; L16—up to 2500 lb.; L20—up to to 3500 lb.

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NEW MODULAR ACTUATOR CATALOG 57A

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Stock Transactions

Washington—Acquisition of $50,000 in 4¼% debenture bonds in Capital Airlines Inc., by T. D. Neelands Jr., director, has been reported by the Securities and Exchange Commission. Neeland's holding is now $100,000 in bonds.

J. D. Stetson Coleman, director, disposed of $10,000 in 4¼% convertible bonds, leaving a holding of $50,000. Coleman also disposed of 1,000 common shares leaving a holding of 2,000. Hayes Dever, officer, disposed of 100 common shares leaving a holding of 2,000. Other transactions for the period Aug. 11 to Sept. 10 include:

Aero Supply Manufacturing Co. Acquisition of 200 common shares by Harold E. Christensen, director, for a holding of 600; acquisition of 1,500 common shares by Estate "A," a beneficial owner, under Leo Strauss, officer, its entire holding. The Henmar Investing Corp., a beneficial owner under Leo Strauss, has 20,335 with Strauss directly holding 18,585 common shares.

Air-Way Industries Inc. Acquisition of 300 common shares by Edward Lamb, director, for a holding of 41,766; acquisition of 55 Common shares by Edward Lamb Enterprises, a beneficial owner under Lamb, for a holding of 42,962 with Dispatch Inc. beneficially holding 14,357 common shares under Edward Lamb. Edward Lamb Enterprises, a beneficial owner, acquired 500 common shares for a holding of 387,048; acquisition of 1,440 common shares by Woodruff, Inc., a beneficial owner under Prudence H. Lamb, also a beneficial owner, for a holding of 7,860; acquisition of 140 common shares by Edward Lamb Enterprises, a beneficial owner, acquired 500 for a holding of 108,373 with Dispatch, Inc., beneficially holding 5,835 and Mrs. Lamb beneficially holding 50,263 common shares.

Alaska Airlines Inc. Acquisition of $2,500 worth of 5½% convertible debentures by Frank C. LaGrange, director, his entire holding; acquisition of 26,153 common shares by Raymond W. Marshall, director, for a holding of 69,153; disposal of 40,153 common shares by Utilities Equipment Co., a beneficial owner under Marshall, leaving a holding of 144,776; acquisition of 1,400 common shares by Charles F. Willis Jr., officer and director, his entire holding.

American Airlines Inc. Acquisition of 100 common shares by Edwin H. Herzog, director for a holding of 400.

American Bosch Arma. Disposal of 2,400 common shares by Holding Co., a beneficial owner under William S. Wasserman, director, leaving a holding of 10,000; disposal of 100 common shares by Trusts, a beneficial owner under Wasserman, leaving a holding of 4,569 with Wasserman directly holding 12 common shares.

AVCO Manufacturing Corp. Acquisition of 1,000 common shares by Rudolph H. Deetjen, director, his entire holding; acquisition of 200 $2.25 preferred shares by Rudolph H. Deetjen, director, his entire holding.

Bell Aircraft Corp. Acquisition of 7,000 common shares by Equity General Corp., a beneficial owner, for a holding of 1,331,266; acquisition of 100 common shares by Walter A. Yates, director, for a holding of 4,450.

Bendix Aviation Corp. Disposal of 1,098 common shares by Palmer Nicholls, officer, leaving a holding of 2,386.

California Eastern Aviation. Disposal of 500 common shares by William W. Brinkerhoff, officer and director, leaving a holding of 71,711; disposal of 2,300 common shares by Samuel J. Solomon, officer, leaving a holding of 25,848.

Curtiss-Wright Corp. Acquisition of 7,500 common shares, through exercise of option, and disposal of 7,500 common shares by Roy T. Hurley, officer and director, making a holding of 42,500; with Mrs. Hurley beneficially holding 100 common shares; acquisition of 300 common shares by Frank W. Mencik, officer, for a holding of 5,100; acquisition of 500 common shares, through exercise of option, and disposal of 500 common shares by Joseph V. Miccio, officer and director, leaving a holding of 5,500.

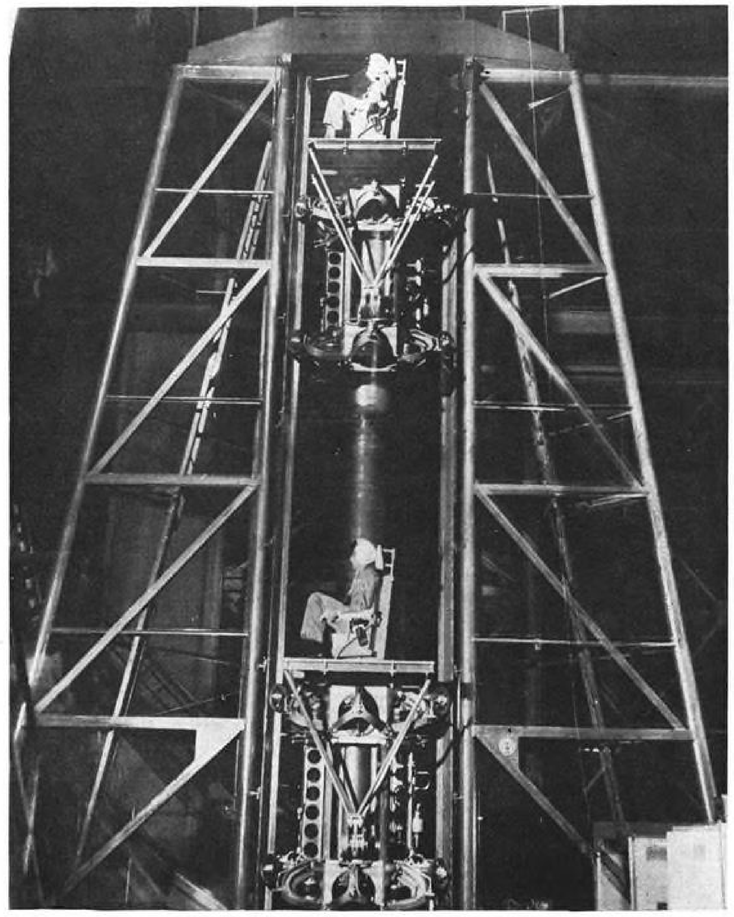
Douglas Aircraft Co. Inc. Disposal of 3,100 capital shares by Donald W. Douglas, officer and director, leaving a holding of 20,000; disposal of 155 capital shares by Nat Paschall, officer and director, leaving a holding of 2,095 with trusts under Paschall disposing of its entire beneficial holding of 45.

Eastern Airlines Inc. Acquisition of 200 common shares by Leslie P. Arnold, officer, for a holding of 4,400; acquisition of 2,700 common shares by L. S. Rockefeller, director, for a holding of 97,000 with a Trust under Rockefeller beneficially holding 3,542.

Fairbanks Morse & Co. Acquisition of 9,900 common shares by Penn-Texas Corp., a beneficial owner, for a holding of 443,650; acquisition of $10,000 worth 5¾% convertible sub-debentures by J. A. Cuneo, officer, his entire holding.

General Dynamics Corp. Acquisition of 5,000 common shares through exercise of option by Gordon Dean, officer, for a holding of 5,150; acquisition of 10,000 common shares through exercise of option by Joseph T. McNarney, officer and director, for a holding of 10,513; acquisition of 7,000 common shares, through exercise of option, by J. V. Naish, officer, for a holding of 7,200; disposal of 9,300 common shares by Earl D. Johnson, officer and director, leaving a holding of 12,000; disposal of 1,600 common shares by Allen D. Marshall, officer, leaving a holding of 8,100.

W. R. Grace & Co. Acquisition of 3,000 common shares through exercise of option by Andrew B. Shea, officer and director, for a holding of 8,011.



Turbulent Flight Simulator

This large machine was designed to simulate the buffeting experienced by a fast-flying jet pilot in rough weather at low altitudes. Subject, strapped into an aircraft-type seat which is mounted on a 30-ft.-high elevator mechanism can be bounced up and down at 19 mph. in an 18 ft. path. At maximum travel, man will move upward from zero velocity to 19 mph. and back to zero in 1⅔ sec., then instantly start similar acceleration in the opposite direction. Though rider experiences a maximum of only 2½G, rapid repetition of opposite motions makes the ride rough. Motion of the carriage is preplanned and programmed electrically. A manual override switch can stop the accelerator instantly. Double exposure shows man at upper and lower extremes of his 18 ft. travel. Accelerator was built for USAF's Air Research and Development Command by L.A.B. Corp., Skaneateles, N. Y.

Piper Revises Product Lineup for 1958



CUSTOMERS will get first deliveries of new Comanche 180, costing $14,500, in early 1958.

By Erwin J. Bulban

Williamsport, Pa.—In face of an increasingly strong buyers' market brought about by the business aircraft industry's high production rate in recent years and to meet stiffened competition, Piper Aircraft Corp. has made major revisions in its product lineup for 1958.

Company distributors and dealers meeting here for their annual sales forum were shown these innovations in the Piper line for next year:

- **First production models** of the new PA-24 four-place low-wing Comanche, which are scheduled to go to customers sometime in February. Distributors will begin receiving Comanche demonstrators in December 1957.
- **Apache light twin** powered by 160-hp. Lycoming O320-BIA high compression engine, providing a cruise speed of 134 mph. at 75% power at 7,000 ft. Take-off and climb are improved about 10% and range is increased 7%.

New Airplane

Piper engineers lifted the curtain slightly on the future to show the company's sales force a new airplane they have under development for 1959—the light twin Aztec—an improved Apache fitted with 250-hp. Lycoming O540 engines providing a cruise speed of more than 200 mph. Gross weight will be approximately 4,700 lb. compared with Apache's maximum gross of 3,800 lb. Company has been flight-testing a converted Apache with the 250-hp. engines for six months.

Also currently in flight test is the more powerful version of the 180-hp. Comanche fitted with a 250-hp. Lycoming. This airplane, which will be approximately 25 mph. faster than the 160-mph. current Comanche, will be ready for production in mid-1958.

Standard version of the Comanche 180 will cost $14,500 with basic instruments and minus radio. Two other models will be available, Custom and Super Custom. Former will have a Narco Superhomer with nine crystals, low frequency receiver with separate power supply, headset microphone and two antennas, artificial horizon, directional gyro, electric turn-and-bank indicator, rate of climb indicator, clock, outside air temperature gage, vacuum pump and drive. Super Custom will have this equipment plus a Narco Omnigator Mk. 2 with nine crystals in place of the Superhomer and LF receiver and Lear ADF-12E. Although no prices are officially quoted by Piper for these models, indications are that the Super Custom Comanche 180 will cost approximately $17,700.

Initial Run

Initial production of the Comanche will be kept to approximately 400-500 airplanes the first year, primarily because full toolup will take about that long to complete. High volume output at this point would require a major boost in prices because of added labor costs that would be required—perhaps more than $4,000, Aviation Week was told.

Grossing 2,550 lb. and weighing 1,475 lb. empty, the Comanche 180 has a useful load of 1,075 lb. Optimum cruise speed (75% power, 8,000 ft.) is 160 mph. and stall speed with flaps lowered is 58 mph. Carrying the standard fuel load of 50 gal., range is 800 mi.; with 60 gal., at this power and altitude, range is increased to 960 mi. A detailed Aviation Week pilot evaluation of the Comanche 180 will be carried in a forthcoming issue.

Higher compression (8.5:1) engines for the Apache and Tri-Pacer provide the additional 10 hp. at a weight increase of only six pounds. They make possible more efficient fuel consumption, since they burn .45 lb./hp. hr. as against .50 lb./hp. hr. for the earlier 150-hp. engine.



LITTLE CHANGE, except in paint scheme, is evident in 1958 PA-18A utility model.

Octane Rating Important

But owners are cautioned by Lycoming that use of 91/96 octane aviation gasoline in the 160-hp. O360-BIA and -B2A engines is mandatory; failure to maintain this requirement will lead to loss of all warranty on the engine. Lycoming points out that it will be advisable for operators of these engines to stay with the airplanes while servicing, since fueling personnel may assume that the new Piper models take 80/87 octane as in the past. If there is no 91/96 octane available. Lycoming notes that the owners should go to the next higher rating such as 100/130 or 115/145.

Use of 80/87 on the high compression engines will probably lead to detonation and pre-ignition causing burnt pistons, broken valves and damaged rings and resulting in blowby and engine failure. Continued use of higher octanes than recommended promotes lead fouling.

Piper will continue to offer the 150-hp. Lycomings in both the Apache and Tri-Pacer as optional equipment, but expects that its largest sales in 1958 will be for the higher-powered models.

Individual Seats

Seating changes in the 1958 Apache include use of two individual rear seats in place of the standard full width seat in earlier models—all seats are adjustable fore and aft and backs can be tilted to any of three positions, the farthest down comparable to reclining seats on the airlines. If desired, a fifth seat can be fitted to the floor tracks. With the increased power, the Apache can carry five passengers with full main tanks (72 gal.) and full auxiliaries (36 gal.) for a range of more than 1,200 mi., Piper points out.

Another cabin innovation in the new light twin is adjustable head rests for each seat as optional equipment.

Aerodynamically, a wing root fillet has been added at the leading edge to smooth out airflow over the wing and tail at low speeds, cutting down much of the Apache's buffet at landing and stall speeds. A larger 27,500 Btu. Southwind gasoline cabin heater has been



HIGH COMPRESSION 160-hp. Lycomings provide 1958 with gains in performance (see data below). Improved carburetor heat system, wing fairings are among new features.

1958 Piper Apache

SPECIFICATIONS

Two Lycoming O320-B engines—160 hp @ 2700 rpm.

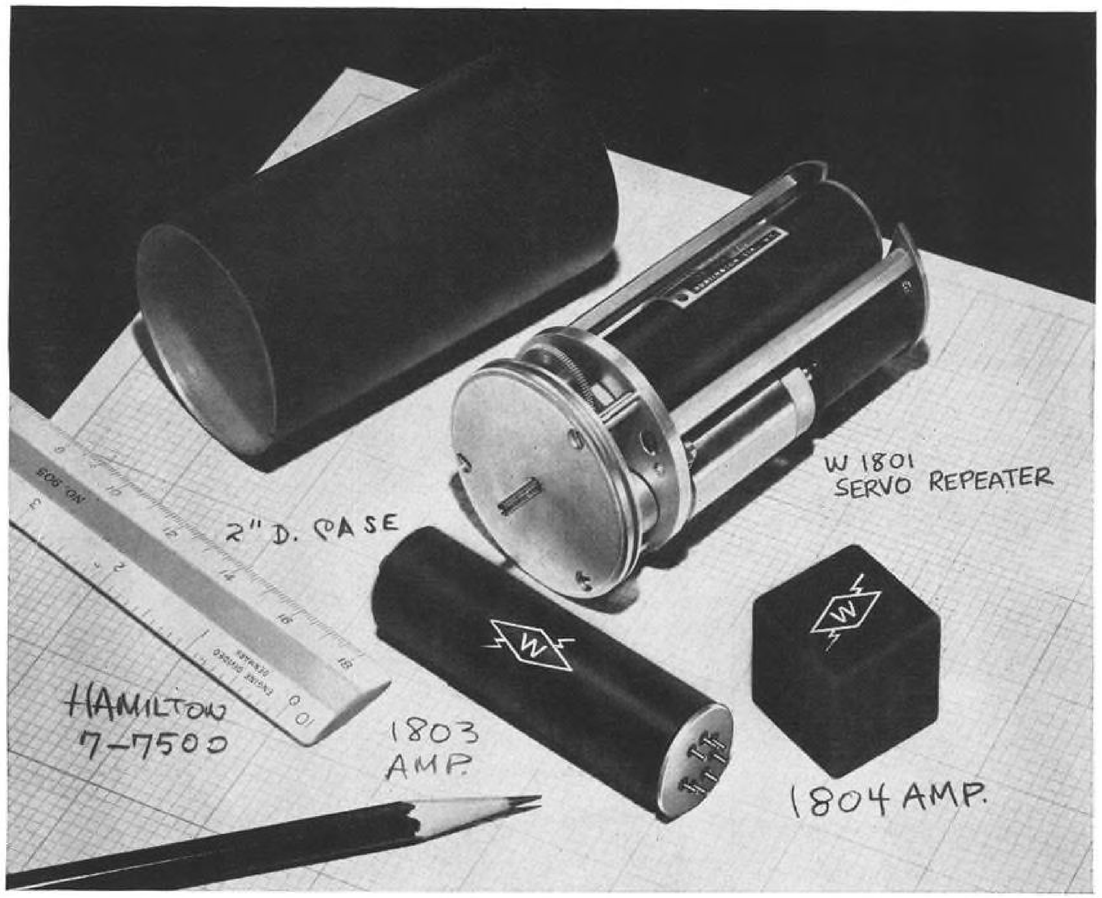
Gross weight (lb.)	3,500*	3,800
Empty weight (lb.)	2,230	2,230
Useful load (lb.)**	1,270	1,570
Fuel capacity (gal.)	72	72
Auxiliary cells installed	108	108
Wing span (ft.)	37	37
Wing area (sq. ft.)	204	204
Length (ft.)	27.1	27.1
Height (ft.)	9.5	9.5
Wing loading (lb./sq. ft.)	17.2	18.6
Power loading (lb./hp.)	10.9	11.9
Baggage capacity (lb. maximum)	200	200
Baggage compartment (cu. ft.)	25	25
Cargo space (cu. ft.) Rear seat removed	80	80

* Since most flights will not need the large payload designed into the Apache, specifications at 3,500 lb. gross are furnished as well as at 3,800 lb.

** Loading options—standard Apache (3,800 lb. gross).

1958 Apache Performance Data

Top speed (mph.)	183	183
Cruise speed at altitude 7,000 ft. (at 75% power—mph.)	173	171
Stalling speed (power off, flaps down—mph.)	59	61
Take-off run (ft.)	900	1,190
Landing roll (flaps down—ft.)	670	750
Best rate of climb speed (mph.)	100	100
Rate of climb (fpm.)	1,480	1,260
Best single-engine rate of climb speed (mph.)	95	95
Single-engine rate of climb (fpm.)	260	180
Service ceiling (ft.)	20,000	17,000
Absolute ceiling (ft.)	22,000	19,000
Single-engine absolute ceiling (ft.)	7,300	5,500
Fuel consumption (at 75% power—gal./hr.)	18.8	18.8
Cruise range with 72 gal.		
At 75% power at sea level (mi.)	650	640
At economy cruise (mi.)	853	840
Cruise range with 108 gal.		
At 75% power at sea level (mi.)	950	940
At economy cruise (mi.)	1,280	1,260



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MICROMATION—provides maximum operational performance with size and weight reductions up to 60 per cent . . . designed to meet military specifications.

MICROMATION now makes available—

Model W1801—Transistorized Servo Repeater System; size 2" Dia. x 4" long, weight 13 oz. *including* amplifier, power supply, synchro motor and gear head.

Model W1803—Transistorized Servo Amplifier; size 13/16" Dia. x 2¾" long, weight 2 oz.

Model W1804—Transistorized Servo Amplifier; size 1" x 1" x 1".

In the housing of the W1801 Servo Repeater System illustrated are all the electronic and electromechanical components to develop shaft position output with torque exceeding 20 oz.-in. Static accuracy is within 0.1° of input from synchro or transducer. Velocity constant is 60 sec.$^{-1}$. Requires only 115V, 400 cps supply. Other configurations are available to suit your requirements. Uses include control of positioning devices, valves or computer elements. May also be used as aircraft indicators. Meets military specifications.

Model W1803 Amplifier as used in the W1801 Servo Repeater is designed for minimum mounting surface—13/16" Dia.

Model W1804 Amplifier is identical electrically but packaged for minimum volume—1" x 1" x 1".

Both accept synchro, potentiometer, or other transducer data. Both drive size 8 or size 10 motors.

Interested?

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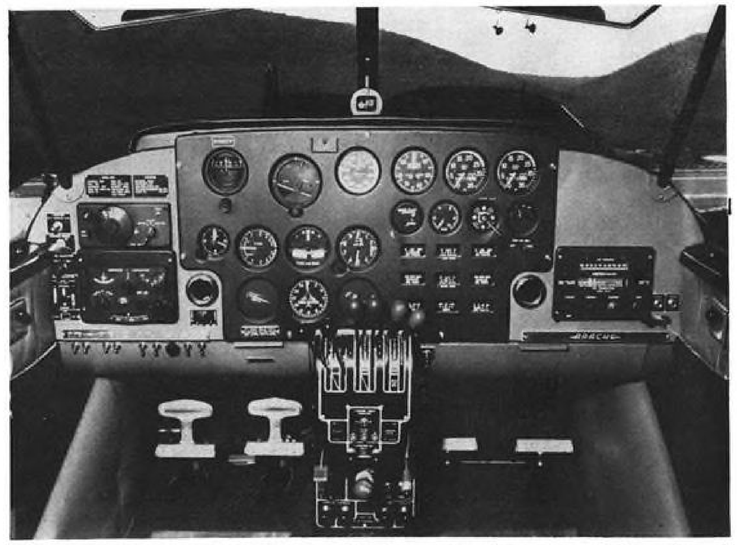
Waldorf
INSTRUMENT COMPANY
Division of F. C. Huyck & Sons

DEPARTMENT EC-45 • ELECTRONICS DIVISION • WALDORF INSTRUMENT COMPANY • HUNTINGTON STATION, L. I., NEW YORK

installed replacing the former 20,000 Btu. unit; nose landing light has been increased to 250 watts from 100 watts and carburetor heat has been improved. In the latter change, Piper engineers say they get a fast 200-deg. rise in the carburetor air box with practically no drop in manifold pressure.

Prices for the 1958 Apaches start at $35,990 for the Standard model with 160-hp. engines. Custom version will be $38,945 and Super Custom will be $40,755. For comparison the 1958 Apache with 150-hp. Lycomings will cost $34,990 for the Standard model, $37,945 for the Custom and $39,755 for the Super Custom.

Aside from interior restyling and the 160-hp. engine, the new Tri-Pacer is basically similar to previous models. Prices for the 1958 models: Standard, $8,595; Custom, $9,270 and Super Custom, $10,475. With the 150-hp. Lycoming, respective prices are: $8,385, $9,070 and $10,275.



APACHE panel is especially designed to take a large variety of instrument flight equipment.

More Dealers

Keynoting their growing prosperity, more distributor and dealer personnel and wives attended the 1958 sales meeting than any previous year, requiring a shift from the company's home town of Lock Haven to nearby Williamsport.

There were approximately six distributors whose sales in the fiscal year ending September 30th were in the $1 million bracket, one whose tally exceeded $2 million by a wide margin, one who almost reached $3 million and another who came close to $4 million.

For them, Piper sales manager J. W. (Jake) Miller set a goal for the 1958 fiscal year of $39,250,000 in commercial sales at list price. This compares to $35.7 million they achieved in Fiscal 1957. And he told them that he expects them to achieve sales of $60 million at list prices in 1960.

Indications are that Piper's increase in sales volume in Fiscal 1958 will come as much from increased prices as from a jump in number of units. Leveling off of sales last year after the business aircraft industry's record increase in 1956 will probably continue into 1958, and then show another noticeable rise, Miller told AVIATION WEEK.

One of the major obstacles facing the industry has been its inability to make noticeable gains in cracking the novice market, Piper dealers were told. Up to now the sales picture has been mainly one of "horsetrading," with only about 25% of sales going to first-time owners.

Financing Aid

Wider use of financing would also brighten the picture, Miller noted. He pointed out that the top Piper distribu-



NEW TRI-PACER, with 160-hp. high-compression Lycoming has 7% more range.

1958 Piper Tri-Pacer

SPECIFICATIONS			
Engine.....Lycoming 0320-B @ 160 hp. @ 2,700 rpm.		Fuel capacity (gals.).....	36
		PERFORMANCE	
Gross weight (lb.).....	2,000	Topspeed (mph.).....	141
Empty weight (lb.).....	1,110	Cruise speed at 7,000′ altitude (at 75% power-mph.).....	134
Useful load (lb.).....	890	Stall speed (flaps extended-mph.)	49
Wing span (ft.).....	29.3	Rate of climb (fpm.).....	800
Wing area (sq. ft.).....	147.5	Service ceiling (ft.).....	16,500
Wing chord (ft.).....	5.25	Absolute ceiling (ft.).....	19,000
Length (ft.).....	20.6	Fuel consumption (at 75% power-gph.).....	9.0
Height (ft.).....	8.33		
Propeller diameter (ft.).....	6.33	Cruise range with 36 gal. (mi.) (at 75% power at 7,000 ft.)...	536
Power loading (lb./hp).....	12.5		
Wing loading (lb./sq. ft.).....	13.5	Cruise range with 44 gal. (mi.) (at 75% power at 7,000 ft.)...	655
Baggage capacity (lb.).....	100		



Lockheed's F-104A Starfighter, designed for air superiority duty with the Air Force

Bring your tough ones to Zenith

Like a missile with a man in it, the Lockheed F-104A spears the sky at speeds of over 1200 mph—and Zenith rides with it, right on the nose!

To build the radome on this remarkable aircraft demanded unprecedented techniques in the construction of a resin-bonded glass-fiber form. Besides its vital radar function, the radome unit is an integral part of the aerodynamic design. In effect this radome is the nose cone of a manned projectile with the velocity of a 16-inch shell. It must withstand the shock of the sound barrier. It must endure the scorching heat of atmospheric friction. And it must maintain its electronic sensitivity unimpaired.

To meet these extreme requirements, Zenith worked hard and long with Lockheed engineers. The result was a new plastic material—a material that gives the maximum attainable electrical performance at elevated temperatures while retaining its full rigidity and strength.

This was the sort of tough assignment that whets our appetite at Zenith. Our continued success in coping with challenges like this has taught us how to form resin-bonded glass fiber for almost every electronic and structural purpose, in almost every shape and size. And we can apply modern, production-line methods to the job, and often slash costs and tooling time in the bargain.

Zenith's reinforced plastics are the *only* answer for some structural components—and a better answer for many. We invite you to "bring your tough ones to Zenith."

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Zenith Plastics Company

1600 West 135th Street, Gardena, California
Subsidiary of Minnesota Mining and Manufacturing Company

FORM OF THE FUTURE: RESIN-BONDED GLASS FIBER



Sabre Clips Apache

Piper Apache light twin business plane made a safe landing at Elgin Airport, Ill., after the top of its tail was clipped off by a two-plane element of F-86L Sabre jet fighters making a radar approach into O'Hare Field, Chicago, at about 7 p.m. CST, recently. Accident occurred in vicinity of Barrington at about 2,000 ft. under favorable VFR conditions, while Apache pilot Clint Brown was en route to Elgin. According to Brown, subsequent investigation revealed that none of the pilots involved saw each other; that Air Force had the F-86Ls on its radar, but not the Apache.

tors last year probably financed 80% of their sales. Those not exceeding their quotas probably used financing on only 10%-15% of their business. Last figures he had available showed that in 1956 about 52% of the aircraft sold were moved via financing.

Importance of dealers selling used Piper airplanes taken on trade-ins on new airplane sales instead of disposing of them to outlets specializing in used aircraft also was emphasized by Miller. He pointed out that even 15 used Apaches or 25-35 used Tri-Pacers in "outside" channels can noticeably depress prices of earlier models.

Suggested was a method of tabulating used Piper Aircraft held by dealers and a system of circulating this list among the sales organization so that the aircraft could be placed where they might be needed, thus lessening the chances of large numbers of planes going out on the open market.

Export sales are showing steady increase; in Fiscal 1957, Piper moved 20½% of its units overseas compared to 14.2% in the previous year. In Fiscal 1957 40% of all PA-18s and PA-18As went abroad as did about 13% of the total Apache output and about 10% of Tri-Pacer production.

Deliveries to New Zealand, for example, increased from two Piper airplanes in 1955 to 19 in 1956 to 32 in 1957. Easing of import restrictions in that country and Australia make them important future markets, according to distributors in those areas. The Australian distributor told AVIATION WEEK that although there are now only 20 Pipers of all makes there now, he has import licenses to bring in 40 more this year and will bring in a Comanche as soon as he can get one.

Addison Airport Makes Lease Arrangement

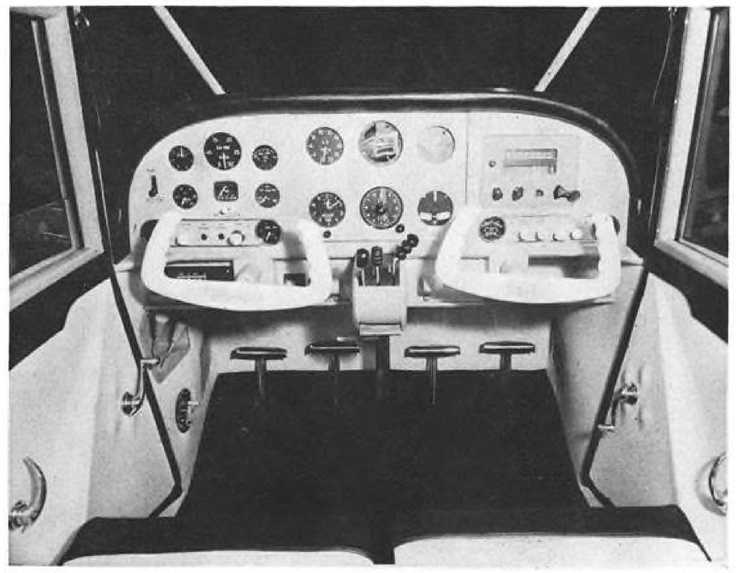
Long-term leasing arrangement of more than $250,000 covering two 160-ft. x 160-ft. hangars has been arranged between Addison Airport, North Dallas, Tex., and United States Leasing Corp.'s Dallas office.

Basically, U. S. Leasing purchases the

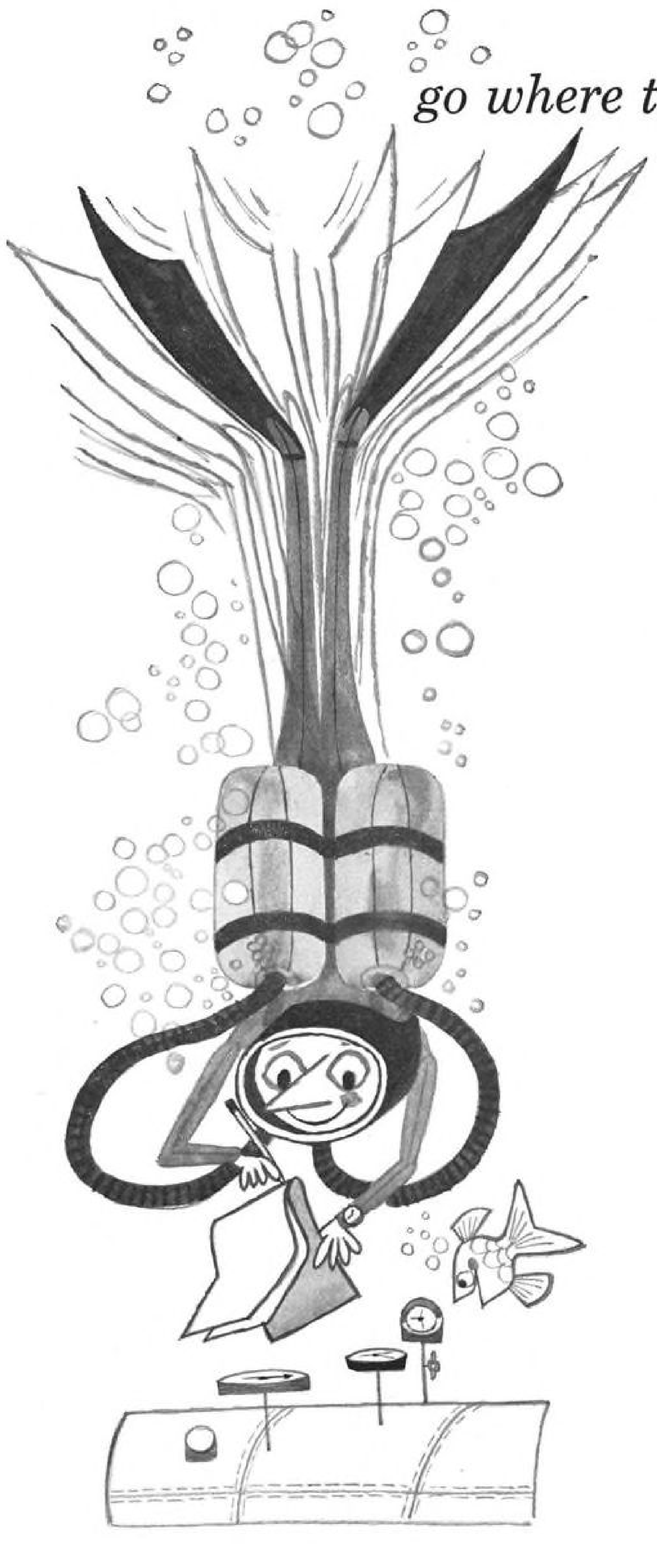


British Test 'Luxury' Light Plane

Designed specifically for executive operation, new Auster Atlantic four-seater is designed to compete with Piper Tri-Pacer and Cessna 172-182 series business planes. Auster reports he has not yet flown the nosewheel-type version, only a tailwheel prototype. Powered with a Continental E185-10 engine rated at 205 hp. takeoff and 185 hp. normal, the Atlantic is designed to cruise at approximately 135 mph. and have a range of 450 mi. Planned is a maximum payload of 745 lb. for approximately one-hour range; normal payload for 440-mi. range is estimated as 610 lb. at 124 mph. Takeoff distance is calculated at 135-225 yd. in still air depending on load; initial rate of climb would vary from 800-1,150 fpm. Although the airplane has not yet reached the production line, Auster estimates that fully equipped it will cost approximately $14,000. Among equipment shown is American-built Narco radio (upper right on panel).



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two new hangars and re-leases the property to Addison Airport, Inc., which in turn is leasing them to executive plane owners on long-term arrangements. The airport is primarily designed for business plane operations, comprises a total investment of $2,291,000 in facilities.

According to Lee Van Atta, Southwestern representative for U. S. Leasing, the company currently has an unused credit of some $15 million for making similar arrangements with airport operators.

Private Contractor Wins Army Contract

Central American Airways Flying Service has again been successful bidder to operate the Third U. S. Army instrument flight school, providing students eight weeks of training, including 70 hr. flight time, 40 hr. synthetic training and 90 hr. of academic instruction.

Operating at Bush Field, Augusta, Ga., Central American is utilizing 10 1957 Beech H35 Bonanzas to provide all-weather transition to the Army's twin-engine Beech L-23 Twin Bonanza liaison planes. Planes are equipped with Aircraft Radio Corp. radio and navigation equipment, Wright "60" Executive 60-channel VHF transceivers, plus a Lear five-channel glide-slope receiver.

Students are taught every type of instrument approach during the course, including GCA. Near the end of the course each one is taken on a three-day cross-country instrument flight. For synthetic training the school operates Link AN-T-18 trainers fitted with automatic VOR, ILS and ADF.

Weather near the field is stated to be ideal for instrument work since it normally has low stratus cloud formations, and icing at lower levels is common. Beech Bonanzas used at the school operate five days a week and average about seven hours of flight time daily.

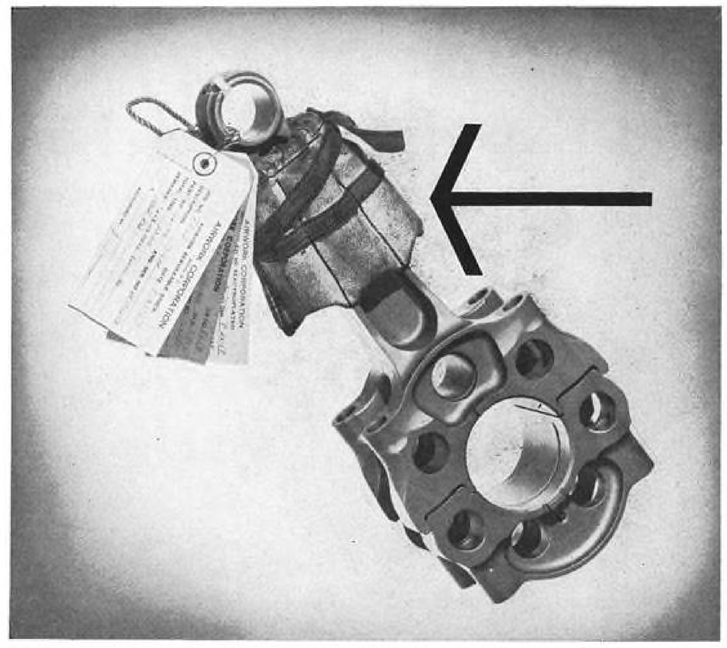
Lightweight De-Icers Readied for Twins

New York—Large number of light twin business planes lack all-weather capability because of owners' reluctance to equip aircraft with currently available de-icing gear they consider imposes penalties they can't afford on useful load.

At least one de-icing equipment manufacturer, cognizant of the large market this class of aircraft offers him, is developing a new line of boot-type gear to provide protection for under 50 lb. installed weight, AVIATION WEEK has learned. Current installations for an Aero Commander run about 83 lb., for the Royal Gull amphibian about 88 lb., Cessna 310 about 93 lb., Beech Twin-Bonanza about 99 lb. and Piper Apache about 82 lb., according to B. F. Goodrich supplied data. In the case of the Apache, the Piper spokesman say that they have no knowledge of a boot installation on this type.

Piper told AVIATION WEEK that it considers current installations too heavy for its airplane and reports that it is independently investigating a privately developed hot-air system for the Apache. Basically the system would utilize a heat exchanger and use freon gas as the agent for carrying the heat. According to the developer of the system it is so effective that it vaporizes moisture as it hits the wings. System is reported to weigh 30-40 lb. installed.

New boot-type equipment currently being developed by B. F. Goodrich will probably weigh about 50 lb. Although it uses proven principles, the system will actually be new. Company engineers estimate that they can take about 20% off weight of current boots by using a thinner material. By modifying current pumps, changing cycling of inflation — using alternate tube method in place of simultaneous system—some 50% of required solenoids can be deleted, saving at least 10 lb.



Why Should An Inspector Do This?

Because the correct fit of link pins to a master rod is a high precision job. Only a difference of 0.0003″ in diameter makes the difference between a pin that fits correctly, and one that doesn't!

At Airwork, 54 different diameters of link pins are needed to correctly fit master rods on just one popular engine. Naturally, it takes an inspector, equipped with the best of precision gauges to select the pins that fit exactly.

Those pouches keep pins and the mating rod together; protecting the pins until they reach final assembly. This is just one more Airwork procedure that helps produce a longer lasting trouble-free engine.

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CARRYING sling with load of structural steel for power line tower is adjusted on S-58 for airlift to mountain ridge site.

S-58 Expedites Power Line Installation

By Richard Sweeney

Ventura, Calif.—Trial use of helicopters to install high voltage electrical power transmission lines proved so successful that Southern California Edison Co. is planning to use rotary wing aircraft extensively in future power line installations.

Decision resulted from recent operation in which Rotor-Aids, Ventura helicopter firm, was called in relatively late on construction job in progress to airlift structural steel for towers of new 26-mi. line. Operation was primarily a study of capabilities, in which Edison leased an S-58 from Sikorsky which Rotor-Aids operated along with its own Bell equipment in the study program.

In transmission line planning, land rights-of-way are a major cost factor in that, up to now, line paths and tower sites have been largely dictated by accessibility of sites via roads over which men, materials and equipment could be trucked for construction. Another high cost is road maintenance year in and year out, as long as the line exists.

Litigation Time Cut

Another aspect of rights of way and cost are proceedings involved when a company has to resort to condemnation proceedings to acquire the right to install lines. Use of the helicopter first enables a company to stay away from areas where landowners would naturally resist line installation, thus eliminating loss of time in litigation legal costs. Second, it enables a company to generally install a more complete line without part of it held up in law proceedings.

Rotor-Aids and the performance of the helicopter led Edison to plan the



AVERAGE line of sight distance from loading depot to tower site was 3.9 mi.

S-58 DROPS load of steel (below) at tower site. Two pilots sharing tasks improved efficiency.



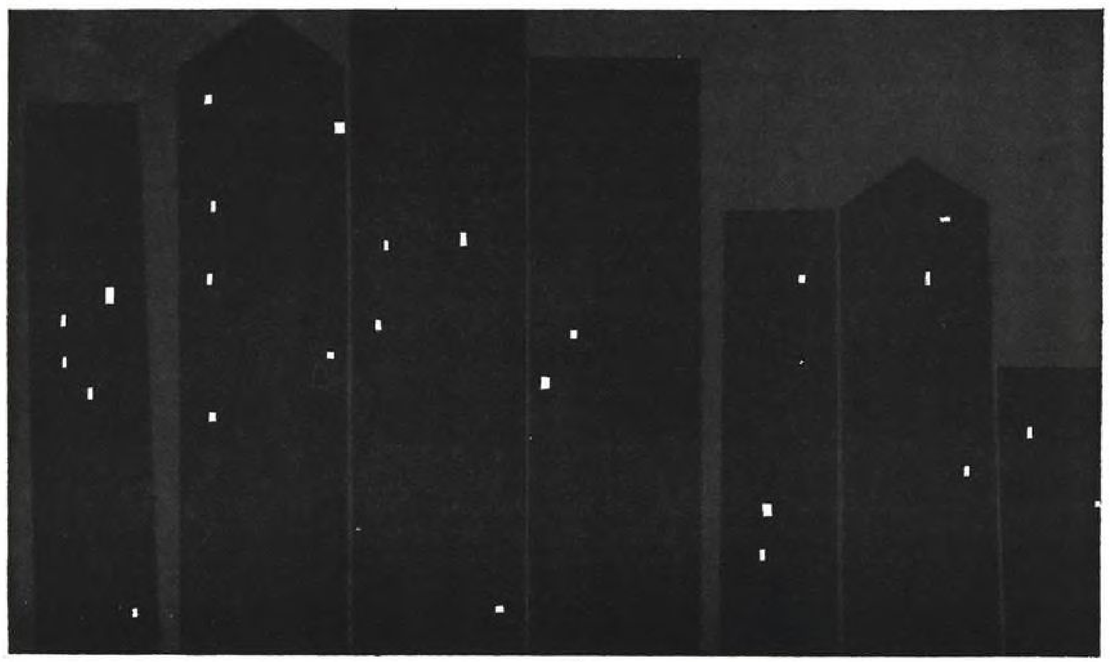


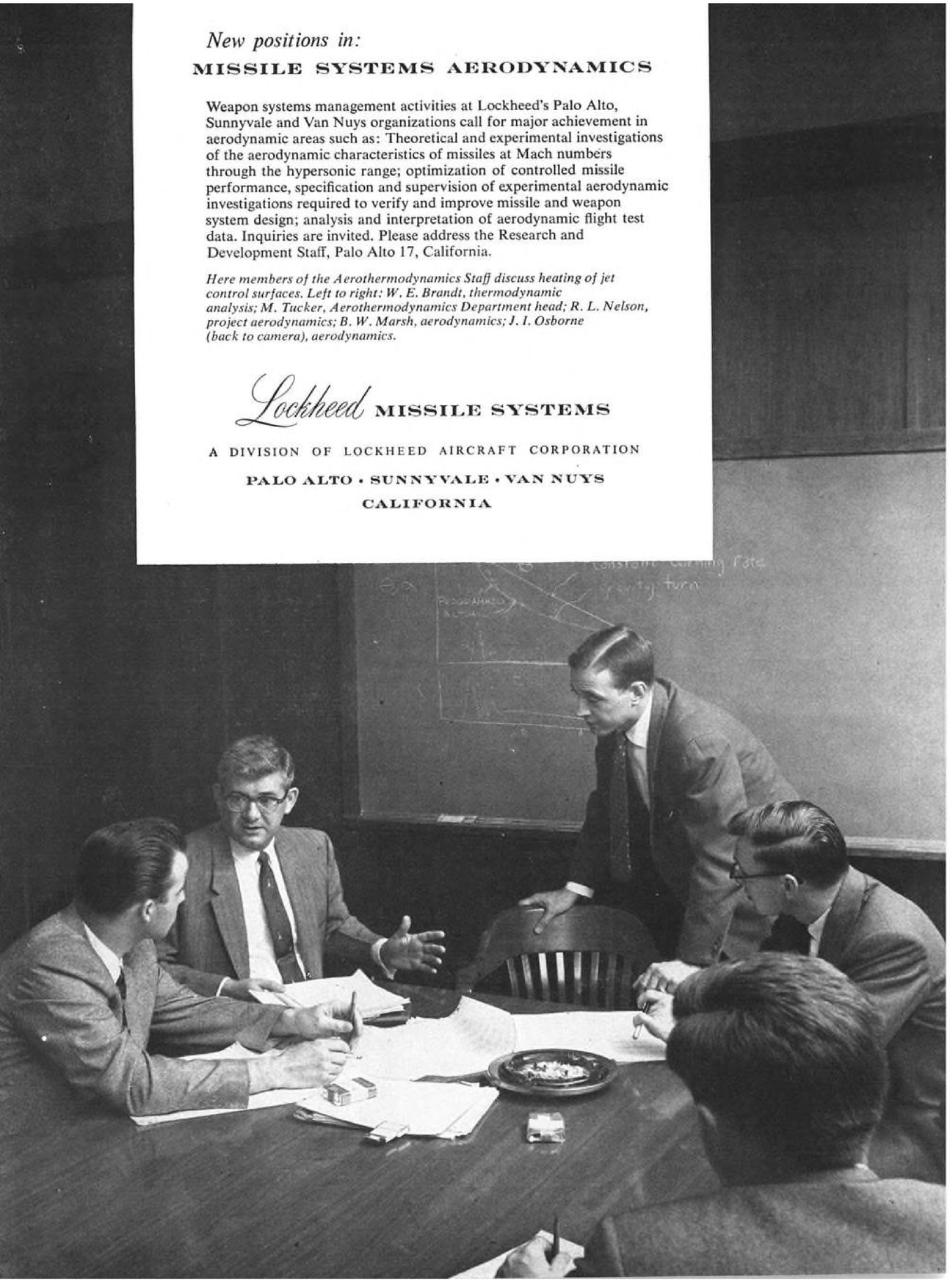


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Weapon systems management activities at Lockheed's Palo Alto, Sunnyvale and Van Nuys organizations call for major achievement in aerodynamic areas such as: Theoretical and experimental investigations of the aerodynamic characteristics of missiles at Mach numbers through the hypersonic range; optimization of controlled missile performance, specification and supervision of experimental aerodynamic investigations required to verify and improve missile and weapon system design; analysis and interpretation of aerodynamic flight test data. Inquiries are invited. Please address the Research and Development Staff, Palo Alto 17, California.

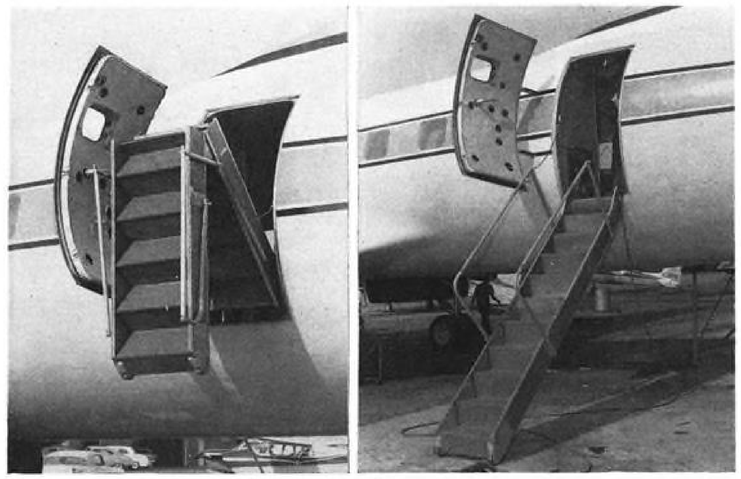
Here members of the Aerothermodynamics Staff discuss heating of jet control surfaces. Left to right: W. E. Brandt, thermodynamic analysis; M. Tucker, Aerothermodynamics Department head; R. L. Nelson, project aerodynamics; B. W. Marsh, aerodynamics; J. I. Osborne (back to camera), aerodynamics.

Lockheed MISSILE SYSTEMS

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CALIFORNIA



Executive Convair Gets Light Stairway

Retractable stairway, some 200 lb. lighter than standard Convair-Liner installation, was fitted to this executive CV-240 within nine weeks of customer's order by Pacific Airmotive Corp. Plane, a former Sabena Belgian Airlines' transport, is one of the approximately 40 Convairs manufactured without a self-contained stairway. Pacific Airmotive located its stairway at the plane's rear door, made provision for opening it from the cabin or from the ground. Major problems involved space limitations, proper alignment of sequence valves and auxiliary cylinders to open and close the door, hydraulic pressure requirements for various stages of retraction cycle. Modified CV-240 belongs to Murray Corporation of America, Detroit, Mich.

following sequence for construction of the next transmission line:

• **Edison will** be able to go into areas where rights of way will cost less, will not need access roads, and lines can be sent along better routes through rough areas.

• **Surveys** for rights of way will be accomplished with Bell helicopters.

• **Small crew** will be flown in to clear tiny area where miniature bulldozer weighing less than 3,500 lb. can be 'coptered in, used to clear 50x50 ft. tower site.

• **Portable auger** will be carried in to drill footing holes. Reinforcing steel for footings, already fabricated into proper shape, will be airlifted by helicopter to sites.

• **Ready mix concrete,** weighing approximately a ton per cubic yard, will be airlifted in buckets. Each tower requires four footings, with 4 cu. yd. per footing.

• **Tower steel** will be flown in, bundled for 3,500 lb. per load.

• **Towers will** be erected with floating gin pole, which weighs less than 3,500 lb., will be carried by helicopter from site to site.

• **Line stringing** will be accomplished by helicopter and ground crews.

In transmission lines, conductor cable is not completely fixed at each tower, rather is attached at certain extra strong points called dead end towers, which are located with varying numbers of supporting towers in between according to terrain. When a section is to be strung, copters fly in a tension machine to the dead end tower at each end of section to be worked.

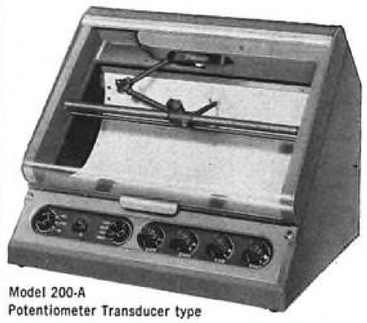
Stringing Operation

Using reels, a Bell helicopter will place ¼ in. manila rope from one dead end tower to another, with splicing as necessary for rope continuity accomplished by ground crews while 'copter hovers. Ground crews will then use tension machines to pull ¼ in. aircraft cable across the span in place of rope. Aircraft cable will pull ⅝-in. wire rope into place, which will in turn be used to haul the very heavy conductor into position where it is located to dead end towers and attached as necessary to intermediate supporting towers.

Tension machines, crews, will then be carried to next section that is to be strung.

In feasibility program, several factors worked against the helicopter. The steel was already bundled for trucking in packages varying from 1,700 to 3,500 lb. A 50% increase in efficiency could have been gained if the steel was bundled to S-58's maximum 3,500 lb. per flight capacity. Also, to take advantage of road network along already existing line, Edison is constructing a new line close to the operating high voltage line, increasing the hazard to a helicopter carrying loads of steel. Another hazard was flying into sites located just below mountain tops where

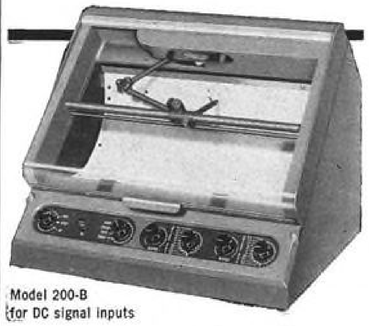
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treacherous and rough air currents were encountered.

Despite non-optimization, helicopter racked up some favorable statistics during the operation.

In overall program, 1,185,378 lb. were airlifted in 65 hr. 13 min. flight time, excluding ferry time from main operating base at Ventura to the three sites used as loading depots. Loading sites were picked so that the average line of sight distance flown per trip was 3.9 mi. from depot to tower site.

Best operating day saw 136,050 lb. carried in 4 hr. 26 min. flying time. Fluctuations occurred in daily weight totals due to variation in loads. While steel was primary cargo, 'copters also lifted insulators, baskets of nuts, bolts and various assorted but necessary items for construction. Baskets, slings and other equipment used in the lift had to be returned from tower site to loading depot.

Finished Quickly

Rotor-Aids originally planned the operation to take upward of four weeks. However, job was finished in 15 flying days between Sept. 30 and Oct. 18. On the basis of 15 calendar days in which 51 hr. 10 min. were flown to haul 936,709 lb., direct operating cost was $11,450 excluding depreciation and insurance.

Other aspects brought out in operation included:

- **More efficient** use of personnel. Rotor-Aids killed two birds with one stone by having one pilot fly the union-required two workers to the tower site for unloading operation, park the Bell helicopter and serve as hand signaler to cargo 'copter while the site was being equipped. When job was completed, Bell lifted entire crew to next site.
- **Planning around** helicopters from the beginning necessitated some changes in basic material packaging for suppliers, such as size of conductor reels, formerly packaged to 6,500 lb., to be reduced to 3,500 lb. reels.

In the hauling operation, Rotor-Aids found that better overall efficiency resulted from having two pilots aboard the S-58. While on this particular job the extra pilot served as safety watcher when operations were very close to existing live high voltage line, but sharing of pilot tasks increased efficiency in areas where existing line was remote from a safety standpoint.

Additional Pilot Duties

At the loading depot, one pilot again served as hand signaler to cargo pilot; supervised steel load groupings to prevent inadvertent overloading; kept trip times, gas records.

Rotor-Aids is headed by Joe Seward and Roy Falconer, both graduate engineers, both Navy pilots, both carrier pilots, both active helicopter and fixed wing pilots. Both took an active part in S-58 flying on the Edison job.

Company has been operating its own 11 Bells, two Model 47Js, two 47Gs, seven Model 47s, and Humble Oil Co.'s four S-58s, four S-55s, in the Gulf of Mexico oil operation (AW Dec. 31, 1956, p. 27) and two S-55s in Alaska. All 34 company pilots are rotated on jobs to the Gulf, to California, to Alaska.

Pilots Experienced

All had more than 750 hr. helicopter time when hired. Company also employs 35 mechanics in doing all its own maintenance except engines on the Bells. On Sikorskys in the Gulf they do some major component work but send other work to the factory. Due to peculiar living conditions in the Gulf operation, Rotor-Aids has had to compromise its desire to do all its own maintenance to avoid delays in shipping time, scheduling at factories for overhaul, with the cost. However, in Ventura, all maintenance except engines is done, but company mechanics are capable of doing this too if required.

Company employs 76 persons, has never had a layoff due to lack of business.

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PRIVATE LINES

Cessna will start deliveries of new Model 175 four-placer in March priced at about $11,000. Powered by a 175-hp. Continental, plane is designed to fill market gap between Model 172 and Model 180, Cessna states.

More than half the loans requested from Small Business Administration by fixed base operators for facilities expansion have been granted, according to a report from the Small Business Administration to the Civil Aeronautics Administration. As of July 31, 1957, some 61 applications requesting $2,729,467 were received. Of these seven were later withdrawn; 27 applications requesting $1,212,293 were approved and 24 involving $1,053,235 were turned down. Three applications totaling $211,500 were pending. Almost half of the total funds approved were for seven hangar projects totaling $515,800. Many of the other loans were to pay off taxes and bank loans.

U.S. Air Force is releasing about 1,505 aircraft for sale through July 1, 1958. Included will be 286 North American B-25s, 104 Beech C-54Gs (Model 18), 162 North American T-28As, 615 Douglas B-26s, 84 North American T-6Gs, 100 North American F-51s, 116 Curtiss C-46As and Ds and 38 Ryan L-17s (Navion). Sales will be made at McClellan AFB, Sacramento, Calif., and Norton AFB, San Bernardino, Calif. Interested parties can contact the Property Disposal Officer at these bases.

Manufacturing rights to complete helicopter started by Michigan Helicopter Development Corp. have been assigned to Metric Aircraft Corp., a newly formed division of Metric Tool Co., St. Clair Shores, Mich. First prototype of the helicopter is scheduled for tests in January. Rotor is four-blade contra-rotating type.

Some 500 pilots have enrolled in four new ground school safety refresher courses being held by Illinois Department of Aeronautics. Offered at no charge, courses cover 33 hr. classroom instruction in navigation, meteorology, civil air regulations and general safety practices. Thus far, 3,894 pilots have taken 59,673 hr. of instruction in the department's safety courses.

The Garrett Corp.'s AiResearch Mfg. Div., Los Angeles, is manufacturing cabin pressurization equipment for the On Mark Model 450 executive transport, being built by the On Mark Engineering Co., Van Nuys, Calif. System is similar to that designed for the Boeing 707 and Convair 880 jet airliners.



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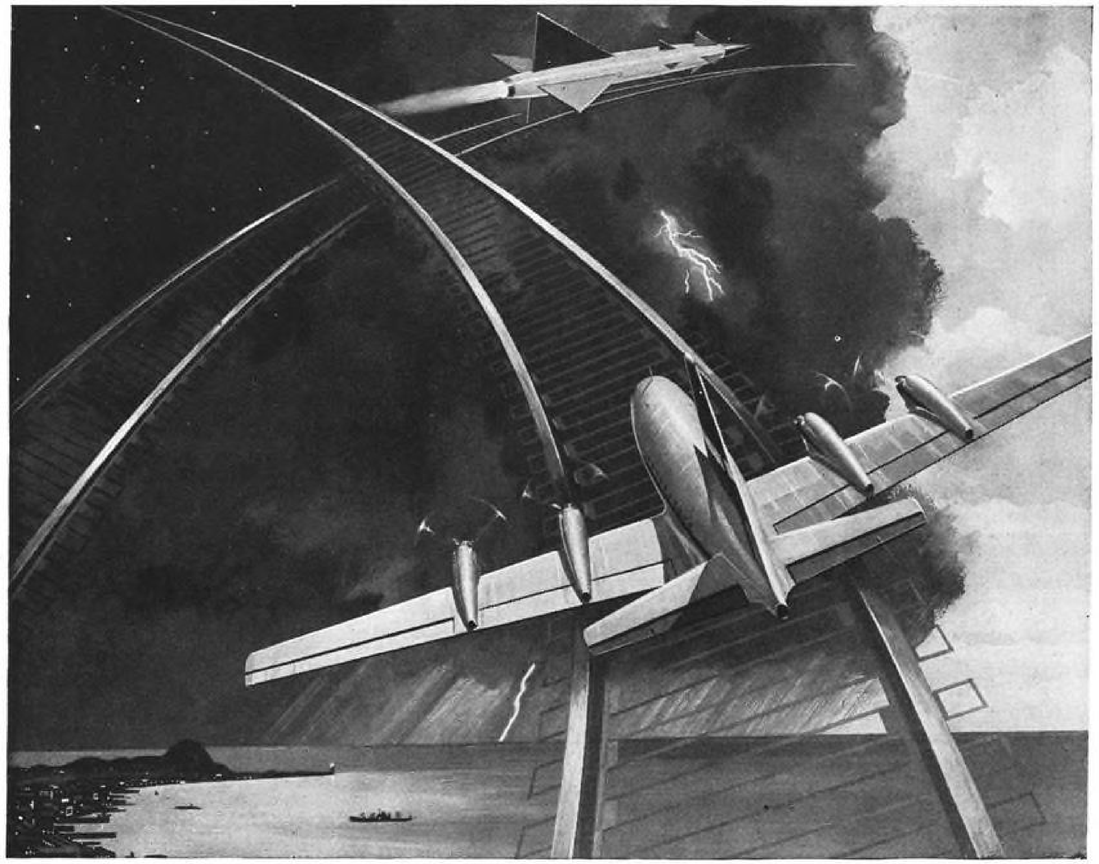
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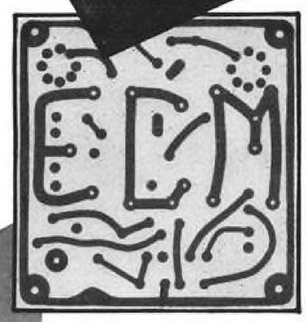
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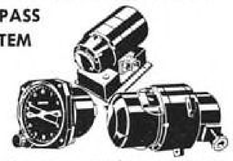
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Wed., Sept. 18, 1957

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LETTERS

Specht and Security

Regarding the case of Capt. Specht (AW March 18, p. 30), I would like to offer some observations from the passengers viewpoint. During the past nine years I have worked as an engineer on an air-to-air missile project. This has involved making three or four round trips by air to the East Coast each year, riding several times a month as a radar engineer in Navy all-weather fighters, and living continually with the military security problem.

There is a strong analogy between a commercial pilots license and a man's security clearance. As far as I am concerned, the pilots position is as "sensitive" as one can find. Our lives are in his hands.

In such circumstances in the security program we have had to depart from our ideals of assuming innocence until guilt is proven. Practically all the cases of withheld or suspended clearances with consequent sudden and unexpected loss of jobs have resulted not because any guilt was proven, but only because all doubt could not be absolutely removed. We prefer to assume that individuals are innocent, but we are not willing to bet that they are with our lives.

After reading the first radio transcript you published, I would never fly with Capt. Specht unless he could prove that he acted in a real emergency. Capt. Specht may be a completely innocent victim of the situation; so were some engineers in our defense work. The passenger has to think first of what unfortunate victims his widowed family would make.

It would certainly be more reassuring if the ALPA showed a trace of interest or understanding of the passenger's viewpoint.

WILLIAM AIKEN
Canoga Park, Calif.

Cockpit Complications

Capt. R. C. Robson (AW Sept. 9, p. 51) couldn't be more right in regard to the "new type" ADF (automatic direction finder) receivers and how difficult it is to use them under operational conditions.

I am flying with this equipment every day, and believe me whoever dreamed this up really goofed.

On close-in terminal problems it is necessary on each receiver to crank three knobs, one for "hundreds," one for "tens" and one for "units." It is then necessary to read three or four numerals poorly distinguished from each other in a "frequency" window.

The digit control knobs are widely separated from each other and below the frequency window. They seem to have little connection with the numbers controlled and when you don't obtain the numbers combination desired (and it is as difficult as opening a safe) in the magic window it seems like moving the knob always makes the numbers move in just the opposite direction of that expected.

As a frequency is changed, to move fingers from one knob to the other requires an actual downward glance each time to make sure you have what you aimed for, which becomes quite a project in a dark cockpit. For easier daytime use my airline has actually painted a white line from the knobs to the frequency numerals they control. It should have been luminous.

Finding the volume control knob, which is quite similar in feel to the other three and directly below the center one, necessitates quite a search as you eliminate one after the other, turning it to see if signal strength goes up or down, but more times than not knocking the receiver off frequency because you had hold of the wrong knob, which necessitates retuning before resumption of the search. Sandpapered fingers are quite helpful.

Keeping two receivers in use required handling of six frequency control knobs and two volume controls knobs for a total of eight. This results in a "heads in the cockpit" condition much, much longer than ever should be necessary in these days of terminal congestion.

I have heard nothing but the bitterest of complaints from those forced to use this monster. Can't we please have our old coffee grinder back, Mr. Finke?

AIRLINE PILOT
Setauket, N. Y.

Aviation Week welcomes the opinion of its readers on the issues raised in the magazine's editorial columns. Address Letters to the Editor, Aviation Week, 330 W. 42 St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

Likes Editorials

I am only an ex G.I. and licensed A&E mechanic, but I just wanted to write to you and let you know that I admire you for your swell editorials in AVIATION WEEK. You may receive some criticism, but in my book you are tops and a credit to your profession. What this country needs is men like you who tell the public the facts no matter who gets hurt, be it a politician or a military man.

I think AVIATION WEEK is a swell magazine for anyone connected with aviation. I will be looking for you in next week's issue.

BERNERD GALE ISLEY
Norfolk, Va.

Private Flying

With reference to an article in your Oct. 14 issue of AVIATION WEEK (p. 133) entitled "Explosive Business Flying Growth Seen," by Erwin J. Bulban, I make the following remarks which may seem like an echo from the past as it seems so seldom that anyone these days takes the time to speak out for practical, down-to-earth, old fashioned realism.

In this entire article, I note that there was only one time that the word "personal" flying was mentioned. The emphasis seemed to be placed on the needs of the airline, military and the business aircraft activities. Now, all of these are important, and none of these should be slighted. Certainly, none should be allowed to encroach on the other. For example, if this happened on our highways and streets, practically every individual would violently protest that the use of his private automobile was being regimented out of existence for the benefit of the trucks and buses. The private owners of the aircraft are in the minority and do not have the proper voice to protect themselves. They are gradually being forced to give up this means of transportation which could be the largest segment of the entire aircraft industry.

Unfortunately, no means of transportation is any better than the utility that is afforded. To make private flying practical for the average man, three things must be made a reality:

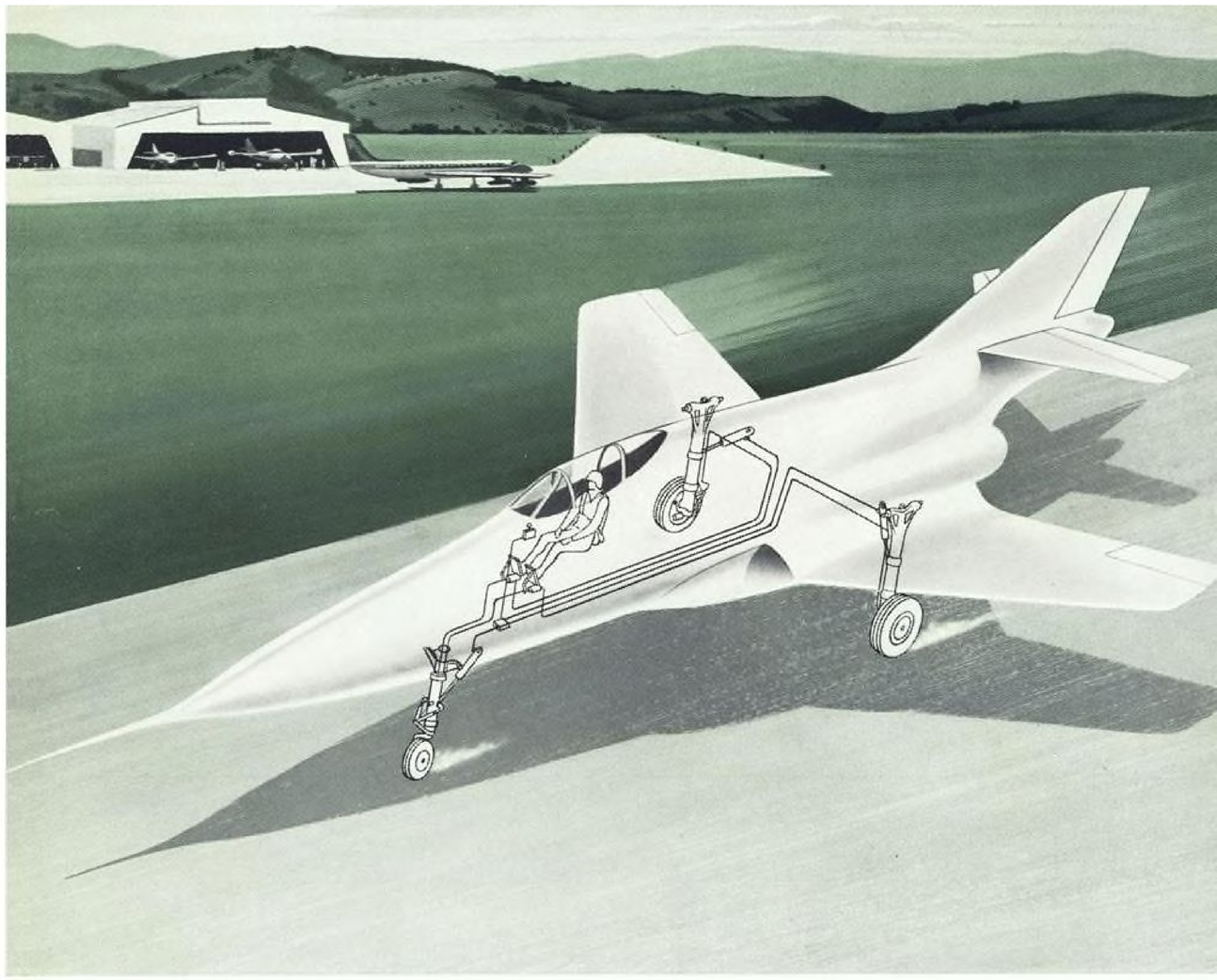
- **Systematic system** of landing strips across the nation.
- **These landing strips** should be identified, the same as our street and highway signs, so that they are easily visible from the air to help the average pilot with his navigation.
- **These landing strips** laid out on a systematic basis to allow him to cope with adverse weather conditions that may prevail from time to time.

This plan is not new. It was studied and formulated during World War II through the efforts of many of our outstanding aircraft men. The plan is so simple and would cost so little compared with the advancement of our economy and raising a standard of our people. But it seems unbelievable that the people of a great nation such as ours should not take effective action to put this plan into effect. Maybe the reason that it was never put into effect was that it created no new bureaus or agencies and would be handled by government agencies which already exist, and in addition to this it certainly would enhance free, competitive enterprise, which is the real American way. Maybe we all desire to creep lower into the state of socialism.

I note that Mr. E. R. Quesada, special assistant to President Eisenhower and chairman of the Airways Modernization Board, is in need of personnel to carry on activities of this board. I certainly hope for the good of the industry and the country that he can obtain the personnel. Unfortunately, our aircraft industry is full of "armchair pilots" and "sidewalk building superintendents." We all should remember that the automobile business was not built over night. The automobile did not advance until we created roads to operate them on. The same applies to the private airplane.

I again emphasize that we had better go back to some old fashioned, realistic thinking and reverse the transition in thinking which is nearly hysterical at the moment. Our minds are running from propellers to jets to missiles to anti-missiles and to satellites in such a furious pace that something is going to have to bring us back down to earth.

HUGH C. ROBBINS, President
Robbins Aviation, Inc.
Los Angeles, Calif.



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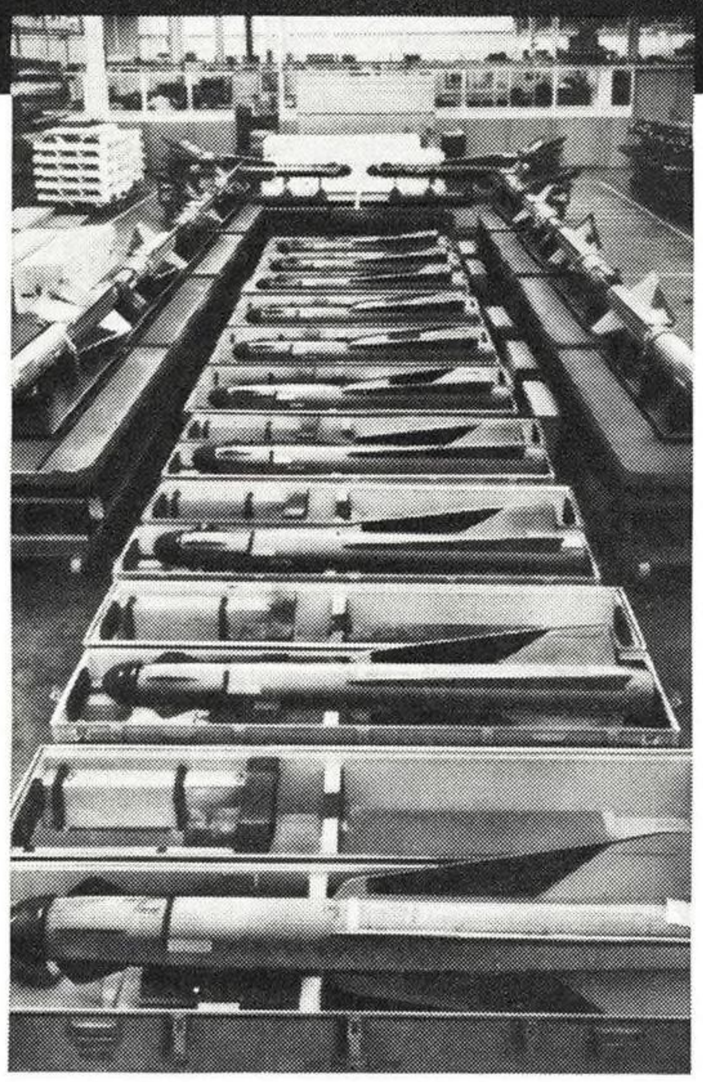
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Falcon Guided Missiles in final assembly building at Hughes Aircraft Company's Tucson plant. After assembly the complete missile is individually packed in a container made of Reynolds Aluminum.

Hughes Falcon... missile with a "brain" finds and hits enemy bombers

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