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November 26, 1956 50 cents


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## AVIATION CALENDAR

**Nov. 26-30**—Human Engineering Conference, Third International Automation Exposition, Trade Show Building, New York City.

**Nov. 29-30**—1956 Operations Research Conference, Society for Advancement of Management, Hotel Commodore, New York, N. Y.

**Dec. 5-7**—Instrumentation Conference & Exhibit, sponsored by the Professional Group on Instrumentation and the Atlanta, Ga., Section, Institute of Radio Engineers, Biltmore Hotel, Atlanta, Ga.

**Dec. 6-7**—Third Annual Meeting, American Astronautical Society, Hotel Edison, New York, N. Y.

**Dec. 7**—Open House and Air Power Show, Myrtle Beach AFB, S. C.

**Dec. 7**—Symposium on Ecology of Air Transport, Institute of the Aeronautical Sciences, 7660 Beverly Blvd., Los Angeles, Calif.

**Dec. 17**—Annual Wright Day Dinner, Sheraton Park Hotel, Washington, D. C.

**Dec. 28-31**—Third King Orange International Model Plane Contest, U. S. Marine Corps Air Station, Miami, Fla.

**Jan. 21-22, 1957**—Symposium on Solar Furnace Design and Operation, Hotel Westward Ho, Phoenix, Ariz.

**Jan. 28-31**—8th Plant Maintenance & Engineering Conference, Public Auditorium, Cleveland, Ohio.

**Jan. 31**—Sixth Annual Instrument Short Course, Los Angeles Harbor Junior College, Wilmington, Calif. Additional course will be held Feb. 1.

**Feb. 7**—Operations Research Symposium, University Museum Lecture Hall, University of Pennsylvania, Philadelphia, Pa.

**Feb. 7**—Annual Mid-Winter Symposium of the New York Section, Instrument Society of America, Garden City Hotel, Long Island, N. Y.

**Feb. 14-15**—1957 Transistor and Solid State Circuits Conference, University of Pennsylvania, Philadelphia, Pa.

**Feb. 26-28**—1957 Western Joint Computer Conference, Statler Hotel, Los Angeles, Calif.

**Mar. 7-9**—National Conference on Aviation Education, Hotel Mayflower, Washington, D. C.


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222-4

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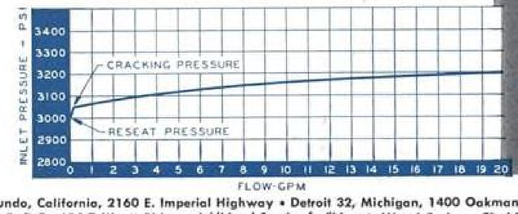


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NOVEMBER 26, 1956

# AVIATION WEEK

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**COVER:** Piper Aircraft Corp.'s 1957 business aircraft fly in echelon near the company's Lock Haven, Pa., plant. Led by the PA-23 Apache twin are the new PA-24 Comanche, PA-22 Tri-Pacer and PA-18 Super Cub. Piper expects to top $36 million in retail sales next year, not including deliveries of the new $13,500 Comanche, which will reach the field starting next April.

Picture Credits:
Cover—Gordon Vincent; 27, 37—Wide World.

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# EDITORIAL

## Focus on Latin America

The Latin American Aviation Conference recently held in Miami under auspices of the Aircraft Industries Assn. Export Committee served a number of useful purposes.

First, it focused attention of North American manufacturers on the rapidly expanding export market for their products in Latin America and the increasingly stiff competition they are facing from European manufacturers in that area.

Second, it gave representatives of Latin American air forces and airlines a forum in which to discuss frankly their problems in doing business with North American manufacturers and the U. S. government. The wealth of candid detail spread before the conference on specific complaints regarding U. S. commercial and military aviation policy on Latin America was ample proof that the Latin American representatives want and need this type of channel to express their views.

As one prominent Latin American airline president told AVIATION WEEK: "The most important thing about this conference is the simple fact that it was held." The fact that 200 U.S. manufacturers, bankers, Air Force officers and State Department officials were willing to spend three days discussing these export problems was convincing proof to the Latin American representatives that at least a start has been made on a new North American attitude toward their activities.

### Key Problems

It is evident that financing, modernization and logistics support are the key problems facing Latin American air forces and airlines. Both want and need the most modern equipment available off manufacturers' production lines. The recent purchases of British Hunter fighters, Canberra bombers and Viscount turboprop airliners by Latin American countries is positive proof that, if they can't get it from North America, they will turn elsewhere to do their aircraft shopping. The irony of a British manufacturer, with a fighter program heavily subsidized with U. S. dollars through off-shore procurement, selling the same type fighter in the Latin American export market against U. S. competition, did not pass unnoticed at the conference.

In the airline business, the need for the most modern transport equipment is an essential ingredient for survival and growth. It is sheer folly to expect Latin American airlines to be satisfied with anything but the most modern and economical equipment that suits their individual needs. Robert Smith, president of LACSA, the Costa Rican airline, stated the Latin American aircraft financing problem in blunt, unequivocal terms. He pointed out that the Latin American airlines, like their North American counterparts, were facing equipment purchasing programs that surpassed the total of their net worth. As a result, they will need the same type of long-term financing methods now being used by the major U. S. carriers to finance their huge purchases of jet transports. Present policy of commercial banks, World Bank and Export-Import Bank are obsolete and useless in meeting their current Latin American airline financing problem. Mr. Smith further emphasized that Latin American airlines are playing an important role in the economic development of their region. Unless they are able to expand with modern equipment, the overall economic growth of the Latin American frontier will be retarded.

### Challenge to U. S.

Mr. Smith's proposal for the formation of a group composed of representatives from the Air Transport Assn., Aircraft Industries Assn., U. S. Air Force and U. S. private bankers to explore the possibilities of extending the same type of long-term financing to Latin American airlines as that U. S. airlines are now getting from insurance firms should be implemented immediately as the first step in formulating a more realistic financing policy for the Latin American aircraft market.

Along the same line, the Aircraft Industries Assn. cannot afford to dismiss lightly the complaints registered against the shoddy goods delivered to Latin American customers by U.S. aircraft "junk" dealers. The fact that the Latin American customers indicated they would welcome AIA functioning as a guarantee of manufacturers' reliability should be sufficient evidence to show a need for a new type of activity to protect interests of legitimate manufacturers and dealers against the inroads of the "junkies."

Proper logistic support is a much less glamorous sector than initial sales of equipment. But, without proper attention here, North American products will get a bad name for productivity. It is evident that the USAF policy of selling military aircraft at a low initial cost but without any provision for follow on logistical support needs revision.

### False Economy

Although the Latin American customer gets his equipment at a lower initial price, he generally pays more in the long run by trying to support its operation on a helter-skelter basis. We think this may be false economy. It may be much sounder to buy directly from a manufacturer who can guarantee proper technical and logistical support for a stated period and who has a vested interest in seeing that his products provide good service for the customer.

The first Latin American Aviation Conference was an unqualified success. But it was just a start on tackling what will be this hemisphere's most important aviation problem of the foreseeable future. We strongly urge that the conference be held again next year, taking advantage of the experience gained to sharpen and improve the program. We also urge that manufacturers, bankers, government officials, Air Force officers and airline executives from all the Americas continue the spirit of frank discussion of their mutual problems that was begun in Miami earlier this month.

—Robert Hotz

# WHO'S WHERE

## In the Front Office

**John E. Parker,** chairman-finance committee and a director of Hall-Scott, Inc., a director, Glenn L. Martin Co., Baltimore, Md.

**L. L. Waite,** vice president of North American Aviation, Inc., a director, Radio-Electronics-Television Manufacturers Assn., Washington, D. C.

**Geoffrey W. Hall,** a vice chairman, Fairey Aviation Company, Ltd., London, England. Mr. Hall is also general manager. Also: **Richard Fairey,** a vice chairman; **Robert L. Lickley,** technical director; **John C. MacPherson,** financial director; and **Alan Vines,** production director.

**Errett M. Grable,** president of Wear-Ever International, Inc., a director, Firth Sterling, Inc., Pittsburgh, Pa.

**Bernard W. Lueck,** vice president and a director, Zenith Plastics Co., Gardena, Calif.

**Arthur W. Forsberg,** vice president and plant manager, Air-Marine Motors, Inc., Amityville, N. Y.

**Albert J. Berdis,** a vice president, Olin Mathieson Chemical Corp., New York, N. Y.

**Paul M. Platzman,** vice president-sales and manufacturing, Acoustica Associates, Inc., Glenwood Landing, N. Y.

## Honors and Elections

**Dr. Edward Pearson Warner,** president of the Council of the International Civil Aviation Organization (ICAO), has been awarded the Wright Brothers Memorial Trophy for 1956. The trophy, administered by the National Aeronautic Association, has been awarded annually since 1948 "for significant public service of enduring value to aviation in the U. S."

**Harry F. Guggenheim,** president of the Guggenheim Fund for the promotion of aeronautics, **Igor Sikorsky,** helicopter pioneer, and **Grover Loening,** aeronautical engineer and inventor, were awarded certificates as "Elder Statesmen of Aviation," by the National Aeronautics Association at the annual dinner of the Wings Club of New York.

**Galen Bertram,** Southwest Kansas Aircraft Sales, has been elected president of the National Aviation Trade Association for 1957. Other officers are: **Richard R. Washburn** (southern flight service), eastern vice president; **Larry Hunt** (Air Oasis Co.), western vice president; and **J. David Finger** (Westchester Airport, Inc.), treasurer.

## Changes

**George F. Bremer,** supervisor-development planning (military requirements-aircraft engines operations), Allison Division, General Motors Corp., Indianapolis, Ind.

**J. C. Owen,** manager-advanced engineering department, and **Philip Movitz,** quality control manager, Grand Rapids Division, Lear, Inc., Grand Rapids, Mich.

**Henry W. Beardsley,** passenger sales manager-U. S., Pan American World Airways.

**Ogden C. Gorman,** European sales manager, Seaboard & Western Airlines.

# INDUSTRY OBSERVER

► **Initial test flights of the Convair B-58 supersonic bomber have indicated that it will fly supersonically at normal military power from its four General Electric J79 engines without using afterburners. The B-58 podded engine installations include afterburners on the J79. B-58 has now logged close to two hours flight time in two flights and has outrun an F-100 chase plane without using full power.**

► Studies of competitive rocket systems for ranges up to 1,500 mi. show that some current solid propellants can produce an overall system of equivalent performance to a liquid-propellant system. Solid fuel advantages include ease of logistics and handling and lower cost.

► **Best current solution to the problem of aerodynamic heating on re-entry of a hypersonic ballistic missile is to slow down the separated warhead at high altitudes—solving the problem by practically avoiding it. Heating, even for slowed shape, is still appreciable.**

► Lockheed F-104A has reached an altitude of approximately 80,000 ft. Relights have been made with the aircraft's General Electric J79 engine at altitudes of up to 60,000 ft.

► **North American Aviation's third F-107 fighter-bomber is nearing completion. Unless present procurement plans are changed, this will be the last unit built. An Air Force cut slashed the order from nine planes to three.**

► New high-energy fuel plant is scheduled for construction near Muskogee, Okla., under Navy Bureau of Aeronautics cognizance. Facility, being designed by Ralph M. Parsons Co., Los Angeles engineering firm, will be operated by Callery Chemical Co., a subsidiary of the Mine Safety Appliances Co. in Pittsburgh, pioneer in boron hydride fuel development.

► **Petrinacrylite, a new solid propellant for rocket motors, has been developed by Rohm & Haas for Army Ordnance. Performance is classified, but recent solid propellant advances have pushed specific impulse values to above the 200-sec. mark to make them competitive with liquid propellants. Specific impulses as high as 300 sec. for solid fuels are expected within the near future.**

► Ski-equipped Lockheed C-130A will be delivered to USAF in mid-February for tests at Bimidji, Minn., and in the Arctic and sub-Arctic. Requirements were originated about two years ago; work has been underway at Lockheed for the past year. "Ski-130" will be capable of carrying loads of upwards to 30,000 lb. Projected use is as a supply vehicle for the Dew Line.

► **Army's Dart missile system is expected to become an operational weapon in about 18 months. An interim-phase weapon could be obtained sooner, but the services and manufacturers have determined the false economy of the interim system, both for missiles and aircraft.**

► Brantly Helicopter Corp., Frederick, Okla., plans a larger version of its B-2 helicopter. Designated the B-3, the twin-engine, tandem-rotor aircraft will be capable of single-engine performance with six passengers. Brantly B-2, which recently completed evaluation tests at Ft. Rucker, received favorable reports from both the Army and Navy.

► **Avro Aircraft Ltd. has sent a sales team to Colombia, Brazil and Venezuela to promote its CF-100 twin-jet all-weather fighter for use by South American air forces.**

► Lockheed F-104 design, laid down six years ago, provided for sufficient ground clearance to mount an atomic bomb externally beneath the fuselage, although no such armament application has yet been ordered. Missiles can be substituted for wingtip tanks with no change in the aircraft's center of gravity.

► **Bofors, a Swedish manufacturer, is developing an underwater-to-air missile as an anti-aircraft weapon for submarines.**

# Washington Roundup

## Sidetracked SWG 13

Although the report of Special Working Group 13 on air traffic control was accepted last week as a "technical document" by the Air Coordinating Committee, it still failed to obtain final approval and was sent to an *ad hoc* committee for review and "editing." Some observers fear the latest move is an attempt by the Commerce Department to water down the study before it is released publicly. First part of SWG 13 includes a blunt appraisal of reasons why airways and air traffic control development has bogged down and names the agencies it considers responsible for the retarded progress. One of the values of the report lies in the projection of these factors to ways and means of overcoming future delays in airways development. Second part of the report advocates positive control of all air traffic in certain areas. Aircraft Owners and Pilots Assn. vigorously opposes such positive control, and some quarters believe Commerce wants to by-pass the issue rather than widen the controversy by taking an official stand.

## Knowledge and Tap Dancing

One of the strongest statements yet on the amount and quality of technical training given to American students as opposed to that given to their Russian counterparts has come from Rear Adm. Hyman Rickover, assistant chief of the Bureau of Ships for Nuclear Propulsion and chief of the Atomic Energy Commission's Naval Reactors Branch. Speaking on a CBS television program, Adm. Rickover said:

". . . The Russians are out to gain the scientific and engineering leadership of the world. They have been doing this in a planned way for the last 30 years. They are devoting about 8% of their national income to education. I believe we devote somewhere about 3%, and this is a rather strange situation where a country that prides itself on having a standard of living three times as high as that of the Russians cannot afford to spend the same percentage of its income on education.

"It's generally true that people get what they want. If we think that entertainment and television . . . and movies and dances are more important for the children than education—if we think that wall paper hanging and tap dancing and baton twirling contests, paid for at public expense, are more important than to train the minds, this is what we're going to get.

"I believe that education is the most important problem that faces us today. It is even more important than atomic power . . . or than the Navy because if our people aren't properly educated in accordance with the terrific requirements of this rapidly spiraling scientific and industrial civilization, we are bound to go down.

"The Russians, apparently, have recognized this."

## ACTA Future

Air Coach Transport Assn.'s fate may be decided at the membership meeting scheduled to start today in Washington. The organization's future has been uncertain since a group of dissident carriers took over in a sudden coup a month ago. President A. J. Rome resigned, as did six of ACTA's seven directors, and the organization has been run by a committee which includes Amos Heacock, a former ACTA president.

A formal split in the ACTA membership is a good prospect as the result of the coup, and a little known air carrier organization—Supplemental Air Carrier Conference—may be the nucleus for a new airline group. SACC was organized as the Independent Air Carrier Conference in 1947 and changed its name when the Civil Aeronautics Board decided last year to issue new authority to supplemental air carriers.

The group now controlling ACTA will present its new program for the organization at this week's meeting, and new officers are to be elected. The group is basing its sales pitch on a need for more aggressive promotion of military business than was practiced by the old management. The meeting will shape the future form of ACTA, and the airlines disagreeing with this form may decide to band together under a new name, such as SACC, in their search for business.

## No Foreign Relations Change

State Department's conference of government aviation officials, airlines and aircraft manufacturers will produce no changes in U. S. policy on aviation foreign relations. The three-day meeting produced a high-level exchange of views on the Bermuda principles and other U. S. policies, and participants say the discussions were helpful.

But, while the delegates had a chance to get a number of gripes off their chests, there was general agreement that the basic principles which guide U. S. policy are sound and should be supported.

In the discussions, the airlines concentrated heavily upon the need for improved information on classes of traffic, and their efforts probably will produce more efficient gathering of statistics and more productive use of the material already gathered by the Immigration and Naturalization Service and the CAB.

These figures on traffic classes are key factors in disputes over capacity provisions in the Bermuda-type bilateral agreements the U. S. has with other nations. Accurate figures on Third, Fourth and Fifth Freedom traffic would clarify each carrier's position and help determine whether a carrier is violating the capacity provisions of its bilateral agreement.

## Postponed

Actions by two Congressional committees on aviation matters probably will be postponed until January after the new Congress convenes. Both are finding it difficult to obtain a quorum during the off-season. These are:

• **Public hearings before** the Senate Permanent Investigating Subcommittee, headed by Sen. John McClellan (D.-Ark.), on a presumed "leak" of information on the Civil Aeronautics Board's award of a Miami-New York route to Northeast Airlines. Trading of Northeast stock jumped from 400 shares on Aug. 2 to over 20,000 shares on Aug. 3, the day after CAB voted the route in a secret session.

• **Report by the Senate Air Power** Investigating Subcommittee, headed by Sen. Stuart Symington (D.-Mo.). The subcommittee held extensive public and executive hearings this spring and summer but postponed a report until after the election in an effort to have it drafted in a non-partisan atmosphere.

—Washington staff

# Conical Camber Reduces Drag From Lift

**Progressive downward curvature of wing leading edge on XB-58 bridges subsonic-supersonic gap.**

By David A. Anderton

Conical camber is a new aerodynamic design technique used in the Convair XB-58 Hustler to bridge the gap between the different requirements for subsonic cruise and supersonic dash performance.

Conical camber is a particular form of leading-edge curvature that reduces the drag of a thin wing due to its lift in the cruise condition without compromising supersonic performance. The curvature pays an extra dividend; it improves landing and takeoff performance through induced drag reduction.

Flight test results with the B-58 weapons carrier have shown a calculable increase in combat radius attributable to conical camber. The technique can be applied to any wing of swept-back planform designed for both subsonic cruise speed—up to approximately Mach 1—and supersonic dash.

The concept was derived theoretically and proven experimentally by three scientists from the staff of the 6 x 6-ft. supersonic wind tunnel of the Ames Aeronautical Laboratory of the National Advisory Committee for Aeronautics: Charles W. Frick, Jr., former head of the staff and now with Convair; John C. Heitmeyer, now with Lockheed, and Charles F. Hall, now head of the tunnel staff.

The sketch of the delta-winged aircraft shows the basic idea of conical camber. It is a progressive downward curvature of the wing leading edge which increases in radius of curvature as it passes from the root chord to the tip chord.

An approximation of this kind of camber first appeared on the leading edge of the Convair F-102A when that airplane was modified extensively to improve its performance through the use of the area rule (AW Sept. 12, 1955, p. 12). Because the F-102A was a modification, the leading edge was not altered as greatly as it could have been in a new design. Future production F-102As will incorporate conical camber in the aerodynamically complete form.

The use of conical camber is aimed at reducing the induced drag component associated with the production of lift. At subsonic cruise conditions, this portion of the overall drag is substantial; it is a function only of the lift coefficient and the span loading.

For a given configuration and condition, the lift coefficient is fixed by the wing airfoil section and planform chosen. The only step that can be taken to reduce the induced drag is to adjust the spanwise load distribution to approach the ideal. That ideal is an elliptical diagram, formed by plotting the lift vectors from wing tip to wing tip. Drag is minimum when the resulting curve connecting these vectors describes an ellipse.

But the thin wings of symmetrical section used in contemporary aircraft don't produce that elliptical distribution without some modifications.

The classical aerodynamic approach to getting more lift is to increase the camber or curvature of the airfoil section. That is why sailplanes and big transports use a highly curved airfoil; the ratio of lift to drag is increased markedly as the curvature increases.

This is a good approach for the low subsonic speed range, but it won't do for high speeds in the supersonic area.

Actually camber will do the job, but it has to be a special kind of camber; the conical kind, built into the airfoil section near the leading edge.

Conical camber not only changes the lift distributions to approach the elliptical ideal, but it also swings the resultant force vector nearer the vertical to reduce the drag component of that force or lift on the wing.

Frick, Heitmeyer and Hall started to study this problem about five years ago, mostly by discussion in long bull sessions about the ways to beat induced drag. Their thinking undoubtedly had been influenced by the fact that over the years of its existence, one of NACA's major objectives has been the reduction of airplane overall drag.

Advances in techniques for cleaning up the airplane had cut parasite drag to the minimum. Whitcomb's area rule theory gave a substantial reduction in wave drag. About the only area left where work was needed was that of the drag due to lift.

The three NACA scientists, after much theorizing, agreed among themselves on some different approaches to the problem. They would split their effort along different lines. The final experimentation proved that the approach that fell to Hall—that of conical camber—was the most productive.

From there to the drawing boards at Convair was a logical progression.

# Defense Department Liberalizes Progress Payment Regulations

By Claude Witze

**Washington**—Defense Department modified its contract financing policy last week primarily to help small business firms obtain assistance when needed and provide all industry better arrangements for progress and advance payments.

At the same time, AVIATION WEEK learned, the department's Contract Finance Committee is conducting a survey to uncover industry complaints against slow payment from military disbursing offices. A questionnaire is now being circulated on which contractors are asked to report how long it takes them to receive payment on billings.

A shakeup in the progress and advance payment concept results from a recommendation of the President Eisenhower's Cabinet Committee on Small Business but is applicable to large contractors as well. Basically, the changes are designed to expedite use of progress payment clauses in contracts by making Defense Department buyers less hesitant to accept such terms.

A new directive, Number 7800.4 dated Nov. 16, makes it clear that the need for advance or progress payments is not to be considered a handicap when bids on defense contracts are opened. It also emphasizes that such help is to be facilitated and speeded when requested by small business firms.

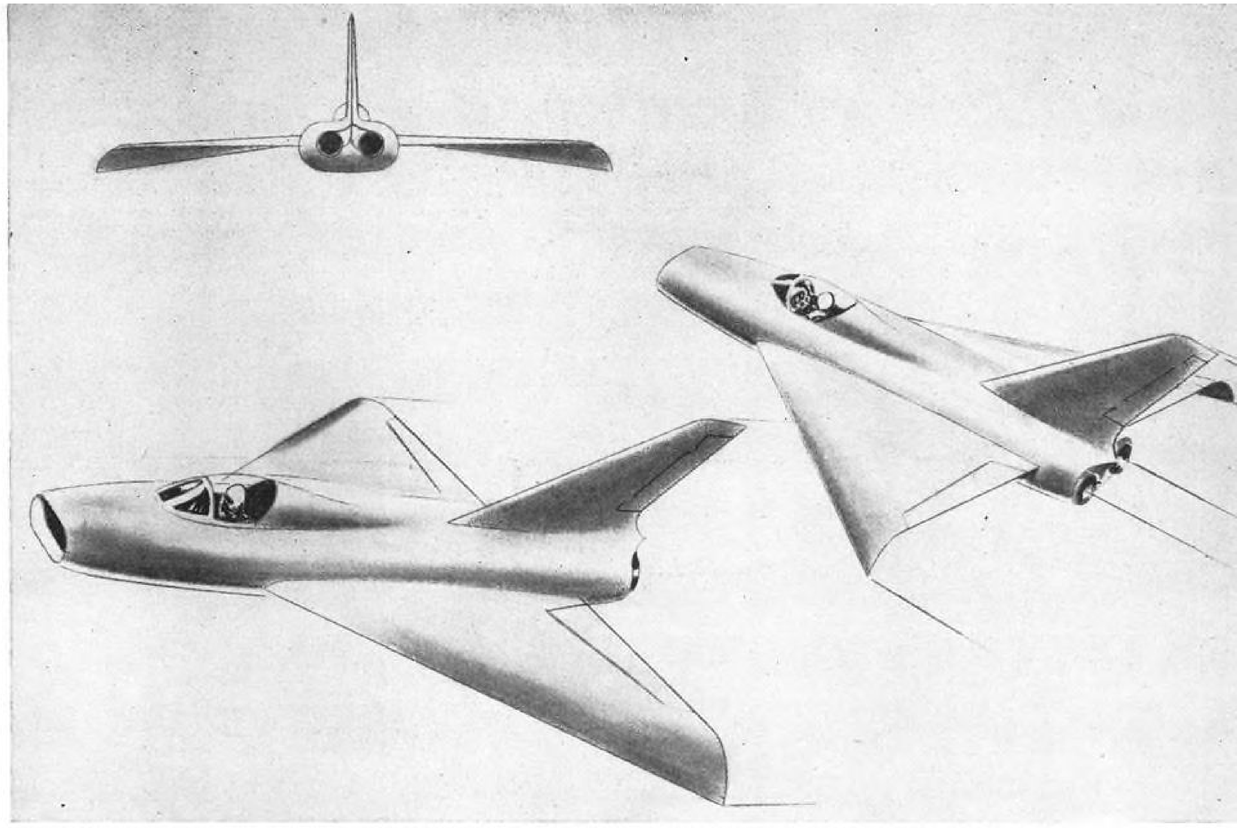
A Defense Department spokesman said this regulation has been on the books for almost five years but has been lifted from the status of a recommendation to buyers. It is now a policy. The new directive says:

"A contractor deemed reliable, competent, capable and otherwise responsible, must not be regarded as any less responsible by reason of the need for reasonable contract financing provided or guaranteed by a military department."

The Defense Department itself is expected, in these cases, to assist any financing through contract terms rather than forcing the company to use loans or credit from the outside, including the Small Business Administration.

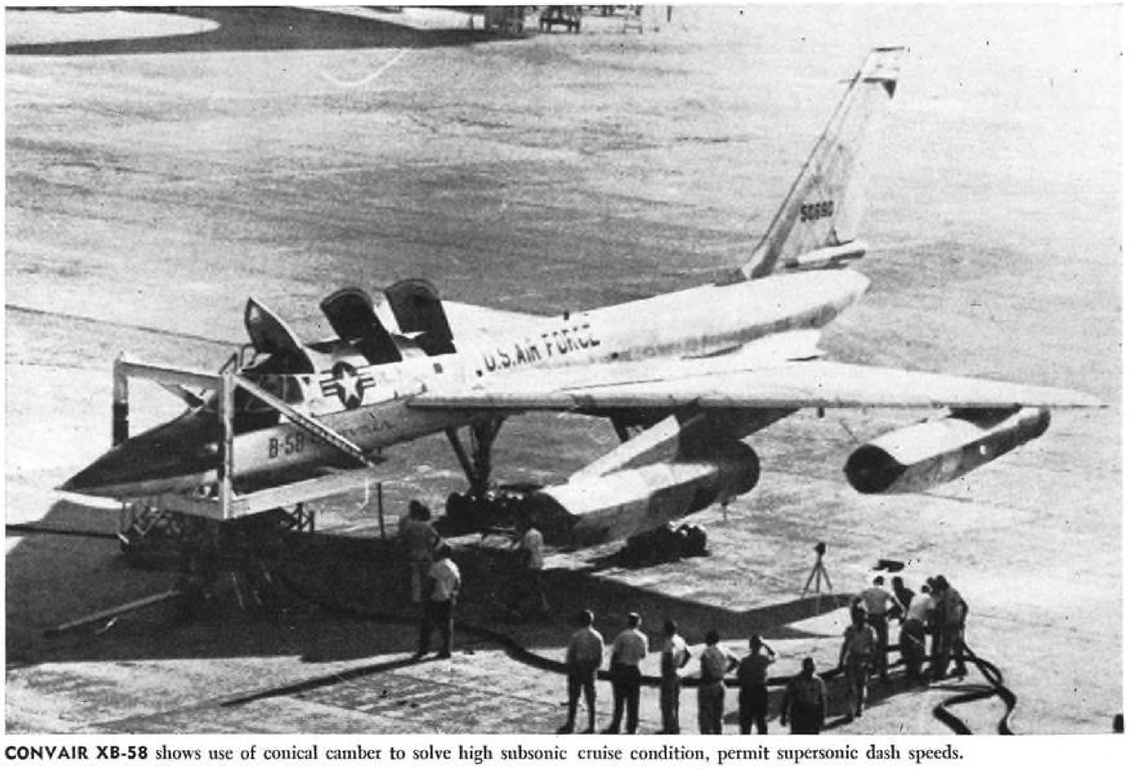
"In bald terms," a spokesman declared, "this means the buyer must not





**CONICAL** camber principle for reducing induced drag in cruise conditions is illustrated in this sketch of delta-winged plane.

**CONICAL** camber principle for reducing induced drag in cruise conditions is illustrated in this sketch of delta-winged plane.




**CONVAIR XB-58** shows use of conical camber to solve high subsonic cruise condition, permit supersonic dash speeds.

hinge the award of a contract on the ability of a small firm to get a loan, from SBA or anywhere else."

In the same manner, the new directive emphasizes that the buyer is not free to turn down requests for progress payments, even in the case of relatively small deals with small business. It requires, on the contrary, that invitations for bids must specify that the need for advance or progress payments will not be a handicap to the prospective contractor.

### Past Practice

In the past, it was common for the invitation to be silent on the subject of progress payments and for a bidder to be counted out of the competition if he had included progress payments as a condition. Thus, the new directive aims to broaden the use of progress payments in advertised contracts.

It specifies that a progress payment clause will be included in the contract, if it is requested and the contracting officer finds it justified on the basis of long lead time and pre-delivery costs that must be spent by the contractor. The directive continues:

". . . Invitations for bids providing for progress payments shall also state that bids including requests for progress payments will be evaluated on an equal basis with those not including requests for progress payments."

To lend further emphasis, the directive orders that action by the contracting officer must be timely, eliminate unwarranted delay and not hesitate to make proper financing provisions. The standard calling for approval of unusual progress payments by the head of a procurement office or flag officer is waived.

When it comes to collecting progress payments, existing regulations are revised to permit the contractor to recover most of his profit as he delivers the product. The old regulation is waived again in this case, abolishing the earlier edict that fixes standards for liquidation of progress payments.

On agreement between the contracting officer and the industry, it now is possible for the contract to include more generous terms, so long as they stay within certain limitations.

On the subject of advance payments, the new directive recognizes that a small business firm may have all the accepted attributes of a good source and still lack the ability to finance its operation through orthodox business methods. If such a manufacturer has the necessary skill and is otherwise qualified, the order says, "there should be no hesitation in recommending to higher authority that advance payments be established."

### Speeds Action

The directive, in effect, tells the defense buyer not to turn his back on a company in this situation. By statute, the provision of advance payments requires approval of a service secretary or assistant secretary. This rule has not been eased, but the new directive is designed to speed action in such a case and to cut back on the rejections.

In the Defense Department, basic source of the new directive is a memorandum signed by Secretary Charles E. Wilson in September. This called for measures "to facilitate necessary financing assistance of small suppliers."

It specified that the new orders must "insure promptness in all payments on contracts when due," besides insuring that the need for advance and progress payments will not prejudice the awarding of defense contracts, the memorandum said prime contractors should be encouraged to extend progress payments to their subcontractors "whenever the need arises."

# USAF Views Missile Transition

**Washington**—USAF transition from manned aircraft to guided missile systems, scheduled to move at an increasing rate over the next four years, will bring about a basic revolution in the aircraft industry. Maj. Gen. David H. Baker, head of procurement and production for the Air Materiel Command, anticipates these major challenges to the industry:

- **Over abundance of many facilities** for manufacturing and testing as new plants are put up to replace outdated aircraft factories.
- **Less Government Furnished** Aeronautical Equipment (GFAE) and more reliance on the prime contractor to assemble a complete system.
- **Greater USAF reliance** upon scientific and engineering support from industry.
- **Greater use of automation,** new production techniques and materials.
- **New yardstick** to measure production efficiency. Cost per pound of air frame no longer will suffice.

In a speech before the Aviation Writers Assn., Gen. Baker tied several of these problems to the ever-increasing complexity of modern weapon systems and called on engineers to help solve this basic difficulty.

Indicating that industry will be called upon to provide more and more maintenance support, he also warned that, "unless industry simplifies some of the missile systems now under development, we will be unable to operate them, much less to maintain them without scientific or highly qualified engineering personnel at the operational sites themselves."

All missiles, the General pointed out, "must be reliable and must accomplish the mission on the first try." A major step in this direction can be taken, he said, by dissolving "the barriers between the design engineers and the production engineers.

Gen. Baker predicted that the need for new factories will overshadow the task of new and more accurate machine tools to fabricate missiles.

"Some of our older aircraft plants," he said, "have not been readily adaptable to missile production and have been replaced with more modern plants which over the first few years of production will more than pay for their investment.

"However," he continued, "if new plants are deemed necessary for development and production of missiles, whether paid for partially or completely by industry, the industry must plan to dispose of existing aircraft plants as new plants phase in, for, as the missile dollars increase, we can forecast ultimately a reduction in the aircraft dollars.

"This is an extremely important matter for, unless this is accomplished, we will find ourselves over-facilitized. In such an event, the high cost of maintaining and operating present aircraft plants at a low level of production will certainly strain our limited budgets, and we will find an increasing percentage of taxpayers and industry's funds going into non-productive overhead."

As an index of the speed with which the Air Force is shifting to missiles, Gen. Baker disclosed that about 8% of present deliveries are in this field, measured by their dollar value.

Three to four years from now, he said, the percentage will be greatly increased.

For the future, Gen. Baker said a major project will be the task of integrating the detection, warning and tracking of enemy weapons with the aiming, firing, guidance control and traget kill of our own weapons.

Gen Baker warned that this job will call for greater cooperation between industries.

"The Air Force can only serve as the focal point for leveling and balancing these efforts," he said, "but the major burden of accomplishment will fall to industry."

He indicated that the Air Materiel Command will continue to enforce strong dependence on subcontractors, including small business, while insisting that proper attention be paid to standardization, duplication, costs and maintenance of a mobilization base.



# Latins Demand Better Planes, Financing

**Miami**—Financing, modernization of equipment and proper logistic support were the main problems on which the 200 delegates to the Latin American Aviation Conference here focused during three days of discussion between U. S. suppliers of aircraft and their Latin American customers.

The conference, sponsored by the Export Committee of the Aircraft Industries Assn., attracted air force and airline delegations from 17 Latin American countries, plus more than 100 U.S. aircraft industry executives and bankers, USAF officers and government officials.

Among the major complaints voiced by Latin American representatives were:

- **Need for new methods** of financing Latin American purchases of aircraft and equipment with special emphasis on longer terms and lower down payments.
- **Need for modernization** of Latin America's current equipment inventory, including both military aircraft and airline transports.
- **Need for faster, cheaper** and more efficient availability of spares required for logistic support of both air force and airline operations.
- **Need for a broader assault** on the langauge barrier which now limits training and operations activities on U.S. equipment in Latin America.
- **Need for U.S. policing** of unscrupulous dealers in aircraft and parts who have delivered shoddy and unusable materials to Latin American customers.

### Inspection Needs

Latin American representatives proposed that the Aircraft Industries Assn. act as a clearing house of information for them on reputable U. S. dealers in the export market. AIA officials at the conference indicated no enthusiasm for this proposal.

Civil Aeronautics Administration representatives said they already were offering an inspection service on export equipment, but that this was no sure guarantee since material could deteriorate in the interval between inspection and delivery.

Maj. Gen. Truman H. Landon, commander of the Caribbean Air Command, told the conference one of the major problems facing Latin American air forces is the development of a reasonable, simple, inexpensive jet training plane. Gen. Landon warned that buying conventional piston engine trainers now might be very wasteful in countries with severe aviation budget limitations and warned that many jet trainer types now being built for USAF would be too expensive for purchase below the Rio Grande.

Gen. Landon also urged Latin American air force leaders to plan their military aviation requirements on a realistic basis, including the real defense needs of their country in relation to its economic assets. He warned that no nation, not even the United States, has sufficient economic resources to permit wasteful and unrealistic planning on such an expensive commodity as military airpower.

### Co-ordinating Group Urged

A plea for establishment of an Organization of Inter-American Aeronautical Co-operation (OICA) to coordinate the Western Hemisphere aviation policy was urged by the Colombian air force through its spokesman, Lt. Col. Carlos Uribe, Colombian air attache in Washington.

This new organization would function in an advisory capacity to all American nations on technical, financial and operational problems, both in the military and civil aviation fields.

Col. Uribe emphasized that the Colombian proposal was presented as a broad concept in an attempt to provide a better clearing house for inter-American aviation problems.

Col. Uribe also warned that Latin American aviation enterprises face a serious problem in the future because they are operating obsolete equipment with no guarantee of a steady supply of spare parts and replacements.

Robert Smith, president of LACSA Costa Rican airline, emphasized the phenomenal growth of 70 Latin American airlines during the post-war decade and the need for new modern equipment to continue the rate of growth for air transport that was required by the Latin American economy.

He said Latin American governments are just beginning to recognize the potential of the airborne tourist market for their economies and predicted that eventually the tourist trade will be more important to Latin America than any other single commodity.

"We are going to have to renew our domestic and international fleets at a cost several times our combined net worth," he told the conference. "We must have as efficient equipment as possible to meet the growing competition of roads, railroads, ocean liners and the competition of bigger and stronger air companies from the U.S., Canada and Europe. We can and will attract new investment capital in each of our countries without necessarily increasing government ownership.

"However, we cannot expect to meet all of our capital demands with equity issues. We must obtain financial credit from aircraft suppliers and such credit agencies as the Export-Import Bank and the World Bank, two great institutions that have done so much for Latin America in the past."

### Present Policies Inadequate

Smith warned that present policies of private banks and these two government institutions are not adequate to meet the airline financing problem and called for a new approach to the problem. He urged formation of a committee composed of representatives of Aircraft Industries Assn., Air Transport Assn., USAF and private U.S. banks to explore methods of making long-term financing available to Latin American airlines similar to the insurance company financing now used by U.S. domestic airlines to buy their new jet transport fleets.

"There is strong evidence," Smith warned, "that English, French and Russian equipment will be available under more favorable terms than American equipment. If so, that may well be a determining factor in selection of equipment for many Latin American airlines. Therefore, this is a mutual problem of primary importance for the manufacturer, the airlines and the credit institutions."

Robert Anson, general manager of SALA, Costa Rican overhaul and maintenance organization, cited cases of U.S. surplus dealers delivering unusable equipment to Latin American customers that had been deliberately puttied and painted to conceal major defects and urged that some type of "better business bureau" be established to screen legitimate aircraft and parts dealers from the "junkies" who sell shoddy goods.

## New Business Planes

**Miami—New business aircraft developments mentioned at Aircraft Industry Assn.'s Latin American Aviation Conference here included these models:**

- **Beech E50 Twin-Bonanza powered by new supercharged Lycoming 340-hp. engines is in production. This 1957 model will gross approximately 7,000 lb. and cruise at about 230 mph., approximately 30 mph. faster than the 1956 D50.**
- **Beech 95 Travel Air four-placer will gross at 4,000 lb., cruise at 200 mph. and have a range of about 1,300 mi.**
- **Taylorcraft five-placer is the latest development of the Conway, Pa., firm. Prototype is now being built and is scheduled to fly in 1957.**

# Moss Probes Security Review, Finds Abuses in Defense Agency

By Katherine Johnsen

**Washington**—Pentagon's Office of Security Review was the target of the final 1956 hearing of the House Subcommittee on Information.

After lengthy questioning, subcommittee chairman Rep. John Moss (D.-Calif.) told Joseph Edgerton, OSR director, and Lee Hargus, deputy director, that the office should properly be re-named "The Office of Security Review and Censorship."

The subcommittee postponed further hearings until January to give the staff more time to study the recommendations of the Coolidge Committee on security leaks and the recommendations of the Research and Development Policy Council on the need for an increased flow of scientific and technical information (AW Nov. 19, p. 30).

### OSR's Authority

With one recommendation of the Coolidge report, Moss took prompt and unqualified exception—that newsmen be summoned before juries, if necessary, to solve serious leaks of secret information. Instead of "merely expressing disagreement" with this recommendation, Moss said Defense Secretary Charles Wilson "should have sharply rejected the suggestion. Had I been in his place, I would have stricken out that part before signing any letter transmitting the report."

Rep. Dante Fascell (D.-Fla.) said he was skeptical of the need for an Office of Security Review after hearing Edgerton testify that:

- **Only the originating service** is capable of determining what does or does not affect security.
- **OSR has had no consolidated list** of the security directives of the three services since mid-1950—the outbreak of the Korean war. "It is just impossible to keep current," Edgerton said.

Edgerton said the value of OSR was in coordination and in "bringing about a meeting of minds" when the position on security of one service may not be accepted by another service. He admitted, however, that OSR has no authority "to either classify or declassify information."

Detailed questioning failed to develop any standard criteria used by OSR in determining whether information should be passed on to Assistant Secretary of Defense Robert Tripp Ross for review for policy considerations.

### Decision by Chance

Finally, asked by Chairman Moss whether this determination was "by chance or by system," Edgerton said it was "by chance."

The subcommittee also was critical of Ross' office and of OSR, which was organized under Ross, for invading the policy field by determining the release of information. Moss introduced two specific cases.

The first was a letter from Hargus to the Saturday Evening Post objecting to the publication of an article on Spain on the grounds that it was "a rather sneering approach to the problems and limitations of the Spanish people" and that its publication "would be considered offensive by Spanish authorities to the point that U.S. interests in Spain might be prejudiced."

Moss told Hargus that his objections were "outside your authority and highly improper." He said the article—entitled "The American Invasion of Spain" and subsequently published last Jan. 28—presented "a conscientious reporter's view of the situation." Spain, he said, recognized the critical attitude of many Americans to its regime. He added that the publication of the article "didn't cause the slightest ripple in U.S. relations with Spain."

### Protest by Gates

The second case was an Oct. 25 memorandum by Under Secretary of the Navy Thomas S. Gates, Jr., (AW Nov. 12, p. 25), which said Ross' office was passing on policy as well as the security aspects of his speeches. Directed to Ross, the Secretary of the Navy, Commander of Naval Operations, Commander of the Marine Corps and the four assistant secretaries of the Navy, the memorandum declared:

"On Oct. 23, I discussed with Mr. Ross . . . the general problem of clearance of speeches. The subject had come to my attention when I read the comments which had been submitted on two of my proposed presentations. Most of the suggestions made by Mr. Ross' office were improvements on the original text. However, as some of them appeared to be outside of the realm of security and did not appear to me to be in opposition to positive Defense Department policy, I did not know whether to take them as suggestions or as directives.

### Speech Assistance

"Mr. Ross informed me that his office makes every effort to assist us with our speeches. When appropriate, he sends them to State Department, the Atomic Energy Commission and other government agencies for advice. On occasion, he has requested comments from the Secretary of Defense and Adm. Radford. He assured me that all comments made on our scripts were merely in the form of suggestions except those dealing with security, and he agreed that all security questions would be clearly designated as such."

## AIA Attacks Coolidge Report

Washington—Strong protest against charges by the Defense Department's Coolidge Committee that the aircraft industry is guilty of violating security in order to build up prestige has been filed by the Aircraft Industries Assn.

In a firm letter to Defense Secretary Charles E. Wilson, AIA President DeWitt C. Ramsey charged that industry efforts to safeguard information is made difficult by Defense Department practices.

Specifically, he cited the Defense Department's insistence on maintaining classification over information that cannot possibly be kept secret, such as on aircraft that are rolled out to operate in public places.

"It is unreasonable," Ramsey wrote, "to expect our contracting members to deny or to conceal the existence of such equipment under such circumstances."

The Coolidge Committee accused the industry of giving secrets to trade and technical journals and suggested tighter rules to prevent these leaks in information (AW Nov. 19, p. 28).

In his letter to Wilson, Ramsey called this charge "wholly unjustified." He also came to the defense of the military services and the press, which shared the blame in the opinion of the committee.

Ramsey said it is a fact "that current practices of the Department of Defense in the security of information are such that there is no consistency or uniformity in the implementation of policies and directives.

"This tends to break down the entire system of security of information and places our member companies in difficult, and often embarrassing, situations."

On the subject of the trade and technical press, Ramsey told Wilson that "most of these writers are experienced people who are perfectly capable of drawing their own conclusions, sometimes on the basis of partial information."



## Martin Seeks World Nuclear Power Markets

**Baltimore**—Glenn L. Martin Co. announced the formation last week of Martin International, a wholly-owned subsidiary, to develop world markets for nuclear powered electrical generating systems.

George B. Shaw, vice president for procurement and previously the director of commercial sales, was named president of the new subsidiary.

Martin already has negotiated a contract for an atomic plant with the Dominican Republic to increase Ciudad Trujillo's generating capacity from 45,000 to 57,000 kilowatts. Negotiations have been opened with Cuba and Brazil. Martin's sales campaign is concentrating upon countries dependent on "fossil fuels"—coal, oil, and gas. The company is emphasizing power systems with a production capacity of from 10,000 to 15,000 kilowatts in its development program which has been underway for three years under military contracts.

## ACF Industries Gets Reactor Contract

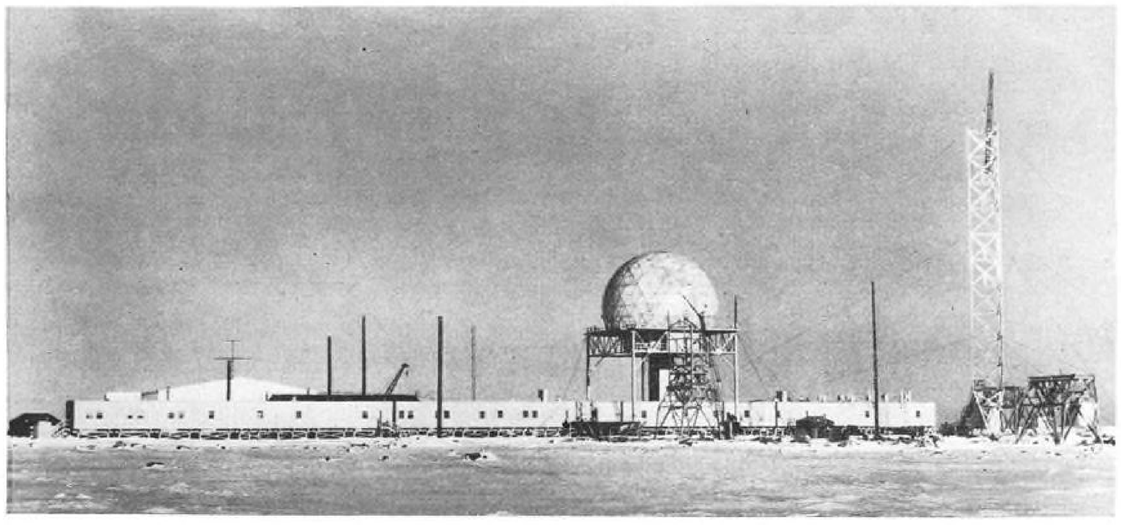
**Washington**—A 10 megawatt water cooled reactor for the Air Research and Development Command's Nuclear Engineering Test Facility at Wright Air Development Center will be designed and fabricated by the Nuclear Energy Products Division of ACF Industries.

First operation is planned for mid-1958. One major task for the reactor will be technical test support for Air Force's WS-125A nuclear bomber (AW Aug. 6, p. 173).

Irradiation cells on two sides of the reactor will include environmental chambers capable of simulating high altitudes for studying the behavior of material and components under varying thermal and radioactive conditions.

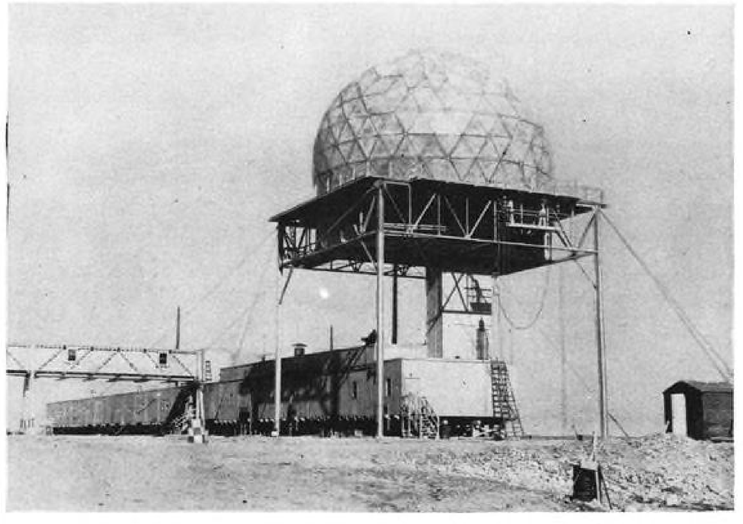
ACF will design, fabricate, supervise construction, prepare a safeguard report and instruct USAF personnel in operation of the reactor.

ACF is a subcontractor to Maxon Construction Co., Inc., of Dayton, which holds the prime contract from Army Engineers. This is the fifth research reactor sale for ACF's nuclear division in less than a year. Although the 3,000-man division is about six years old, most of its work in the past has been on classified projects. The reactor branch was formed just over a year ago.



## First Dew Line Station Finished

First Dew Line radar station has been completed and turned over to Federal Electric Corp., which will operate and maintain the chain of Arctic radar stations. USAF spokesman says Western Electric, which is building the Dew Line, is ahead of schedule. Radar is housed in new type of plastic radome designed specifically for Arctic use. The radome (closeup right) is built up from diamond-shaped pieces of reinforced fiberglass. Construction technique for radome was developed by Geodesic, Inc.



## Photochemical Cause Of Airglow Proved

Fluorescence of sodium vapor released from an Aerobee-Hi in the upper atmosphere has proved that night airglow is generated by a photochemical process. The test climaxed a five year study of the elusive light which occurs even when direct or reflected rays from the sun and stars are absent.

The study has been made by the Geophysics Research Directorate of the Air Force Cambridge Research Center and has involved four Aerobee firings and numerous laboratory experiments. Results were fairly well established by earlier tests (AW Aug. 6, p. 138), but possible direct influence of the sun had not been eliminated and reacting chemicals had not been completely identified. First tests used nitric oxide instead of sodium vapor.

In the recent firing, sodium vapor was streamed from an altitude of 30 mi. to the top of the rocket's trajectory at 85 mi. and back down to an altitude of 40 mi. The reaction upon the sodium vapor of solar energy stored photochemically between 30 and 60 mi. produced a bright yellow glow. Above 60 mi. there was no reaction. No direct or reflected sunlight was present.

Experts believe the fundamental knowledge gained from the study will be very important to aeronautics, but immediate applications are uncertain. It has been suggested that the ionized gas clouds could be used as reflectors for more reliable scatter communication. Another idea is that they may be used for local illumination in combat areas.

## New York Airport Smog Is Surveyed

**New York**—Importance of air pollution in reducing airport visibility is under study by New York University in a project sponsored by Flight Safety Foundation.

Comparison of conditions at New York International, LaGuardia and Newark Airports with those at Westchester County Airport, where air is clearer, will be recorded over a period of at least a year by the university's College of Engineering researchers.

First field studies began last week with visual observations from a Port of New York Authority Bell 49G helicopter of smoke and smog conditions at the metropolitan airports.

Sampling stations will be set up at the three airports for recording air pollution concentrations. According to the university, it is known that pollution causes fog to persist longer than it does in clean air, but hitherto no systematic study has been made in the New York area.

## High-Speed Radiosonde Developed

**Baltimore**—A cheaper, more accurate and adaptable radiosonde for use at altitudes of up to 60,000 ft. and speeds up to Mach .98 has been developed by the Air Research and Development Command. It is now being standardized for Air Force use.

The radiosonde is used to determine temperature, humidity and air pressure in remote areas where there are no permanent weather stations.

The improved model, which costs $80 as compared with $100 for the earlier model, was developed by Wright Air Development Center's Aerial Reconnaissance Laboratory. It was flight tested from 1954 until this year. The radiosonde is 2½ in. long, 5 in. in diameter and weighs 9 lb.

Limits on the earlier model were Mach .43 and 30,000 ft. Reliability on the newer version is 95% as compared with 80% in the earlier model.

Seven Air Force weather squadrons drop some 25,000 radiosondes each year in the northern hermisphere, primarily over oceans and polar regions. Data radioed to a plane during the drop is decoded, recorded, evaluated and radioed to a central weather station for use on a world wide weather network.

**NEW RADIOSONDE** developed by ARDC is adjusted for pressure setting by Wilson A. Maxim of Wright Air Development Center Aerial Reconnaissance Laboratory.

## New Film Processor Developed for USAF

**Baltimore**—A photographic processor that develops each negative individually on a roll of aerial film has been developed for the Air Force.

Until now, rolls of negatives were processed on an average development time, resulting in the loss of valuable reconnaissance data on below-average negatives.

The Houston-Fearless Division of the Color Corp. of America built the 24 ft. long, 6 ft. high prototype under the direction of the Air Research and Development Command's Wright Air Development Center. Later machines will be smaller. Eastman Kodak Co. contributed what ARDC called "a radically new type of aerial camera film" to be used with the processor.

The processor handles films from 200 to 400 ft. long and can process some 3,000 negatives a day. It is air transportable when disassembled. Here is how the processor works:

• **Pre-development chamber.** Film is threaded over rollers which guide it through the processor at 5 ft. per min. It is treated first in this chamber and a partially developed picture is brought out. Development is then halted by a stop bath.

• **Scanner section.** An operator using an infra-red viewer and light source can examine each negative and set in additional development or allow the film to move on for automatic determination of this question.

• **Electronic evaluator.** Here an infra-red beam scans each negative to determine its lightest portions and decide how much, if any, further development is needed.

• **Programmer.** Information from the electronic evaluator is fed to the programmer, which assigns one of 396 rotating cams to each negative. The cam controls treatment of the negative as it moves through the variable development section.

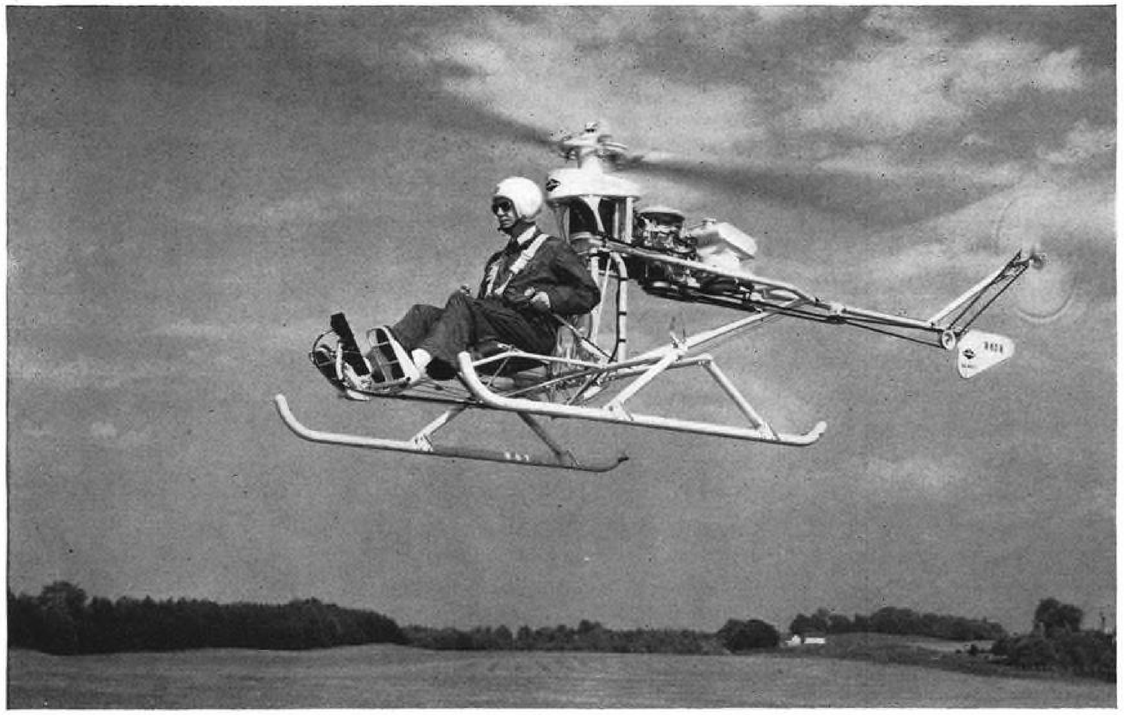
• **Variable development section.** Here each negative is developed by a developer spray in an individual compartment which is the same size as the negative. A number of negatives can be treated at a time, each isolated from the next. The sprays can use either water or developer, depending on need.

When the film leaves the development section, it is sprayed with short stop solution, hypo and water. It then moves past a window where each negative can be reviewed.

Finally it travels back through the lower part of the machine, where hot air blowers dry it before respooling.

C. T. Lindhorn of WADC's Aerial Reconnaissance Laboratory is project engineer for the new processor.





**LIFTING** characteristics of Airmat fabric rotor blade will be studied by Goodyear Aircraft Corp. engineers after mounting on GA400-R Gizmo one man helicopter. Tests are scheduled to begin early next year.

## Goodyear Develops Fabric Rotor Blades

**Akron, Ohio**—Goodyear Aircraft Corp. is developing fabric rotor blades for helicopters and convertiplanes under a Navy Bureau of Aeronautics contract. Tests on a GA400-R Gizmo one man helicopter are scheduled to begin early next year.

Goodyear already has demonstrated the principle of woven inflatable structures with airfoil contours, in its collapsible airplane (AW Feb. 13, p. 39).

Goodyear also is working on a Wright Air Development Center contract to determine basic fabric properties necessary to meet load and fatigue requirements of helicopters. One aim of this work is a flight demonstration with a large blade design.

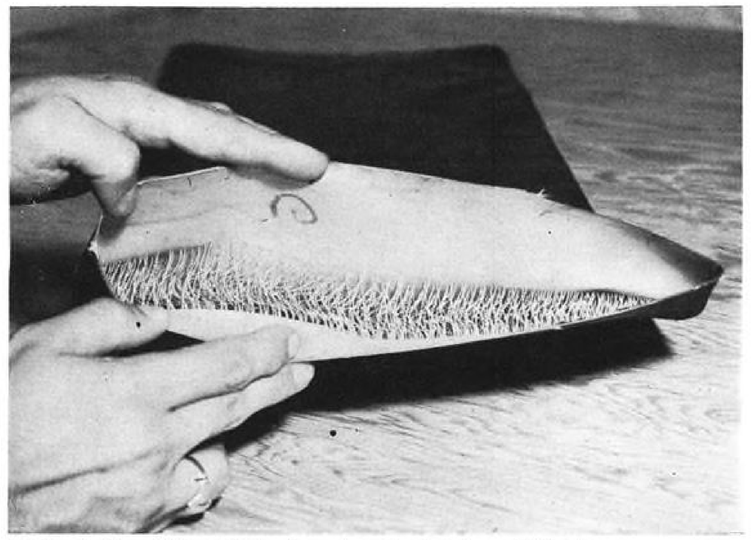
The inflatable structure, called Airmat, was developed by Goodyear Aircraft and Goodyear Tire & Rubber Co. fabric engineers.

Two basic layers of high strength cloth are woven simultaneously with drop threads interconnecting them. Length of the drop threads determine contour. The cloths are then coated, and cover layers are applied to obtain pressure-tight surfaces of the desired strength.

Airmat would permit a minimum storage area, allow for high production rates and a corresponding low cost, Goodyear said.

As a rotor blade, it utilizes both surface tension developed by the inflation pressure and tension added by centrifugal forces. This permits use of low inflation pressure during operation. Therefore, by using a relatively small accessory compressor, there is the possibility of retaining lift in the event of a blade puncture.

Airmat also will revert to its original shape and utility if design limits are exceeded and "failure" occurs, Goodyear said.



**OPEN** end view of Airmat fabric shows drop threads between fabric layers.

## CAA Will Test New Runway Surface Lights

**Washington**—Civil Aeronautics Administration will flight test three experimental runway lighting systems at Andrews Air Force Base, Md., in hope of establishing definite U. S. civil-military standards by next March.

Tests will begin in December, at which time installation of an ILS system and high intensity approach lights will have been completed to permit practical use of the new lights.

The three systems are designed to eliminate the darkened, or "black pit," look of a runway surface which appears to a pilot during flare-out of an airplane following approach under high intensity lights. Each system clears the darkened areas by putting illumination on the runway itself.

Two of the systems involve high intensity lights set into the runway, and are arranged to appear to the pilot as bars of light. One system, developed by Dutch Elfalka, uses steel bars as a protection against airplane impact. The other, a British development, employs a protective cast iron hood.

The third system is a Sylvania Electric unit that illuminates the surface from the side of the runway. Newly-developed high-power fluorescent tube-mounted reflectors are set on the runway edge. Reflecting-paint in checkerboard design on the runway surface is expected to improve the efficiency of the edge-lighting system.

**Vanguard Launching Platform**

Platform for Project Vanguard artificial satellite serves both as a launching device and a static test stand for the three-stage rocket. First stage develops a thrust of 27,000 lb. Stand, designed and built by Loewy-Hydropress Division of Baldwin-Lima-Hamilton Corp., is about 15 ft. square and stands 11-12 ft. high. It incorporates a 7-8 ft. diameter water-cooled throat to turn the first stage rocket's exhaust 90 deg. from vertical to horizontal. Loewy, which made the stand under subcontract to Glenn L. Martin Co., is also in charge of complete instrumentation for the stand, its support mechanisms, utilities, and all associated research, such as heat stress analysis.

## Northeast Asks SEC For Stock Sale Permit

**Boston**—Northeast Airlines last week filed a registration statement with the Securities and Exchange Commission in a move to raise $7 million net capital through the sale of additional common stock.

The offering, underwritten by a nation-wide group headed by Carl M. Loeb, Rhoades & Company, is planned for mid-December.

The underwriters propose to offer stockholders other than those of the Atlas Corp., the majority stockholder, new stock proportionate to present holdings. The general public will be offered 50% of the new issue. Atlas Corp. has agreed to purchase from the underwriters all remaining stock and any shares offered but declined by stockholders.

Proceeds from the stock sale, together with funds made available through an $11 million bank credit agreement, will give Northeast $18 million for use in its expansion and equipment purchasing programs.

## Stratocruiser Ditched, NWA Crew Blamed

**Washington**—Civil Aeronautics Board reports that a Northwest Airlines Stratocruiser was ditched in Puget Sound last April because the crew incorrectly analyzed a control difficulty that occurred after takeoff.

The CAB said the crew was forced to make the analysis under conditions of great urgency and in an extremely short period of time.

The Stratocruiser accident occurred four minutes after takeoff from Seattle-Tacoma Airport.

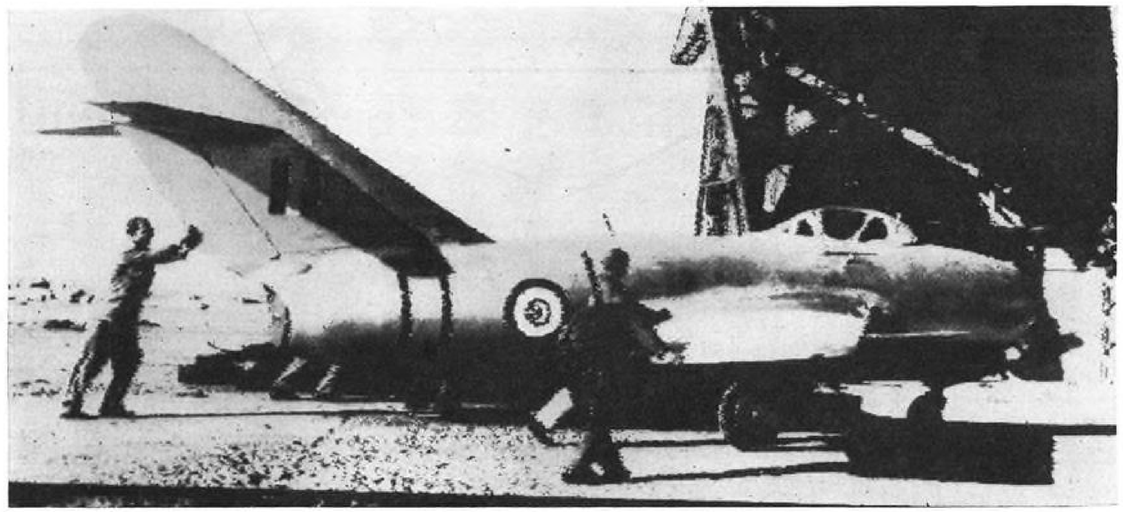
When the aircraft reached an altitude of 1,000 ft. and wing flaps were retracted, severe buffeting was encountered.

The Stratocruiser became difficult to control, and the captain decided to make an emergency landing at McChord Air Force Base. However, as the trouble continued and the aircraft lost altitude, the captain decided to ditch.

The ditching was made on smooth water.

All 32 passengers and the crew of six left the airplane. Four passengers and one crew member drowned before rescue craft reached the scene. The Stratocruiser was a total loss, although it was later raised from the bottom of the Sound.

The Northwest transport encountered buffeting at the time the wing flaps were retracted. The Board found that this buffeting was due to the fact that



**Egyptians "Dummy" MiG-15**

**Egyptians, in caption on radiophoto from Cairo, called this a dummy MiG-15 jet fighter used to decoy British and French bombers from genuine targets at Almaza Airport near the Suez canal. However, close inspection of the photograph indicated the dummy was equipped with hinges on the control surfaces, plug for the tailpipe, and in general showed unique refinement for a dummy. Egyptians claimed dummy aircraft bore brunt of pre-invasion raids.**

all four engine cowl flaps were full open. Flight testing has shown that buffeting occurs on the Stratocruiser when cowl flaps are full open and wing flaps retracted.

When the buffeting developed, the crew failed to determine that it was caused by full-open cowl flaps, which should have been closed before takeoff. The captain thought his wing flaps might have retracted unevenly, creating a split-flap condition.

The CAB said it recognized that a number of events occurred in an extremely short space of time, and that the urgency of the situation required a rapid decision. The Board said the captain acted promptly, but that his incorrect analysis of the control difficulty "led to an unfortunate decision."

The CAB concluded that the flight information manual on conditions created by excessive cowl flap openings was "sufficiently stressed to allow the captain, and indeed the entire crew, to evaluate the difficulty properly within the time available."

## Orders Listed for Convair 880s, DC-8s

**Washington**—California Eastern Aviation has ordered four Convair 880 turbojet transports for use on its long-range overseas routes, and the French airline Union Aero Maritime de Transport has ordered three DC-8s.

Orders for the four Convair transports also will help the contract airline's case when it goes before the Civil Aeronautics Board to ask for a Texas-California route in the impending Dallas-to-the-West Route Case.

Delivery of the DC-8s to UAT will begin in 1960, but the government still must approve purchase of the two on option. DC-8 was selected over Boeing jet transport and Comet IV. Choice of Pratt & Whitney J75 or Rolls-Royce Conway will be made within a month.

## News Digest

**Modified "flying bedstead,"** powered by two Rolls-Royce Nene jet engines, has made several short test flights. First vehicle was flown in August 1954.

**First Lockheed F-104A** Starfighter was lost earlier this month when it experienced a flameout and crashed onto Rogers Dry Lake, two miles south of Edwards AFB, Calif. The pilot, Capt. Harry A. Brown, who was killed in the accident, called the Edwards tower shortly before the crash to report the flameout and said he hoped to glide the plane onto an Edwards runway.

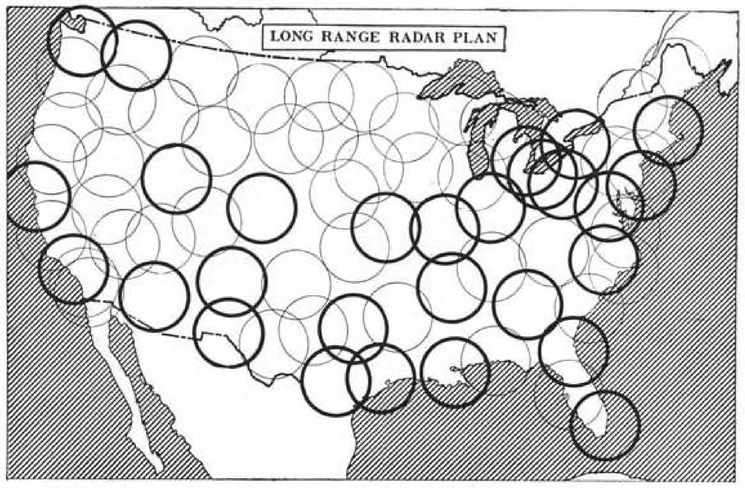
**Research and development** center costing $15 million will be built by Avco Manufacturing Corp. on a 100-acre site in Wilmington, Mass. One of the prime projects at the center will be ICBM nose cone development. Avco will move shock tube from Everett, Mass., to the center, which will be in operation by mid-1958.

**Preliminary investigation** of the crash of a Hurel-Dubois H. D. 321 in Rio de Janeiro Bay Oct. 30, puts the cause as poor visibility. Displayed in a French manufacturers sales show (AW Nov. 12, p. 45), the H. D. 321 crashed when one of its wings touched the water. It sank in water 16 ft. deep.

**Vice Adm. Ralph A. Ofstie,** former deputy chief of naval operations for air, died at Bethesda Naval Hospital on Nov. 18. Adm. Ofstie began his career as a naval aviator in 1922 as a test pilot with the Plans Division of the Bureau of Aeronautics. He established three world speed records for seaplanes and subsequently served as White House aide, commander of the Flight Test Division at Anacostia Naval Air Base and as naval attache in Tokyo and London. During World War II, he commanded the carrier USS Enterprise and participated in aerial attacks on Rabaul, the invasion of Gilbert Islands and the Marshall Islands and the Battle of the Philippine Sea. After two years' service as Deputy Chief of Naval Operations, he commanded the Sixth Fleet from March, 1955, until his illness. Adm. Ofstie is survived by his wife, Joy Bright Hancock Ofstie, former WAVE director.

**First flight** has been made by Air-Fogua's CM171 experimental plane for Turbomeca's new 2,500 lb. thrust Gabizo engine. The Makalu is slightly modified version of Fouga's Magister trainer and has demonstrated its climbing performance by reaching 40,000 ft. 9 min. 20 sec. from takeoff.

# Radar Net Will Be Ready for Jet Control




**LONG-RANGE** radars ordered by CAA will be installed at major airports shown (heavy circles) within two years. These will be supplemented by military radars not shown. Forty-foot antenna (below) will be used in new L-band radars to be produced by Raytheon.


By Philip J. Klass

**New York**—Twenty-three long-range Raytheon radars ordered by the Civil Aeronautics Administration (AW Nov. 19, p. 25) are expected to be in operation within two years, in time to meet the increased traffic control problems posed by new jet transports.

The $9 million order, called "one of the most significant steps in the CAA's history" by James Pyle, acting CAA administrator, is the largest single avionic procurement ever made by that agency. Pyle also revealed that the CAA's $246 million three-year facilities expansion program, which was originally telescoped from a five-year plan, may get additional funds.

The 23 Raytheon sets, together with five air defense radars, will form the nucleus of an eventual network of 70 civil and military stations intended to give traffic controllers complete radar surveillance of the entire country from 15,000 to 70,000 ft. altitude plus airways coverage below 15,000 ft.

### Peak Power

The CAA radars are similar to those ordered from Raytheon last spring by Canada (AW April 23, p. 69). The sets will have a peak power of 500 kw., but in about three years Raytheon says it will be possible to boost peak power to four megawatts merely by adding a new type of radar amplifier, called the Amplitron. The sets operate in L-band.

Present power will give the radars an effective range of 150 statute miles against B-47 size jets, 200 mi. against DC-6 size propeller-driven aircraft, Raytheon says. The addition of the Amplitron should increase the DC-6 detection range from 200 to 350 mi., with a proportional increase for jets, according to Raytheon.

CAA plans to install the new radars at 23 major airport terminals. This will extend the terminal area radar control from the present 50 mi. maximum out to 150-200 mi. The Chicago, Boston, Norfolk triangle will have almost continuous coverage of major airways.

### Radar Locations

The new radars will be installed at the following locations:

Atlanta; Atlantic City, N. J.; Albuquerque; Benson, N. C.; Boston; Buffalo; Cleveland; Denver; Detroit; El Paso; Ft. Worth/Dallas; Houston; Indianapolis; Jacksonville, Fla.; Kansas City; Los Angeles; Memphis; Miami; New Orleans; Oakland, Calif.; Phoenix; Pittsburgh; Salt Lake City; San Antonio; Seattle; Spokane; St. Louis; and Washington D. C.

Major terminals not included on this list, such as New York, Chicago and Norfolk, will utilize military or air defense radars already installed.

The new CAA radars will be outfitted with circular polarization which greatly reduces the signal return from precipitation (clutter). A Raytheon spokesman estimates that circular polarization provides a 20:1 improvement in the ability to detect an airplane in a thunderstorm.

### Radar Features

The sets will have one or two master 16-in. scope consoles with five remote indicators which can be operated at distances up to two miles away. A new improved MTI (moving target indicator) using a three-pulse system is provided to enable the operator to display only moving targets and eliminate clutter from ground objects.

The traffic controller will also be able to superimpose on the radar scope an electronically generated map of the territory under surveillance to show terrain obstacles and to pin point the geographical position of the various aircraft.

The radar stations will be built with complete duplicate equipment for standby operation, except for the 40-ft. diameter antenna.

Automatic monitoring equipment will be provided to spot deterioration in radar performance and to alert the operator automatically.

### Only the Beginning

Pyle cautioned that although the CAA expects to achieve major improvements in traffic flow with its new radars, this is not the complete answer to present problems. "We have to improve our communications facilities, install more navigation aids and recruit and train additional personnel," Pyle said.

In answer to a question about possible pay-scale downgrading of traffic controllers in line with a recent civil Service Commission study (AW Oct. 1, p. 41), Pyle said that there would be a two-year moratorium to permit the transfer of affected controllers to higher density locations where their present skills and ratings could be used without salary drop.

Pyle praised the military, and particularly the Air Force, for its cooperation in working with the CAA to develop ways to permit the use of air defense radar information for civil air traffic control.

Pyle said that the CAA will make data from its civil radars available to the military if so desired.

# International Travel Dominated By Airline Industry in Fiscal '56

By Craig Lewis

**Washington**—Airlines industry dominated the international scene during Fiscal 1956 during which travel between the U.S. and other nations set new records.

A report from the U.S. Immigration and Naturalization Service for the year ending on June 30, shows that 2,071,130 passengers arrived at U.S. ports by sea and air, and 1,813,498 passengers departed. Arrivals increased 13%, and departures gained 15% over the previous year's traffic.

During the 1956 fiscal year, 68% of all passenger traffic between the U.S and other nations traveled by air. Air traffic increased 141% between 1950 and 1956, while sea travel increased only 16%. Air travel gained 20% between 1955 and 1956, while sea travel rose only 2%.

These travel statistics cover passenger traffic between U.S. ports and foreign countries but do not include travel across U.S. border to Canada and Mexico, travel by seamen or military personnel or travel between the U.S. and its possessions. Cruise travelers also are excluded.

On the heavily traveled routes to Europe, more passengers traveled by air than by sea for the first time. While sea traffic has leveled off in the past three years, air travel has continued to grow. In 1956, 404,701 passengers flew from the U.S. to Europe, and 380,087 went by sea.

Most alien travelers continue to prefer sea transportation, but most U. S. citizens prefer to fly.

In Fiscal 1956, travel from the U.S. increased to all major areas of the world but Africa. The African decline was due to a decrease in travel to French Morocco.

Last June, a peak month for North Atlantic travel, 123,572 people left the U.S. for Europe, and over 100,000 of them were U.S. citizens, many of them on vacation. Nearly two thirds of the European traffic goes to the United Kingdom, France and Germany.

German traffic does not have the marked seasonal pattern of travel to other countries, much of it consisting of families of military and civilian missions.

Travel to Asia increased 64% between 1952 and 1956, and was up 24% in the last year alone. Increases were noted in travel to Japan, which attracts 60% of all Asian travel; to Hong Kong, Israel, the Philippines and the Ryukyu Islands, including Okinawa. Within the past two years, air travel to Asia has increased. Last year more than half of all passengers for Asia went by air.

Increases in travel to Peru and Venezuela accounted for most of the 10% rise in travel to South America last year. U.S. citizens accounted for 44% of the traffic to South America, and nearly half of them went to Venezuela. The airlines carry almost 80% of all passengers going from the U.S. to South America.

While U.S. airlines continue to carry more passengers, the foreign flag airlines' share of the market also gained last year. Travel on U.S. carriers increased 18%, travel on foreign airlines increased 26%.

On European routes, American flag airlines carried 58% of the total air traffic; 86% of the passengers flying to Asia traveled on U.S. carriers. Japanese and Israeli airlines carried most of the remaining Asian traffic.

Virtually all air traffic to Africa flew on U.S. carriers, and three-fourths of the travel to the Australian-New Zealand area was on an American carrier. Canadian and Australian airlines carried the remainder bound for the area.

In the North American area, 70% of the air passengers chose American carriers. Nine out of 10 travelers flying to Bermuda went on U.S. carriers, while the other 10% flew on British aircraft. U.S. airlines carried 75% of the air traffic to the British West Indies and 66% of the traffic to Cuba.

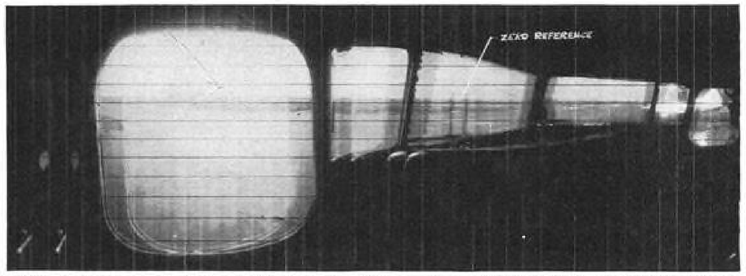
On routes to South America, the American airlines flew 62% of the passengers. Most of the balance was carried by Colombian and Venezuelan airlines with 27% of the total.

While the U.S. flag airlines continued to dominate air travel, sea travel on ships of U.S. registry declined 6%. At the same time, foreign flag ships carried 7% more passengers last year than they did the year before. Foreign flag ships carry about two-thirds of the passenger traffic to and from the U.S.

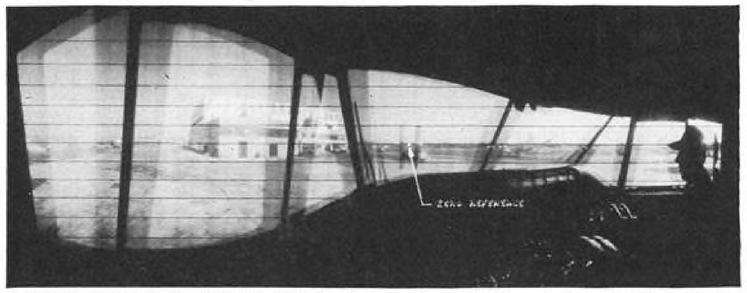
## Fuel Available Abroad

**Paris—American and foreign airlines operating out of Paris report no fuel shortage problems and that no plans are underway to curtail present schedules.**

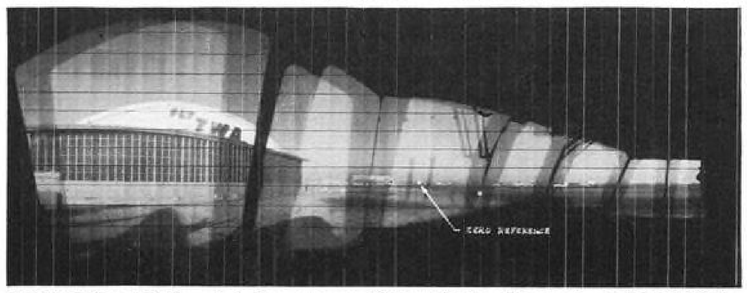
**Airlines explain that the high octane gas they use is unaffected by the present Middle East crisis. Most aviation gasoline used here is of Venezuelan or American origin and is largely refined in the U. S. before shipment here.**



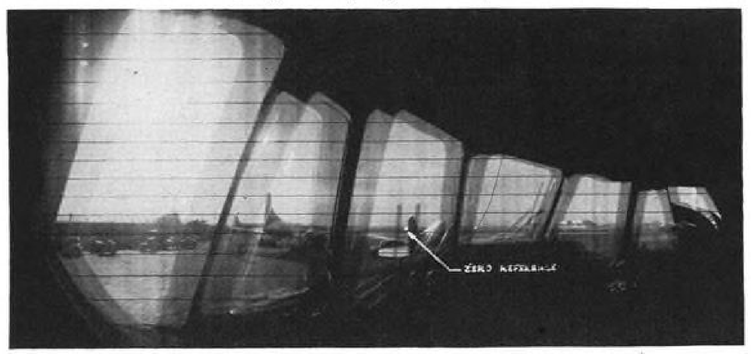

**DC-7** at ½ deg. nose down flight attitude, distance from pilot's seat to windshield, 28 in.



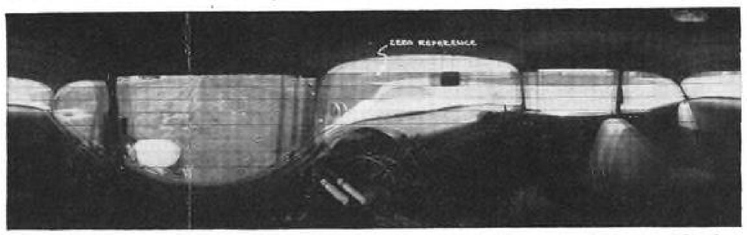

**MARTIN 4-0-4** at level flight attitude, distance from pilot's seat to windshield, 27 in.




**SUPER G** Constellation at ½ deg. nose up flight attitude, distance to windshield 21 in.




**VICKERS VISCOUNT** at level flight attitude, distance to windshield 24 in.




**1953 FORD** two-door sedan gives driver a horizontal visual range of almost 360 deg.

# Bad Visibility Blamed In Mid-Air Collisions

By L. L. Doty

**Washington**—Aircraft Owners and Pilots Assn. has blamed poor cockpit visibility of transport aircraft for the majority of mid-air collisions and near-misses involving airliners. The association also charged that the "carelessness" of airline pilots is a major contributor to the present collision hazard.

According to a Civil Aeronautics Board study of 127 mid-air collisions reported between 1948 and 1955, 11 of the accidents were between air carriers and private aircraft. Military and private planes were involved in 16 accidents, while 96 of the collisions involved private aircraft only. In the report, the CAB concluded that "past experience has shown that general (private) aircraft have been involved in the highest number of mid-air collisions by far (AW July 30, p. 32)." There are an estimated 60,000 private aircraft in the U. S., and 1,600 airliners. The military has a total of approximately 42,000 aircraft on hand in the U. S. and overseas.

In support of its charges against the airlines, AOPA distributed composite photographs comparing cockpit visibility of transport aircraft with the visual range of a 1953 Ford two-door sedan. The photographs were taken by the Civil Aeronautics Administration's Technical Development Center in Indianapolis.

AOPA contended that the airline pilot has "from 170 to 200 degrees" horizontal visibility as compared with the "almost 360 degrees" of horizontal range available to the automobile driver. "It is the deficiency of vertical visibility," it added, "where the airline pilot suffers most."

Photographs show, AOPA said, that adequate vertical visibility is available only from the nearest left-hand window, and "that the pilot in the left-hand seat cannot see an overtaking airplane on his right until it is flying abreast of his aircraft at approximately the same altitude."

According to latest collision test results issued by the Technical Development Center, pilots of single engine civil aircraft have an azimuth visibility advantage over pilots of multi-engine private and airline aircraft (AW Nov. 5, p. 38). Azimuth visibility on military jet aircraft is superior to that of any aircraft studied by the center.

However, the tests disclosed that an average multi-engine aircraft has a slight visibility advantage over other types in vertical range below the line of azimuth. Vertical cut-off angle of pilot vision averages eight degrees on military jets with single and tandem seating; six degrees on single engine private aircraft and 10 degrees on multi-engine planes.

Above the center line, jets again hold an edge over other types of aircraft. Cut-off angle of vision above azimuth averages 40 degrees on military jets; 38 degrees on single engine aircraft and 20 degrees on multi-engine private and transport aircraft.

AOPA said most collisions occur while aircraft are under visual flight rules and added:

"AOPA has long contended that the absence of adequate visibility, in all directions, and the failure of pilots to watch where they are going, are major factors in causing mid-air collisions," the group stated.

The CAB study bore out AOPA's statement that most collisions occur when "visibility is good." Clear weather, it said, prevailed in 117 of the 127 accidents.

AOPA said that it had formally petitioned the CAB last March to establish cockpit visibility standards for all civil aircraft.

It added that no formal action on the petition has been announced although it was considered at CAB's annual airworthiness review last September. The recommendation met opposition from manufacturers, AOPA said.

# Air Express Handles Big Magazine Issue

**New York**—Air Express earned over $51,000 in revenue from its biggest single shipment, 429,031 lb. of Newsweek magazines handled in a special operation following the elections.

Using 21 chartered aircraft and space on regular flights of most scheduled airlines, Air Express moved a million copies of the magazine from the main Dayton, Ohio, printing plant, another quarter million from a Los Angeles printer.

Deliveries were made to 18 regional post offices for mailing and to 525 cities in the U. S. and Canada for newsstand distribution.

Air Express utilized 609 extra vehicles and 36 extra employes for the operation.

The magazine's normal Sunday printing schedule was moved back until Tuesday night to include election results and analyses. Air Express coordinated the movement from a project headquarters in Dayton. First shipment went out at 12:49 a.m. Nov. 7 by Trans World Airlines to Columbus. American Airlines, Flying Tiger, Riddle, Slick, United and Lake Central provided the charter flights.

Air Express handled a similar project for Newsweek in 1940, moving 35,000 lb. of magazines containing Roosevelt-Willkie election returns.

# Addition of East, Midwest Routes Doubles Riddle's Cargo Business

By Glenn Garrison

**Miami**—Riddle Airlines has doubled its scheduled air cargo business since starting service last January to most of the 13 midwestern and eastern cities added to its route pattern by the Civil Aeronautics Board last year.

Expanding its ground facilities and aircraft fleet, the airline expects to do even better in 1957 and to increase its carriage of mail and express.

Riddle has lifted more than 33 million pounds of commercial cargo this year so far, expects the totals to exceed 40 million. Last year, operating only between New York, Miami and Puerto Rico except for seasonal services to a few other Florida points, Riddle carried 20 million pounds of cargo.

Following the CAB decision last November in the North-South Airfreight Renewal Case awarding Riddle a five-year certificate and the new routes, the cargo carrier moved fast to get into the additional cities by the Jan. 20, 1956, effective date. Now cities served regularly are Jacksonville, Philadelphia and Boston in the East; Atlanta, Cincinnati, Cleveland, Detroit and Chicago on the carrier's route to the Midwest. Other cities, including Richmond, Louisville, Washington, Baltimore and Columbus, are served on a demand basis and will ultimately be scheduled stops.

Riddle needed equipment when its new services opened, according to Charles L. Hood, vice president-sales. Its fleet as of October 1955 totaled 22 C-46s and four DC-4s, with a number of the Curtiss aircraft tied up in military contract work.

Some C-46s were leased to fill the immediate gap until additional Riddle planes—10 C-46s—were delivered this year. The airline also leased a DC-6A from the Air Force and put it into New York-Miami service on Nov. 1.

Another DC-6A is being purchased from Douglas, with delivery expected in October 1957. Three more have been optioned and are expected during the summer and fall of 1958. Discussions also have been held with Lockheed, Hood says, regarding possible purchase of Constellation 1049H equipment.

The C-46, however, will be in use as a feeder aircraft for a long time, according to John Paul Riddle, president of the airline. The carrier's own C-46 equipment is undergoing a T-category modification program which is expected to increase the planes' speed from 195

## DC-7C Makes Record Flight

Scandinavian Airlines System DC-7C taxis to ramp at Bromma Airport, Stockholm, after flying 6,005 mi. non-stop from Long Beach, Calif. carrying only the 7,824 gal. of fuel in its standard tanks. Great circle route over Labrador, Greenland and Iceland, flown at economy cruise speed of about 270 mph. and altitudes of 13,000-17,000 ft., required 21 hr., 44 min. Conducted under Federation Aeronautique Internationale supervision, flight exceeded record of 5,700 mi. set by a DC-6B on a Los Angeles-Paris flight in 1953.

to 230 mph. and to up the gross-weight from 48,000 to 50,000 lb. Riddle figures the present direct operating cost of his C-46 equipment at 10.5 cents per ton-mile with full payload, and hopes the modified planes will cost 15% less to operate.

Riddle foresees a tremendous potential in the new markets his airline is serving, and expects another 60% boost in traffic next year. Common carriage business will provide the greatest opportunity for the airline, its president feels, but military work—which this year about equals the commercial business in terms of hours flown—will continue to be sought. The carrier handles Dew Line and Logair's assignments for the military and started a new $10 million Logair contract on July 1.

### Airfreight Prospects

One reason prospects for air cargo development are bright, according to Riddle, is the cumulative effect of airfreight promotion by all carriers. Growing availability of cargo facilities is seen by Riddle as another favorable factor, although he believes many airport managements should give more attention to their cargo handling expansion.

Load factors dropped with the inauguration of the new routes, Riddle reports, but are climbing back as new traffic develops. Last year, over the limited routes with their long-haul character, the airline's average load factor topped 87%. This year, with new shorter-haul segments on the expanded route pattern, load factors dropped to 60%. By October they had passed 70% again.

Traffic from Riddle's five midwestern route stations has increased steadily, according to the airline, with almost six million pounds originating at these points, January through September.

Chicago service provides Riddle with important interline business through the east-west carriers. An example is shipment of prepackaged assemblies from the West Coast, connecting with Riddle and destined for Lockheed Aircraft's C-130 plant near Atlanta. From Atlanta to the south, Riddle is handling, among other things, a volume of mail orders teletyped from Florida to Sears-Roebuck.

### Product Variety

Typical shippers in the new territory are automobile, chemical, wearing apparel, pharmaceutical and electronic concerns. Extension of Riddle's routes ties in Puerto Rico with markets in the Midwest, and a variety of products are moving over these segments.

During the two months between the CAB decision and the Jan. 20 effective date of the new authority, Riddle people had their hands full finding ground facilities and personnel for the new stations.

Hood and other officials went on the road to set up the stations, while Riddle concentrated his efforts at Miami in the search for aircraft.

At some airports, facilities were not immediately available and the Riddle officials worked out temporary arrangements with other organizations. They arranged with Slick at Detroit, for example, to handle Riddle's operation there for a short time. Riddle now has its own facility and people at Detroit. At Chicago, on the other hand, Riddle is still using Slick facilities at O'Hare Airport, while a Riddle station manager and agents are handling the operation.

Washington National Airport, where no facilities could be found, was served by Riddle through an arrangement with California Eastern, according to Hood. Scheduled Washington service has since been discontinued by Riddle because the southbound potential was found to be poor, but either Washington or Baltimore will be served when the schedule pattern evens out.

In working out schedules, Hood says, "care must be used to build a balance of traffic between stations or you will shorthaul yourself to death."

Another concern of the management team setting up the new stations was leasing trucking facilities for ground pickup and delivery. This problem was simplified in September when Riddle became part of Air Cargo, Inc.

In May, the airline was authorized to carry mail to all points on its system and by the end of September had lifted 44,628 lb. Air mail and parcel post business is expected to increase greatly, according to Riddle.

The airline has filed a petition for reconsideration of the New York-Florida case, in which Riddle sought to carry passengers, and also has applied for authority to haul passengers between Puerto Rico and Miami.

But air cargo business will continue to be the carrier's main concern in the foreseeable future, according to its president.


**Transport Testbeds**

**Three transport aircraft with piston engines replaced by Napier Eland turboprop engines are photographed together as part of Napier's sales push for the engine. Convair 340 (foreground) was demonstrated at IATA general meeting at Edinburgh (AW Sept. 24, p. 47). Elizabethan (Airspeed Ambassador) is in the middle and Vickers Varsity in background. Retention of piston engine mounting bulkhead for ease of conversion meant using nacelle larger than necessary for Eland 36-in. frontal diameter.**

## SHORTLINES

► **Aer Lingus** reports revenues of $5,298,720 and a profit of $963,000 for the first half of its current fiscal year. The Irish airline carried 314,056 passengers during the six-month period; its revenue load factor was 76%.

► **Braniff Airways** has declared two 15 cent dividends for its 2,948,119 shares of common stock. First dividend is payable Nov. 28 to shareholders of record as of Nov. 23; the second is payable on Dec. 28 to shareholders of record as of Dec. 17.

► **British Overseas Airways Corp.** will cut fares on its New York-Nassau route on Dec. 16. New round trip fares will be $137 tourist and $181.80 first-class. Along with the removal of federal taxes on these fares, the reductions save

$47.80 tourist and $21.70 first-class. BOAC will operate nine New York-Nassau flights a week this winter, all with Boeing Stratocruisers.

► **Canadian Pacific Airlines** last week increased its Toronto-Mexico City service from two to three flights a week and introduced the family plan on the route. The airline also increased its Mexico City-Buenos Aires service to two flights a week in order to improve connections between the two services.

► **Capital Airlines** began Viscount service from New York International Airport this month with five daily flights to Cleveland, Detroit, Chicago and Minneapolis-St. Paul.

► **Delta Air Lines** has granted pay increases totaling $1 million to non-supervisory, administrative and non-contract personnel. These categories cover 80% of Delta's 5,483 employes.

► **Italy's Ministry of Defense** has announced that a regular helicopter service will be operated between Rome and Naples. A new company reportedly will be established to build helicopters and operate them. It will be a joint venture of Alitalia, Linee Aeree Italiane and Fiat.

► **Lake Central Airlines** carried 14,744 passengers in October, a 23.4% gain over the previous October, and operated with a load factor of 49.83% during the month.

► **Lockheed Aircraft Service-Intl.** delivered 746 aircraft in the third quarter, bringing the total for the first nine months of this year to 2,094 aircraft.

► **Pan American World Airways** pulled a switch and published a guide to travel in the U. S. "New Horizons, U. S. A." was compiled with the help of American Airlines and numerous domestic travel organizations. The book is designed to promote travel to the U. S. in overseas markets and will be printed in French, German, Italian and Spanish, as well as English.

► **Qantas Empire Airways** has ordered weather radar for its Super Constellations from the Radio Corp. of America.

► **South African Airways'** Constellation and DC-7 fleets will be equipped with Bendix X-Band weather radar.

► **Swissair** is using three DC-6Bs to fly the United Nations International Police Force from the Naples staging area to Egypt. While the troop movement lasts, Swissair will fly six flights a day, carrying 400 men with their equipment.

## AIRLINE OBSERVER

► Watch for a decision on a downtown airlines terminal building in Chicago within the next two months. Chicago's Downtown Terminal Committee is being prodded by a number of civic associations for a decision on one of the 22 sites the committee has under consideration. North-Western Railway Station is receiving strong backing as an airline terminal, although some officials object to its inconvenient location outside the Loop. Observers say the railroad has offered to operate commuter train service every thirty minutes between downtown Chicago and O'Hare Field if the station is selected by the airlines. Other ready-made terminals being studied are Dearborn Railroad Station and the Greyhound Bus Terminal.

► **Thomas Basnight, former assistant to John Groves of the Air Transport Assn. Air Traffic Control Department in New York, will join the Air Line Pilot's Assn. on Dec. 1 as a Washington representative of the Engineering and Air Safety Department and assistant to Larry Cates.**

► Lockheed's second 1649A, first of Trans World Airlines' order for 25 of the new Super Constellations, is off the production line and is scheduled for its first flight in January. Flight tests will serve to certify the plane's systems.

► **Heart patients can travel by air without undue danger, although oxygen administration may be necessary in pressurized transport aircraft, according to Dr. Lawrence E. Lamb, director of the cardiology department of the USAF School of Aviation Medicine at Randolph Field, Tex. Dr. Lamb warned that cardiac patients have a lower altitude threshhold than normal persons and said, beyond 18,000 ft. altitude, heart collapse may occur. However, in cabins pressurized to 8,000 ft., administration of oxygen will reproduce a sea level environment enabling cardiac patients to travel in comfort.**

► U. S. delegates to the International Labor Office meeting on civil aviation beginning today in Geneva and continuing to Dec. 8 are Robert Wharton, assistant vice president of personnel, Delta Air Lines; Joseph O'Brien, executive director, Airlines Personnel Relations Conference, and Clarence Sayen, president of the Air Line Pilots Assn. Items on the agenda include flight personnel work hours, income security of flight personnel after retirement or grounding and a review of employment conditions in civil aviation.

► **Hawaii Aeronautics Commission may delay until next year the naming of a successor to Randolph Lee as its director. Lee resigned earlier this month. The commission also plans to ask the 1957 legislature to increase the director's salary. Present level is $11,000.**

► Delta Air Lines translated a number of its booklets, including a history of the airline and speeches by President C. E. Woolman, into French to accommodate a group of French Diet members booked on a recent flight from Washington to New Orleans.

► **Mutual of Omaha will offer travel insurance to international air travelers at a standard premium rate of $5 for $62,500 coverage regardless of the part of the world visited. Current rates vary between $10 and $20 for the same amount, depending upon the traveler's destination. Sales and service of new travel policies will be administered by Teletrip Co., a wholly owned subsidiary of Mutual of Omaha.**

► Total miles flown by political campaigners in the 1956 election were 25% above the 1952 campaign figure. Republicans and Democrats estimate that party workers covered a total of more than 220,000 miles of air travel up to election time, and that 100,000 scheduled airline reservations were used for campaign purposes. President Eisenhower, however, flew less than half the total miles he covered in 1952.

► **Cargo handling methods at all Slick Airways terminals are undergoing study and analysis by Drake, Startzman, Sheahan and Barclay, distribution and materials handling consultants of New York. The study is aimed toward streamlining all aspects of cargo handling to reduce costs and promote greater cargo capacity.**

# Airline Traffic — September 1956

| | Revenue Passengers | Revenue Passenger Miles (000) | Load Factor | U. S. Mail | Express | Freight | Total Revenue Ton-Miles | Per Cent Revenue to Available Ton-Miles |
|---|---|---|---|---|---|---|---|---|
| **DOMESTIC TRUNK** | | | | | | | | |
| American | 687,030 | 439,189 | 70.44 | 1,517,116 | 982,150 | 6,749,807 | 51,497,903 | 62.07 |
| Braniff | 151,899 | 61,907 | 63.89 | 215,340 | 136,955 | 363,394 | 6,653,886 | 56.63 |
| Capital | 284,967 | 97,273 | 58.52 | 284,717 | 219,848 | 319,631 | 10,136,871 | 44.87 |
| Continental | 63,196 | 23,313 | 58.29 | 67,965 | 26,488 | 99,622 | 2,433,399 | 49.31 |
| Delta | 195,361 | 89,364 | 55.25 | 290,184 | 325,859 | 651,068 | 9,852,917 | 52.01 |
| Eastern | 595,243 | 272,066 | 56.06 | 917,232 | 502,679 | 1,284,329 | 30,320,847 | 44.78 |
| National | 91,335 | 56,909 | 58.36 | 220,591 | 49,108 | 351,781 | 6,429,997 | 57.76 |
| Northeast | 59,225 | 11,860 | 57.71 | 9,216 | 20,172 | 30,740 | 1,135,874 | 54.16 |
| Northwest | 124,491 | 86,148 | 68.24 | 370,315 | 262,917 | 735,573 | 9,812,602 | 59.06 |
| Trans World | 382,841 | 311,555 | 69.66 | 927,127 | 897,208 | 2,176,530 | 33,857,680 | 63.21 |
| United | 589,469 | 423,475 | 71.75 | 2,110,916 | 1,195,359 | 5,008,631 | 49,049,318 | 62.65 |
| Western | 103,616 | 52,634 | 63.57 | 211,389 | 83,868 | 170,993 | 5,499,635 | 56.05 |
| **INTERNATIONAL** | | | | | | | | |
| American | 12,926 | 9,079 | 65.07 | 12,338 | 602 | 305,070 | 1,254,750 | 65.58 |
| Braniff | 2,640 | 6,092 | 53.14 | 18,877 | ..... | 56,520 | 773,451 | 56.49 |
| Caribbean Atlantic | 11,433 | 782 | 54.08 | 1,032 | ..... | 8,507 | 79,258 | 52.63 |
| Delta | 4,649 | 5,716 | 63.17 | 6,410 | ..... | 39,252 | 643,780 | 50.99 |
| Eastern | 22,181 | 29,551 | 64.30 | 60,609 | ..... | 80,356 | 3,279,055 | 56.39 |
| National | 6,850 | 3,689 | 38.39 | 7,602 | 3,838 | 33,741 | 420,750 | 39.97 |
| Northwest | 10,839 | 24,515 | 69.97 | 822,502 | 18,763 | 823,088 | 4,353,124 | 76.22 |
| Pan American | | | | | | | | |
| Alaska | 9,486 | 10,429 | 71.56 | 46,700 | ..... | 404,211 | 1,531,532 | 62.26 |
| Atlantic | 107,092 | 143,247 | 67.12 | 944,071 | ..... | 2,229,962 | 18,051,193 | 63.91 |
| Pacific | 26,731 | 80,001 | 75.58 | 942,089 | ..... | 1,284,012 | 10,493,380 | 70.91 |
| Latin America | 94,445 | 96,730 | 66.12 | 319,334 | ..... | 3,242,588 | 12,772,590 | 63.19 |
| Panagra | 12,284 | 14,446 | 61.55 | 52,919 | ..... | 280,108 | 1,888,849 | 59.66 |
| Trans World | 31,154 | 83,551 | 70.75 | 687,016 | ..... | 831,933 | 10,228,279 | 73.31 |
| United | 12,065 | 29,985 | 84.40 | 91,945 | ..... | 59,158 | 3,211,918 | 77.34 |
| **LOCAL SERVICE** | | | | | | | | |
| Allegheny | 39,274 | 6,532 | 46.36 | 6,712 | 20,529 | 9,800 | 660,550 | 47.67 |
| Bonanza | 10,652 | 2,349 | 44.31 | 3,399 | 2,791 | 8,005 | 238,051 | 43.09 |
| Central | 9,200 | 1,874 | 37.94 | 3,587 | 3,038 | 5,932 | 191,819 | 33.97 |
| Frontier | 18,427 | 4,770 | 51.42 | 15,174 | 8,537 | 56,902 | 630,227 | 63.17 |
| Lake Central | 13,003 | 2,077 | 48.92 | 2,424 | 16,118 | ..... | 206,638 | 42.68 |
| Mohawk | 33,072 | 5,795 | 50.04 | 5,457 | 10,162 | 12,599 | 586,928 | 50.16 |
| North Central | 54,483 | 8,854 | 56.07 | 17,828 | 35,633 | ..... | 899,022 | 50.33 |
| Ozark | 30,471 | 4,701 | 41.04 | 10,154 | 20,907 | 13,006 | 484,032 | 42.85 |
| Piedmont | 35,982 | 6,754 | 54.73 | 13,080 | 16,453 | 13,471 | 690,154 | 54.89 |
| Southern | 15,912 | 2,797 | 43.99 | 7,820 | 17,403 | ..... | 293,103 | 42.55 |
| Southwest | 29,533 | 6,080 | 56.39 | 7,567 | 4,616 | 7,860 | 598,787 | 54.26 |
| Trans Texas | 20,109 | 4,573 | 41.05 | 11,924 | 8,948 | 23,634 | 480,478 | 38.08 |
| West Coast | 20,037 | 3,576 | 48.08 | 3,058 | 2,234 | 5,502 | 334,266 | 47.88 |
| **HAWAIIAN** | | | | | | | | |
| Hawaiian | 35,281 | 4,807 | 56.35 | 3,752 | ..... | 106,600 | 533,216 | 55.30 |
| Trans Pacific | 19,917 | 2,487 | 57.21 | 701 | ..... | 13,002 | 205,446 | 55.49 |
| **CARGO LINES** | | | | | | | | |
| Aerovias Sud Americana | ..... | ..... | ..... | ..... | ..... | 556,985 | 556,985 | 69.01 |
| Flying Tiger | 6,155 | 23,237 | 99.53 | 31,188 | 48,351 | 6,369,005 | 8,772,296 | 83.35 |
| Slick | 5,414 | 25,514 | 93.89 | 65,838 | 74,375 | 5,001,756 | 7,693,408 | 79.87 |
| Riddle* | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Seaboard & Western | 2,256 | 7,038 | 100.00 | ..... | ..... | 2,221,567 | 2,925,434 | 85.24 |
| **HELICOPTER** | | | | | | | | |
| New York Airways | 3,894 | 73 | 58.87 | 972 | 1,351 | 621 | 9,779 | 64.11 |
| Los Angeles Airways | 2,123 | 81 | 52.25 | 3,918 | 1,780 | ..... | 13,262 | 55.30 |
| Chicago Helicopter | ..... | ..... | ..... | 2,403 | ..... | ..... | 2,403 | 43.78 |
| **ALASKA** | | | | | | | | |
| Alaska Airlines | 6,497 | 1,779 | 53.38 | 29,484 | ..... | 280,359 | 509,222 | 53.37 |
| Alaska Coast | 5,472 | 484 | 67.60 | 4,457 | ..... | 4,238 | 58,153 | 68.81 |
| Cordova | 2,336 | 417 | 62.33 | 5,021 | ..... | 347,787 | 395,249 | 51.00 |
| Ellis Air Lines | 7,681 | 396 | 56.97 | 2,152 | ..... | 3,067 | 45,421 | 65.65 |
| Northern Consolidated | 2,586 | 774 | 53.60 | 21,210 | 280 | 299,647 | 406,609 | 80.67 |
| Pacific Northern | 11,609 | 9,173 | 51.69 | 74,786 | ..... | 317,310 | 1,383,458 | 64.92 |
| Reeve Aleutian | 940 | 476 | 68.99 | 12,725 | ..... | 42,882 | 106,471 | 75.23 |
| Wien Alaska | 3,610 | 1,489 | 17.68 | 27,774 | ..... | 942,627 | 1,124,285 | 91.62 |

*Not available.

Compiled by AVIATION WEEK from airline reports to the Civil Aeronautics Board.

# How fast tomorrow?

MAN HAS TRAVELED over 1,900 mph. Already there's talk about 4,000 mph. Tomorrow it may be 10,000 mph. Is there a limit to the speed of tomorrow's aircraft . . . or even today's?

There may be. One of the many factors which will define this limit is steel.

No presently available steel or any other material meets all the requirements for strength, corrosion resistance, fabricability and producibility. The strongest steels, in general, are the most difficult to fabricate. The most corrosion-resistant steels require the most critical alloying elements—elements that quickly become scarce in an emergency.

All the problems, all the possible solutions, have been studied for several years by United States Steel, with the cooperation of various airframe manufacturers. Intensive research continues on those steels that give the greatest promise of providing *optimum service* for *all* the diversified requirements of today's and tomorrow's aircraft.

You will find more detailed information on this problem and its solution in our new booklet, "Special Steels for the Aircraft of Tomorrow." Send for a free copy.

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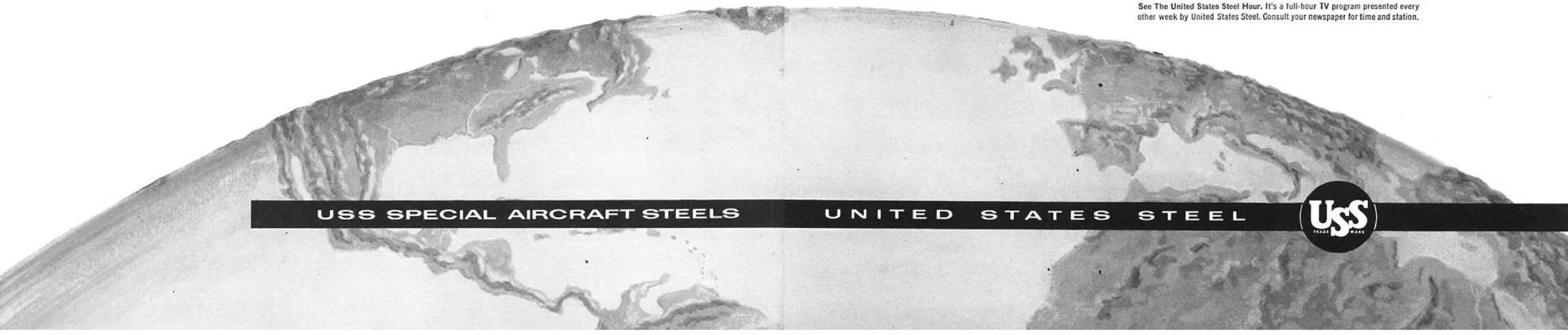
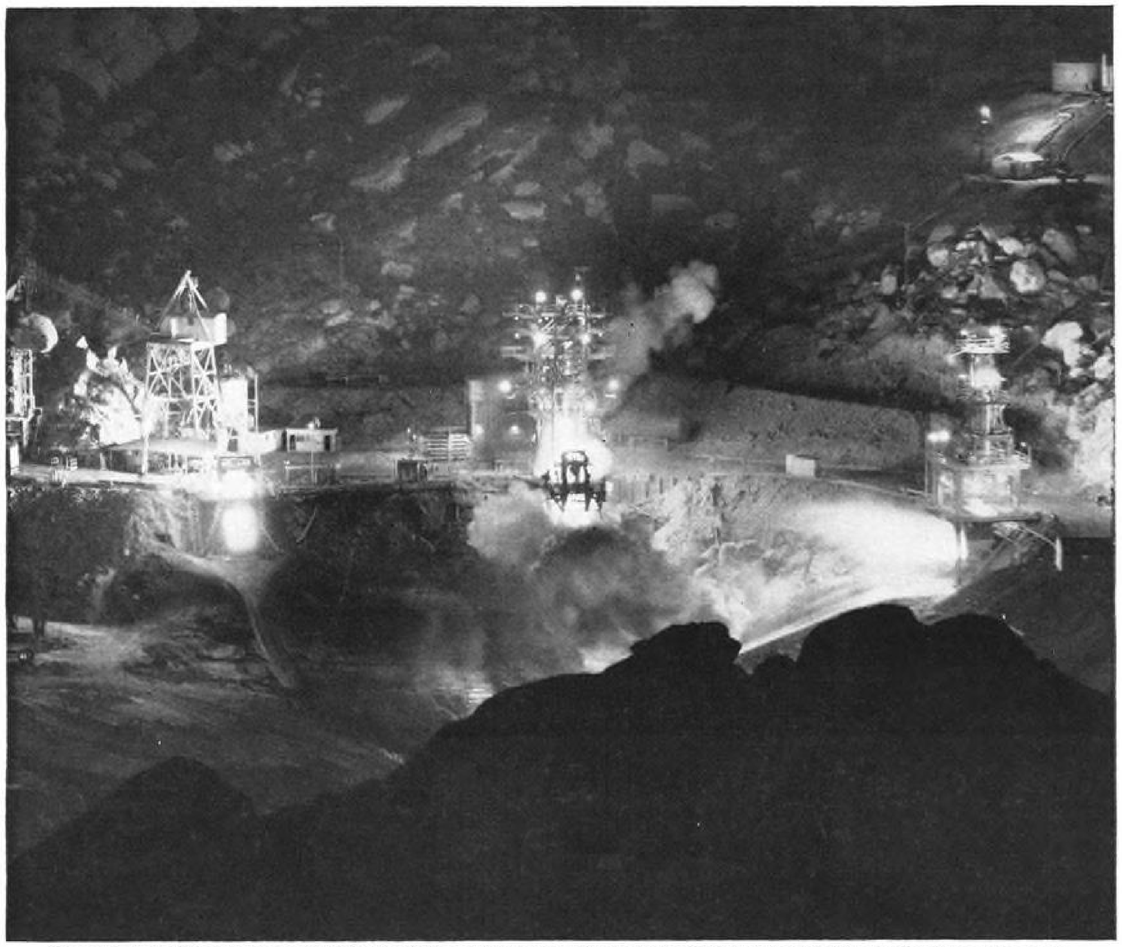


USS SPECIAL AIRCRAFT STEELS

UNITED STATES STEEL

USS

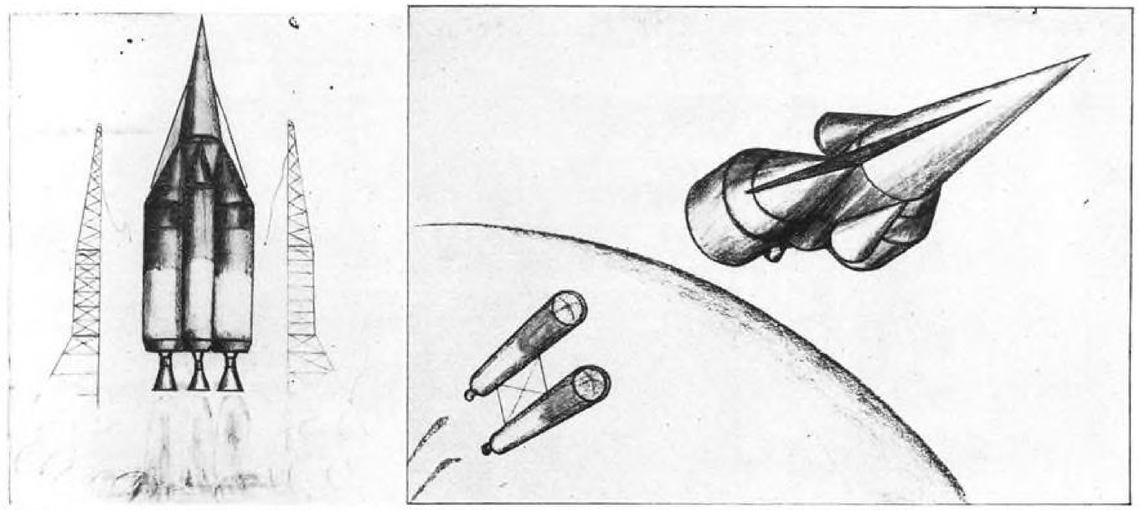


Dawn-to-dark firing tests speed delivery of the mighty power plants that will thrust America's missiles into outer space.

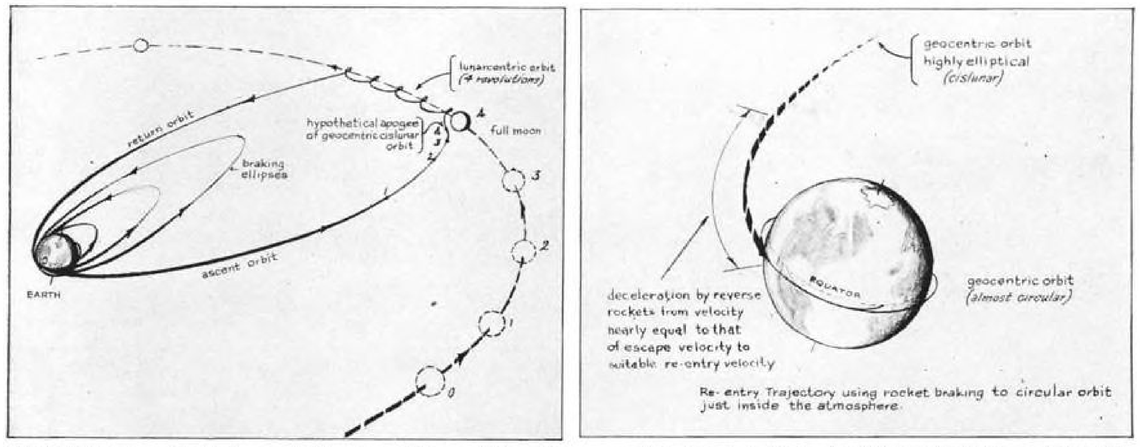








**LUNAR** probe vehicle (left) uses liquid oxygen, alcohol in first two cluster type stage pairs. Third stage (right), atomic rocket with liquid hydrogen as working fluid, separates after 500 sec. boost. Aft pods store hydrogen, act as drag brakes in re-entry.




**NUMBERS** in lunar flight diagram (left) show relative positions of moon, vehicle. No. 1 is 25 hr., 2 is 50 hr., 3 is 75 hr. and 4 is 110 hr. Braking ellipses are used for re-entry. Powered braking return is shown in diagram at right.

# Company Formed to Study Space Design

By Irving Stone

Sherman Oaks, Calif.—Believing that now is the time to lay the groundwork for space travel, a group of scientists and engineers have initiated studies to establish feasibility of the various approaches.

Their company, Systems Laboratories Corp., was formed for preliminary design of basic systems for interplanetary travel.

Bolstering its initial studies, the company is establishing an immediate practical framework for its long-range aims by participating in existing advanced out-of-atmosphere missile projects.

Formed a little more than half a year ago, SLC is still a small company, selecting its professional staff with great care and including recognized authorities in such fields as trajectories and orbits, radar, electro-magnetic theory, dynamics, guidance and control, servomechanisms, materials, and nuclear engineering, physics.

## Staff Breakdown

SLC now has 44 employes. There are 18 full-time engineers and scientists, an additional 6 employed part time, and 11 consultants, some of whom are scheduled to become full-time staff members.

The total includes 17 PhDs.

In effect, SLC is a closed corporation—its stock is not offered for public sale. All professional personnel associated with the company have invested in it, although this is not a requirement.

Founders are Dr. John L. Barnes; Richard H. De Lano, one of the coholders of the Falcon missile patent, and Dr. James A. Marsh, who was head

**TWO OF THE** founders of Systems Laboratories Corp., are Dr. John L. Barnes (left), president of the company, and Richard H. De Lano, secretary. Company was formed to create preliminary design of basic systems for interplanetary travel. Dr. Barnes is manipulating simple orrery, which demonstrates revolution of planets around sun.

of the radar group at North American Aviation's Downey plant.

Barnes, who is president, has had 27 years of professional experience. He is still professor of engineering at University of California, Los Angeles. During five years at North American Aviation he was chief of the Aerophysics Laboratory Guidance Section and associate director of the Electro-Mechanical Engineering Dept. Barnes also did consulting work for Ramo-Wooldridge Corp. on the intercontinental ballistic missile program. He was associated with Lockheed's Missile Systems Division for a short time, then became affiliated with Systems Research Corp. when that company was formed by former Lockheed personnel. Systems Research was taken over by Ford Motor Co. as Aeronutronic Systems, Inc., but Barnes chose not to go along, forming SLC with De Lano and Marsh.

### Merger Offers

In its relatively short existence, SLC already has had a number of offers to be absorbed by large companies, but isn't considering merger or other affiliation at this time, preferring to remain independent.

SLC has subcontracts in the field of missile systems from Republic Aviation Corp. These subcontracts encompass feasibility studies and study of various subsystems. Included are aspects of propulsion, navigation, control, and space dynamics (concerned with trajectories of vehicles outside the atmosphere—beyond 600 mi.).

The company also has subcontracts from two other large organizations and this work covers categories similar to those under the Republic subcontracts.

### Other Contracts

A number of other study contracts, also concerned with out-of-atmosphere vehicles, are being negotiated with industry companies.

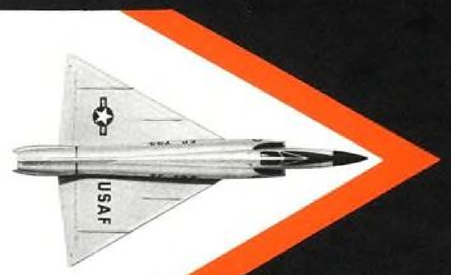
Emphasis of SLC's work under its subcontracts is on the scientific problems which must be solved before advanced engineering can be accomplished. These problems are associated with projected missile systems of a conceptual and scientific status far beyond that which exists today. Some of these systems apply to vehicles which are projected to operate beyond the atmosphere for extended periods of time.

Income from this subcontract work is what SLC lives on, bolstering its economic status to permit the expansion the company contemplates.

More important, this work is considered a key factor in advancing the company's fundamental aim—preliminary design of basic systems for interplanetary travel.

Meanwhile, SLC is devoting a good portion of its talent to the investigation of problems foreseen as associated with space travel of the near future, particularly to the nearest space body, the moon.

Barnes believes that within the next 15 years, if enough research and development support is available, a




# KAISER ALUMINUM BUYS ERIE FORGING PLANT ...PLANS $5 MILLION EXPANSION!

At Kaiser Aluminum we're planning big things for aluminum forgings . . . and we've just spent almost $3 million to prove it!

By buying our formerly leased forging plant at Erie, Pennsylvania, we have paved the way for a $5 million expansion program that will increase the plant's annual capacity by more than 6 million pounds and broaden the range of forgings.

In addition to the 31 pieces of forging equipment of various capacities at Kaiser Aluminum's Erie plant, two new hydraulic presses with capacities of 750 and 1500 tons have been installed and are already in operation.

Three more hydraulic presses with capacities of 3000, 5000 and 8000 tons will be in operation by December of 1957. New buildings and supporting equipment are also planned.

***What This Expansion Means to You***

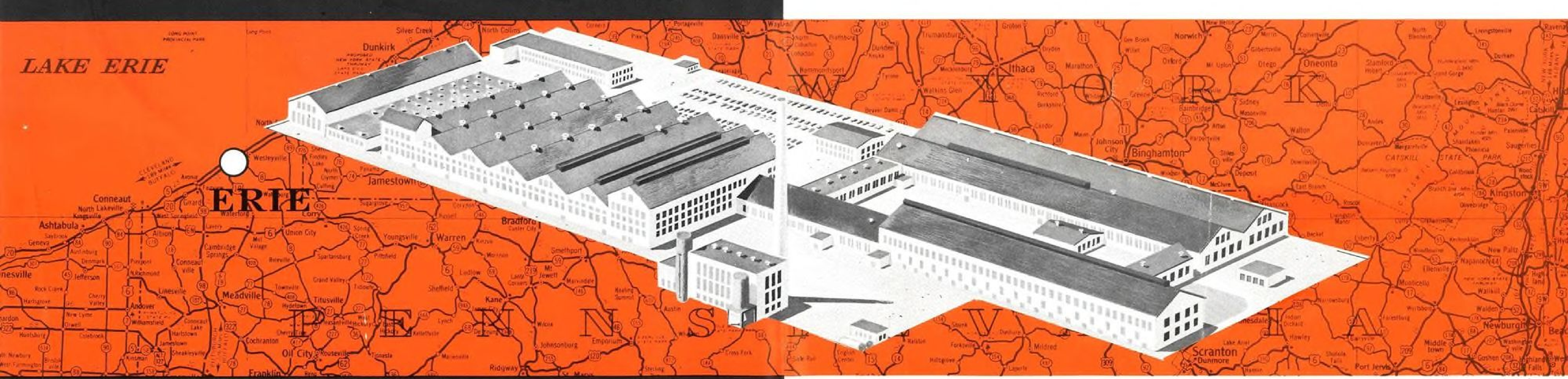
Now Kaiser Aluminum can offer you larger, more complex aluminum forgings . . . made to even closer tolerances.

And with these new production facilities, Kaiser Aluminum can assure you of a larger supply of quality no-draft and standard aluminum forgings to meet your increased needs.

When you specify Kaiser Aluminum's forgings you have the assurance that they are backed up by the most modern die producing equipment, heat treating equipment and testing laboratories in existence.

The full resources of Kaiser Aluminum's Erie plant—a balanced combination of engineering skill, forging know-how and a wide range of modern equipment—are yours to draw upon.

For complete information, contact any Kaiser Aluminum sales office listed in your telephone directory. Kaiser Aluminum & Chemical Sales, Inc., General Sales Office, Palmolive Bldg., Chicago 11, Illinois; Executive Office, Kaiser Bldg., Oakland 12, California.

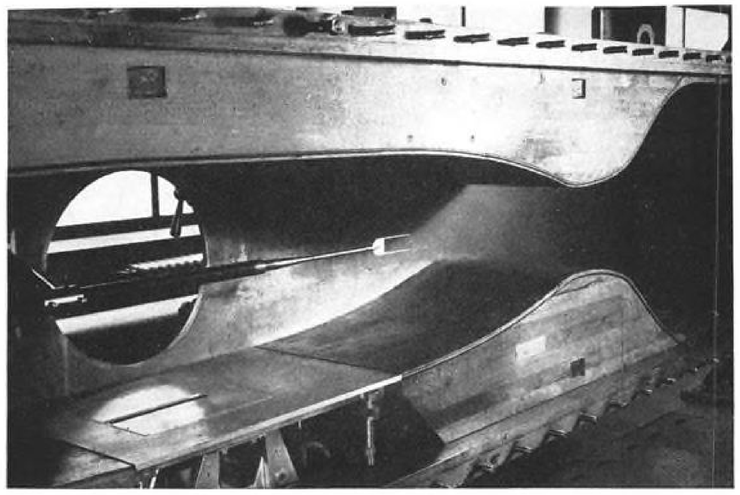



# Kaiser Aluminum

***setting the pace—in growth, quality and service***

Located on a 57-acre site, the Erie plant presently has nine buildings covering 328,000 square feet. Die forgings up to 200 pounds in weight and hand forgings up to 2000 pounds may be produced with present equipment.

Kaiser Aluminum began operations at this plant in 1954 on a lease basis. Purchase and expansion of the Erie plan is part of Kaiser Aluminum's broad overall expansion program to better serve users of aluminum everywhere.



## NATO Wind Tunnel

Supersonic 16 × 16-in. wind tunnel is one of the facilities at the new Training Center for Experimental Aerodynamics, a joint Belgian-U.S. project at Rhode St. Genese, Belgium. (AW Oct. 22, p. 66). Tunnel is capable of speeds up to Mach 2.3.

manned space vehicle can circle the moon and return to earth safely. He believes that within the next 5 to 10 years vehicles carrying instruments only will make the lunar trip.

SLC sees its field of study to be vital because, first, space travel will be a natural development of continued aeronautical progress, and, secondly, accomplishment of space travel will be accelerated to provide data on global weather phenomena, composition of cosmic radiation outside the atmosphere, amount of cosmic material traveling through space, and observation of astronomical bodies without obscuration and distortion by the earth's atmosphere.

### Data Comparison

SLC's scientists and engineers are accumulating data (including experimental data which has been obtained with sounding rockets), comparing it with existing theories, and formulating improved theory, as indicated, to fit the data.

This general approach is directed to anticipated difficulties associated with interplanetary vehicles in such areas as:

- **Propulsion.**
- **Communication.**
- **Navigation.**
- **Bio-psychological environment.**
- **Interaction between subsystems.**
- **Atmospheric re-entry.**

Barnes believes that the satellite refueling stations which have been widely proposed for travel to the moon will be avoided through the use of nuclear fission rocket propulsion, which probably will be superseded by a nuclear fusion (controlled thermonuclear reaction) rocket engine. The fusion engine will use more available ingredients (deuterium and tritium) and will not be radioactive per se.

The fission engine will be a practical engineering reality for instrumented vehicle application within five years, Barnes believes. The nuclear fusion rocket engine will be developed to the stage of being feasible in that same period, he feels.

With either of these engines, extended travel, as to a distant planet, will introduce the problem of carrying an adequate supply of thrust material. Attempting to contribute to the development of these rocket powerplants, SLC is formulating design criteria for the use of hydrogen or helium as the thrust-generating medium, with the reactor supplying the heat for accelerating the gas particles through an exit nozzle.

### Thrust Augmentation

Another phase of this study is to determine whether it is feasible to augment the thermally generated thrust by increasing the ionization of the gas to add an electrically generated thrust, using extension of the principles used in laboratory linear accelerators. Big job here will be to spread the accelerating force over the cross-section of the mass of gas, if thrust is to be increased measurably.

With the nuclear fusion engine, the big problem will be to create a "container" for the small artificial sun created by the fusion of deuterium and tritium atoms. SLC is formulating theory to provide a practical answer for

the control and containment of the reacting materials. One approach it contemplates is to create a container in the form of an "electro-magnetic bottle" as suggested by Dr. Edward Teller of the University of California, Berkeley.

A proposed configuration for an initial lunar vehicle would use the nuclear fission rocket engine in a central body, surrounded by two pairs of boosters using chemical rockets for boost through the earth's atmosphere. Trajectory control would be through gimballing the main rockets and through auxiliary jets.

Difficulties are foreseen in transmission of radio (including radar) waves through ionized gases which will be encountered in the upper atmosphere. This ionized state will be caused by solar radiation, supersonic or hypersonic shock waves and boundary layer conditions, and by rocket exhaust.

Outside the atmosphere, ionization will still be present in the rocket exhaust, and transmission through this gas will pose problems.

SLC is investigating the optimum frequencies for transmission through ionized gases and exploring the design of missile antennas for most efficient transmission and reception.

Another possibility being considered is to use the ionized boundary layer as an antenna.

This approach may prove feasible because of the conductivity of the ionized gas.

### Uncharging Ions

Ionization in the exhaust from a chemical rocket engine might be reduced by the use of additives in the propellants. These additives would facilitate the recombination of ions into uncharged atoms.

Exhaust from a nuclear fission rocket engine could be especially troublesome if the thrust material (hydrogen or helium) becomes radioactive as it is heated in the reactor. One scheme being advanced by SLC is to isolate the thrust gas from the radiation of the reactor by using, for example, liquid sodium to transfer reactor heat to the gas.

For long out-of-atmosphere trips, such as to the moon, inertial navigation, almost certain to be used, will require correction of gyro drift, Barnes declares. SLC is considering various methods for accomplishing this correction. One is through observation of the relative position of the sun (or other stars), earth or moon. This observation would be done automatically by photo-electric equipment, using infra-red visual and ultra-violet radiation frequencies.

Another method, which might be used to supplement this procedure, is to follow the vehicle by radar from the earth and communicate this position to the vehicle. This would involve the design of an extremely long-range radar with a sufficiently narrow beam with enough energy to excite a radio beacon in the space vehicle to return a pulse to earth for determination of distance and direction of the vehicle (AW Sept. 3, p. 82).

### Human Factors

Approaches to overcome some of the biological and psychological problems arising from the environment of space travel are being planned by SLC scientists. One scheme tagged for study is the introduction of an artificial force field to compensate for the absence of gravity. One possibility is the use of centrifugal force which could be introduced by rotating the passenger cabin within the vehicle. This, for example, would permit the passenger to swallow food and would prevent mental disorientation.

For protection of personnel from solar radiation, SLC is contemplating the design of optical filters.

For protection from cosmic radiation and impact from small meteoric particles, SLC scientists are beginning to think about materials which would be feasible for vehicle skin and personnel shield as well. This would afford minimum mass and design simplicity.

SLC system philosophy is to avoid optimum design of individual subsystems without regard to relation to other subsystems. Present studies are attempting to find best distribution of the total allowable mass among the various subsystems. Aim of this general study is to achieve an economic gross weight.

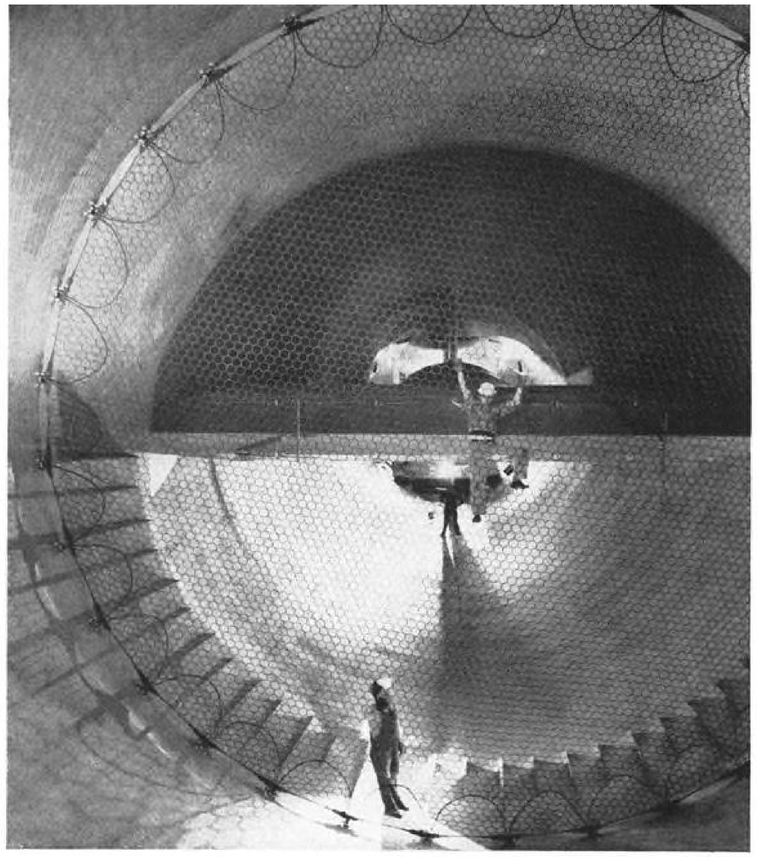
### Heat Problems

Studies also are being projected to determine optimum location of subsystems to minimize interaction effects of solar and internally generated heat, as well as effects of nuclear radiation from the fission reactor section of the rocket powerplant.

Though re-entry into the earth's atmosphere will be the homestretch of the space trip, Barnes sees it as one of the toughest phases to complete.

SLC scientists are now considering various methods for overcoming the heating problem of re-entry. One method which now appears reasonably feasible and which is projected for detailed calculations is the trajectory of a gradually tightening spiral approach wherein the earth is circled in the thin upper atmosphere to achieve the slowdown required for passing through the lower, denser air.

Also playing an important part in the re-entry phase will be determination of thermal-aerodynamic and ionization behavior of hypersonic flow in a "tapered"



**Transonic Safety Net**

Heavy duty screen is downstream of test section in Arnold Engineering Development Center transonic wind tunnel. Purpose of net is to catch possible flying debris before damaging 225-ton whirling compressor. Net is made up of thousands of strands of steel cable designed to absorb as much as 200,000 ft./lb. of kinetic energy.

(thin-to-dense) atmosphere for the purpose of establishing the optimum shape of the vehicle. SLC scientists contemplate that improved hypersonic flow theories will be required to fit the experimental data currently being generated.

This will take into account ionization effects on amount of heat being generated and will permit better predictions on point of transition from laminar to turbulent flow.

Other methods of re-entry slowdown projected for theoretical study at SLC include use of air brakes, jet brakes, and a combination of these.

## Computer Can Shorten Data Reduction Work

New electrically driven analog computer performs harmonic analysis and curve fitting and can be used by relatively inexperienced operators. It is manufactured by Gerber Scientific Instrument Co. and is being marketed for $1,350.

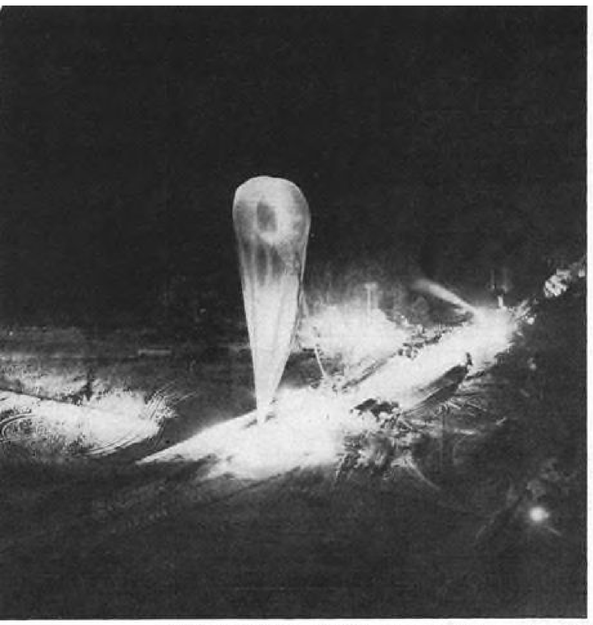
The unit will analyze a curve in terms of a Fourier series, a power series or an orthogonal polynominal and produce a slope equation or an integral equation of the curve.

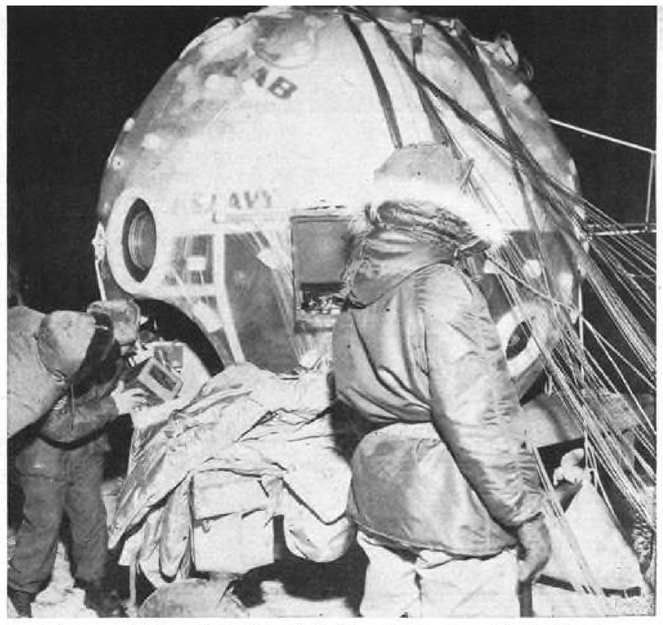
The answers are recorded on a program sheet specifically designed for each type of analysis.

Fourier coefficients can be determined for 48 constants. Power series coefficients can be determined to the eighth power. Least square equations for curves fitting arbitrary test points can be obtained to the fifth power and up to 50 equally spaced points.

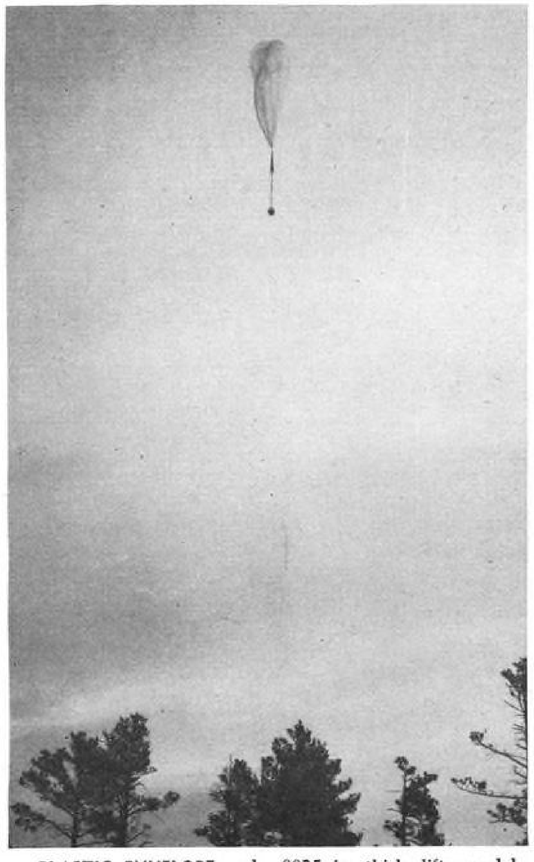
The equameter can fit power series equations to curves or test points for use in automatic digital computers without expensive analog to digital converters and considerable amounts of engineering time.

An engineering aide equipped with an equameter can free an engineer from data reduction work and reduce the time required for the operation. He can perform a twelve term Fourier analyses in less than ten minutes and get a fourth power fit on a recorded or plotted curve in approximately the same time.





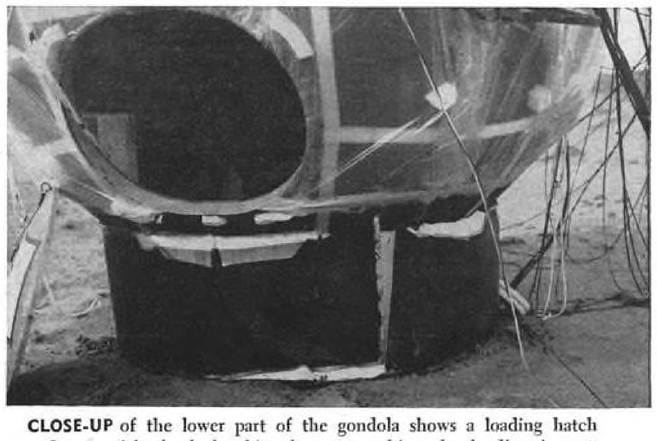
**INFLATING** the 128 ft. diameter balloon in pre-dawn darkness an hour before take off (left) at Stratosphere Bowl, N. D. Ground crew (right) loads the spherical gondola with special apparatus. Gondola appears to be covered with plastic.



**PLASTIC ENVELOPE,** only .0025 in. thick, lifts gondola. Note parachute.

# Balloon Reaches 76,000 ft.

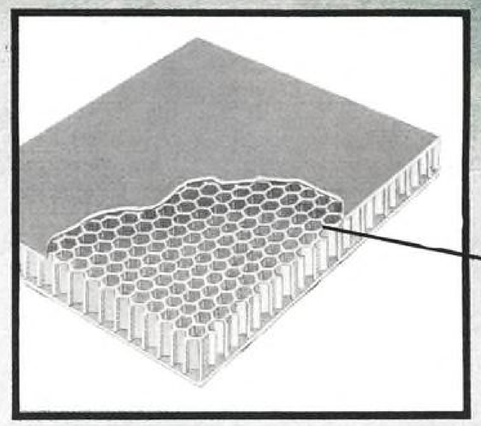
New, manned balloon altitude record of 76,000 ft. was set by Lt. Cmdrs. M. D. Ross and M. L. Lewis on Nov. 6. (Old record of 72,394 ft. was made in 1935.) Plastic envelope had a capacity of 803,000 cu. ft. of helium. Total weight lifted was 2,150 lb. of which balloon, lines and parachute weighed 705 lb.; crew and personal gear 380 lb.; gondola and fittings 500 lb.; equipment and supplies 256 lb., and ballast, 300 lb. Flight took off at 6:19 a.m. and landed at 10:23 a.m. for a duration of 4:04 hr. Balloon made a rapid descent because of a malfunctioning automatic helium valve which was designed to remove the balloon's free lift. In spite of the sudden drop, the balloonists suffered no injuries and the gondola remained intact. The Office of Naval Research, which sponsored the flight, has not revealed what high altitude data was collected as a result of the flight, nor when and if another will be attempted soon.

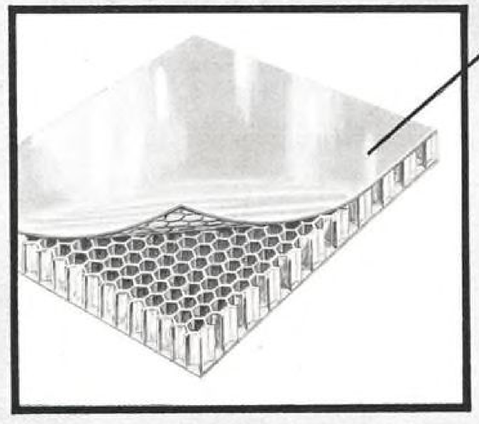


**CLOSE-UP** of the lower part of the gondola shows a loading hatch and a special, shock-absorbing base to cushion the landing impact. Base was built like a cargo drop platform.

# Brunswick ... your prime source for aircraft sub-assemblies

Advanced techniques and facilities in the areas of reinforced plastics, metal honeycomb and conventional metalwork have made Brunswick a prime supplier to the nation's leading airframe manufacturers. One important new addition to the defense air arm combines *all three* types of construction in one single component manufactured by Brunswick.





**REINFORCED PLASTICS**

In the field of reinforced plastics, Brunswick continues to offer experience and facilities involving the broadest range of materials and applications. Honeycomb core, foamed in place, solid laminate and anti-icing fabrications of virtually all sizes are currently in service and in quantity production.

**METAL HONEYCOMB FABRICATIONS**

Brunswick is skilled in manufacturing techniques that make possible the fabrication of metal honeycomb components calling for exceptionally close tolerances and compound curvatures. The result: metal honeycomb is now being used in a wider and wider range of components such as engine nacelles, bomb bay doors, nose wheel doors, trailing edges and control surfaces, numerous internal and external structures.

## Exclusive agreement adds facilities of

## Technical Research Group

This combination of the skills of T.R.G. and Brunswick places at your disposal the most advanced techniques in design, development and production of radomes and low frequency antenna housings. Technical Research Group is a senior scientific organization providing design, development and research services to industry and the government in the fields of mathematics, physics and chemistry. It has earned its initial reputation in the development and study of electromagnetic theory, radar systems and components, and nuclear reactors and reactor shielding.

**CONVENTIONAL AIRCRAFT METALWORK**

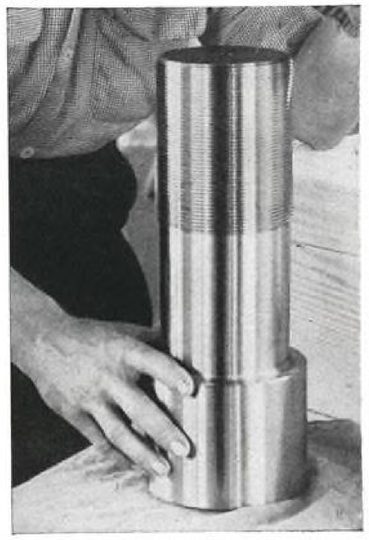
Brunswick continues to supply the industry with such components as pressurized windshield and canopy assemblies, major radar assemblies and ailerons and flaps. Whatever the problem, whatever the materials . . . a discussion with Brunswick could prove valuable to you.

**THE BRUNSWICK-BALKE-COLLENDER CO.**

623 South Wabash Avenue, Chicago 5, Illinois

## PRODUCTION BRIEFING

**Cleveland Cap Screw Co.**, Cleveland, Ohio, is making 50 4½ in. diameter screws for the nozzle assembly of the supersonic propulsion wind tunnel at Arnold Engineering Development Center, Tullahoma, Tenn. The cost will be about $6,000. Made of AISI 4140 (high-carbon chrome molybdenum steel), the heads and shanks are machined and the threads formed on a centerless grinder. Following heat treatment to a Rockwell C hardness of 38-42, they are ground to a super fine 32 micro inch finish on cylindrical grinders, and silver plated over a nickel undercoat. Screw shown weighs 80 lb.

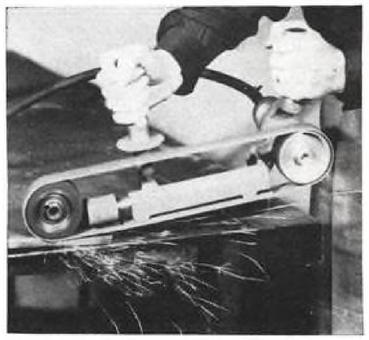


**Kaiser Aluminum & Chemical Corp.**, Oakland, Calif., will add extensive facilities for the production of aluminum plate to the sheet and foil rolling mill now under construction at Ravenswood, W. Va. What Kaiser calls "the world's largest stretcher" will be used to stress relieve aluminum plate up to six inches thick.

**L. A. Young Spring and Wire Corp.**, Detroit, Mich., acquired the assets of Extruded Hinge Co., Ypsilanti, Mich., for $600,000.

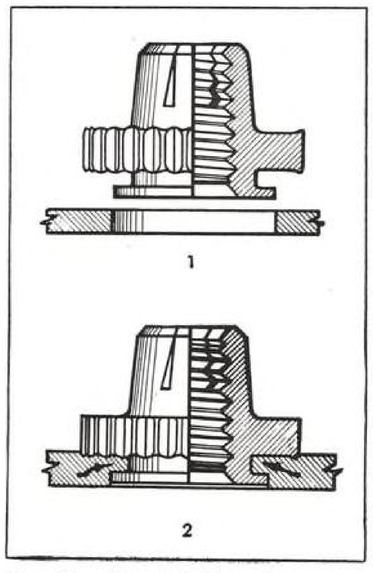
**All-State Welding Alloys Co.**, White Plains, N. Y., has developed a line of alloys and fluxes which make it feasible to weld aluminum to steel, stainless steel, monel, nickel, copper, brass.

**Weatherhead Co.**, Cleveland, Ohio, organized a new corporation to acquire the assets of Eastern Aircraft Products Corp. and Eastern Precision Parts Co., Orange, N.J. The name and operations of the Eastern companies, which make self-sealing quick disconnects, breakaway couplings, valves and electro-mechanical devices, will be continued.



**Grinding & Polishing Machinery Corp.**, Indianapolis 5, Ind. has an improved version of a portable abrasive belt hand tool. Model 3-36 weighs 6¾ lbs. and is air driven at 4,700 sfpm.

**Part of the Air Force's** heavy press program, an 8,000-ton extrusion press is now in full production at Harvey Aluminum, Torrance, Calif. A companion 12,000-ton press is nearing completion. Advantage of extrusion presses is that dies for complicated cross sections can be made easily for new designs. Thus built up sections of angles, etc., can be replaced by efficient, specially-shaped spars with cross-sections tailored to the design.




**New Press-Nut** is held in sheet metal by cold flowing of the parent metal upon assembly impact. Designed to meet government specifications, the self-locking nut is made by Rosan, Inc., Newport Beach, Calif.

**RAMJET NOZZLE LINER** (left) and ramjet nozzle housing (upper and lower right) are two Curtiss-Wright subcontractor-made parts which match in size and placement of attachment fittings. They probably are for the North American Navaho missile. The 48-in. diameter ramjet on which these would be used would have a thrust of 30,000-40,000 lb.

# Subcontractors Build Navaho-Size Nozzle

By Robert Cushman

Two Curtiss-Wright ramjet parts remarkable for their large size and sophistication are in limited production, probably for the Navaho missile. Most declassified ramjet hardware to date has been "boiler-plate" for wind tunnel research.

One of the parts, a ramjet nozzle liner is being made in small monthly quantities by T. R. Finn Co., Hawthorne, N. J. A nozzle housing is being made in similar small quantities by Lycoming Division, Avco Corp., Stratford, Conn.

The large size of these parts—the Lycoming nozzle is 48 in. diameter and 45 in. long—indicate that a ramjet using these parts could have a net thrust on the order of 30,000 to 40,000 lb. at Mach 2 or 3 at 50,000 to 70,000 ft. Navaho has two Curtiss-Wright ramjets and therefore total thrust would be in the vicinity of 60,000 to 80,000 lb. (AW Nov. 19, p. 23).

That the two parts are related is indicated not only by the dimensions of the Finn liner, which could fit nicely inside the Lycoming nozzle, but the 30 attachment clips on the liner match the 30 fastening devices inside the Lycoming part. Space between the parts would be used for cooling fluid.

### Fabrication Details

Both are made of Inconel. The liner is made by a proprietary Finn process which uses a series of specially designed rolls to cold form the metal sheets. Basis of the process's success, the inventor, Charles Brunstetter, said, is that certain dimensions are shrunk stretching others. This prevents the uncontrollable "growth" of the part that occurs during most competitive methods of forming.

The eight (since reduced to two) sections so formed are heliarc welded together. The final weld (shown held by clamps) would probably not be made until the liner has been fitted inside the nozzle. The corrugations are for rigidity and thermal expansion.

Finn said that its proprietary method, called "shrink-stretching," is much faster (one-tenth the time) and cheaper (one-fifth the cost) than spinning.

The Lycoming nozzle assembly which would bolt to the aft end of the ramjet's combustion section, is made from a number of spun rings welded together. Lycoming says that it is the largest diameter sheet metal component ever produced for an aircraft engine. Because of Inconel machining difficulties, Lycoming uses a high speed tool with very light cuts and low surface speed. The thin .05 in. flanges must be supported by a cerrotru interior filling for the final truing up of the complete weld.

### Low-Alloy Metal

Cerrotru is a low-alloy metal which can be melted out with boiling water after machining is finished.

Finn shrink-stretch process, Brunstetter said, is good for forming accurate compound contour sheet metal parts from ⅜ in. thick down to .005 in. thick. He said it is almost the only way of forming certain aircraft parts out of the high temperature super-alloys such as Inconel-X, Inconel-W, N-155, the Hatelloys and Uniloys.

# WHAT'S NEW

## Reports Available

• **Theory and Design of Servomechanisms**—by J. C. Gille, M. Pelegrin and P. Decauline-Pub. by Dunod, 92 Rue Bonaparte, Paris 6e, France. $28.90 including postage; 700 pp. The book is directed at servo engineers and designers, principally in the aeronautical field. It includes a section dealing with the philosophy of Cybernetics. The five sections of the book are labeled: Linear Dynamics, Linear Servosystems, Nonlinear Servosystems, Servocomponent Design, and Servosynthesis.

• **A Metallurgical Study of Molybdenum** (PB 111753)—by S. L. Case—Prepared by Battelle Memorial Institute for the Office of Naval Research, and available from OTS, U. S. Department of Commerce, Washington 25, D. C. $2.75; 107pp.

In this report, results of a five-year study of the metallurgy of molybdenum are summarized, evaluated and interpreted.

• **Hydrogen Embrittlement and Static Fatigue in High Strength Steel** (PB 121064)—by R. D. Johnson, H. H. Johnson, W. J. Barnett and A. R. Troiano—Prepared by Case University of Technology for Wright Air Development Center, and available from OTS, U. S. Department of Commerce, Washington 25, D. C. $1.25; 41pp.

In this report, previous investigations into delayed failure and hydrogen embrittlement in high strength steel under commercial electroplating conditions were extended and the results correlated.

• **Onset of Fast Crack Propagation in High Strength Steel and Aluminum Alloys** (PB 121224)—by G. R. Irwin—Prepared by Naval Research Laboratory, and available from OTS, U. S. Department of Commerce, Washington 25, D. C. $.50; 16pp.

In the study, force tendency, a concept of driving force per unit crack front, was applied to fracturing in metals and the results are shown.

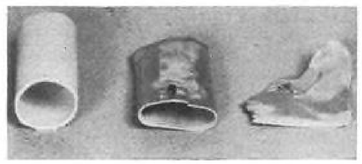
• **Thermal-Shock Investigation** (PB 121109)—by T. A. Hunter, L. L. Thomas, and A. R. Bobrowsky—Prepared by the University of Michigan for Wright Air Development Center, and available from OTS, U. S. Department of Commerce, Washington 25, D. C. $2.75; 106pp.

Results of a three-year study of the relative resistance of 14 metals to thermal shocking from the temperature range of 1600F to 2000F are contained in this final report.

# NEW AVIATION PRODUCTS

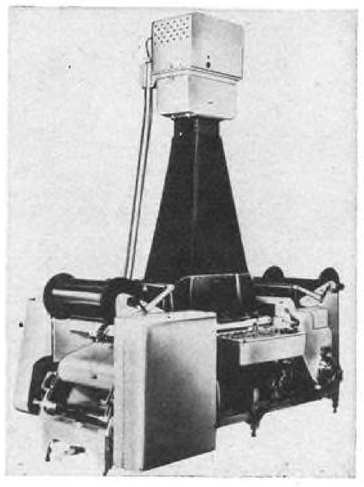
## Irradiated Polymer

Gamma irradiated polymers such as polethylene have increased heat resistance and tensile strength, and reduced cold flow and stress cracking. Electrical insulating properties and chemical inertness remain good. Polyethylene was irradiated by gamma emission from Cobalt 60 source at Stanford Research Center, Menlo Park, Calif. Maker claims "Hyrad" is developed



from this. It is run through high energy beam of electrons. Hyrad can be dipped in molten solder at 600F and remain unaffected. Other polyethylene melts and degrades in 30 seconds. Samples above were exposed to 300F for 96 hours. Sample at left was modified by the new process and irradiated. Center sample was irradiated and right sample was untreated.

**W. R. Grace & Co., 3 Hanover Sq., New York 5, N. Y.**



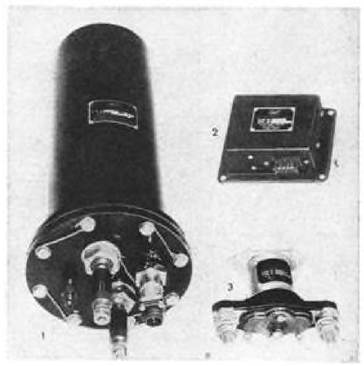
## Electronic Dodger

Photo prints are dodged automatically by type T231 electronic photo printer producing useful results from negatives which would be unprintable using hand dodging. Printer projects brilliant light spot from cathode ray tube. Spot scans negative and print with varying intensity controlled by unit which measures light reaching print and compares this with best possible value. Best effect requires proper scanning pattern, spot size and spectral output. Process is so exact that prints can be made at high speed while in roll form. Need for remakes is eliminated.

**Norden-Ketay Corp., 99 Park Ave., New York, N. Y.**

## Hot Prime Cuts Cold Start Time

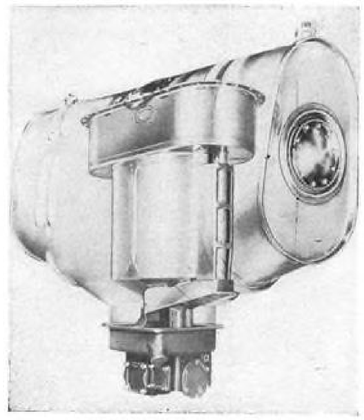
Hot fuel prime system for use after cold soak in temperatures as low as —65F makes possible quick starts of reciprocating engines without use of ground pre-heating equipment, insulating blankets or extra manpower. Temperature of fuel in prime tank is raised to 220F in two minutes by electrical resistance heating elements in prime tank walls. Higher temperature makes for better fuel vaporization. Disconnection of heating element makes system usable in warmer climates. It operates on 24 volt source or may be used with 208 volt, three-phase, AC system. In heated fuel starting, primer switch is pushed before starter is energized. Unit may be used on ground equipment. Weight is 10 lb.



**United Aircraft Products, Inc., 116 Bolander Ave., Dayton 1, Ohio**

## Cold Weather Oil Unit

Deaerating cold weather oil system costing an additional 12 lb. per engine replaces tons of hot air carts, ducts and nose hangars, and reduces reciprocating engine warm-up time in arctic temperatures from 3-6-hr. minimums to less than 30 min. System is installed in more than 400 airplanes and helicopters and is in use in many pieces of ground equipment. It segregates diluted oil in hopper circuit from congealed oil in tank, keeping it from being used and fed into tank before heat is available to raise greater part of oil to flow point. Heat exchange through hopper walls helps melt down congealed oil in tank. When oil in hopper circuit reaches 130F, thermostat controlled diverter valve begins to bleed hot oil into tank. At 160F, tank port is completely open and hopper port is nearly closed.



A small flow through the hopper port is always permitted to prevent the entrance of air with tank oil at the top of the hopper. Diversion of flow through tank deacrates oil and reduces oxidation sludging.

**United Aircraft Products, 1116 Bolander Ave., Dayton 1, Ohio**

## Strobe Shows Shake Specimen

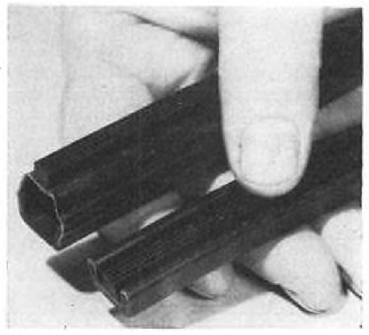
Stroboscope synchronizer permits observer to see part being shake-tested by showing it at any point in the vibration cycle or by reducing the action to slow motion. This cuts time wasted stopping test to observe part. Operator can observe specific mechanical resonances and their effects. Failure can be observed as it develops. Called Model 103A Slip-Sync, it automatically synchronizes strobe lights with vibration exciters regardless of frequency, amplitude or scan rate by controling time-position of flash relative to shake frequency signal. Phase and amplitude of vibration are visible. Slow motion rate

is continually adjustable from ⅓ to 3 cps. by front control panel. Range is from 5 to 10,000 cps.

Chadwick-Helmuth Co., 472 E. Durate Rd., Monrovia, Calif.

### Non-Stretch Pressure Seal

Lightweight, non-stretching inflatable seals of nylon reinforced rubber are intended to seal pressurized cockpits, cargo pod junctures and submerged parts of water-borne craft. New seals



are lighter, require less pressure than earlier stretching seals. They also seal and release quicker and more positively. More than two dozen types of American fighters and bombers use canopy seals of this design.

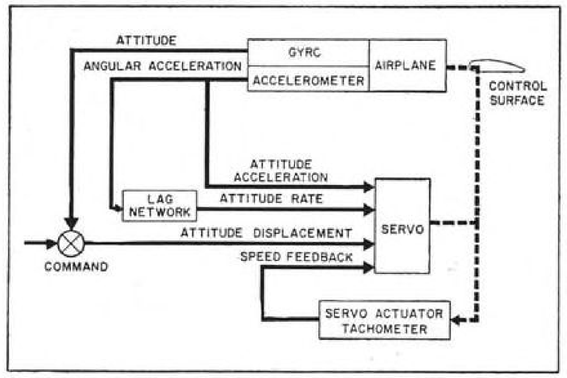
B. F. Goodrich Aviation Products Division, Akron, Ohio

## ALSO ON THE MARKET

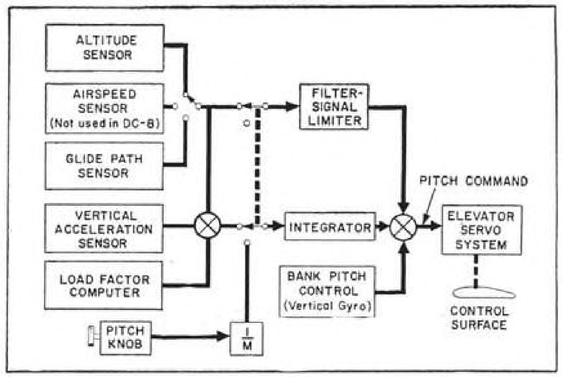
**Multiple wire thermocouple glands** provide easy entrance into pressure vessels of 1, 2, 4, 6 or 8 wires by Conax method of sealing bare wires at pressures from full vacuum to 20,000 psi. Glands may be used at temperatures ranging from − 300F. to + 1,850F; range of temperature and pressure is determined by type of sealant used—Neoprene, Teflon or Lava.—Conax Corp., 7811 Sheridan Drive, Buffalo 21, N. Y.

**Model 2E610 electronic cabinet cooling** fan is designed for mounting on a standard 19 in. wide rack with 10½ in. panel height. Item is a twin 6½ in. centrifugal blower with each wheel double inlet; it is equipped with a ⅛ hp. double shaft motor and produces 800 CFM under normal operating conditions.—McLean Engineering Laboratories, P.O. Box 228, Princeton, N. J.

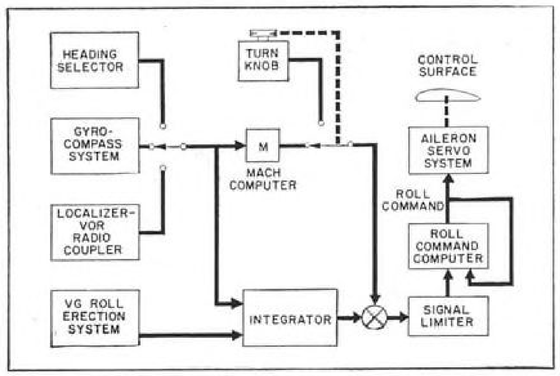
**Pressure relief valve** in Y, Z, AB, or CD class meets all requirements of MIL-V-5523C (proposed). Units are available in Inline or Tee configuration for immediate delivery or can be supplied in any type housing to meet specific requirements.—Waterman Engineering Co., 725 Custer Ave., Evanston, Ill.



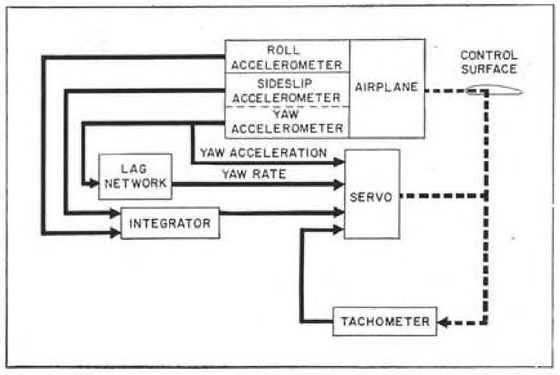

**SPERRY SP-30** autopilot basic pitch-roll axis servo system.




**ELEVATOR CHANNEL** (pitch axis) block diagram.




**AILERON** channel (roll axis) block diagram.




**RUDDER** channel (yaw axis) block diagram.

# Sperry Innovates Design in Autopilot for Jet Transport

By Philip J. Klass

Sperry Gyroscope Co. has made a break with tradition in the design of its new SP-30 autopilot to meet the more difficult stabilization requirements imposed by the increased speed and altitude range of large jet aircraft.

The SP-30 will be used on the Douglas DC-8 and is a serious contender for several other new jet aircraft.

The use of "inertial stabilization," which substitutes accelerometers for the usual rate gyro and eliminates feedback of control surface position, is only one of many SP-30 innovations.

## Quicker Response

Sperry says the new stabilization techniques will enable the autopilot to respond far more quickly to gusts and changes in airplane configuration, providing tighter control of heading, attitude, altitude and flight path during an automatic approach. The new technique makes the SP-30 equally responsive to disturbances over a wide range of aircraft speeds and altitudes, Sperry says.

The new SP-30 concepts are an outgrowth of Sperry's work in developing automatic flight control systems for the B-47 and B-52—work which has given the company considerable know-how in stabilizing large jet aircraft.

Douglas DC-8 pilots will find all of the automatic assists provided by the older Sperry A-12 and its competitors, plus a few new ones:

• **Altitude control.** Inertial stabilization in combination with a new sensitive barometric altitude sensor is expected to provide a five-fold improvement over the A-12 in accuracy of holding altitude and in prevention of porpoising, according to George Jude, director of Sperry's flight control engineering department. This estimate is based on simulator studies and limited flight tests to date.

• **Automatic approach.** If the pilot so desires, he need only head the DC-8 to intersect the ILS localizer and the SP-30 will carry on automatically from there.

The autopilot will turn the airplane onto the localizer and "capture" the beam. Automatically the autopilot will switch to tighter localizer control, switch off altitude control when the glide slope is intersected and then head down the beam. The SP-30 automatically compensates for steady crosswinds.

• **Heading selection.** This is a fairly recent autopilot addition which enables the pilot to select any desired new heading and causes the autopilot to maneuver the airplane smoothly onto the selected heading.

• **Yaw damping.** A new feature for civil autopilots, but old hat on military jets, is the use of the rudder channel to provide automatic stability augmentation both in manual and automatic flight.

DC-8 pilots will find that the yaw damper also provides automatic ball-centered turn coordination without any human rudder pedal action.

## New Controller

Pilots will find a new look in the appearance of the SP-30 console controller—the device used to select operating modes and to introduce airplane maneuvers through the autopilot (see photo, p. 77). But the most significant difference is not apparent to the eye.

In the older A-12, rotation of the controller pitch wheel produced a proportional change in airplane pitch attitude. In the new SP-30 controller, pitch maneuvers are introduced by means of a spring-loaded (self-centering) toggle-switch type of control. Displacement of this pitch control from center produces a rate-of-change of airplane pitch attitude proportional to control displacement.

To prevent the possibility of the pilot inadvertently actuating the pitch or turn control knobs and introducing sudden maneuvers, these controller signals are not introduced directly into the main control surface servo circuits. Instead they operate small servo motors called command computers, which generate duplicate signals that operate the control surface servo actuator. This provides a buffer between the pilot's controller and the airplane control surfaces.

To permit smooth, precise maneuvers over the full airplane speed range, the signal sensitivity of the SP-30 pitch maneuvering control is automatically decreased as speed of the airplane increases.

## Safety Features

Sperry has incorporated a number of other design features aimed at improving the reliability and safety of the SP-30 automatic flight control system. These include:

• **Three-axis malfunction protection.** Automatic monitoring control is designed to detect system failures that might cause sudden control surface deflection, then disconnect the autopilot. The system, which uses paired accelerometers and other components, can also detect failures in gyros or other sensing elements, according to P. Halpert, chief engineer of Sperry's Aeronautical Equipment Division.

• **No vacuum tubes.** Sperry has used transistors, diodes and magnetic amplifiers throughout, thereby eliminating all vacuum tubes in the SP-30.

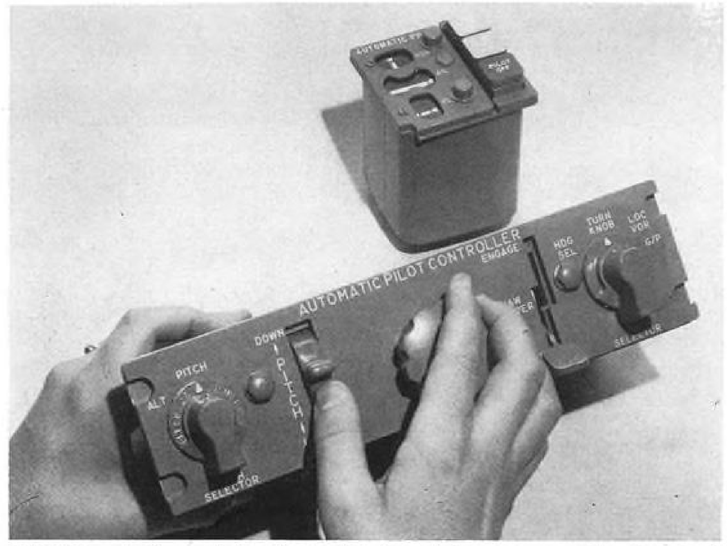
• **Redundant circuitry.** As a further hedge against serious malfunctions, Sperry has designed its three main servo amplifiers (which power the control surface actuators) with duplicate components and circuitry. The two transistor pre-amplifiers and the two mag-amp output stages are cross-connected in a matrix so that most types of failures will not incapacitate the whole amplifier. For example, failure of one transistor pre-amp drops overall amplifier gain by only 20%. If one of the mag-amp output stages should fail, the servo actuator can still deliver up to 50% of its normal maximum force and there is no loss of amplifier gain or shift of null, Sperry says.

• **Maneuver limiter.** SP-30 pitch and roll channels each contain circuits which can be set to limit the maximum pitch or bank angle signal which can get through to the servo amplifiers, thereby limiting maximum airplane pitch and bank angles. During an automatic approach, the maximum possible bank angle is reduced automatically after the localizer beam has been captured.

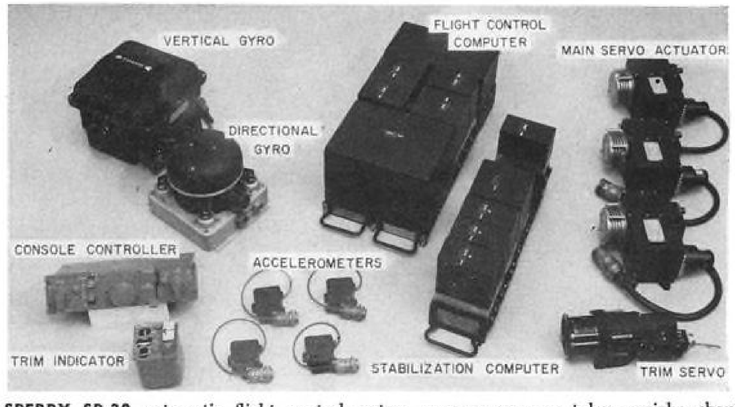
## Stabilization Techniques

Until the latter part of World War II, automatic pilots largely used displacement type control systems. The autopilot gyro measured any displacement of the airplane from a desired attitude or heading, then deflected the control surface by an amount and at a speed proportional to this airplane displacement.

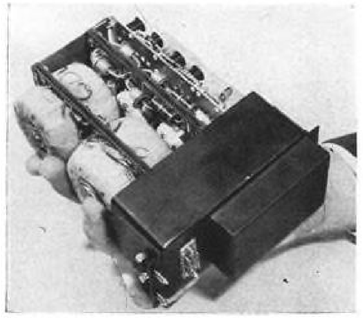
With the advent of higher speed aircraft with less inherent stability, autopilot designers found that the re-



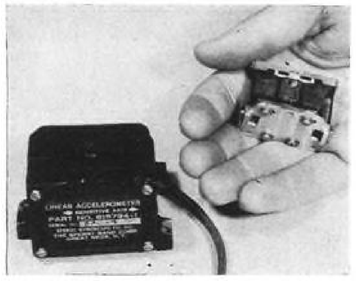

**CONSOLE** controller, used by pilot to introduce airplane maneuvers through autopilot, has novel type pitch axis control. Behind is control surface trim indicator.




**SPERRY SP-30** automatic flight control system uses no vacuum tubes, weighs about 30 percent less than its A-12 predecessor, despite additional operating features.



**MAIN** servo amplifier uses transistors, magnetic amplifiers plus circuit redundancy to provide increased reliability.



**LINEAR** accelerometer, used in pairs, measures airplane angular acceleration.

sponse and performance of a displacement type autopilot was not adequate. This led to the addition of a rate signal which caused the autopilot to deflect the control surface proportional to both the magnitude and the rate of airplane displacement. For example, if the airplane were changing attitude rapidly, the autopilot would deflect the control surface faster and farther than for a slow change in airplane attitude.

In some autopilots, notably the Sperry A-12 and the Lear F-5, this rate signal is obtained by taking the first derivative of the gyro displacement signal.

In more recent military autopilots, and in the new Eclipse-Pioneer PB-20, designers have used rate gyros to obtain this rate signal.

### Inertial Stabilization

Sperry has now added a full second derivative signal—airplane angular acceleration.

This signal is obtained from a pair of electrically-connected linear accelerometers, mounted five or more feet apart, which together perform as an angular acceleration sensor. One of the two accelerometers used to measure pitch axis acceleration is mounted near the airplane center of gravity, while the other is installed in the nose. The yaw axis accelerometers are similarly located, while the roll axis accelero-

meters are both mounted near the c.g., but separated in the vertical plane.

In addition to using this airplane angular acceleration signal directly, Sperry also integrates it (in a lag network) to provide a rate signal, thereby eliminating the need for separate rate gyros. The airplane displacement signal is obtained in conventional fashion from vertical and directional gyros.

Examination of the block diagram (p. 76) for the basic servo systems used in the pitch and roll axes reveals that there is no position feedback from the control surface—a rather surprising omission in airline-type autopilots. (There is, however, a tach generator feedback from the servo actuator to permit use of high gain servo amplifiers.)

### Speedy Response

Any displacement of the airplane produces gyro and accelerometer signals which call for corrective control surface deflection. Such deflection does not produce any opposing signal (as in conventional autopilots) until the airplane itself begins to respond. When this happens, the angular accelerometer generates a signal which opposes the original gyro signal, slowing down the rate of control surface deflection and eventually reversing it.

Without the constraint of a displacement feedback signal from the control surface, the autopilot is able to apply its corrective action more rapidly. Nonlinearities in the airplane control system or boost valves, which can cause serious stability problems in an autopilot using position feedback, are not a problem in the SP-30, according to R. H. Wagner, head of Sperry's transport flight control engineering department.

A conventional autopilot, whose control surface deflection is proportional to airplane displacement and rate, may encounter stability problems in wide speed range aircraft because the control moment produced by a given control surface deflection varies with airplane speed. To meet this problem, new military jet autopilots have added automatic gain changers which vary system performance as a function of airplane speed.

### Control Moment

The Sperry SP-30 needs no gain changer for this purpose because a given airplane displacement produces essentially a proportional control moment (angular acceleration) rather than a proportional control surface deflection, Wagner points out.

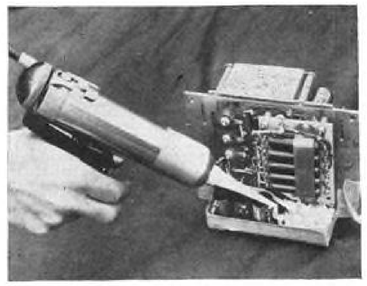
The Sperry inertial stabilization techniques provide a solution to another problem encountered in jet aircraft—finding a good source of static air for operating the autopilot altitude sensor. Under changing airplane attitudes or configurations, the static source may

indicate a loss of altitude momentarily when the airplane has actually gained altitude, or vice versa. The human pilot can be told to disregard this momentary reverse-sense indication but it badly confuses the automatic altitude control of a conventional autopilot.

To get around this problem, the SP-30 derives a rate-of-change of vertical position signal from one of the accelerometers located at the airplane c.g. by integrating its output signal. This inertially derived rate-of-change signal, without the lags characteristic of a bellows-type sensor, provides the initial intelligence to the SP-30 that the airplane has changed altitude.

A servo-powered bellows type altitude sensor, whose output is filtered to take out reverse-sense transients, provides a displacement signal. The signal also is integrated, by means of a motor-driven integrator, thereby providing a displacement, integral, and rate signal for use in maintaining the airplane at a constant altitude. (The integrator also functions to compensate for aircraft pitch trim changes.)

During a turn, the increased vertical acceleration measured by the accelerometer would appear to the SP-30 as a change of altitude when such was not the case. To prevent this, a load factor computer produces a signal proportional to bank angle when the airplane is in a turn which cancels out the signal developed by the accelerometer during a turn.



## Cushion

**New silicone rubber that cures at room temperature is used by Northrop Aircraft to cushion its avionic equipment against shock and vibration and to keep out moisture. New Silastic RTV, applied with air gun, can be slit open after curing to permit replacement of components, then patched over with more silicone rubber.**

The same type of circuitry used for altitude control is employed in the pitch channel during an automatic approach to produce greater stability during the final phase of an ILS approach, according to Wagner. The use of inertial damping should permit automatic approaches to lower altitudes without the familiar oscillation that takes place as the beam narrows, Wagner concludes on the basis of simulator studies and flight tests in a B-26, and DC-3.

The use of a rate-of-change of airplane vertical position, obtained by integrating the output of the vertical accelerometer, makes the SP-30 resist any tendency of the airplane to deviate from the glide slope. This signal is supplemented by the conventional beam displacement signal from the glide slope receiver, suitably filtered to eliminate transients, plus the integral of beam displacement.

### Turn Control

The SP-30 follows the practice of recent military jet autopilots of introducing heading changes through the aileron channel instead of through the rudder channel. (See block diagram, p. 77.) Signals from the gyro compass system, heading selector, or ILS localizer/VOR radio coupler are introduced into the aileron channel as both displacement and integral of displacement. A Mach computer serves to vary automatically the relationship between heading error and the bank angle signal introduced into the aileron channel servo amplifier. The higher the airplane speed, the greater the bank angle signal produced for a giving heading error.

During an automatic approach the SP-30 cuts itself free from a magnetic heading reference. This allows the airplane to weather vane into any existing crosswind at whatever crab angle is needed to keep the airplane on localizer beam center. The motor-driven integrator enables the autopilot to compensate for persistent errors in localizer control, such as sharp changes in crosswinds during an instrument approach.

### High Speed Problem

Northerly turning errors encountered in simple magnetic compasses become a problem at the jetliner speeds. If the airplane should drop a wing slowly, putting it into a mild turn, the gyro compass heading control might be expected to detect the change in heading and level the wings.

However, if the airplane is headed in a northerly direction, the compass sensor aligns to a false north, precessing the directional gyro in the same direction in which the airplane is turning so that the autopilot does not detect any change of heading or take corrective action.

Although the vertical gyro erection system automatically cuts off when the bank angle is 5-7 deg. (or a maneuver is introduced from the controller), slow turn is not sufficient to cut the gyro free of its erection system. Hence the centrifugal forces generated by the turn will precess the gyro to a false vertical in such a direction as to cause the autopilot to increase the airplane bank angle and rate of turn further.

To counteract this phenomenon, the spurious vertical signal from the liquid level accelerometer mounted on the

## New Storage Drum

Novel computer magnetic storage drum has 64 channels but requires only two pick-off heads instead of the 64 normally needed. The Northrop Aircraft development mounts the two pick-off heads on a carriage which moves the length of the drum in one second. Drum has a 2,000 word capacity and rotates at 1,800 rpm. New design greatly reduces channel switching circuitry complexity and overall computer size, provides greater reliability, Northrop says.

vertical gyro, which is used to sense the apparent direction of gravity is fed into the roll channel integrator. This spurious vertical signal is integrated, to match the integration that takes places in the gyro precessing action, and introduced into the roll axis. This deflects the ailerons until the erection sensor signal is zero, thereby leveling the wings and eliminating the slow turn. The same circuit functions similarly to eliminate the effects of accelerations produced by gusts, Jude says.

### Rudder Channel

SP-30 stability augmentation is obtained by using a yaw angular acceleration signal, and its integral (rate of yaw) to produce corrective rudder action. When the airplane is banked, either manually or through the autopilot, a signal developed by the roll angular accelerometer is integrated to produce a rudder displacement proportional to the airplane's rate of roll. Once the airplane is in a turn, a signal from one of the pair of yaw angular accelerometers senses sideslip. This signal is integrated and used to hold whatever rudder deflection is required to provide a ball-centered turn.

For safety reasons the Civil Aeronautics Administration requires that maximum autopilot servo force be limited to a value which can not produce more than a one G maneuvering load on the airplane under the most adverse flight speed or configuration. While this is a laudable objective, it results in a servo whose maximum torque can only pull a fraction of one G at other airspeeds and configurations thereby limiting the autopilot's effectiveness.

### Servo Torque

The SP-30 has a novel arrangement which makes it possible to match maximum servo torque to the airplane's needs and vary this maximum with airplane speed. Equally important, from a stabilization standpoint, maximum servo torque is varied in a manner which does not change overall system gain, according to Wagner.

This is accomplished by changing the level of excitation in the magnetic output stages of the servo amplifiers automatically as a function of airplane speed.

The SP-30 installation for the DC-8 will use electrical motor-driven servos, although hydraulic actuators can be provided. The motors are d.c. split field series type. The entire servo weighs only 10 lb., about half the weight of its A-12 predecessor. Engaging and disengaging the servo and its output pulley are accomplished electrically by means of a solenoid operated clutch.

To minimize the possibility of the clutch jamming and preventing disengagement, Sperry uses a clutch design

which engages and disengages by flexing rather than by sliding action. If the clutch should jam, the pilot can slip the clutch gear against its wide angle teeth by applying 150-200% of normal maximum servo torque on his control column.

If this should fail, the pilot can exert more force and drive back through the motor to operate the control surface manually.

To permit frequent field checks on maximum servo torque, Sperry has included provision for inserting a torque measuring device in the servo without removing it from the airplane.

## New Facility Offers Computer Services

**El Segundo, Calif.**—New analog computer facility specifically established to serve West Coast industry has been opened here by Electronic Associates, Inc.

Equipment of the facility, known as the EAI Computation Center, will be available on an hourly rental basis.

Housed in a new 5,000 sq. ft. building, the facility is fitted with two complete analog computer systems, five electronic multipliers, and a 30 x 30-in. two-pen plotting board. Hourly rental charges are $45 for each computer, $8 for the multiplier rack, and $5.25 for the plotter. Rental of both computers will include use of the plotter at no extra cost.

A staff of applications engineers is available for problem set-up and computer operation, at the hourly rate of $15.

Six private engineering offices are available for customer use for problem preparational and data reduction phases.

The center offers these options:

- **Customer can operate** the computer with his own personnel.
- **Customer can utilize** EAI engineering personnel to assist in programming and solving the problem on the computer.
- **EAI will take** customer's problem and handle the solution. This service is limited and depends on the type of problem and the EAI staff available for its solution.

Time on the center's computers is booked almost through January. Users include Radioplane Co., Hughes Aircraft Co., Ramo-Wooldridge Corp., and Atomics International Division of North American Aviation, Inc. Rheem Mfg. Co. also has used the facilities.

In its expansion program, EAI is opening another analog computing center in Brussels, Belgium, within the next six months.

The computation center which EAI opened in Princeton, N. J., in 1954, to serve industry on a rental basis, is still in operation.



## Expansions, Changes In Avionics Industry

Minneapolis-Honeywell has purchased Davies Laboratories, Beltsville, Md., maker of high speed data recording systems using magnetic tape. New acquisition will be headed by Gomer L. Davies, founder, under the direction of H. F. Dever, M-H vice president and head of its Industrial Division. Davies Laboratories will remain at its present location.

Other recently announced avionics industry expansions and changes include:

- **Philco Corp.** has purchased Sierra Electronic Corp., San Carlos, Calif., a research and instrument manufacturing firm. New acquisition will be operated as a wholly owned subsidiary under its former president, Willard Feldscher, as vice president and general manager. Philco says it plans to expand Sierra's present efforts and technical manpower.

- **Hoffman Laboratories, Inc.,** Los Angeles, will build a new 40,000 sq. ft. research and development facility opposite present Hoffman Laboratories building on South Grand Ave. Company also has broken ground for new 10,000 sq. ft. building to house its administrative offices.

- **Communications Accessories Co.,** Hickman Mills, Mo., maker of toroidal components and magnetic amplifiers will move in February to new 57,000 sq. ft. building in Lee's Summit, another suburb of Kansas City, Mo. The firm is a subsidiary of Collins Radio.

## FILTER CENTER

► **New USAF Reliability Group**—Air Materiel Command will form new Communications-Electronics Reliability Committee, supported by the Air Research and Development Command, to find contract policy improvements which will increase avionic manufacturers' reliability responsibilities. The program is in line with policy laid down by Defense Department's Advisory Group for Reliability in Electronic Equipment (AGREE) (AW Mar. 12, p. 249). New group also will seek to include reliability evaluations in both R&D and production contracts and to find methods to improve maintenance field failure reporting.

► **New Tube Filament Material**—Battelle Institute has started two-year program to learn more about rhenium and its possible use in vacuum tube filaments in place of tungsten. Rhenium, a "scarce" metal, costs nearly as much as platinum at present. However it exhibits good ductility after temperature cycling in sharp contrast to the brittleness of tungsten. Program is sponsored by Air Force Cambridge Research Center.


**'Little Sage'**

**USAF's first automatic ground control intercept system for air defense, the AN/GPA-37, operates from radar data and automatically computes intercept path, transmitting GCI commands directly to the interceptor's automatic fire control system through a radio data link. Although not as fully automatic or sophisticated as the SAGE system (AW Jan. 30, p. 46) the AN/GPA-37 is now in use by Air Defense Command. It was developed by Columbia University, re-engineered and produced by General Electric's Heavy Military Electronic Equipment Dept. under Rome Air Development Center sponsorship.**

► **Meteor and Aurora Scatter Study**—Stanford Research Institute will study VHF and UHF signal reflections from meteor trails and ionization associated with the Aurora Borealis under Rome Air Development Center sponsorship. SRI's research at frequencies of 100 to

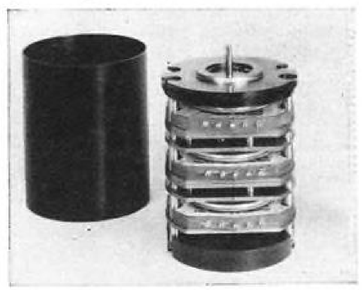
400 mc. will supplement previous studies at lower frequencies. Two large special radars will be used in the program. One is a 50 kw. FM transmitter modified for pulse transmission at 100 mc.; the other will use a large klystron capable of generating up to 70 kw. at 200-400 mc. Both transmitters will be mounted in van-type shelters. Large 60-foot diameter parabolic antennas designed by SRI, capable of being moved in both azimuth and elevation, will be used.

## NEW AVIONIC PRODUCTS

### Computer Devices

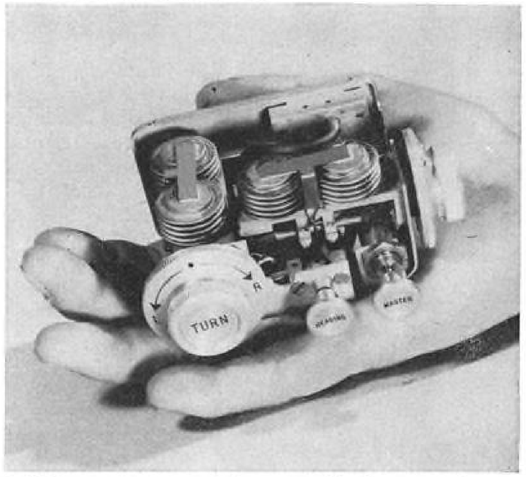
• **Magnetic core storage unit,** Model 1092-BU-7, for use as a temporary store, buffer or delay unit, has capacity for 1,092 characters each up to 7 bits in length. The 7 bits of each character are loaded and unloaded in parallel. The characters are introduced into the storage unit sequentially and are immediately available at the output in the same sequence. Minimum loading or unloading time is 14 microseconds with 6 microseconds needed to switch from a loading to unloading operation. Telemeter Magnetics, Inc., 2245 Pontius Ave., Los Angeles 64, Calif.

• **Small digitizer,** for converting analog data into binary coded decimal digital form, comes in basic three decimal digit model weighing 8 oz. and measuring 2 in. dia. x 2¼ in. long. Additional decimal places can be obtained by adding modules each of which adds



¾ in. in length and 2 oz. in weight. Manufacturer says that unique code and dual brush system eliminates readout ambiguity. Federal Telephone & Radio Co., Clifton, N. J.

• **High-speed magnetic shift register,** Model DK107, operates at speeds up to 500 kc. with maximum digit repetition rate above one megacycle, uses two cores per bit. Unit comes in encapsulated case with miniature tube base. Airtronics, Inc., 5522 Dorsey Lane, Washington 16, D. C.




**TACTAIR T-3 CONTROL HEAD** has two pairs of aneroid capsules (right) which transmit commands from control knobs to control servos.

# Business Autopilot Goes to Distributors

By Erwin J. Bulban

New York—First units of the new Tactair T-3 lightweight low-cost three-directional autopilot designed specifically for business aircraft are reaching distributor's shelves following three years of development and flight test. Priced at $2,395, the T-3 weighs less than 10 lb. installed and is applicable to airplanes through the Beech 18 class.

The T-3 design embodies two major features:

- **No electrical power** is required, the unit being pneumatically powered.
- **Heading lock** is incorporated that will bring the airplane on selected course from a steering of up to 90 deg. either direction. There is also a heading "memory" that will automatically return the airplane to any pre-selected course should the pilot manually override the autopilot.

## Modified Instruments

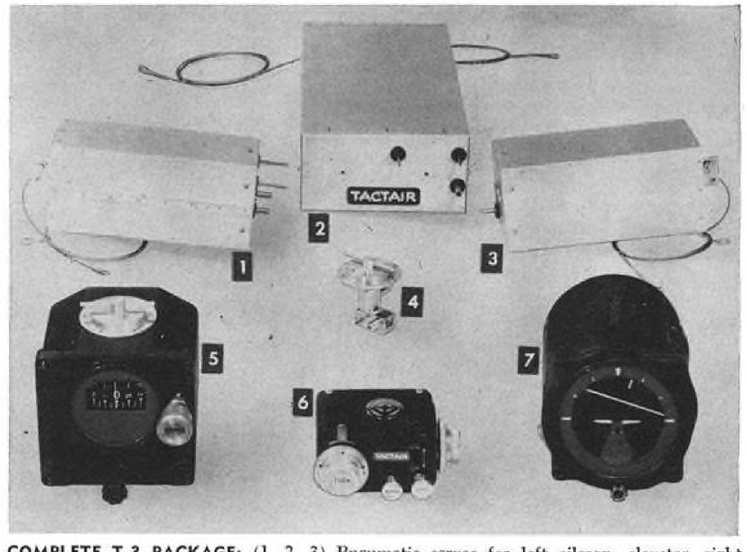
Pitch and roll control is taken from sensing units on the artificial horizon and heading is received from the directional gyro. In purchasing the T-3, the buyer turns in his horizon and gyro and receives two fully overhauled and modified instruments as part of the installation.

Manufacturer of the T-3 is Tactair Autopilot Division of Aircraft Products Co., Bridgeport, Pa.

Operation of the T-3 is based on adaptation of the air gage, a laboratory-type instrument used to measure infinitesimal tolerances. The air gage indicates pressure change as the amount of air space varies over a suction hole. These air gages are incorporated in the T-3's directional gyro and artificial horizon, with precision cams in these instruments moving as the gyros register changes in the plane's attitude. As the cams move, they vary the gap of air over the suction holes.

This change provides variance in the amount of suction, giving highly accurate sensing to pneumatic amplifiers which then relay the information to the servos that activate the aircraft's controls.

Suction is derived from the aircraft engine's vacuum pump. To operate the sensing units, the suction operates at four inches of mercury. The actual servos or bellows that actuate the plane's controls operate on an eight-inch vacuum and can exert up to 125 lb. force, far more than is required to




**COMPLETE T-3 PACKAGE:** (1, 2, 3) Pneumatic servos for left aileron, elevator, right aileron; (4) master shut-off valve; (5) directional gyro, with heading card installed above regular compass card; (6) command head control and (7) modified artificial horizon.

work most aircraft control systems. Neoprene tubing connects the system's components.

The variable sensing, inherent in a pneumatic system, eliminates the "on-off" action of electrically operated autopilots and Tactair claims that control forces are applied more smoothly with their unit. Simplicity and weight savings are enhanced with the elimination of follow-up linkages which are not needed because of Tactair's inherent force follow-up. Linkage of the servos to the controls is direct. The T-3 remains passive except when changes are indicated.

### Basic Elements

Installation components comprise the command control in the cockpit measuring 3¼-in wide x 2-in. deep and the three control boxes containing the basic sensing and amplifier valving and bellows-type servos to actuate the controls. One box combines two servos for elevator control; the other units handle the ailerons.

Rudder control units were considered unnecessary for the modern types of aircraft on which Tactair contemplated initial installations, since most of these are basically controlled directionally by aileron, rudder acting merely as a trim. A separate rudder control system is being developed for addition to the basic T-3 late next year.

The T-3 is instantly engaged by depressing the engagement button on the command control. Since there are no electrical components, no warm-up time is required. Straight flight and turns are made with the knob on the face of the command head, or, if the heading lock is engaged, with the directional gyro. Turning the knob provides standard three degrees per second turns. Level flight is controlled by another knob on the right of the control head. Aneroid capsules inside the control head relay commands to the control servos.

The course selector consists of an additional circular heading card installed by Tactair above the standard compass card in the directional gyro. To steer a selected course, the pilot sets the heading card to the desired point, then pushes the heading lock. The T-3 will then bring the airplane to that course and hold it there.

### Next Installation

Currently approved for all models of the Beech Bonanza, the T-3 is scheduled for installation next on the Cessna 180 and Piper Tri-Pacer; approvals for twin-engine models, including the Beech D18S and E18S, are expected to be received from Civil Aeronautics Administration in the first six months of 1957.

The manufacturer has had CAA approval on the Bonanza for two years and pilot models have been undergoing field testing on four Bonanzas in the Philadelphia, Pa., area since then. Tactair has been holding up detailed announcements on the T-3 until the units reached distributor's shelves.

Originally the company planned a starting production run of 100 units; reaction from the field as a result of demonstrations to prospective distributors has prompted the manufacturer to increase the first run to 600 units. It plans output to attain 50 units monthly in February. As a result of recent negotiations it is possible that one of the major business aircraft manufacturers will make the T-3 available to purchasers of its airplanes as factory-installed equipment at an early date.

To date, Tactair's distributor lineup includes: Atlantic Aviation Service, Inc., Wilmington, Del.; Atlantic Aviation Corp., Teterboro, N. J.; Page Airways, Rochester, N. Y., (which received the initial production models); Beckett Aviation, Pittsburgh, Pa.; Ohio Aviation Co., Dayton, Ohio; Youngstown Airways, Youngstown, Ohio; Aircraftco, Wichita, Kans.; and Norman Larson Co., Van Nuys, Calif.

M-185 mockup is checked by Steve Brown (left) and maintenance chief Leonard Lee.

# Pilot Cites M-185 Jet Economy

New York—Four-jet Fairchild M-185 executive transport will have a lower per mile operating cost than Continental Can Co.'s current piston-engine business planes, Chief Pilot Steve Brown asserts.

Using the Air Transport Assn. formula on a minimum of 600 hours annual flying time, Brown calculates that the M-185 will cost $1.05 per mile to operate versus $1.20 per mile for the company's Lockheed Lodestars. He also figures that the jet will fly cheaper per mile than the turboprop-powered Fairchild F-27, which Brown calculates will cost $1.18.

Three M-185's are scheduled for delivery to Continental Can beginning in 1960 and an F-27 in July 1958 (AW Sept. 3, p. 100). Brown says that these four new aircraft will increase the number of air miles available to the company by almost 100% and will enable Continental Can executives to fly 50% more mileage at twice the speed of the firm's present fleet.

Brown says that the M-185s will cost the company approximately $950,000 each and the F-27 $750,000 fully equipped. Amortization on the planes is calculated over a 10-year period.

Any company using 300,000 mi. or more of air transportation annually can use a jet in the M-185's class profitably, he states. He also noted that the M-185 will reduce deadheading time. The M-185 can fly from Miami, Fla., to New York City in 2 hr. 20 min., compared

### Comanche Useful Load To Be 1,100-1,200 lb.

New York—New Piper Comanche four-place business plane will have a useful load of 1,100 lb. in the 180-hp. version and 1,200 lb. in the 250-hp. model, according to first data revealed by the manufacturer. Standard fuel capacity will be 50 gal., providing a five-hour range. There will be provision for 10-gal. auxiliary fuel.

Two models of the new PA-24 Comanche will be made. As reported exclusively in Aviation Week (Oct. 22, p. 30), Piper will introduce one version with a 180-hp. Lycoming engine selling for approximately $13,500 to be delivered beginning April 1; another model with a 250-hp. Lycoming selling for about $16,900 will be available about Dec. 1. No speed data has been released to date pending flight tests of the second prototype. It is expected that the 250-hp. Comanche will be 25 mph. faster than the 180-hp. model.

with six hours using current equipment, he says. "We could deadhead the M-185 at 50 cents a mile, because our only cost factor would be prorated crew salary, fuel and maintenance," he points out.

Brown also feels that jet business transports will be safer and easier to fly than current obsolete piston-engine aircraft.

In calculating M-185 operating costs, he doubled the per mile fuel cost recommended by ATA, because unlike major airlines, most corporate aircraft operators purchase fuel at retail rates at the various fields they use. Continental Can, which maintains a fuel supply at its Morristown, N. J., Airport base, could save five cents a gallon on jet fuel by bulk purchases, but, as Brown points out, it still would have to buy 50% of its requirements at higher rates elsewhere.

In addition to Continental Can Co., Continental Oil Co. has also ordered a Fairchild M-185. Three other large corporations are discussing purchase of the jet transport.

## PAC Buys Conversion Facility From Lear

New York—Pacific Aircraft Corp., Burbank, Calif., purchased the complete facilities of Learcraft Conversions, Inc., including the Aircraft Engineering Division of Lear, Inc., Santa Monica, Calif., builder of Learstar multi-engine executive transports. The facility also handled modification, maintenance and overhaul of executive DC-3s, Convair 340s, Beech 18s, Aero Commanders and other planes.

Lear Aircraft Engineering Division's projects will continue to be handled by PAC without interruption utilizing personnel of the former Lear subsidiary. Renamed PacAero Engineering Corp., it will be operated as completely separate corporation by the new owner. Vernon B. Benfer, former general manager of the Lear division, is president of PacAero.

Purchase price of the acquisition was not disclosed. It involves transfer of 70,000 shares of Pacific Airmotive Corp. stock, and is retroactive to Nov. 1, 1956. The new facility adds 75,000 sq. ft. of hangar space and 170,000 sq. ft. of ramp area to PAC's plant.

## Air Taxi Services Show Gains for 1956

**St. Louis, Mo.**—Members of the National Air Taxi Conference report they carried 87,319 passengers in 1956, an increase of some 8,000 over last year. Total revenue passenger-miles this year were 7,491,242, an increase of more than 1 million over 1955. NATC officials noted that the year's operations just concluded were carried out with a 100% safety record.

New NATC officials elected at the air taxi organization's annual meeting were: President, William J. Lotzer, Air Taxi, Inc., Division of Gran-Aire, Inc., Milwaukee, Wisc.; 1st vice president, K. V. Brugh, Jr., Greensboro-High Point Air Service, Inc., Greensboro, N. C.; 2nd vice president, W. Clayton Lemon, Air Taxi Service, Roanoke, Va. Representatives named were: Julius Goldman, Revere Airways, Revere, Mass., and Norman Larson, Norman Larson Co., Van Nuys, Calif.

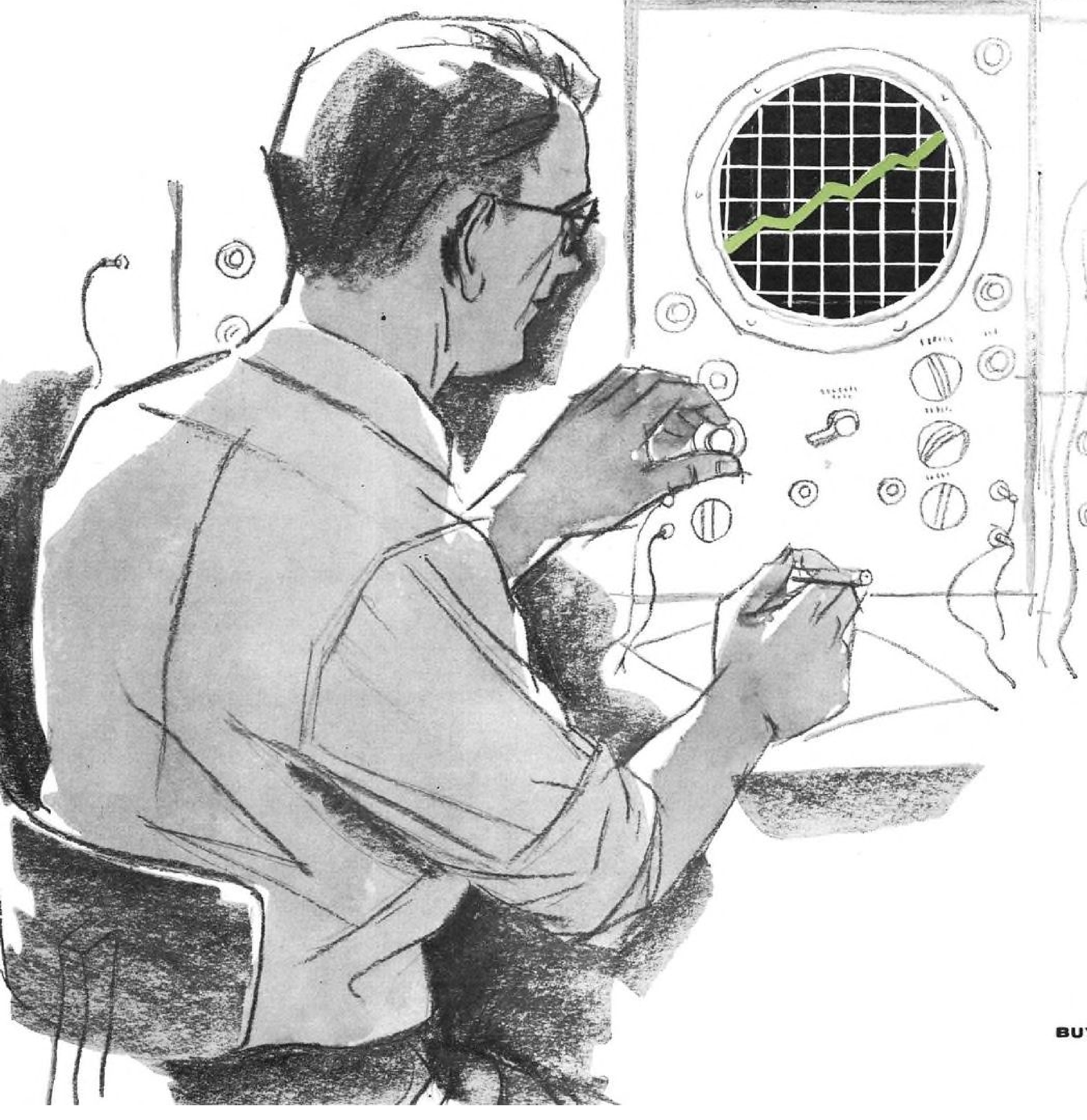
## PRIVATE LINES

**Vickers Viscount 801D** turboprop transport has been purchased by Niarchos Group, major oil tanker operator, for movement of executives and crews.

**Traffic Coordinating Committee,** Detroit, Mich., approved trial use of a helicopter for solving traffic problems. The helicopter will be borrowed from Bell Aircraft Corp., through Whirlair, Inc., Detroit City Airport. Detroit's police commissioner favors using the craft not only to help on traffic problems but also for rescue work and waterfront patrol.

**Wings, Inc.,** Wings Field, Pa., canceled its sales agreements with Beech Aircraft Corp. and Piper Aircraft Corp., and signed a direct factory dealer contract with Cessna Aircraft Co.

# AVIATION WEEK PREFERRED



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*CAB Accident Investigation Report:*

# DC-3 Pilot Lost Sight of Airport, Crashed

## THE ACCIDENT

A West Coast Airlines DC-3, N 62374, flew into the side of a hill 1¼ miles northeast of the runway threshold during an approach to Pullman-Moscow Airport, Pullman, Wash., about 1940,[1] Feb. 26, 1956. The aircraft was substantially damaged and the copilot and two of the twelve passengers received minor injuries.

## HISTORY OF FLIGHT

West Coast Airlines' Flight 97 of Feb. 26 was a scheduled passenger flight between Idaho Falls, Idaho, and Spokane, Wash. with intermediate stops at Pocatello, Burley, Twin Falls, Boise, and Lewiston, Idaho; and Pullman, Pasco, and Walla Walla, Wash. It departed Idaho Falls at 1430 and flew routinely to Boise, where a scheduled crew change was made. The new crew consisted of Captain Houghton H. Whithed, First Officer Alfred R. Klein, and Flight Attendant Clifford E. Hammond.

An IFR flight plan was filed at Boise and the flight departed there at 1706. Following a normal landing at Lewiston, Captain Whithed checked the weather with the company's station agent at Pullman, and the flight departed Lewiston at 1916 with 12 passengers. Gross weight of the aircraft was 23,518 lb., 2,228 lb. below that allowable, and the load was properly distributed.

When in the vicinity of Pullman, at 1929, an ADF (Automatic Direction Finder) instrument approach was made, using the company's "H" facility, and visual contact was established at 3,500 ft. msl. The aircraft flew over the airport and then made a right turn, followed by a left turn, planned to align with the runway.

During this maneuver a small snow squall was encountered and momentarily the captain lost visual contact. Shortly thereafter the aircraft struck the side of a hill and crashed in a snow-covered field.

## INVESTIGATION

Inspection at the scene, which was open, rolling farmland, disclosed that the aircraft had made its first contact at a point 1¼ miles northeast of the airport while moving on a course of 230 degrees. (The runway is aligned on a 229-degree heading.) The altitude of the point of contact is 2,660 ft. msl., 109 ft. higher than the runway. Flight 97 had failed by 50 ft. to clear a round-topped hill, which lies between the point of contact and the airport. Three to 10 in. of snow covered the ground at the scene and plainly registered the initial imprint of the wheels and the sequence of contacts that followed.

First impact, which occurred while the aircraft was in a nose-high attitude, caused both main wheels to fail rearward driving each drag strut upward through the wing; the second ground contact was made 100 ft. beyond the first, and the aircraft then skidded 650 ft.

Both propellers were broken from the engines and both engines were broken from their mounts. The aircraft came to rest in an upright attitude on the bottom of its fuselage.

Examination of both engines and both propellers indicated that they were capable of normal operation prior to impact. Examination of the airframe disclosed repairable impact damage to the center section, the fuselage bottom, and the nacelles but disclosed no defect that could have existed prior to impact. Both outer wing panels also suffered major damage.

The airport at Pullman has a single landing strip, 100 ft. wide and 4,931 ft. long, aligned 229 degrees and 49 degrees magnetic. Hills, reaching 100 to 250 ft. above the landing strip, lie in all directions within one mile.

The company-owned "H" facility is located near the center of the landing strip. West Coast Airlines uses two ADF approach procedures: No. 1, which requires reference to a commercial broadcasting station that operates on week days only, was not available on Sunday, Feb. 26; No. 2 specifies:

"Initial approach from the south at 5,100 ft. Outbound track is 225 degrees from the 'H'. Procedure turn is to the south, minimum altitude 4,000 ft. Maximum distance 25 mi. Minimum altitude over the 'H' on final approach is 3,500 ft.

"If visual contact is not established over the 'H' on final, or landing is not accomplished the following 'Missed Approach' procedure is established. Turn left and climb to 5,500 ft. on a 225-degree track from the 'H' within 10 mi. of the station."

A stationary front existed from Vancouver Island across southern British Columbia, thence southeastward through eastern Montana during the afternoon of Feb. 26, 1956. At the same time an occluded front was moving eastward across western Washington. To the south and east of these two fronts, namely, eastern Washington and western Idaho, a westerly flow of relatively cold unstable air existed.

At the time the flight departed from Boise, en route weather was being reported as generally overcast with light rain at Walla Walla, light snow at Spokane and Pullman, and precipitation generally over the mountains.

Ceilings were being reported ranging from 1,200 to 5,000 ft. and visibility 10 mi. or better, except three-quarters of a mile at Pullman.

The area forecast available to the flight at Boise indicated the following expected conditions en route: Broken to overcast, with ceilings mostly 4,500 or better but occasionally lowering in snow showers to ceiling 800, sky obscured, visibility one to three miles.

Snow showers were expected to be frequent over all mountains. The terminal forecast for the Spokane area after 2000 was gusty southwest wind and occasional ceiling 600, sky obscured, visibility one mile, light snow and fog. The Lewiston terminal forecast was ceiling 3,000 overcast, occasional light rain showers, wind southsouthwest 12. No terminal forecasts are issued for Pullman.

### Company Station Called

Testimony of flight crew and dispatch personnel disclosed that at 1855, prior to departure from Lewiston, Flight 97 called the company station at Pullman and requested the local weather.

The reply was, "Special No. 15 1850 Pacific time: precipitation, ceiling 1,000 ft.[2] obscuration; visibility 2 mi.;[3] light snow; temperature 30; dewpoint 30; wind southwest 8." The flight then requested the runway condition and was told there was a thin layer of ice, the braking was "fair," and it looked all right to come in. This was the last weather requested or received by Flight 97.

At 1929 the flight reported over the "H" facility at Pullman. Captain Whithed started his ADF approach, and extended and checked the landing gear. This approach was completed in a routine manner and visual contact was established over the southwest end of the runway (which is 2,551 ft. msl.) with the obstruction lights in sight.

After visual contact had been established Captain Whithed flew over the runway for its entire length and noted his heading as 50 degrees while descending to 3,100 ft., and advanced power to 25-26-in. to maintain that altitude.

Reaching the eastern end of the runway and moving out over the unlighted area east of the airport, the captain started a restricted-visibility procedure turn. This maneuver is used to assist the pilot in reversing his course and provide a means of staying fairly close to the runway on which he plans to land and be certain that on completion of the procedure he will be aligned with the runway and at the right position to complete his final approach and

[1] All times herein are Pacific standard and are based on the 24-hour clock.

[2] WCA's night approach limits at Pullman-Moscow were 900 ft. ceiling and 2 mi. visibility. After this accident they were changed to 1,000 ft. and 3 mi. with descent prohibited unless all runway lights could be seen.

[3] The weather observer on duty testified that the actual observation of visibility at night is limited to the farthest lighted target; to the east this is three-fourths mile.

## SAFETY

landing by visual means. Accordingly, he made a standard rate right turn to a heading of 95 degrees and held it for 40 seconds. Thereafter he executed a standard rate left turn to the runway heading of 230 degrees.

This series of maneuvers performed at 3,100 ft. and 110 kt. throughout was calculated to end with the aircraft aligned with the runway on the proper heading. During much of the final turn few, if any, lights on the ground were within the angles of vision from the cockpit. At the approximate instant of completing the procedure turn the flight encountered a snow squall, which reduced visibility to zero for an estimated 10 seconds.

Captain Whithed testified that during this interval on instruments he reached for his throttles to abandon the approach but changed his mind when the airport lighting again became visible and completion of the landing appeared to be a routine matter. (Copilot Klein was calling out the airspeed which still was about 110 kt. at that time.) Captain Whithed saw that he had reached a point from which the airport lights were on a bearing about 10 degrees farther south than he had planned.

Captain Whithed testified that he then altered his heading an estimated 10 degrees to the south to bear upon the lights at the threshold and he continued his approach, starting his descent along a path a little to the north and at a small angle from the projected centerline of the runway. At that time he reduced his manifold pressure to about 19 in., and his speed to 90 or 95 kt. A moment later his only landmark, the lights on the airport, disappeared.

### Visual Loss

Believing the loss of visual reference to be only another snow squall he attempted to initiate a missed approach by climbing through the squall. He told his copilot to raise the gear (flaps had not been extended) and to shut off carburetor heat; he, Whithed, opened the throttles, pulled back on the elevator controls, and started reducing propeller pitch.

The airplane had been put into a climbing attitude at about 90 kt. but had not started to climb when at 2,660 ft. msl., it struck the snow-covered hillside which was in its path to the runway threshold. At the time of impact the copilot had not had time to retract the gear and it was still locked down.

During the preliminary maneuvers of the approach, Flight Attendant Hammond checked the passengers' safety belts and found them all properly buckled. At impact one girl passenger was thrown from her seat into the aisle although the belt had not broken. Passenger evacuation through the main passenger door was started. The captain and first officer came through into the cabin and assisted in the handling of the evacuation, which was discontinued as soon as it became apparent there was no danger of fire.

Three to 10 inches of snow on the ground and falling snow, with wind, estimated by Captain Whithed to be 30 to 35 m.p.h., made it less comfortable outside. The cabin door was left open, and passengers went out and in while waiting for removal.

One passenger, Dr. Loehr, a practicing physician from Moscow, Idaho, was well

acquainted with the terrain. He examined all in need of attention; one girl with nose bleed, the copilot with facial lacerations, and a woman who thought the shock may have caused injury to her back.

Then he and the captain sought and found a farmhouse with a telephone. After Captain Whithed reported the location of the aircraft, the farmer used his tractor and a trailer to assist passengers to the highway and ambulances removed all occupants to the local hospital for examination.

## ANALYSIS

The weather records, communications, logs, and the crew testimony disclose that the flight was entirely routine until it reached the Pullman-Moscow Airport, completed the instrument approach, and the circling approach had advanced to the very end of the planned 225-degree turn into final.

While this turn was being made darkness and the lack of visible lights in the sky or on the ground prevented continuous reference to visual landmarks and compelled flight by reference to instruments.

The weather as recorded, reported to the flight crew, and observed by them was above authorized minimums except for about 10 seconds while the aircraft was passing through a snow squall. During that 10-second interval Captain Whithed decided to abandon the approach, but when he emerged from the snow squall and reestablished visual contact, he reversed his decision.

Captain Whithed had landed at Pullman-Moscow many times and felt quite familiar with the approach pattern he was following. Although he was slightly north of his alignment upon starting the final leg, he considered the correction for this to be no additional hazard as he then had the runway lights in sight.

He continued his approach following a pattern that was normal except for the small deviation toward the north. When the lights ahead disappeared again the captain, according to his testimony, thought a second snow squall was in his path straight ahead, and as the condition seemed to be worse than reported and to be below minimums, he tried to abandon the approach.

But the restriction to visibility ahead was not merely airborne snow; it was in fact a snow-covered hill, or more likely a snow-covered hill shrouded in falling or wind-driven snow. In fact, at this point the aircraft had actually descended too low to clear the terrain. Whithed also testified that when he pulled the plane up it did not stall, but he did feel it descend as if in a downdraft.

In his attempt to pull out for a go-around, Captain Whithed had changed the attitude of the aircraft to tail-down, thus getting much of the effect of a flare-out and probably reducing the force of impact a great deal.

## FINDINGS

On the basis of all available evidence the Board finds that:

1. The aircraft and both pilots were properly certificated for the flight involved.
2. The company records show that the

## SAFETY

aircraft was loaded within allowable limits as to the amount and distribution of weight.

3. The weather was forecast to be within limits for the entire operation.

4. The weather encountered by the flight was generally as forecast.

5. Snow squalls encountered along the final approach path could not be observed from the weather station at Pullman-Moscow, and could not be seen by Flight 97 until it had actually entered them.

6. At the last moment of Captain Whithed's turn into final, loss of visual reference caused slight misalignment with the runway.

7. Captain Whithed accepted this misalignment as something he could correct without significant reduction of safety, and continued his approach.

8. The aircraft descended too low to clear the terrain ahead.

9. Visual reference to the airport was lost a second time and the airplane struck a snow-covered hill 50 ft. below its top while a missed approach was being initiated.

### PROBABLE CAUSE

The Board determines that the probable cause of this accident was the continuation of a landing approach following loss of visual reference to the airport, and the delayed attempt to execute a missed approach.

By the civil aeronautics board:

/s/ James R. Durfee
/s/ Chan Gurney
/s/ Harmar D. Denny
/s/ G. Joseph Minetti

Adams, vice chairman, did not participate in the adoption of this report.

### SUPPLEMENTAL DATA

The Civil Aeronautics Board was notified of this accident at 2015, Feb. 26, 1956. An investigation was started immediately in accordance with the provisions of Section 702 (a) (2) of the Civil Aeronautics Act of 1938, as amended. The investigation included examination of the physical evidence at the scene and of the company records. Also depositions were taken at Seattle, Wash., on Mar. 15 and 16, 1956.

### AIR CARRIER

West Coast Airlines, Inc., is a scheduled air carrier incorporated in the State of Washington. It maintains its headquarters at Seattle, and operates DC-3 aircraft on scheduled routes in Washington, Oregon, and Idaho. It possesses a currently effective certificate of public convenience and necessity for route No. 77 issued by the Civil Aeronautics Board and air carrier operating certificate No. 702 issued by the Civil Aeronautics Administration which authorize carrying of persons, property, and mail between various places in the area and over the route prescribed.

### FLIGHT PERSONNEL

Captain Houghton H. Whithed, age 40, held a valid airman certificate No. 54764 with rating as airline transport pilot on DC-3 equipment. Company records show he had logged 13,984:24 hours, of which 10,030:24 were in DC-3s, and 682 hours were instrument flying. His last physical

was dated Feb. 20, 1956, and his last six-months proficiency check was in September, 1955. He had been in the employ of the company since June 19, 1946.

First Officer Alfred R. Klein, age 33, held airman certificate No. 467204 with airline transport rating in DC-3 aircraft. He had a total of 6,598:40 hours, of which 467 hours were instrument time. His last physical was dated May 1955.

Flight Attendant Clifford E. Hammond, age 26, had been in the employ of West Coast Airlines since Oct. 2, 1955. In September 1955, he satisfactorily completed a test in emergency procedures.

### THE AIRCRAFT

Douglas DC-3, N 62374, manufactured Feb. 2, 1944, serial No. 12559, was owned and operated by West Coast Airlines.

It had logged time as follows:

Total—17,797:51 hours

Time since last major overhaul—120:45 hours

Time since line maintenance—46:55 hours

The powerplant engines were Pratt and Whitney, model 1830-90D:

| | Right | Left |
|---|---|---|
| Serial No. | 450358 | 316451 |
| Total time (hours) | 893:21 | 270:42 |
| Time since overhaul | 893:21 | 270:42 |
| Date manufactured | 5-25-41 | 6-13-44 |

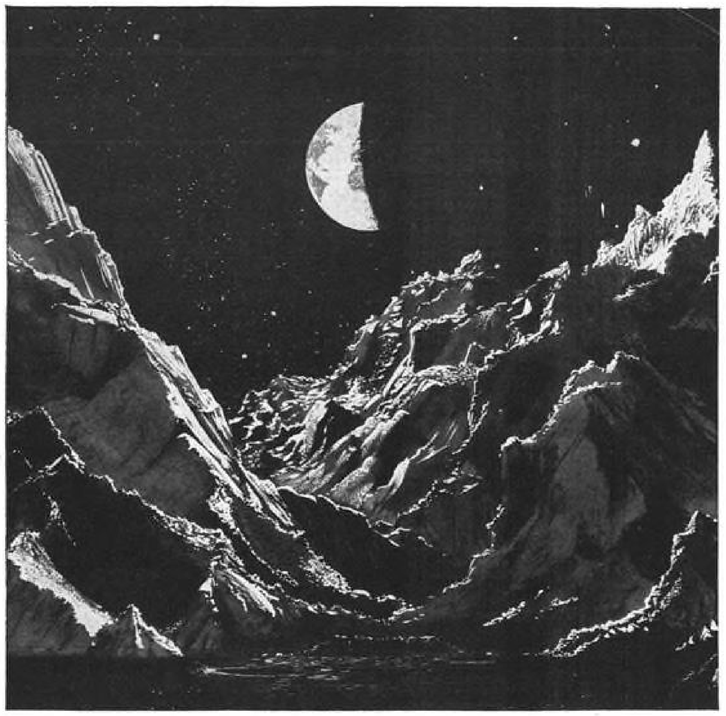
The propellers were Hamilton Standard, model 23E50-473 hubs and model 6353A-18 blades:

| | Right | Left |
|---|---|---|
| Serial No. | 4257 | 54846 |
| Time—Total | 9,124:13 | 1,149:03 |
| Time since overhaul | 2,660:44 | 1,149:03 |
| Blades Nos. | 67688 | P-198186 |
| | 67689 | P-198187 |
| | 67690 | P-198188 |

## Foreign Sales Units Appointed by Vertol

**Morton, Pa.**—Preparing for foreign commercial as well as military sales, Vertol Aircraft Corp., manufacturer of the H-21 helicopter, has appointed 13 sales representatives in Europe, South America and Far East:

- **Belgium**, Aerobel, Brussels.
- **Denmark**, Mogens Harttung, Copenhagen.
- **France**, Helicop-Air, Paris.
- **West Germany**, Finanz-Und Verwaltungs-Gesellshaft, Bremen.
- **The Netherlands**, Schreiner & Co. N. V., The Hague.
- **Norway**, H. H. Broch, Oslo.
- **Spain and Portugal**, Carlos Cudell Goetz, Lisbon.
- **Sweden**, Salen & Wicander, A. B., Stockholm.
- **Switzerland**, Air-Import Corp., Lucerne.
- **United Kingdom**, Rotowings Ltd., London.
- **Peru**, Ingenieria Commercial S. A., Lima.
- **Venezuela**, Servicios Circa C. A., Caracas.
- **Japan**, C. Itoh & Co. Ltd., Toyko.



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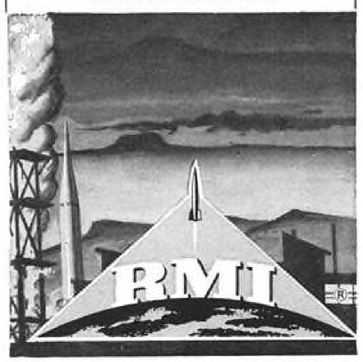






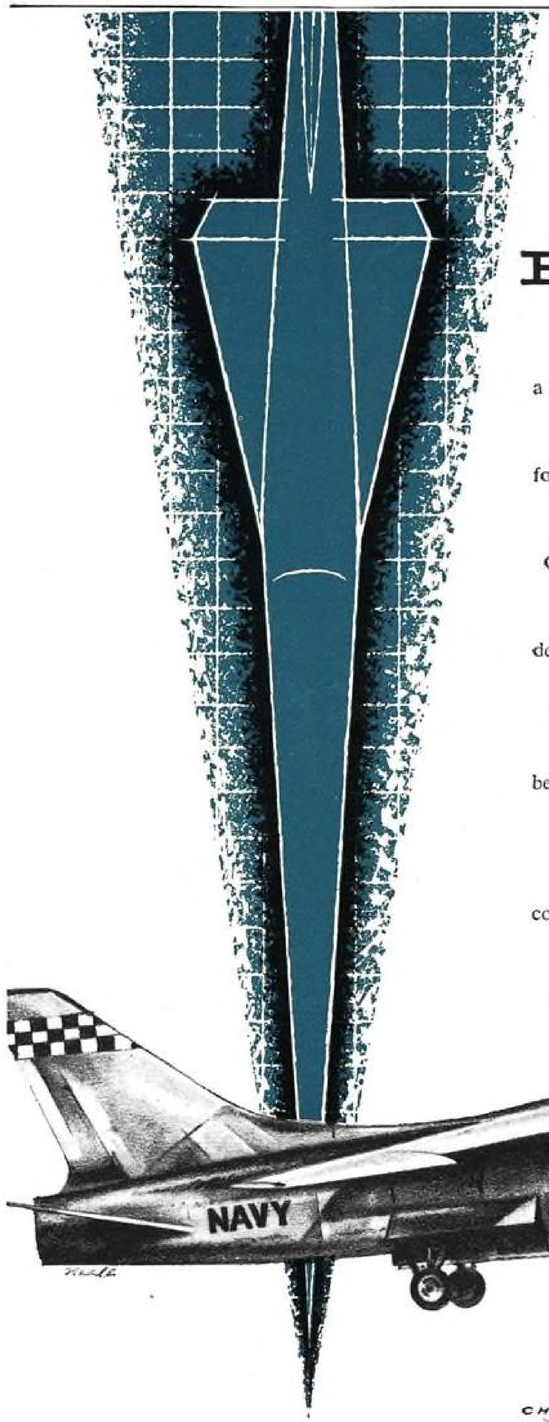

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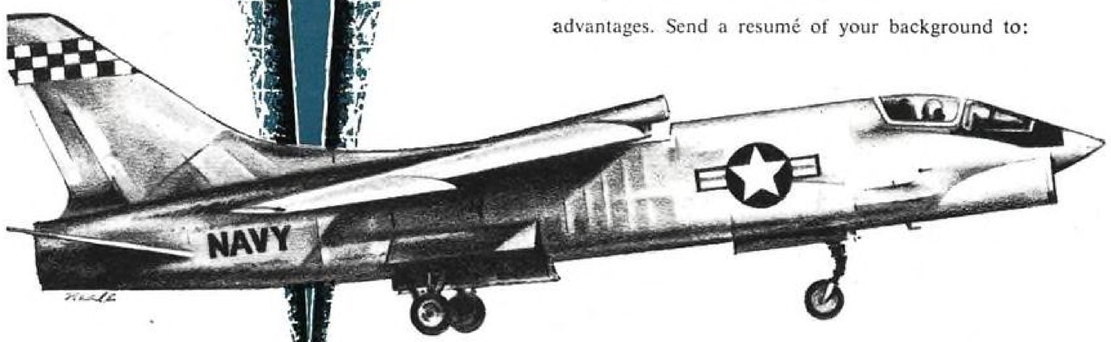


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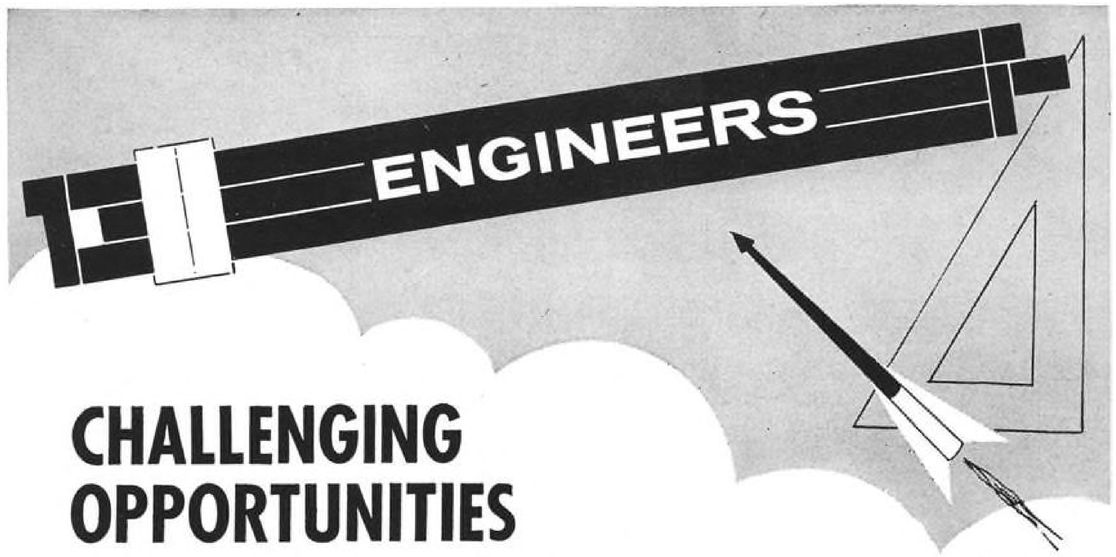


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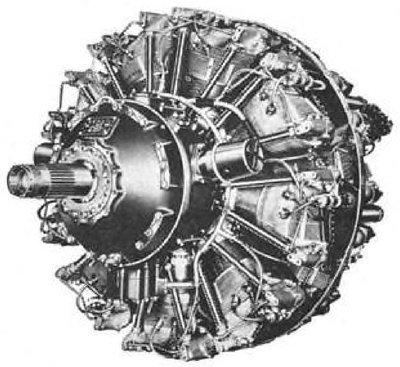

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AVIATION WEEK, NOVEMBER 26, 1956



CLASSIFIED ADVERTISING

F. J. Eberle, Business Mgr.



ADVERTISERS INDEX

# LETTERS

## Shares NACA Feeling

Your Nov. 5 editorial tribute to the NACA and the men who make it tick gave effective voice to sentiments widely shared in the aircraft industry but all too rarely expressed.

We in the business realize what a primitive state our military and commercial aviation would be in today had it not been for NACA. Yet the importance of this agency has never been adequately appreciated by the general public or by Congress.

I sincerely hope copies of your editorial will be given wide distribution among members of Congress, the Bureau of the Budget, the Selective Service System, the Civil Service Commission, and (if this be treason . . . etc.) college placement offices.

G. G. Kayten
Chief Aerodynamics Engineer
The Glenn L. Martin Co.
Baltimore 3, Md.

## Lauds Algeria Series

I was fortunate enough to be the only American representative on hand during both phases of the recent evaluation of the H-21 and H-34 in Algeria. In between the phases, I concentrated my activities at the Army base at Setif.

I wish to say at this time that it is my personal belief Robert Farrell has done a magnificent job of reporting on a quite abstract subject. In reading the articles (AW Sept. 17, p. 28, Sept. 24, p. 88, and Oct. 1, p. 73), I found practically no items I would have covered in a substantially different manner than did Mr. Farrell.

Frequently when reading a news or narrative article on a subject with which I am intimately familiar I find the author has not gathered all the facts or has drawn what I consider to be improper conclusions based on his interpretation of the facts he has obtained. This is certainly not the case in Mr. Farrell's Algerian report.

Congratulations on an excellent presentation. It is through fine articles like this that I repeatedly find Aviation Week is the most valuable aviation periodical to reach my desk.

T. R. Pierpoint
Service Manager
Vertol Aircraft Corp.
Morton, Pa.

## Altimeter Ready Now

In your Oct. 22 issue (p. 154) Mr. Robert E. Trimble expresses the hope that someone 'comes up with' an accurate altimeter before the 1,000 ft. on top clearance is eliminated.

The purpose of this letter is to draw to Mr. Trimble's attention, as well as the attention of your many other readers who must have observed Mr. Trimble's comments, that someone has "come up with" an accurate altimeter. As a matter of fact, two recent improvements in altimeters made by the Kollsman Instrument Corp. have come a long way toward eliminating the conditions described in Mr. Trimble's letter.

***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.***

In your Mar. 5 issue (p. 69) a description of the Kollsman Integrated Flight Instrument System pointed out that altitude information was given by the system within an accuracy of plus or minus 100 ft. at 40,000 ft. Although this is a commercial development and the system was designed primarily for, and in conjunction with, the scheduled airlines, there is no reason why other aircraft, such as the military, could not use this equipment. Secondly, the new altimeters designed to the new precision specifications go a long way toward removing instrument error.

Of course, having an accurate instrument is only part of the story. For example, I am sure that if Mr. Trimble's correspondent were to investigate further he would find that most of the variation in altimeter readings experienced by the eight F-80s flying at 36,000 ft. were caused by variations in the static systems of the airplanes, and a relatively small amount by the variations in the instruments themselves. This is where the new Kollsman Integrated Flight Instrument System comes into its own. Through the use of this system the errors in the static system as well as variations within the instruments are corrected.

I am in complete sympathy with Mr. Trimble's thoughts in this matter, but now that the equipment has been designed and is in production it's up to the operators to see that the proper use is made of it.

Everett H. Schroeder
Kollsman Instrument Corp.
Elmhurst, N. Y.

## Passenger Delay

Just a line to congratulate you on your editorial of Oct. 8 (Passenger Service Pays Off). Perhaps this will help the exasperating problem of just letting people wait. Maybe more airlines will like to see the good publicity. Last week I was disgusted with transfer from Madrid at Idlewild; a long delay and they wouldn't let passengers back off the plane.

John M. Hanson
Hoover Electronics Co.
Baltimore, Md.

## Heat Exchanger

Your article "Heating Studies Tax Apparatus Ingenuity" (AW Oct. 29, p. 46) describes a ceramic heat exchanger being constructed by the NACA and describes the pilot model of the heat exchanger. It is of interest to note that a full scale ceramic heat exchanger which has operated at 2,500F has been in successful operation at the hypersonic facility of the Polytechnic Institute of Brooklyn for the past two years. A 12-in. jet of air with velocity exceeding 6,000 fps. at a total stream temperature of 2,500F can be produced. (See for reference, WADC-TN 55-695, November 1955, and The Proceedings of the High-Speed Conference on Aeronautics, Polytechnic Institute of Brooklyn, 1955).

This heater, conception and construction of which was sponsored by the Aeronautical Research Laboratory of the Wright Air Development Center, USAF, is believed to have been the first of its kind in operation in connection with hypersonic wind tunnels. It is gratifying to see that this successful pioneering effort has influenced the construction and use of similar heat exchangers for this purpose in other facilities in the United States.

Martin H. Bloom
Associate Professor
Aeronautical Engineering
Polytechnic Institute of Brooklyn
Freeport, N. Y.

## Utter Disregard

Such disgusting irresponsibility can no longer pass without protest (AW Sept. 10, p. 23, Industry Observer).

No civil pilot, even one flying someone else's equipment, would dare show such utter disregard for the aircraft or the safety of lives and property at his destination.

Instead of being lauded for a brilliant performance, the Air Force personnel involved in the arrival of F-100C aircraft in the Bendix Trophy Race with no fuel or with only 20 gallons left in the tank must be strongly criticized.

A gamble of this sort with several million dollars worth of taxpayers' airplanes (in the presence of absolutely no military necessity) can not be justified.

Are we to assume that the pilots are not familiar with the fuel consumption of their aircraft, or that the people responsible for permitting their participation do not care about these factors, or the need for these airplanes in our national defense effort?

Much more than a wrist slapping is required here. Such criminal disregard for safety of persons, property, and taxpayers' aircraft, needed for our defense, must never be repeated.

Jim Fitzhugh
San Diego, Calif.

## Britannia Error

In your issue of Aug. 20 (p. 23) it is stated that "maximum letdown rate for the Bristol Britannia is limited to 500 fpm. . .". I am afraid this is very wide of the mark. We recommend that, with the Britannia 310, operators can schedule a rate of descent of 2,000-2,500 fpm. The corresponding rate in the cabin is, of course, only equivalent to 200-300 fpm.

A point of interest is that, during its tour of North America, the Britannia 102 regularly descended at up to 2,000 fpm when following airline let-down procedures.

Peter King
The Bristol Aeroplane Company Ltd.
Bristol, England

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