AVIATION WEEK

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September 23, 1957 50 cents

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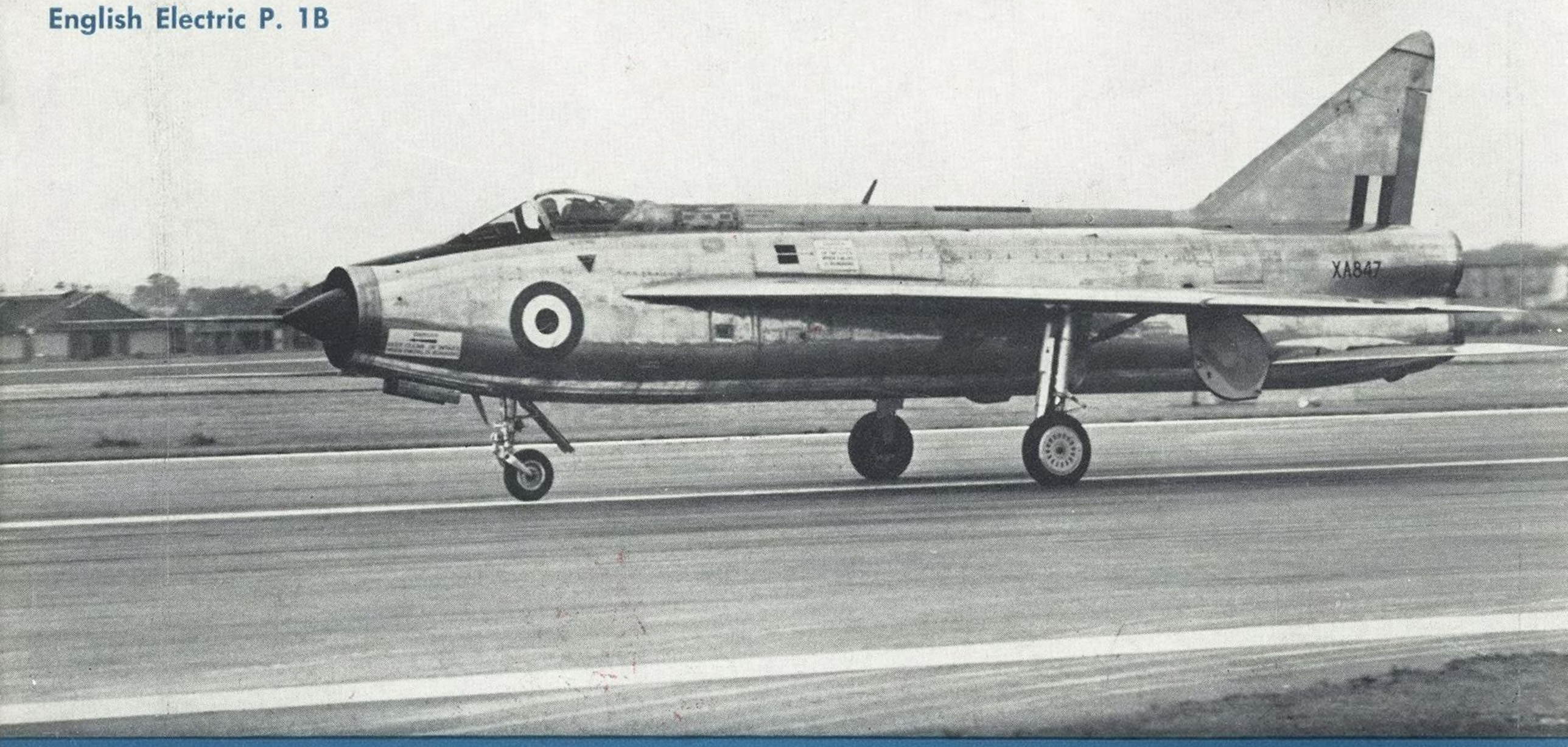
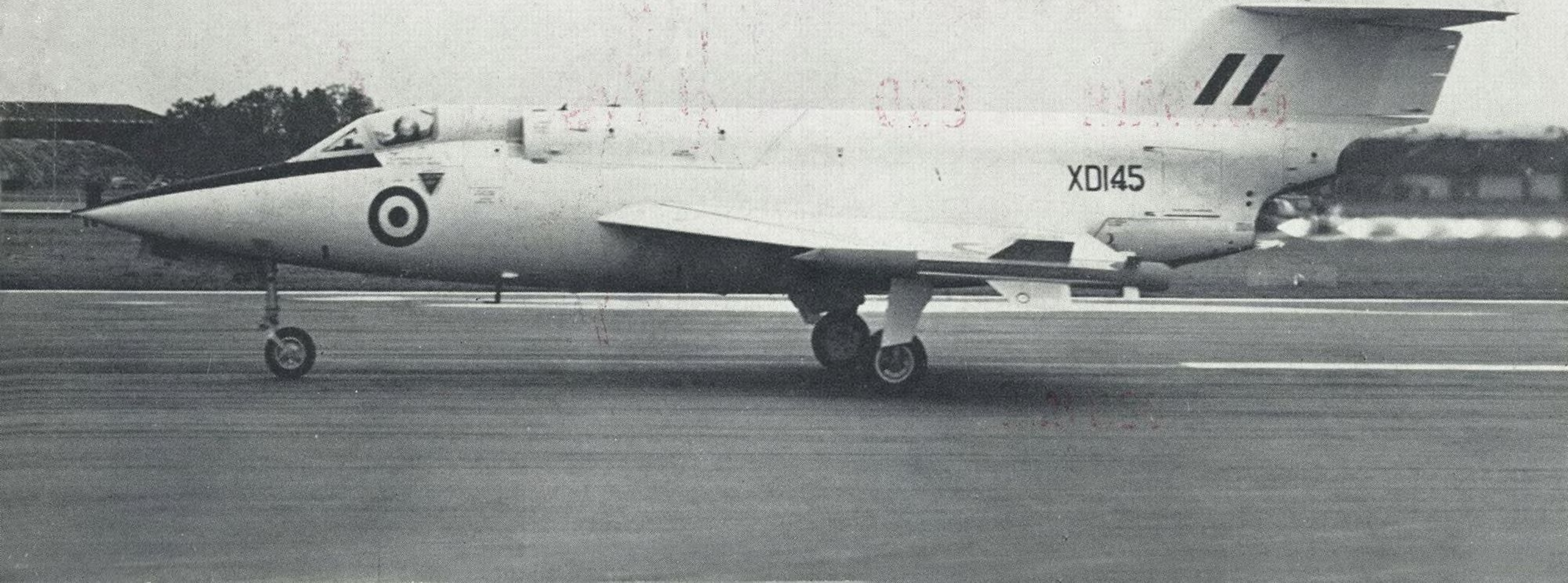
English Electric P. 1B



Saunders-Roe SR. 53



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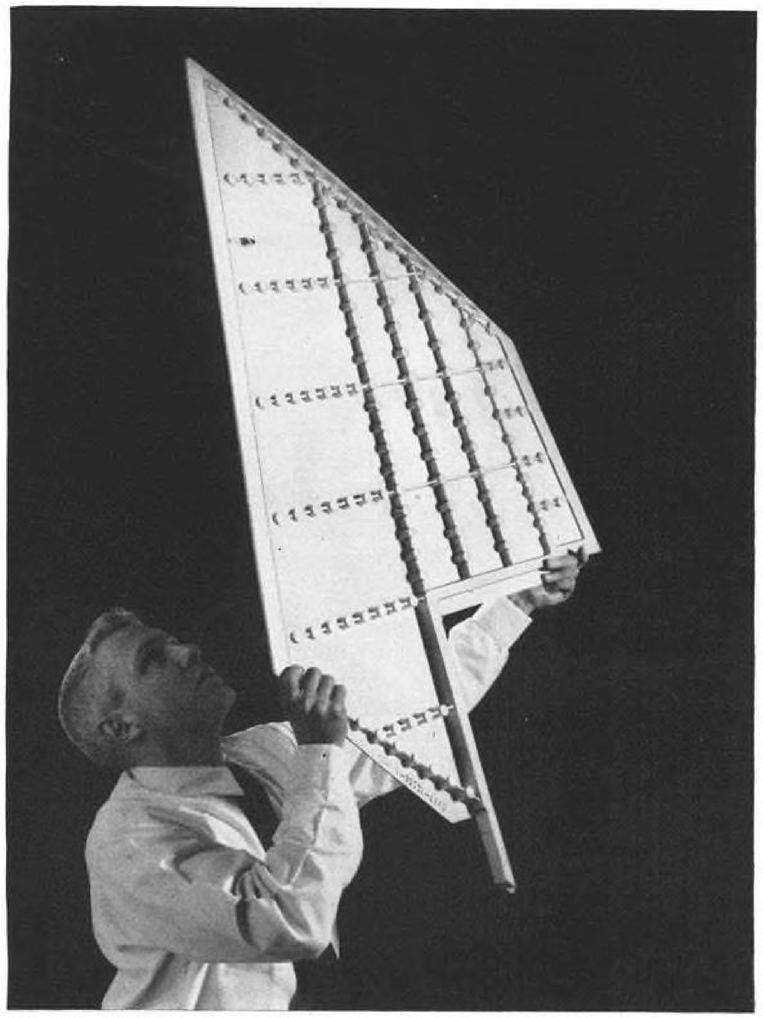

THIN-WALL magnesium casting for the Regulus missile fin produced by Dow.

AVIATION CALENDAR

Sept. 23-25—Fall Meeting American Society of Mechanical Engineers, Statler Hotel, Hartford, Conn.

Sept. 25—Pratt & Whitney Aircraft Engine Maintenance and Operation Forum, sponsored by Southwest Airmotive Co., Melrose Hotel, Dallas, Tex.

Sept. 26-27—Fifth Michigan Aeronautics Conference, jointly sponsored by University of Michigan Transportation Institute, Western Michigan University and The Aero Club of Michigan, Alpena, Mich.

Sept. 28-29—North Central Regional Conference, Civil Air Patrol, Town House Hotel, Kansas City, Kans.

Sept. 30-Oct. 5—National Aeronautic Meeting, Aircraft Production Forum & Aircraft Engineering Display, Society of Automotive Engineers, Hotel Ambassador, Los Angeles.

Sept. 30-Oct. 5—International Conference on rocket and earth satellite programs for the International Geophysical Year. For invitation write: Director of Information, U. S. National Committee, IGY, National Academy of Sciences, 2101 Constitution Ave., N.W., Wash., D. C.

Oct. 2-4—National Airports Conference, University of Oklahoma, Norman, Okla.

Oct. 2-4—Tenth Annual Meeting and Forum, National Business Aircraft Assn., Cosmopolitan Hotel, Denver, Colo.

Oct. 4—First Annual Awards Banquet, Society of Experimental Test Pilots, Beverly-Hilton Hotel, Los Angeles.

Oct. 6-8—International Northwest Aviation Council, 21st annual convention, Palliser Hotel, Calgary, Alberta, Canada.

Oct. 7-9—13th Annual National Electronics Conference, Hotel Sherman, Chicago, Ill.

Oct. 7-9—Fourth Annual Lubrication Conference, sponsored by American Society of Lubrication Engineers and American Society of Mechanical Engineers, Royal York Hotel, Toronto, Canada.

Oct. 7-10—Triennial Inspection, Lewis Flight Propulsion Laboratory, Cleveland.

Oct. 7-12—Eighth Annual Congress, International Astronautical Federation, Barce-

(Continued on page 6)

AVIATION WEEK • SEPTEMBER 23, 1957

Vol. 67, No. 12

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AVIATION CALENDAR

(*Continued from page 4*)

Iona, Spain. For details write: IAF, 35 Lowell Rd., Concord, Mass.

Oct. 8—Tenth Annual Airport Development and Operations Conference, Onondaga Hotel, Syracuse, N. Y.

Oct. 9-11—National Fall Convention, Society for Experimental Stress Analysis, El Cortes Hotel, San Diego, Calif.

Oct. 10-11—National Noise Abatement Symposium, Sherman Hotel, Chicago, Ill.

Oct. 16-18—Conference on Computers in Control, American Institute of Electrical Engineers, Chalfonte-Haddon Hall, Hotel, Atlantic City, N. J.

Oct. 16-18—1957 IRE Canadian Convention, Automotive Building, Exhibition Park, Toronto, Ont., Canada.

Oct. 17-18—13th Annual Convention, The Magnesium Association, Biltmore Hotel, New York.

Oct. 20-22—American Helicopter Society Fourth Annual Western Forum, Hotel Statler, St. Louis, Mo.

Oct. 21-22—Canadian Aeronautical Institute—Institute of the Aeronautical Sciences Meeting, Montreal, Canada.

Oct. 21-23—Conference on new developments in the field of power, American Society of Mechanical Engineers, Americus Hotel, Allentown, Pa.

Oct. 21-25—45th National Safety Congress, Conrad Hilton Hotel, Chicago.

Oct. 24-25—Fourteenth Annual Display, Aircraft Electrical Equipment, Aircraft Electrical Society, Pan Pacific Auditorium, Los Angeles.

Oct. 28-29—Third Annual Meeting, Association of the U. S. Army, Sheraton-Park Hotel, Washington, D. C.

Oct. 28-29—First National Conference on Applied Meteorology, Hotel Statler, Hartford, Conn.

Oct. 28-30—Annual East Coast Conference on Aeronautical and Navigational Electronics, Fifth Regiment Armory, Baltimore, Md.

Oct. 28-31—Second Winter Meeting, American Nuclear Society, Henry Hudson Hotel, New York.

Oct. 28-31—National Industrial Packaging & Handling Exposition, Atlantic City Convention Hall, N. J.

Oct. 30—Aviation Electrical Equipment Display, U. S. Grant Hotel, San Diego.

Oct. 31-Nov. 1—Fourth Annual Meeting, Professional Group on Nuclear Science, Henry Hudson Hotel, New York.

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

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

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

Nov. 6-8—Third Annual Symposium on Aeronautical Communications, Hotel Utica, Utica, N. Y.

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

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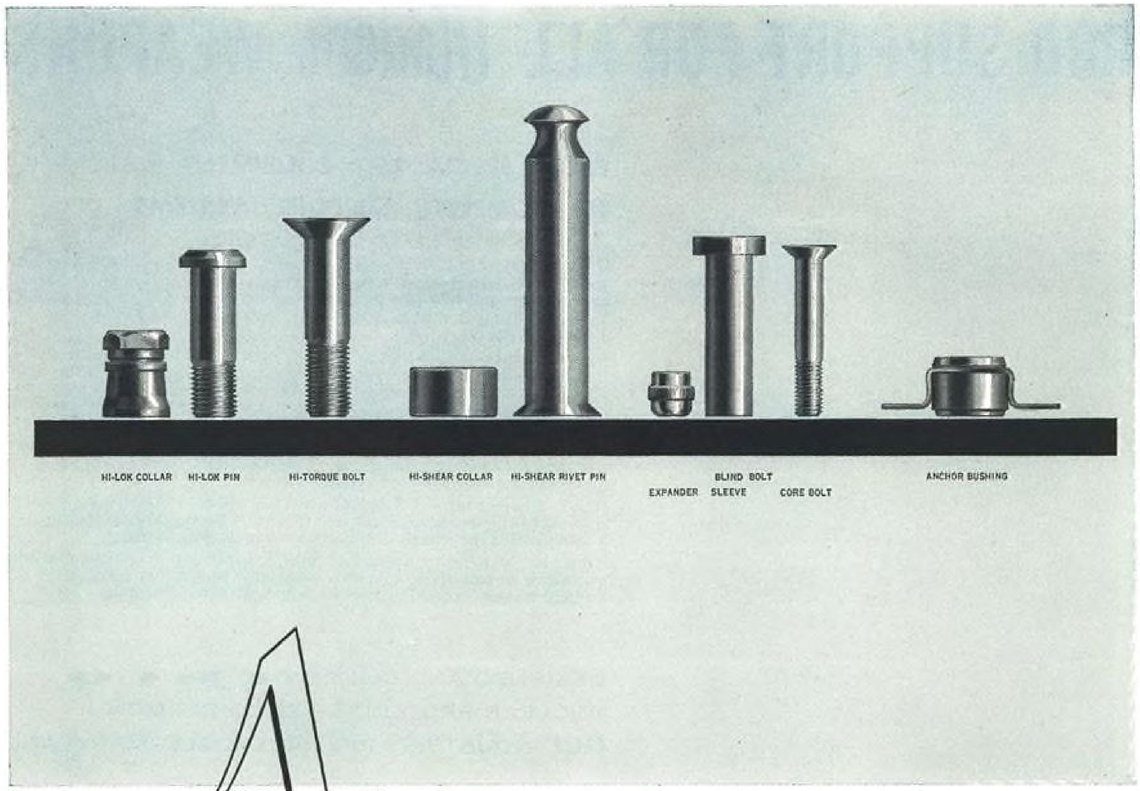

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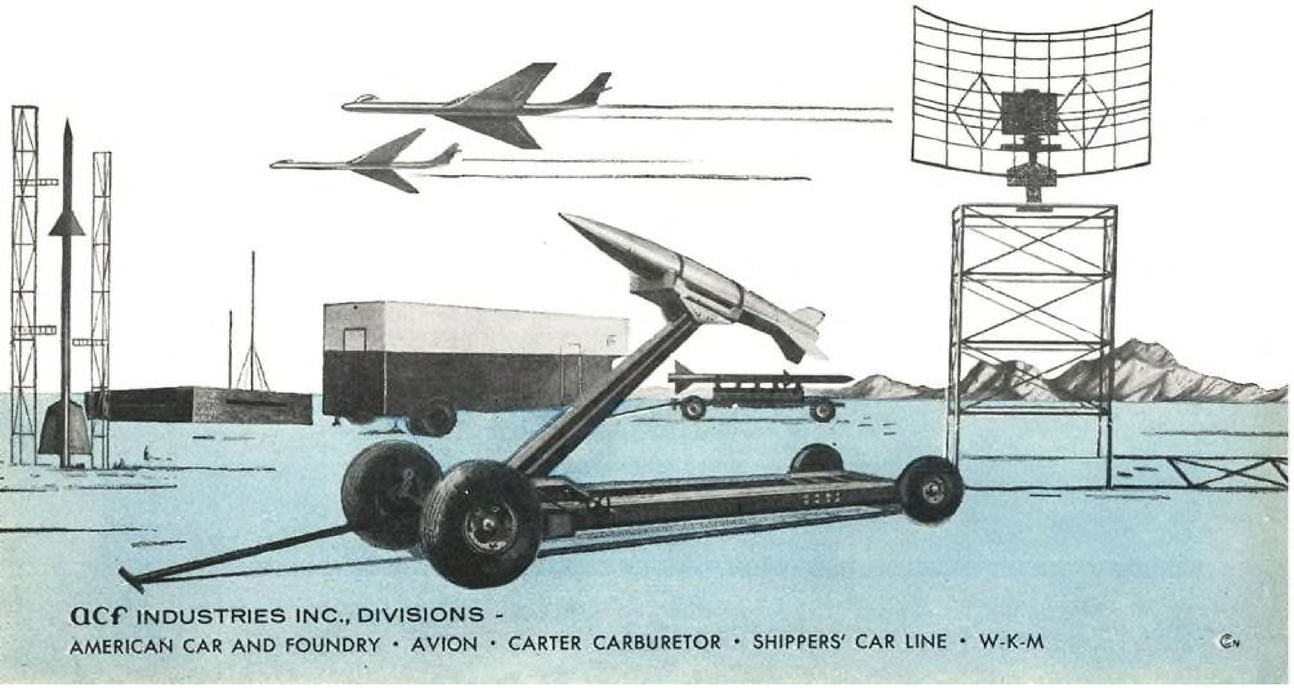

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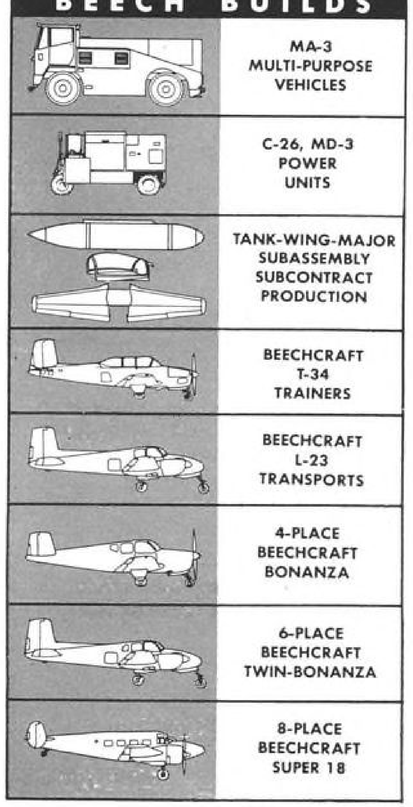

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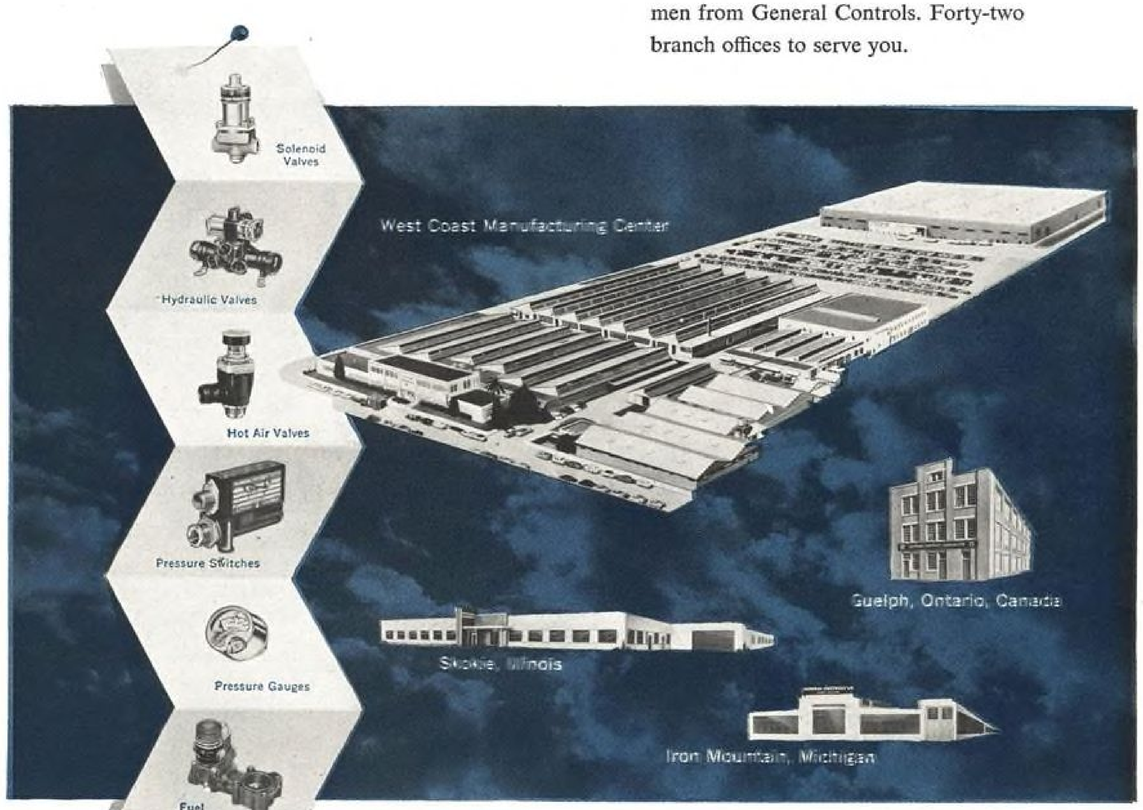

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September 23, 1957

AVIATION WEEK

Vol. 67, No. 12

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COVER: English Electric P. 1B (top) is the latest version of Britain's fastest fighter. Circular engine inlet replacing one of oval shape is the most obvious change. This aircraft also does not have the conical camber of the P. 1A. Saunders Roe SR. 53, with mixed rocket and turbojet power, is latest English military aircraft. In keeping with its economy program the government has withdrawn support of a more advanced version although the original model has performed well. Saunders Roe is proceeding with the development as a private venture.

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EDITORIAL

Who Really Develops Missiles?

One of the most consistently peddled myths in the Army's current propaganda campaign to convince the American public and Congress that it should be given prime responsibility for all advanced ballistic missile development is the statement that its Redstone Arsenal scientists pioneered ballistic missile development in this country and presently have a virtual monopoly on technical capability in this field. This is, of course, simply not true as even a cursory examination of missile development history will reveal.

In fairness to the group of civilian scientists now working at the Redstone Arsenal and their technical and spiritual leader Wernher von Braun, it should be pointed out that they do not make these claims on their own behalf and, in fact, are semi-embarrassed by the fantastic claims made for them by their more technically naive military and pamphleteering supporters. It is the uninformed leadership of the Army supported by a corps of professional and amateur public relations promoters who are responsible for spreading the myths of missile development and it is on them that the blame for this shameful performance should be firmly fixed.

As we have emphasized in earlier editorials (AW March 18, p. 21) ballistic missile development in this country has been carried out by all three services—Air Force, Navy and Army since the closing days of World War II. There are no facts in missile history to support the Army's claim for a monopoly in this field. The Army deserves credit for its work with the captured German V-2s, the development of the Corporal with the help of Firestone Rubber Co., Gilfillan Bros. and the Jet Propulsion Laboratory of CalTech, the Hermes project with General Electric technical support and the Redstone, for which von Braun's group of former German scientists deserve major credit but which relies on a North American Aviation Inc. rocket engine for its propulsion. We know of no Air Force or Navy effort to omit or belittle this Army missile work. Why then has the Army's uniformed brass embarked on a campaign to gloss over and belittle similar ballistic missile development done by the aviation industry for the Air Force and Navy? The technical history of the Convair MX774 project, which first proved out the swivel rocket control system, the North American NATIV program, the Martin Co. Viking program and Aerojet's Aerobee series are too well known among missile technicians to require detailing here. No amount of Army propaganda can expunge them from the authentic technical history of the missile era.

The Army's current fever pitch of propaganda really stems from an enormous technological inferiority complex. The Army is the most technically naive group in the three military services and was the last to realize the vital necessity of harnessing the galloping new technologies of nuclear fission and aerodynamics to its functions. With the exception of the Corps of Engineers, there are few high ranking Army officers who have even a smidgeon of technical training or education. Even at this late date, there are only a half dozen Army generals who can fly an aircraft. The new chief of Army aviation is just now learning to fly at an advanced age AFTER he was given the Army's top aviation post. In the ballistic missile field, the Army artillerists are far beyond their technical capabilities. This is the reason they have developed the cult of Redstone and the former German scientists.

Wernher von Braun and his able group of former Peenemunde technicians represent virtually the Army's entire technical capability in this field. Consequently, the uniformed Army brass clings to them almost hysterically for shelter in the technological storms that are revolutionizing the military profession.

Nobody familiar with the ballistic missile development picture would attempt to minimize the contributions to this field made by von Braun and the Redstone scientists. Nor would anybody who knew the technical score make the claim as did one missile pamphleteer that "95% of U. S. ballistics knowhow is in the Army." The Redstone Arsenal scientists are but a part, and a relatively small though significant part, of a sizeable effort being devoted to ballistic missiles development in this country.

The ballistics missile development program feeds on research data provided by National Advisory Committee for Aeronautics, the Office of Naval Research, the USAF Air Research and Development Command and a score of aviation industry scientific teams. At the working level, there is a heavy crossfeed of new technical information between all three services and the industry teams working with them. The Redstone scientists are nourished by this technical crossfeed and, in fact, would have tough sledding without it.

It is ironic that the technically naive Army brass are trying to inflate the size and scope of Redstone's work into a ballistic missile monopoly when, in fact, their progress is based in no small degree on the technical interchange with USAF, Navy, NACA and the aviation industry.

For example, the Army propagandists have "leaked" stories to daily newspapers that the Redstone group "solved" the nose cone re-entry problem. Redstone has contributed some excellent work in this field with its Jupiter C multi-stage research vehicle but so has NACA with its blunt nose cone development, USAF and Lockheed with the X-17 research rocket and General Electric and Avco with their plasma jet and shock tube studies. No one of these agencies has a monopoly on "solving" the nose cone re-entry problem, and all would agree that the solution is developing as a result of the breadth of effort and constant interchange of information rather than from a blinding flash of genius from a cloistered group.

The Army is playing a desperate game of military politics with its missile misinformation to regain the prestige and importance it has already lost by its tardy recognition of the revolutionary importance of science and industry in modern warfare. It may muddy the missile waters momentarily, but no amount of Army propaganda will alter the basic fact that real progress in the development of missiles or any other highly technical weapon system depends on the efforts of many research agencies and industrial teams, and no single agency or technical group has a monopoly on development capability in any field of science. —Robert Hotz

WHO'S WHERE

In the Front Office

Roe Nardone, a director and the director of engineering, Haydu Electronic Products, Inc., Plainfield, N. J.

C. G. Holschuh, a director, Sperry Gyroscope Company, division of Sperry Rand Corp., Great Neck, N. Y.

Charles C. Tillinghast, Jr., a director Administration Committee member, and vice president-foreign investments and plants, Bendix Aviation Corp., Detroit, Mich.

Edwin D. Campbell, vice president-administration, Laboratory for Electronics, Inc., Boston, Mass.

Albert H. Clarke, vice president-manufacturing, Crouse-Hinds Co., Syracuse, N. Y. **Russell P. Northup** succeeds Mr. Clarke as vice president-engineering.

Ogden W. Boden, vice president-engineering, Stanley Aviation Corp., Denver, Colo.

Rowland H. Spencer, vice president and general manager-aviation division, Butler Overseas Corp., New York, N. Y.

Richard T. Orth, vice president-planning, Sanders Associates, Inc., Nashua, N. H.

Dr. Bernard Jacobs, vice president-research, General Transistor Corp., Jamaica, N. Y.

James K. Nunan, vice president-electronics, Clevite Corp., Cleveland, Ohio.

William H. Clark, vice president-manufacturing, Schroeder Manufacturing, Inc., Long Beach, Calif.

John B. Montgomery, general manager, Aircraft Gas Turbine Division, General Electric Co., Cincinnati, Ohio.

Ralph E. Rechel, administrative assistant to the president, Air Transport Association of America, Washington, D. C. Also: **Daniel B. Priest,** assistant to vice president-public relations.

Capt. James J. Davis, Jr., Operations Officer, and **Capt. Robert D. Cox, Jr.,** Technical Director, Naval Aviation Supply Office, USN, Philadelphia, Pa.

Honors and Elections

Lewis W. Imm, president of Librascope, Inc., has received the Navy's Distinguished Public Service Medal for his outstanding contributions in the field of Naval ordnance and fire control techniques, including airborne periscope and digital computers for bombing and navigation.

Thomas Wolfe, of Thomas Wolfe and Associates, has been appointed executive director of The Aircraft Service Association, Los Angeles, Calif.

Changes

William H. Balentine, manager-Instrument Division, Thomas A Edison Industries, West Orange, N. J.

Roland L. Guerin, Jr., director-special projects, The Hufford Corp., El Segundo, Calif.

Clarence A. Wetherill, engineering staff specialist-avionics systems, Stromberg-Carlson, division of General Dynamics Corp., San Diego, Calif.

INDUSTRY OBSERVER

► Nike guided missile series includes an unnamed missile with a range between that of the Hercules and Zeus. Intended for use against slower vehicles than an ICBM, the weapon will not be developed until the Army's role in air defense is clarified by the Defense Department.

► **Army's Hawk will be a much simpler weapon to operate than any of the Nike series. Most of the ground direction work will be eliminated through use of the missile's internal guidance system. Low operating altitude of the Hawk prevents use of command guidance of the Nike type.**

► Extremely sensitive magnetometer for submarine detection, which is reportedly capable of detecting change of only one part per million in strength of earth's magnetic field, is one possible application for a new type Maser developed by French Atomic Energy Laboratory. New device, which operates at audio frequencies at room temperatures, makes use of precession of hydrogen nuclei in liquid instead of electron precession as in previous solid-state Masers (AW Aug. 19, p. 76).

► **Martin Co., which now has contracts for 24 P6M SeaMaster jet seaplanes, is installing tooling capable of a production run of 200 of the aircraft despite the cutback in the program by Navy (AW Aug. 26, p. 33). Third SeaMaster prototype is scheduled to begin flight tests late this fall.**

► Douglas Aircraft Co. is asking for bids by Oct. 11 on the design and construction of the display generator portion of the flat tube analog panel display it is building for Navy. One and a half years are to be allowed for the design and development. Unit would take information from the master computer and turn it into a form suitable for display on flat tube and other portions of the display.

► **Air Defense Command has issued a requirement for Navy-type arresting hooks for three of its Century series fighters—the McDonnell F-101, Convair F-102 and Lockheed F-104. ADC also will install overrun barriers at most or all of its bases. Reason is that the command has lost over $12 million worth of fighters during the last 12 months because of overshoots.**

► General Precision Laboratory is negotiating with Decca Navigator System Inc. and Bendix Pacific, Decca's U.S. and Canadian licensee, over the possible marriage of General Precision's Radar Doppler navigator with Decca hyperbolic navigation systems and/or Decca flight log cockpit chart display.

► **Experimental verification of Einstein's special theory to relativity will be attempted by RIAS Inc., subsidiary of The Martin Co., sometime this fall. Theory says that as velocity of a moving object approaches the speed of light, mass approaches infinity and time approaches zero. Theory will be tested by accelerating ionized helium atoms to very high speeds and then attempting to measure transverse Doppler shifts of the element's characteristic light frequency. Similar experiment was performed in 1938, but RIAS scientists hope to improve measurement accuracy by one or two orders of magnitude.**

► Army believes STOL aircraft may need new type instruments or automatic controls to ease pilot burden. Tests at University of Wichita indicate average flyer's reaction time and judgment do not permit full utilization of the aircraft's short field potential, particularly on landings.

► **Army is investigating large diameter, low pressure tires for use on unprepared landing fields. Special landing gear would include valve mechanism connected with load sensing device. It would automatically reduce the tire pressure on impact with the ground.**

► Republic Aviation Corp. will make a decision within the near future as to whether it will go ahead with plans to produce the Sud Alouette light helicopter under license. Alouette recently completed Phase 2 evaluation tests at Edwards AFB, Calif., and USAF officials are reportedly enthusiastic over its performance.

Washington Roundup

Louis Johnson: About-Face

Sharpest about-face in recent military history was performed last week by Louis Johnson, who once served as Secretary of Defense for President Truman. Best remembered for his strenuous economy efforts that were a factor in America's lack of preparation for the Korean war, Johnson now favors full support for an adequate national defense "cost what it may." He told the American Legion last week that "We must announce our convictions that no price is too high to pay for the precious gift of national security."

Painful Reminder

Campaign to keep the lid on budget spending has begun even before any real attempts have been made to try and pry it off. Recent budget battle was "actually only a major skirmish in a continuing war on runaway government spending," U. S. Chamber of Commerce President Philip M. Talbott told the Washington chapter of National Association of Accountants.

Accountants "can translate the terminology of government fiscal affairs for others and wherever you live, wherever you go, you can if you will add firepower to the cause of economy," Talbott said. "Bureaucratic lobbying" for supplemental and deficiency appropriations is a "threat to the cause of economy" that could "nullify all the good work that has been done," Talbott said.

Last May 2, during the "major skirmish" over government spending, Defense Secretary Charles E. Wilson said: "My friends in the U. S. Chamber of Commerce, they represent some of the richest people in this country and they have never been more prosperous, and for them to squawk so much about the budget gives me a pain."

Congressional Eye

Congressional interest in air agreements between the U. S. and other countries has developed rapidly as the result of bitter opposition U. S. carriers expressed to the bilateral agreements reached with the Dutch and Australia earlier this summer (AW June 24, p. 54). Last week, two congressmen decided to see for themselves the processes involved in bargaining for air routes and traffic rights. Rep. Oren Harris (D.-Ark.), chairman of the House Interstate and Foreign Commerce Committee, and Charles A. Wolverton (D.-N. J.) joined U. S. negotiators as observers at the bilateral talks with Brazil which began on Thursday.

Missiles Save

Last-minute fix in speech by Pentagon missile czar William Holaday changed the words, "We have sent ballistic missiles thousands of miles . . . to read: "We have sent a test ballistic missile thousands of miles. . . ."

Holaday told a symposium on free radicals of chemicals here that "We may well be faced in the foreseeable future with some indigestion . . . from too many air defense systems," both missiles and short-range interceptors. "We are actually suffering from too much talent in industry to design and develop missiles," Holaday said. "This is good in the sense of being able to have a better selection of competing missiles but it also makes it difficult to make any selection."

USAF Safety

USAF's flying safety record is improving despite continuing changeover to jets and the increasing complexity of fighters and bombers. In the first six months of 1957, the service hit an all-time low of 14 major accidents for each 100,000 flying hours.

The all-time high was in 1922, with 506 per 100,000 flying hours, USAF now has 1,150 aircraft flying at any given moment.

Hughes' Stock Appeal

Attorneys for Howard Hughes hope to work out an agreement with the Civil Aeronautics Board this week that will permit Hughes to retain his holdings in Atlas Corp., which holds 51% interest in Northeast Airlines. Hughes controls Trans World Airlines through Hughes Tool Co.

An investigation by the CAB was initiated to determine if Hughes' interest in Atlas would also give him control of Northeast in violation of the Civil Aeronautics Act. At a hearing last week, CAB Examiner Paul N. Pfeiffer postponed the proceedings for two weeks to give attorneys an opportunity to work out an agreement in which Hughes might retain his stock but have no participation in the management of Atlas.

Farewell VIP

There'll be no more VIPs, Very Important Persons, so far as the Air Force is concerned. The phrase and the plush accommodations and time-consuming ceremonies associated with it have become victims of USAF's economy drive. By regulation, the term is dead. Its successor is DV, or Distinguished Visitor, who is supposed to decline any offers smacking of VIP treatment.

Navy Denial

Navy is denying reports that its offshore radar picket effort has been curtailed because of budget austerity. Two squadrons of picket planes have been eliminated, leaving two on the East Coast and two on the West Coast. Navy maintains, however, that the tempo of its patrol will not be slackened and that present equipment will be fully adequate.

Airline Stock Slump

Airline common stock listings are now hovering close to their lowest level of the year. Declines have been sharp in the majority of cases with TWA, Capital and United experiencing the most severe drops. Only Western Airlines stock gives any indication of stability, showing an approximate three point decline from a 1957 high of 25¾ to 22¼ late last week. A large part of the decline can be attributed to the sluggish trend of the market in general during the past few months, but many observers feel that the industry's campaign in the recent suspended passenger fare investigation in which the low rate of revenue yield was emphasized caused a depressing reaction among investors. Airline earnings have been off most of the year and in almost every case, refinancing programs are under way in preparation for heavy re-equipment plans during the next five years.

Washington staff

Air Force to Continue R&D Cancellations

Fundamental research programs to get some relief; guidelines for all contractors expected soon.

Washington—USAF, aware of the indignation and confusion created by stop-gap economy measures in its research and development program, is taking quick counteracting steps. It hopes to have preliminary guidelines for contractors by the middle of next week, but officials point out that spending flexibility—and therefore confusion—will continue throughout the fiscal year.

Outlook is for further research and development cuts before Jan. 1. USAF, like the Defense Department (see page 29), is finding that the spending rate is still above administration-imposed ceilings in spite of stringent economy efforts.

First and most violent reaction to research and development economies came in the area of fundamental research (AW Sept. 16, p. 27).

The outcry quickly produced some counteraction at higher Air Force echelons.

Universities and other non-profit or not-for-profit institutions charged that renewal of contracts has been at a standstill since July 1 and said contract cancellations have been arbitrary, without proper consideration of importance of the work or immediate and long-range effects on the contractor.

USAF 'Panicked'

One university spokesman told AVIATION WEEK that USAF "has been panicked by a bunch of bookkeepers."

USAF in effect admitted that that is what happened. A quick look at the ledger by financial experts indicated the most immediate savings were to be made in basic research contracts, where no hardware was involved, where payroll and other overhead affecting termination costs would be low, and where no testing of end items would be necessary after a contract was canceled, as it would with the Navaho missile, for example.

A later look by technical experts just as quickly indicated the lack of wisdom in cutting fundamental research first, one USAF official said.

"It is a good general axiom that in the more lean years, one should broaden out horizons and look further into the future," he said. "If you can't do all the work you want to, you should at least gear to the few big steps."

USAF is now taking a hard second look at spending ceilings for the Air Force Office of Scientific Research, USAF's Cambridge Research Center, Wright Air Development Center and other Air Research and Development Command agencies that deal largely with universities and other non-profit institutions.

It fully recognizes its moral obligation to provide a degree of stability in contracting with non-profit institutions, which cannot absorb financial blows as readily as industrial contractors, a top official told AVIATION WEEK.

But he also said fundamental research is in for some trimming along with all other Air Force efforts to reduce spending.

Why Confusion?

Basic cause of the confusion at all echelons in the USAF research and development program is that no one knows precisely what the spending rate is.

In past years, operational controls were imposed on the basis of obligational rate. This rate was known with a high degree of accuracy at all times, and actual rate of spending got less attention.

Now the spending rate has been made paramount and operation controls must be imposed on that basis. But the switchover from one yardstick to another has meant that the first quarter of Fiscal 1958 has slipped by—with high spending—while officials were trying to determine how high spending was.

Bills for commitments made in Fiscal 1957 are falling due and must be paid. Costs are being incurred under contracts still in effect. That means virtually no new work has been contracted for, renewals of contracts falling due have been postponed and spending still is higher than it should be.

'Contract by Contract'

"We have got to go practically contract by contract and estimate at what rate they actually are going to spend before we can know what we can do about present work or new contracts," an Air Force official said.

"But we are trying to resolve immediately the question of fundamental research contracts that have already expired. We are getting into a position to resolve others at least by the time they expire."

Soon afterwards, Air Force hopes to give the universities some planning information—some idea of what will happen to contracts well ahead of the time that they expire. Air Force warned, however:

"But that is not to say that there won't be some cuts in fundamental research contracts, or that we can do without continued flexibility. It is essential in research work that you avoid inflexibility.

"That is one reason that fundamental research is an early target. In one sense you are least selective at the fundamental research end, where you are in effect trying everything, and most selective near the production end, where you have chosen only what you want to go on with."

Outlook for industrial contractors is essentially the same as for non-profit contractors—austerity now and more austerity to come, but with more sophistication evident in any economy measure taken from now on.

One milepost in USAF's decision making will be Jan. 1. USAF's $17.9 billion spending ceiling for all its activities is broken into $8.95 billion for each half of the fiscal year. How actual spending stands relative to this goal by Jan. 1 will determine much of what will be done from then until the end of the fiscal year on June 30.

Although the USAF research and development appropriation for this fiscal year is $661 million, spending at the current rate would exceed that amount.

Thus, USAF must somehow temporarily bring the spending curve down below the $661 million line in order to eventually stabilize it at $661.

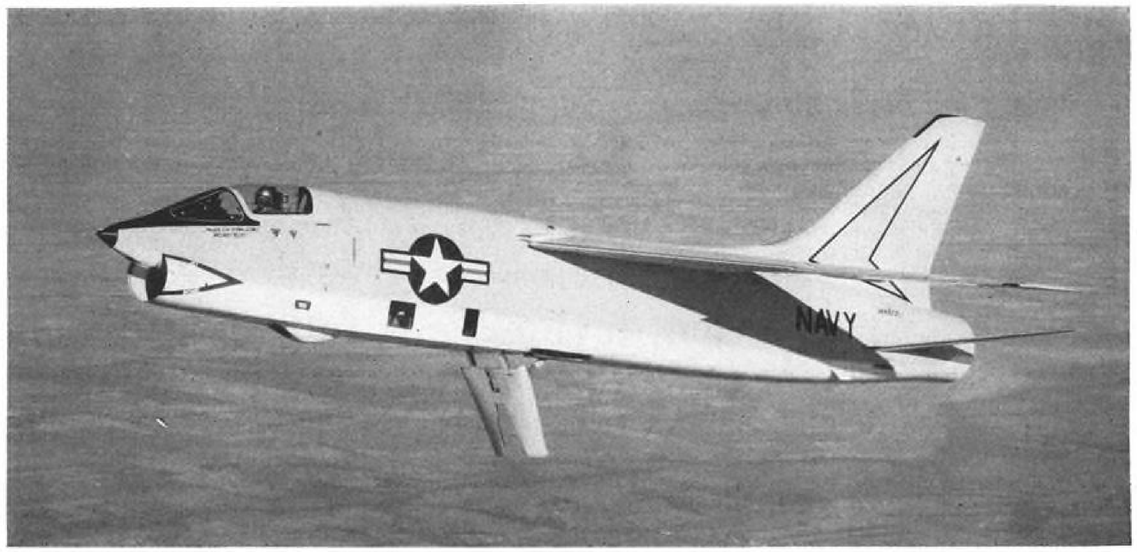
ARDC Reshuffle

Reshuffling of Air Research and Development Command facilities, missions, budgets, etc. is not firm now and will not be for some time (AW Sept. 16, p. 26).

But spending ceiling for Arnold Engineering Development Center, for example, is approximately 25% below its appropriation for Fiscal 1958. This has resulted in layoffs, and some cuts in testing work.

Air Force Office of Scientific Research, with about 600 contracts, has renewals falling due at the rate of about 50 a month. This means that a delay in renewals stretching well into September has thrown the program into considerable confusion. Other centers have been taking similar action, notably WADC and AFCRC. Personnel and Training Research Center at Lackland AFB, Tex., has been one of the hardest hit.

Test bases do less contract work and therefore are affected in different ways—personnel layoffs, limited construction of new facilities, some decrease in test load, etc. These include AEDC at Tullahoma, Tenn.; Flight Test Center at Edwards AFB, Calif.; Missile Development Center at Holloman AFB, N. M.; and Missile Test Center at Patrick AFB, Fla.



Large Dive Brake Slows F8U-1P Crusader

Large dive brake hinged under Chance Vought F8U-1P Crusader's belly effectively slows supersonic photo-reconnaissance plane so that it can keep up with plane from which this photo was taken. This is first picture showing Crusader's dive brake opened. F8U-1P is the one in which Maj. Glenn broke cross-country speed record (AW July 22, p. 30).

University Charges

Universities and other non-profit research groups dealing in "effort" contracts rather than work that produces hardware charge that USAF economy actions so far have:

- **Severely shaken confidence** in USAF as a supporter of research. USAF is painfully aware of this result and is making every attempt to correct it. "The last thing we want to do is destroy the quite compatible relationship we have had with these groups," one Air Force official said. "We recognize what the immediate and the long-range effects would be. We think it is partly a question of communications and that is being worked on. But we also are finding that when you're bumping your head on a spending ceiling you get stoop-shouldered real fast."
- **Come at the worst** possible time—the beginning of an academic year, when professors and graduate students are assigned to and supported partly by specific research contracts.
- **Ignored economic facts** of life peculiar to fundamental research work. Artificial restraint of spending level by time periods is incompatible with research.
- **Threatened to waste more money** than they save. In some recent cancellations, no provision was made for recording and summarizing work done thus far. Therefore, USAF gets nothing for the money spent and cannot continue the work later if the economic picture brightens.

Cancellations, orders from some centers to cut overhead by 5% on all contracts, and failure to act on proposed new contracts have created problems.

But failure to renew contracts that otherwise would have been renewed almost automatically has been biggest cause of complaint—along with inability of most USAF project monitors to give any indication what to expect on renewals in the near future.

University Reaction

Some examples of university reaction:

- **University of Michigan's** Engineering Research Institute as of last week held 50-odd Air Force research contracts. The four it held with one center had all been canceled, although three were in a area which has very high research priority. Others with other centers, even though they had lower priorities, had not been cut. Although first attention to research problems centered on AFOSR, no contracts with that office had been cut either. The four contracts canceled involved $215,000 in funds already authorized and work already contracted for. They also involved 34 individuals. On some contracts the Institute was told to specify a regular rate of expenditure which it expected. On others, it was told to make a 5% reduction in dollars authorized but uncommitted as of the end of July.

"The situation is somewhat more critical than these facts indicate," a spokesman for the Institute said. "The Institute is not separate. It is a part of the university. It undertakes research partly for the benefit of the instructional operation of the university, for the benefit of teachers and graduate students. Some contracts are not directly concerned with the academic work but are strictly public service.

"Being a non-profit organization, we can't accrue funds to hold personnel and continue the work. We can't wait until the government's pleasure to restart. When contracts are canceled, we have to either find work for personnel on other projects or let them go.

"Before we had X dollars and no limit on when to spend them. Now we are being told to determine how much we can spend for August, which is past. We can't live within that situation."

"We are evaluating our position as an Air Force contractor and several steps recently have, we feel, affected the acceptability of Air Force contracts."

- **Massachusetts Institute of Technology.** One of USAF's biggest research contractors among the universities, MIT said it has many people assigned to the task of trying to find out what the research and development cuts will mean. "If there ever was a state of confusion, the Air Force is now it," a spokesman said. "In trying to find out what is going on, we are looking through an almost completely opaque window." MIT points out that timing of cuts is

most unfortunate because the education of engineers, after a serious decline, had taken an upswing. Graduates last year had reached the 26,000 level once again. Interest and enthusiasm of researchers and potential researchers will decline rapidly if support is withdrawn—or even delayed for too long.

• **Cornell Aeronautical Laboratory.** Economy moves have had no great effect yet. Feeling here is that logic will prevail eventually. Meanwhile, where requests have been made for 5% cutbacks, CAL is reviewing each contract and telling USAF precisely what can and can't be done under it.

• **New York University.** NYU holds almost $1 million in Air Force contracts, measured in annual value. Major concern here is over the potential damage to the state of science generally in the country, especially since funds support so many graduate science students and provide a basic training ground. Cancellations have not been a problem, although cancellations followed a few days later by rescinding orders indicate the degree of confusion. "This is how jittery they (in USAF) are," one spokesman said. "I have never seen a panic of this kind in research."

Renewals are the greatest problem from the standpoint of dollars and planning. "Whether or not the Air Force is going to continue a research program is Air Force's concern, primarily," the spokesman said. "But they should not be in the position of having to tell us they just don't know whether they're going to continue it. They should not sound as if they're saying, 'When there is some money available later you can come and scrounge around for it and maybe you can pick up where you left off.'"

• **Ohio State University.** Research foundation said it has had a few "extreme instances on some contracts of orders that we can't possibly comply with because they were issued without the contracting officer having looked into the specific contract sufficiently." It has also had different orders from different ARDC centers, with no pattern of consistency.

One spokesman said, "In September we get orders telling us what we can spend in September. We also are told we cannot spend by the end of September money already spent by the end of August. It is ridiculous on the face of it."

All institutions contacted agreed that 5% cuts or more could have been taken in stride with proper advance notice and some flexibility. But they emphasized that it is very difficult to estimate either expenditures by time period or overall expenditures under research contracts. An estimate within 10% is considered very good. Therefore being asked to reduce contracts by 5% across the board is nearly impossible.

Some USAF letters to contractors ask that cuts be made in overhead and fixed charges but not in direct labor. But 5% of the whole cost of a project may equal 50% of the overhead. Attempting to cut overhead puts an administrative burden on direct labor and decreases labor's research productivity. One of the prime factors contributing to overhead, contractors say, is USAF's own indecisiveness about what research it is going to continue to support.

One of the most frequent observations made by universities was that the Office of Naval Research and Army Research agencies have accomplished research contract savings with far less confusion and greater selectivity. Air Force's greatest problem in this regard is that scope of its research program not only is much greater but has been expanding more rapidly.

Gen. Irvine Tells Industry to Get Tangible Product for Pay Check

Los Angeles—One of the biggest problems facing the economy and the aviation industry in particular is to find ways of ensuring that something tangible is produced when people are paid to work, Lt. Gen. C. S. Irvine, USAF deputy chief of staff for materiel, told the Electronics Industries Assn. symposium on Numerical Control Systems for Machine Tools last week.

Gen. Irvine said reducing employment or cutting wages is no solution to the inflation problem. The purchasing power of money, he said, can only be increased by increasing productivity per man hour and per dollar. Since military expenses are such a big part of the economy, the services must take much of the responsibility for improving the ratio of output to cost, which is the same thing as the ratio of goods and services to money, he added.

The General cited numerical machine control as a means of tripling productivity and in a few cases of multiplying it by a factor of as much as 20. To get better value from engineering effort, he said USAF will require more progress from one design generation to the next. As an example, he said, the Mach 2 fighter generation will be skipped. New designs must be capable of Mach 3.

'Muscle' Cuts

While conceding the economic necessity of eliminating unproductive expenses, Gen. Irvine emphasized the importance of cutting intelligently. "Every now and then we have cut off a little more than fat. Sometimes we have cut off a little muscle too."

Pointing out the importance of peacetime defense production, he said: "If war comes, the Russians will have the advantage of choosing when, where and how it will be fought. We are certain that we will do our job or fail to do it with the airplanes that are on the end of the runway when the war starts. We must be ready all the time."

Automation is the best answer to the vast manpower of Russia, Gen. Irvine said. "They have engineering know-how comparable to our own and they are willing to devote a greater portion of their national resources to military build-up than we do. So far, they have not to my knowledge made use of the really modern production techniques. This leads me to believe that the technological gap which the Soviets have been closing at an alarming rate may be widened again in our favor if we exploit fully the potentials of numerical control and electronic computer equipments."

Control Contracts

USAF already has let about $20 million worth of contracts for development and production of better numerically controlled production tools and modification of equipment using older, less efficient methods of control. Replacement of tracer controls which duplicate a template by tape controlled tools, directly eliminates a time consuming and costly production step.

Tripling productivity of machine made parts is of significance to the aircraft and missile industry because of the growing ratio of machine work to manual assembly in jigs and fixtures. Size of pieces relative to the whole airplane is becoming larger and use of extruded, milled skin, large forged structural members etc., is cutting the amount of manual work. Even assembly is being mechanized to some extent with automatic riveting machines and welders.

Three axis numerical control has proven effective for profile, contour and skin milling. USAF is convinced that in these applications, numerical control can give absolute uniformity in duplicated parts, continually fixed guidance from the director without human intervention and human error, perfect obedience to specifications on tape or card continuous feedback checking, freedom from spindle and cutter slippages, and freedom from cracking due to incorrect traversing speeds and mill rates. Quality control is inherent in the technique.

Wilson Predicts More Hardware Cuts

By Claude Witze

Washington—Defense Department expenditures continue to run well above the level of a $38 billion ceiling, and there is a substantial possibility that new aircraft procurement cuts will be ordered after Oct. 1.

With one week left in the first quarter of Fiscal 1958, Secretary of Defense Charles E. Wilson indicated expenditures for his department still are at the $40 billion rate on the basis of figures for July and August.

As one means of further cutting costs, Wilson late last week announced another cut of 100,000 in military personnel. He had ordered an earlier 100,000 cut last July. Total strength will be down to 2.6 million by early in Fiscal 1959.

Strengths at last count and goals by next June 30 are: Army 990,000 and 900,000; Navy 678,000 and 645,000; Air Force 922,200 and 875,000; Marines 199,500 and 188,000. Marines also must cut another 8,000 early in Fiscal 1959.

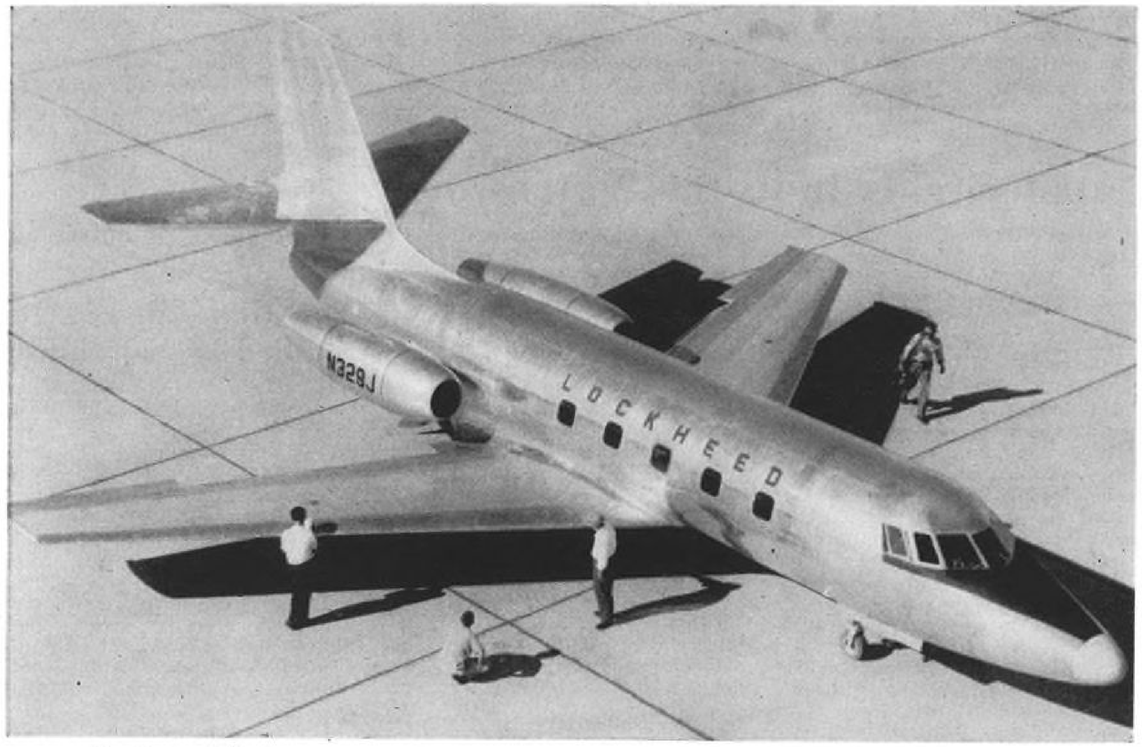
Industry observers in the capital were not optimistic and suggested that there must be a big improvement in the rate of expenditure as tallied on Oct. 1 or there will be more cancellations, stretchouts and delays.

USAF has announced no new program changes, but Navy last week canceled the Triton guided missile, on which it has spent about $25 million. Triton was a surface-to-surface missile developed by Johns Hopkins University. McDonnell Aircraft, Goodyear Aircraft and the Kearfott Co. of Clifton, N. J., were industry participants.

Previous changes in military aircraft procurement include:

• **Cancellations by USAF:** North American Navaho guided missile; Republic XF-103; North American F-107; Douglas C-132.

• **Stretchouts by USAF:** Lockheed F-104; Republic F-105; McDonnell F-101;



JetStar Flies

Prototype 10-passenger CL-329 JetStar light jet utility transport is shown at Edwards AFB (above) prior to first flight (right) on schedule. Plane has two Bristol Orpheus engines in place of twin J85s or J83s on each side to expedite flight test program, pending availability of the small U. S jets. Built with Lockheed funds, JetStar is designed to meet USAF transport/trainer requirements in addition to CAA regulations, broadening its application to include use as a business transport. Company says it is stressed to carrier operational needs. Cruise speed is more than 500 mph.

Convair F-106; Boeing B-52; North American F-100.

• **Cancellations by Navy:** Douglas A4D-3.

• **Stretchouts by Navy:** Chance Vought F8U-1; Douglas F4D-1; Douglas A4D-2; McDonnell F3H-2.

While the economy wave continued to harass both production and research and development offices (see page 26), there was a report from Huntsville, Ala., that the Chrysler Corp., builders of the Army Redstone missile, plans to build a new plant next to Redstone Arsenal for production of the Jupiter intermediate ballistic missile.

Jupiter vs. Thor

While actual fate of the Jupiter and USAF's Thor program were being decided at the Pentagon, it was reported that Chrysler has started to increase its personnel at Huntsville. While the Army Ballistic Missile Agency denied the rumor of a new plant, Tom F. Morrow, a vice president of the company, did not deny the report.

Morrow said: "There is nothing I can tell you at this time. There is too much going on now, security-wise, to say anything."

The Huntsville report said Chrysler planned to spend $300 million on the plant, a figure that raised some skepticism because it would make the factory about the most expensive facility of its kind in the nation. Chrysler already has defense facilities in the Detroit area, some of them built with the aid of government money.

USAF Policy

Pending a Defense Department decision on the IRBM, it was widely believed that USAF would stick to its policy of frowning on new manufacturing plants unless the need is proven essential.

On the other hand, there was evidence that Chrysler may be encouraged by Army interests. The company has been conducting an elaborate advertising campaign boosting the merits of the Redstone and Jupiter projects and paying tribute to Army's missile program.

'Austerity' Is Industry Watchword

Atlantic City, N. J.—Despite the certainty of a sudden, sharp drop in business, members of the Aircraft Industries Assn. were pledged last week to sustain their defense effort. But, AIA President Orval R. Cook warned that acceleration of the complex industry will not be a simple matter after the Defense Department's present economy drive has applied brakes to the design and production of new weapons.

Cook, former USAF materiel officer, said "nothing cataclysmic has happened" to the industry, although it must make some important adjustments. At the same time, he told the American Legion Aeronautics Committee, AIA agrees the military services have no obligation to support the industry.

"Our companies have never felt that the nation owes them an existence," Cook declared. "With a change in requirements and a reduction in the production of air armaments, competition will be severe. The industry has always been competitive and it will continue to be."

Industry Cuts

Cook said the industry as a whole will effect a 5% cut in its work force by the end of next month. A similar 5% cut in progress payments will force contractors to use bank loans for financial relief. Overtime has been slashed to a minimum and facilities will be cut back.

"Austerity," he said, "will be the watchword throughout the entire airframe, engine and components industry."

The AIA chief predicted that subcontracting will be reduced. He said pullbacks will take place as the workload decreases in airframe and engine factories because "it makes little sense that a manufacturer whose facilities and work force are not fully occupied would continue to farm out work if he can do the job better and at lower cost."

Cook said guided missiles are going to be of increasing importance to the aircraft industry and that the aircraft manufacturers are best equipped to design and build missiles. He deplored the development of missiles in government arsenals and universities, pointing out that there is a loss of time and efficiency in moving these projects from outside agencies to industry for production.

Industry Deliveries

Cook cited the decline in aircraft industry deliveries over the past few years.

In airframe pounds, the figures fell from 141 million in 1953 to 130 million in 1954, 114 million in 1955 and 95.5 million in 1956.

He said AIA expected that the real turning point, with the achievement of target strength goals, would be reached in 1961.

Changes in this outlook were forced, he said, by the Defense Department's Fiscal 1958 ceiling of $38 billion in expenditures.

On top of increasing complexity and rising production costs, an important factor in forcing this action was the cut in lead time. Equipment was being delivered ahead of schedule as industry and government efforts in this field began to pay off.

Cook predicted that in the future there will be fewer parallel developments because economy will dictate early choice of a weapon to be put in production.

He said this trend was responsible for cancellation of the North American Navaho missile and predicted that the practice will be followed on future ballistic missile projects.

Maser Interest

Growing interest in Masers will be spurred faster by recent tests that confirm previously unproven theory that new solid-state atomic amplifier can provide extremely low noise microwave amplification. Measurements made by Bell Telephone Laboratories and Lincoln Laboratory show Maser noise level (sensitivity) is 100 times better than existing electron tubes. Some observers now speculate that noise level-improvement of between 100 and 1,000, the top theoretical limit, may ultimately be achieved.

New High-Lift Design Studied by Fairchild

Hagerstown, Md—Fairchild Aircraft Division reported last week that it has completed initial research on a high lift "jet wing" aircraft which the Office of Naval Research terms "a significant step toward development of an entirely new airplane of the future."

A Fairchild spokesman said the "jet wing," which diverts the entire thrust of the powerplants over the wing surface through boundary-layer-type slots, is an extension of the blown-flap high-lift boundary layer control technique. "The tail flap as we know it," another company spokesman said, "will disappear."

The research program, originally sponsored by ONR, was completed under contracts from the Navy's Bureau of Aeronautics and Army's Transportation, Research and Engineering Command.

A new program to develop components for a contemplated "jet wing" prototype is scheduled for completion in June of next year.

One possible application, Fairchild says, could be the use of smaller carriers to launch and recover high-performance aircraft incorporating the "jet wing" design. The company also says the design can be applied to commercial transports.

Short-Haul, Cargo Lines Must Re-Equip

Delft, The Netherlands—A decade of economic and technical consolidation in civil aviation that will see cargo carriers and short-haul operators acquiring the benefits and problems of new aircraft ordinarily associated with trunk lines was forecast here by Arthur Raymond, Douglas Aircraft Co. vice president of engineering.

Raymond, delivering the second annual Dr. Albert Plesman Memorial Address, said the DC-8 generation of jet transports will not become obsolete soon enough to open a supply of used aircraft for non-trunk line carriers before their present equipment must be replaced. Obsolescence of the jet transports is retarded, he said, because no performance improvement large enough to justify the expense of a new design can be made until a supersonic type becomes economically practicable. Until new engine developments of the 1970-1980 decade arrive, the range is too short and operating costs too high at supersonic speeds.

A major question is how the non-trunk operators will meet the first cost of new equipment when they are compelled to buy it, Raymond said. He added that the problem would be staggering if the technological advances were encountered in a static traffic situation but will be largely self solving with the growing traffic generally forecast.

New Design Plans

If, by 1967, all International Civil Aviation Organization member airline fleets use turbine powered aircraft and traffic volume meets expectations, non-ICAO operations will absorb all existing piston powered aircraft and perhaps require more. Among the factors that will push shorthaul passenger carriers to buy new equipment will be the taste for jet flight comforts and convenience passengers acquire on trunk lines.

The anticipated demand for new transport equipment and the growing insecurity of military business are reflected in the multiplication of the number of companies announcing new transport designs. Raymond likened the situation to that in the automotive business when the automobile first gained wide acceptance. The number of companies competing increased suddenly but over a period of a few years competition first halted, then reversed the trend. Raymond expected the cycle to be played out in the aircraft field.

The buyer of successful new equipment will get a good bargain on the basis of Raymond's comparison of the seat-mile costs of the DC-7C with the anticipated seat-mile cost of the DC-8.

The DC-7C he said, produces 22 units per dollar while the DC-8 produces 34 units per dollar.

Of the 223 airlines of all sizes operating in the world today, less than 40 have ever had the experience of introducing a new model airplane. Selecting the right airplane for the route without any record of the experience of others with the airplane is difficult and no matter how good the design, some expense and trouble must be expected in shaking down the new airplane. Raymond said a company should be sure to consider its own technical and financial resources before buying. One major headache is the training of maintenance and flight crews.

Cargo Market

Specialized cargo aircraft will find a market that many people had given up for lost. "About 10 years ago the air cargo business was cursed by an excess of optimistic predictions. The natural result of a performance which barely reached 4% of the forecast was a plunge into pessimism. Historically, however, the growth of air cargo has been continuing at an average rate of about 25% annually on a world basis. This growth is greater than that of highly regarded passenger traffic."

There are five major divisions of the air cargo market:

- **Emergency shipment.**
- **Movement of high value goods.**
- **Convenience.**
- **Sole means of transport available.**
- **Air shipping to save costs.**

Emergency shipment is today's prime market. One line has reported over 70% of its shipments are perishable or high style merchandise, medicines, spare parts for broken machines and other goods that fall into this emergency category.

Outside the U. S., the difficulty of surface travel makes air cargo play a larger role as the sole means of transport.

Cost Analysis

In a cost analysis of air freight, the costs of warehousing, packaging, financing, inventory control damages, pilferage and obsolescence must be considered as well as the transportation cost.

When all these factors are considered, Raymond said, it will be found that many articles can be sent more cheaply by air freight even at present rates.

Study of these factors indicates that the major sales efforts of cargo carriers might better be directed as the receiver than the shipper.

In many places in the world, air freight is growing more rapidly than in the U. S. Between 1948 and 1955, world increase in air freight was 236% as compared with 220% in the U. S. Canada gained 346% and India 588%. Economic growth of underdeveloped areas should produce increases of even greater magnitude in the next decade, Raymond said.

If tariffs remain at their present level, a forecast based on gross national product indicates a further increase of 140% by 1967.

Raymond said the DC-7D turboprop cargo plane now being designed at Santa Monica would cut today's direct operating costs by one third. With a 60% break-even load factor, this would give the shipper a cost of 10 cents per ton-mile. At that price, Raymond estimated world traffic volume for 1967 at somewhere around 11 billion ton-miles.

Traffic Structure

Regarding world traffic route structures in the next 10 years, Raymond said he expects no basic changes in structure but rather changes in emphasis within the existing framework. He pointed out that political factors are of fundamental importance in this field.

No ideal structure is possible, he said, with the current East-West division of the world since in many cases it prevents single stop operation from one economic center to another along the shortest possible route.

A technical result is to make aircraft heavier to get the extra range needed, thereby increasing the cost of transportation to the traveling public.

Another political problem is the question of traffic rights. When traffic rights are given to a foreign carrier, Raymond said, many operators will feel that their domestic rights are being invaded. In many cases, the extension of traffic rights to foreign lines will provide beneficial or at least harmless competition as well as needed service. However, in some cases, he added, this will serve local rather than general interests.

Many smaller countries that have less to offer in the way of bilateral agreements often have long distances to cover with nothing en route but technical stops.

These can take advantage of great circle routes and may well take traffic from a domestic operator who must stop more often and use a more circuitous route.

NMIC Promotes First Meeting; AIA Doubts Interest of Primes

Washington—National Missile Industry Conference is scheduled to hold an organization meeting here this week, described by its promoters as a session "of prime importance to the well-being of the industry."

Aircraft Industries Assn. reported last week that "probably neither prime contract missile companies nor top management of any companies have participated in the proposal for a NMIC."

While evidence of industry support for the proposed group was still elusive (AW Sept. 16, p. 30), there were indications of a promotional tieup between NMIC and Missiles and Rockets magazine.

Invitations to the first formal meeting were signed by Edward W. S. Hull, assistant editor of the magazine, who said NMIC's "proposers" had asked him to serve as a central source of information until a Washington office is created. Along with Hull's notice went a letter from Erik Bergaust, executive editor of Missiles and Rockets, inviting the addressee to take part in a three-day industrial missile conference here beginning next May 22.

Bergaust says his magazine is "co-sponsoring" the meeting with the industry. The Hull letter makes it clear that NMIC will be the co-sponsor with Missiles and Rockets and that the plans call for an annual exhibition.

AIA Report

Meanwhile, the Guided Missile Committee of AIA has been advised by its Washington office that there is no "clear picture" of the origin of NMIC.

An AIA memorandum lists nine firms whose names are being used by NMIC promoters as "interested" or "instrumental" in the proposed group. Management of at least two of the companies say they never heard of NMIC.

True identity of the industry sponsors of NMIC still is not clear, if they exist.

In a memorandum to the Guided Missile Committee, AIA reported:

"AIA staff personnel have made numerous inquiries concerning the proposed organization from sources of possible information, such as the Defense Department, several GMC members, several AIA companies, as well as the magazine Missiles and Rockets. Tangible results of our inquiries do not present a very clear picture of the origin of the proposed organization, the individuals who have interested themselves in it to date, nor of future actions.

". . . Some of the companies whose names have been mentioned as either being interested in the NMIC or instrumental in its organization are:

- **"Diversey Engineering Co.,** Franklin Park, Ill.
- **"General Chemical Division,** Allied Chemical & Dye Corp., New York City.
- **"Avco Research Laboratory,** Cambridge, Mass.
- **"Austenal Corp.,** New York City.
- **"Reaction Motors Inc.,** Trenton N. J.
- **"Cooper Development Corp.,** Los Angeles, Calif.
- **"General Astronautics Corp.,** Huntsville, Ala.
- **"Haveg Industries Inc.,** Wilmington, Del.
- **"American Rocket Co.,** Wyandotte, Mich.

"Informal checks made with management of a couple of the above companies have indicated no knowledge of the NMIC."

Analysis

AIA's analysis of the information available:

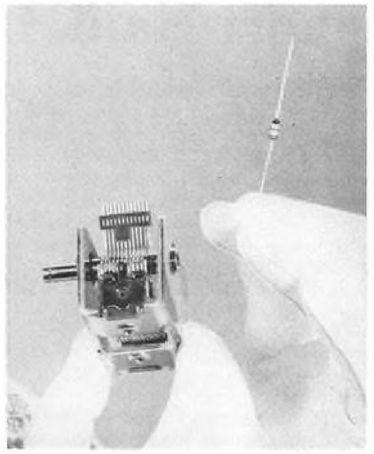
- **"The underlying purpose** of the proposed NMIC appears to have a strong public relations flavor.
- **"The proposal for a NMIC** may bear some resemblance in its campaign for membership and its coverage to the proposal for a 'Guided Missile Institute' of several years ago."

Airlines Say Baltimore Has Adequate Service

Washington—Domestic airlines last week reiterated their stand against diverting flights from Washington's National Airport to Baltimore's Friendship Airport as unnecessary and an inconvenience to the public.

Airline representatives appeared before the Civil Aeronautics Board to testify on the adequacy of airline service in the Baltimore and Washington areas. Both American and United Air Lines told the CAB that their present service scheduled into Baltimore is sufficient to meet the demand.

Baltimore representatives, on the other hand, contend that Friendship does not have enough scheduled service to meet the needs of Baltimore and that a large percentage of its travelers are forced to go to Washington to board flights.



SEMICONDUCTOR variable capacitor (R.) performs same function as radio tuner (L.).

New Semiconductor Aids Miniaturization

Culver City, Calif.—Subminiature semiconductor device which resembles a silicon junction diode but performs the far different function of a variable capacitor, opening way to reduction of size, weight in telemetering and communications equipment, has been developed by Pacific Semiconductors, Inc.

Capacitance of the device is varied by changing the small d.c. bias voltage applied across its terminals. Pacific Semiconductors acknowledges that the basic phenomenon employed has been known for some time (AW April 8, p. 87), but says it is the first to offer a usable device on a regular production basis.

Varicap, as device is called, can be used for tuning frequency modulation (FM) receivers, modulating FM transmitters in telemetering and communications. Device also shows promise as replacement for reactance tube now employed in automatic frequency control circuits.

In addition to small size and weight (comparable to semiconductor diode), new device reportedly has far lower temperature coefficient than conventional variable capacitors.

Present production units are available with Q's of 15-18 at 50 mc. and in capacitance ranges up to 100 Mfd., which tends to limit their use to narrow-band tuning. However, Varicap devices now under development are expected to extend these ranges and increase number of possible applications, company says.

Varicap will operate over temperature range of −65C to 150C. Price is expected to be comparable to conventional silicone diodes.

6th Anglo-American Aeronautical Conference:

Titanium Applications, Testing Appraised

Folkestone—Heated controversies on the applications of titanium and the testing of complete structures to destruction highlighted the sixth Anglo-American Aeronautical Conference here.

First important presentation of user experience with titanium in the industry by Leo Schapiro and Emerson LaBombard of the Douglas Aircraft Co., kicked off the most productive of the discussions. Another major technical argument centered around the philosophy of testing a complete structure to destruction exemplified by the water tank technique used for the Comet and Britannia fuselages.

Dr. A. E. Russell of Bristol and Dr. P. B. Walker of RAE Farnborough took opposite sides in an exchange of comments that provided the best technical wisecrack of the four day meeting.

Security regulations, timed limits to discussion periods, and an astonishingly poor public address system drove delegates to gather in small informal groups to thrash out mutual problems.

Unsuitable Presentation

There were bitter comments from some delegates about quality of papers. As one example there was considered feeling that paper by Dr. J. V. Dunworth on nuclear power applications for aircraft was completely unsuited for such an audience. Dunworth, who is one of Britain's top nuclear technicians, was out of his depth discussing aircraft design applications.

Inflexibility of time limits brought other criticisms. Discussion of Schapiro's titanium paper was just moving nicely—it was the most exciting and productive of the formal meetings—when Sir Sidney Camm, chairman of session, interrupted to close meeting because of lunch.

Observers at conference remembered that Camm had done this at an earlier Anglo-American Conference when he stopped the completion of a presentation in favor of podded turbojet powerplants.

Titanium Testing

Schapiro and LaBombard reviewed nine years' experience with the metal, first in the X-3 research aircraft prototypes and later in the commercial DC-7 series of transports. In three regions of the X-3 where temperatures reached up to 800 deg. C—powerplant, extreme aft fuselage and empennage—849 titanium components were used. Schapiro said failures and fabrication losses were extremely small, practically none of losses were due to inherent metal characteristics, and every forming method available to the plant was used successfully. Weight of titanium in each aircraft totaled 545 lb., representing a weight saving over stainless steel of 395 lb.

Later 450 lb. in 333 parts was introduced on each of the early DC-7 aircraft replacing stainless steel engine firewalls, and only nine parts failed during four years' usage. Amount was stepped up to 800 lb. on DC-7C and projected use on DC-8 is 600 lb. in the engine pods and pylons, 300 lb. at frames and cutouts and 14 lb. of forgings.

Still Expensive

But in spite of this progress Schapiro concluded that at $20 per lb. titanium was still uneconomical and that Douglas was only continuing to use the metal in anticipation of future price reductions.

British metallurgists commended pioneering metalworking achievements and metallurgical analysis done by Douglas with titanium, including company's identification of "hydrogen needles." But other speakers wished the metal had never been lifted from obscurity.

Saying that "a mountain had labored to bring forth a mole," Major P. L. Teed of Vickers Armstrongs—author of a monumental paper on fatigue in metals—asked whether use of only 350 lb. of titanium in an aircraft weighing hundreds of thousands was justification for huge program implemented by Douglas.

Schapiro, stating that he was beginning to warm up to the discussion, retorted that his company had not made a mountain out of it. Douglas' whole approach had been a sober and conservative appraisal of the metal.

Oxide Present

Speakers questioned why so little use had been made of forgings and bolts; Schapiro replied there was extremely hard and brittle oxide present and that on a weight/cost ratio basis, there had been little inducement to tackle severe machining problems of titanium with availability of high strength steels with good fatigue properties.

British opinion on use of titanium was divided, but a number of speakers, notably from Short Brothers and Harland, advocated that more attention should be paid to its exploitation in subsonic aircraft as distinct to present work on high temperature high speed applications.

Short Brothers announced they had built a complete integrally stiffened wing for a subsonic application weighing 14% less than an equivalent aluminum alloy wing. Satisfactory machining techniques, company said, had been established on forgings such as arrester hooks, levers, wing root attachments and fittings. Problems reported by Short on sheet fabrication included thickness variations, hydrogen embrittlement and up to 0.3 in. departure from flatness.

Compressor Blades

Rolls-Royce was the only other company reporting on user experience. It had been using titanium compressor blades "highly successfully" for some time and the particular advantage was the reduced disc weight possible. First blades used commercially pure metal but magnesium was added later, the company reported.

Dr. A. E. Russell, chief engineer, Bristol Aircraft Company, discussed the fail safe and safe life philosophies and ended in argument with Dr. P. B. Walker of RAE Farnborough who had been associated with the watertank fatigue test program for the Comet. Walker maintained that using a complete aircraft tested to destruction highlighted the critical crack-prone areas on which inspection of service aircraft would be concentrated.

Scores Wastefulness

Russell said he was strictly against the wastefulness of expending a complete modern airliner for "preliminary training of inspectors" and insisted that duplicated detailed testing of specimen assemblies was superior.

But Russell also warned that technical instructions to inspectors needed to be completely reviewed and that the fail safe philosophy he advocated should not lead to complacency in the design groups.

An American Airlines spokesman, citing the losses of up to 150 sq. ft. of fuselage in each of two of its aircraft due to mechanical punctures, called for less complacency of hazard of explosive decompression and more design concentration consideration to minimize belly landing damage.

Best attendance of meeting was at C. W. Harper's presentation of work done at NACA's Ames Laboratory on increasing usable lift with boundary layer control.

Dr. G. V. Lachmann, who leads Handley Page's considerable research effort in this field, had high praise

for Harper's paper, saying there were three special points:

- **Concentration on system** and engineering details needed to get a practical low pump horsepower system in the air.
- **Presentation of aerodynamic data** in a simple way so that those outside the wind tunnel fraternity could understand it.
- **Dismissal of the "red herring"** that porous structure needed for distributed suction blocked up in use.

Absence of any flight experience from Handley Page or Vickers indicated the secrecy still surrounding British work in this field. Lachmann did point to the boundary layer control system developed by Australian scientist Wallis which uses a system of suction nozzles placed two or three boundary layer thicknesses apart and acting as vortex generators. The system greatly lowers the suction quantities required with only small reduction in lift coefficients.

He also said his company is using an automatic throttle control system which enables aircraft using BLC to approach on throttle instead of elevators and thus combat their poor flight path characteristics at speeds below minimum drag speed.

Speed Goal

Rolls-Royce claimed that the flow characteristics of the bypass engine made it ideal for BLC aircraft and said it could supply air for blowing without a thrust penalty. Dr. H. H. Kurzweg of Naval Ordnance Laboratory said they are trying to obtain speeds on the order of 16,000 fps. with 40 mm. projectiles fired in a 1,000-ft. pressurized range. Kurzweg, who discussed the role of hyperballistics in aircraft and missiles, said that size of the projectile was determined by need to see boundary layer clearly. The new 1,000 ft. range is now under construction.

Stalling Flutter

Franklin K. Moore of Cornell Aeronautical Laboratory, who presented a treatment of boundary layer unsteadiness, pointed out that there was a possibility of something like stalling flutter in the use of high aspect ratio wings in high lift VTOL or STOL applications. He said that unsteady movement of a boundary layer separation point would also be an obviously powerful mechanism for generation of noise.

Aircraft Firms Submit Financial Figures

Financial details reported to the House Armed Services Investigating Subcommittee by four major manufacturers in connection with the subcommittee's proposed investigation of 17 aircraft engine firms (AW Apr. 1, p. 26) are shown below. Despite much publicity by the subcommittee's chairman, Rep. Edward Hebert (D.-La.), on the importance of the project, it was dropped because members did not want to remain in Washington beyond congressional session.

General Electric Co.
Aircraft Gas Turbine Division

	1952	1956
Total Sales*	$2.9 billion	$4 billion
Sales to U. S. Govt.*	$959 million	$794 million
Percentage of total sales	32%	19%
Net worth*	$872 million	$1.1 billion
Outstanding stock*	$179 million	$433 million
Dividends, annual per share*	$3	$2
Research and development: total value of contract payments outstanding, Dec. 31, 1956	.....	$3.7 million
Dues and contributions	$79,138	$86,459
Portion paid to Aircraft Industries Assn.	$72,831	$57,749
Travel and related expenses	$1.7 million	$2.6 million
Government-owned property	$49.9 million	$90.2 million

*For General Electric Co. as a whole

Avco Manufacturing Corp.
Lycoming Division

	1952	1956
Total Sales	$83 million	$98 million
Sales to U. S. Govt.	$43 million	$68 million
Percentage to total sales	51%	69%
Net worth	$92 million	$74 million
Outstanding stock	$9 million	$9.1 million
Dividends, annual per common share	$.60	0
Research and development: total value of contracts outstanding, Dec. 31, 1956	.....	$6.4 million
Contributions and dues	$13,830	$24,204
Travel and entertainment	$297,616	$519,519
Total selling expense	$779,046	$1.2 million
Government-owned property	$77 million	$87 million
Profits before taxes	8%	7.5%

Westinghouse Electric Corp.
Gas Turbine Division

	1952	1956
Total Sales	$89 million	$50 million
Sales to U. S. Govt.	$89 million	$47 million
Percentage of total sales	100%	94%
Net worth	$39 million	$25 million
Research and development: contract payments outstanding, Dec. 31, 1956	.....	$7.5 million
Dues and contributions	$18,724	$24,105
Portion to Aircraft Industries Assn.	$17,624	$22,124
Traveling and entertainment	$292,122	$518,098
Government-owned property	.....	$95 million
Profits	6.4%	minus 12%

United Aircraft Corp.
Pratt & Whitney Aircraft Corp.

	1952	1956
Total Sales	$667 million	$952 million
Sales to U. S. Govt.	$576 million	$817 million
Percentage of total sales	86%	86%
Net worth	$142 million	$218 million
Outstanding common stock	$3.2 million	$5.1 million
Dividends, annual per common share	$2	$3
Research and development: Total value of contracts outstanding, Dec. 31, 1956	.....	$89.6 million
Contribution and dues	$91,074	$108,674
Travel and entertainment	$1.5 million	$2.8 million
Government-owned property	$37.3 million	$114.3 million
Profits before taxes	7.7%	7.9%

Nike Warhead Price

Atomic warhead for the Nike Hercules missile costs in the neighborhood of $1,000,000. Nike Ajax minus warhead costs about $15,000 for current production models. Hercules should not be much more expensive in quantity. Five different atomic warheads of varying yield are available to Hercules firing batteries.

Skin-Forming Machine Developed for Titan

El Segundo, Calif.—Hufford Corp. last week demonstrated its biaxial stretch machine for forming integrally stiffened extruded skin sections for Martin's Titan intercontinental ballistic missile. Machine is now undergoing proof tests at Hufford and will be shipped to Martin's Denver plant later.

In ICBMs, two approaches have been used structurally. Convair's Atlas uses thin skin with pressurization replacing expended fuel and oxydizer to retain structure's shape, rigidity and integrity, while Titan uses thicker gage aluminum alloy skin integrally stiffened, also an integral tank configuration.

The Hufford machine takes panels extruded by Alcoa and Harvey Aluminum, the latter termed "short" panels measuring 34 x 140 in. as received, while Alcoa panels are 34 x 280 in. Both panels are 2014 alloy, in the T4 condition, 36,000 psi. yield, 57,000 psi. ultimate tensile strength. Ultrasonic inspection is accomplished for flaw detection.

In Hufford processing, surface milling is done first, reducing the main panel thickness to .150 plus or minus .003. High cutter head rotational speed plus slow feed longitudinally yield fine surface finish. Vidigage thickness check is made and profilometer is used to check contour.

Panels are formed to a 60-in. radius, indicating a missile diameter of 10 ft. After the panel is inserted in the machine, sides are gripped and lower die pushes up to give the proper curvature. Die incorporates slots for the stiffeners. Machine end jaws then move in, grip the panel and a stretch to ½% of original length is imparted to set the curvature and prevent springback rather than extend panel length. Stretch also tends to relieve stress imparted in curve forming.

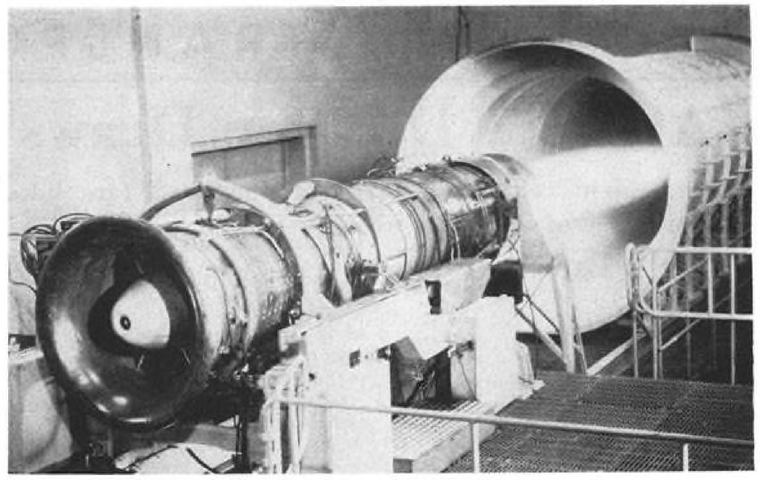
Panels are inspected, heat treated and aged to T6 condition with 57,000 psi. yield and 64,000 psi. ultimate tensile.

The panels are then chemical milled to the final thickness, which is .070 plus or minus .010 for regular sections. And on the exterior surface of the skin, exterior pockets are sculptured between the stiffeners, with material thickness here being .050 plus or minus .005.

Panels are butt welded, 12 forming a circumference, and several in the varying lengths making up the longitudinal tankage portion of the missile. Each panel has three stiffeners in T form with flange approximately 3/16-in. thick away from skin, and web thickness approximately 5/32. Stiffener web is approximately ⅝ in. high from skin junction to bottom flange, while the flange is approximately ⅜ in. wide.

The sculptured sections on the exterior do not run the full panel length, and are located nearer one end than the other after final trim. Pockets are almost as wide as section between stiffeners, with taper at each end and rounded ends, similar to a blunt nose shape with some taper ahead of it.

Missile skins undergo final check, then are shipped to Denver.



British Olympus 101 Undergoes Test

Solar afterburner with variable thrust is fitted on this Bristol Olympus 101 turbojet for tests of the combined powerplant. Olympus 101, primarily a production engine for the Avro Vulcan bombers, is being used as a test engine and is not intended to have afterburner. Afterburner thrust increment can be varied from zero to almost 40% under take-off conditions and has been tested through this range on the stand. Afterburner is expected to be fitted on a later model Olympus turbojet for a new aircraft project. Speculation is that project is a Bristol research aircraft designed for supersonic range above Mach 2.5.

News Digest

Avro Aircraft Ltd. will roll out the CF-105 Avro Arrow delta-wing interceptor Oct. 4 at Malton, near Toronto.

Construction of Republic Aviation Corp. wind tunnel facility began last week at Farmingdale. One tunnel will cover the transonic area; a second will go up to Mach 4. Facility, costing $1,200,000, is of blow down type.

Production schedules of Lockheed T-33 trainers and North American F-86F's have been revised downward because of the lag in pilot training for the Japan Air Self Defense Force. T-33 production will drop from nine to six or seven per month; F-86 production, scheduled to increase to 12 per month, will be held at the present 10 per month rate.

A new $11,000,000 contract from USAF will extend production of Lockheed T-33s at company's Burbank facility into 1959.

Ryan Aeronautical Co. net profit for the nine-month period ending July 31 was $1,076,330 on sales and other income of $46,244,618. Profit was 18% greater than in same period last year, when sales totaled $33,023,043.

RAAF Orders C-130s

Atlanta, Ga.—Royal Australian Air Force has placed order in excess of $35 million with Lockheed Aircraft Corp. for 12 C-130 Hercules propjet transports, including spares, crew training and support equipment.

Delivery of the 62-ton cargo-troop carriers will begin in October 1958, be completed in December 1958. Planes, which are additional to those on order for USAF Tactical Air Command, will be delivered directly from the production line at Marietta, Ga.

CAB Fare Decision Draws IATA Fire

Statement reiterating CAB stand against fare hike raises ire of delegates to annual IATA meeting.

By L. L. Doty

Madrid—International Air Transport Assn. criticism of Civil Aeronautics Board's stand against any fare increase was sharply intensified during the closing sessions of the 13th annual meeting here by the release of a CAB statement reaffirming its position.

The statement, directed to the IATA traffic conference which meets tomorrow in Miami, was termed "untimely" and drew a suggestion from one delegate that U. S. carriers may be acting in collusion with the Board in blocking a fare increase. It was evident, however, that representatives of the U. S. airlines were equally disturbed by the CAB's reaffirmation of its fare philosophy at this time.

Why Disapproval

The Board, in its statement, made public during the meeting, declared that ". . . .There is no economic justification at this time for adjustments which would result in an increase in the overall revenue yield presently accruing to the carriers from operations on the North Atlantic." It added that the Board similarly saw no need for a change in the basic fare levels now in effect on the North, South and Mid-Pacific routes.

The Board emphasized it felt "the currently effective fare levels to be appropriate for the various classes of service now being operated." It added that, in originally disapproving the 5% fare increase proposed by IATA, it pointed out that "the increases paid by the carriers for supplies, etc., have not been reflected in corresponding increases in the cost incurred in providing the service."

It said it strongly supported the third-class fare level agreed upon by IATA members to become effective April 1, 1958 and added:

"This fare will permit, under sound conditions of service, the offering of a service sufficiently attractive with respect to both quality of the service and cost to the passenger, to develop the potential market while, at the same time, affording the carriers an adequate revenue return."

Feeling against the CAB statement ran high among the delegates during the final hours of the annual meeting when the report was circulated, particularly since the association had agreed to accept the CAB decision as final. Sir William Hildred, IATA director general, said the association would not petition the CAB to reconsider its refusal to grant a 5% fare increase but has accepted the disapproval "with dignity."

Fare Increase Advocates

European and U. S. carriers were the strongest advocates of a fare increase during the meeting and reiterated the immediate need for high revenue yields as the only means of offsetting mounting costs being experienced by most carriers.

International traffic carried by European area members well exceeds the international traffic carried by the American members. Dues paid IATA by European and Middle East airlines account for more than half the total dues.

Gen. Georges Fayet, administrator general manager of Compagnie de Transports Aeriens Intercontinentaux, told AVIATION WEEK that a fare increase will be an essential factor toward raising sufficient capital to cover costs of the two DC-7Cs and DC-8s the French carrier has ordered. Other European carriers echoed Fayet's views.

Speaking for British European Airways, Lord Douglas of Kirtleside, retiring IATA president, termed the CAB action in blocking the fare increase a "pity" and underscored the capital requirements of airlines in equipping for the jet age.

Far Eastern airlines were less vehement on the issue and unwilling to reproach the CAB for its action. B. R. Patel of Air India International told AVIATION WEEK he saw no need for an increase, although Seijiro Yanagita, president of Japan Air Lines, said "fares should be up" and added that he would be hesitant in giving his support to a third-class fare on the Pacific.

Tasman Sides With CAB

Sir Leonard Isitt, chairman of Tasman Empire Airways, Ltd. (TEAL), said bluntly that he opposes any fare increase because of existing inequities in the rate of exchange in the New Zealand and Australian pound. He pointed out that the Australian passenger is required to pay a 25% premium on his air transportation because of this difference and that a fare increase would only serve to intensify the disparity.

In this connection, the executive committee of IATA announced during the meeting that resolutions governing currency exchange rates in relation to fares and rates have been drafted. The committee said the proposals "appear very much simpler" than present regulations and, if accepted, "will save carriers a number of headaches in the future." The plan would, in some cases, restrict the payment of fares to specified currencies in particular areas.

Neither Trans-Canada Air Lines nor Canadian Pacific Airlines was behind the move to bring about a fare increase. H. B. Main, executive assistant to the president of CPA, said he sees no need for higher fares and advocates a third-class fare without changing the present fare structure on tourist and first-class rates.

Traffic Conference

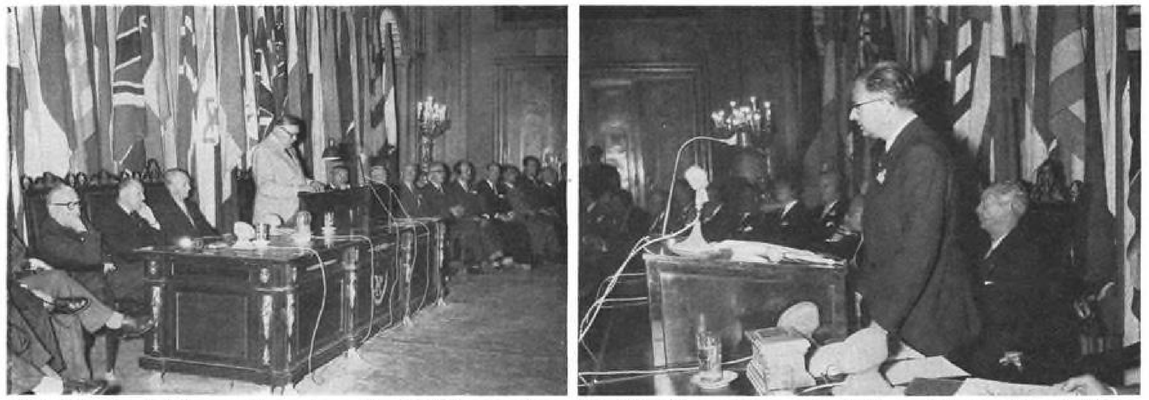
Officially, the traffic advisory committee did not comment specifically on rate proposals, which will be discussed by the traffic conference at Miami this week. It did note, however, that one of the chief items on the traffic conference agenda is the proposed North Atlantic thrift or third-class fare and assured delegates that "everything possible has been done to ensure that this particular project should have adequate consideration before coming to the conference floor."

The conference also is expected to adopt a no-show penalty plan similar to that adopted by the domestic carriers and to pass on recommendations to increase travel agent commissions.

Attempts will be made to reduce the complexity of the international passenger fare structure and steps will be taken to eliminate present deficiencies in the rating system governing freight and cargo shipments.

The executive committee warned that the recent CAB order precluding U. S. carrier members of IATA from being bound by IATA resolutions has "serious implications." The CAB decision, which originally arose from a complaint filed by a non-IATA carrier, pertains to IATA member U. S. carriers involved only in a domestic U. S. segment of the international transportation covered by the regulation in question.

In its criticism of the CAB, the executive committee told the convention



IATA delegates at 13th annual general meeting, Madrid, are welcomed by 1957-58 association president Tomas Delgado, of Iberia Airlines (left). Retiring president Lord Douglas of Kirtleside, British European Airways head, speaks at opening session (right).

that "the situation will require to be watched" and added:

"While the common sense of members has so far limited the possible consequences of the CAB's action, the adoption of the principle inherent in the CAB order by other governments could lead to the complete undermining of the IATA rate structure."

The committee explained that under the CAB philosophy, IATA members can be compelled to carry traffic on domestic sectors at through fares arrived at by a combination of domestic and non-IATA international fares that could feasibly undercut fares agreed upon in the IATA traffic conference.

The executive committee also called the attention of delegates to the high cost of IATA enforcement proceedings. Admitting that enforcement is "absolutely necessary," the committee said $215,000 of the 1958 IATA budget of $1,290,000 is allocated for enforcement activities.

New Treaty?

The legal committee warned delegates that a new international treaty may be required to simplify the charter and interchange of aircraft in order to obtain maximum utilization out of high-cost equipment.

The committee concluded that the Chicago convention "contains a framework that should permit the handling of leases without crew, as well as leases with crew, whether on a term basis, a voyage basis or in interchange."

Although the committee agreed that certain problems can arise in this respect as the result of certain requirements of individual governments, it held that such problems can be handled through the government concerned or by bilateral or regional arrangement.

The committee said, however, that difficulties may arise in the case of the lease of aircraft with crew to an entity other than an airline. The committee suggested that, when such a lease involved the carriage of passengers, any questions as to the liability of the airline as a lessor could be settled by insisting upon the issuance of tickets to passengers carried under a charter agreement. Such a procedure would automatically put the transportation under the rule of the Warsaw Convention which establishes liability limits.

Cargo Leases

Leases of aircraft with crew for the transportation of cargo pose a different problem, the committee said. In such cases, the shipper would hold the airway bills of the lessee or forwarder and not those of the leasing airline.

As a result, the owner of the aircraft would not have the protection of the Warsaw Convention liability limits which he held when carrying cargo under his own airway bills and could, therefore, be open to suit by shippers directly in tort and without limitation. Under the circumstances, the committee recommended some supplement to the Warsaw Convention to prevent any situation that cannot be satisfactorily resolved under the present convention.

The IATA legal committee also called for the completion of a convention on aerial collisions.

ICAO Proposals

The group supported recommendations of the International Civil Aviation Organization air transport committee proposing that the liability of each aircraft involved in a collision should not exceed the following limitations:

- **Twice the limits** of the Warsaw Convention established for passengers, crew, registered baggage and goods and personal possessions.
- **Market value placed** on aircraft involved in a collision immediately prior to the collision.

The legal committee also reiterated IATA's stand on the legal status of the aircraft and the aircraft commander that there is no urgent necessity for a convention to define the authority of the pilot-in-command in relation to offenses committed in aircraft in international flight.

Passengers carried by IATA members in scheduled service showed a 188% increase between 1949 and 1956. Revenue passenger-kilometers jumped 223% during the same period. In its latest statistical report, the association also reports a passenger load factor of 63.9% for 1956 as compared with 60.2% in 1949. Highest load factor was reached in 1951 when 66.4% was recorded.

Passenger Average

Average passengers per aircraft in 1956 amounted to 31.6 and average seats per aircraft, 49.5. Average trip was 1,067 kilometers.

Number of employes in service with IATA member airlines totaled 304,000 last year and the operating fleet of the carriers was 2,790 airplanes.

Czech Airline to Use Tu-104s on Arab Run

Vienna—Czechoslovakia's monopoly airline's transport department revealed recently that the Soviet Union has agreed to let Czechoslovakia buy the first three Soviet Tu-104s. The aircraft are to be delivered to Prague this fall.

The CTK airline will use these craft on Prague to Cairo route, and Prague to Beirut and Damascus. The new lines will start operating in November.

The Tu-104 flights to the Arabic countries will be non-stop. A Prague to Moscow route will also be flown, flight time to be 2 hours 25 minutes. Czechs now have routes to 14 countries; will have 19 countries to do air business with at end of this year.

ACC Details Future Traffic Needs

Washington—Air Coordinating Committee has warned that azimuth and distance measuring capabilities of Vortac will be required for air traffic control and positive separation of aircraft by at least 1965.

In a paper approved by its Air Traffic Control and Navigation Panel, the ACC said the air traffic control system must be based on Vortac facilities and that all aircraft operating under IFR and VFR subject to positive separation must be equipped with both distance measuring and azimuth capability "as soon as possible."

Aircraft which are not intended for use in either IFR flight or VFR flight under positive control will not be required to meet the Vortac standards, the group said.

A target date of no later than 1965 was called for by the ACC in establishing the distance measuring portion of Vortac on a systems basis. However, the group stressed the urgency of the need for implementation of the Vortac system by stating that the target date "should be the earliest practical date which can be met."

The group said normal maximum spacing between successive Vortac facilities serving basic route structures should be 78.16 miles. A maximum spacing of 156.31 miles should be required in selecting Vortac facilities to define and provide service on intermediate altitude route systems. On high altitude route systems, spacing of 312.62 miles should be employed, the ACC stated.

The report, entitled common system operational requirements for Vortac, was approved by the air traffic control and navigation panel acting on behalf of the ACC with the Civil Aeronautics Board abstaining.

Brazilian Line to Add Engine Overhaul Unit

Rio de Janeiro—Panair do Brasil has bought controlling interest in a machine shop here which it will convert into a special division to handle engine rebuilding and maintenance.

Panair expects to save $3 million annually by using the new facility, which will service L-49, DC-7C and later jet engines, probably for Douglas DC-8s. The plant will eventually serve other airlines in engine work. Local engine rebuilding facilities to date have been restricted to DC-3 and lightplane engine jobs.

Minor parts for the shop will be manufactured locally, but big components still will be imported. More local production of components is expected later as Brazil enlarges its foundry and metal-working industries.

Panair do Brasil is partly owned by Pan American World Airways.

Northeast Inaugurates Capital-Miami Run

Washington—Northeast Airlines, a regional carrier that has grown into a major trunkline within the past year, inaugurated nonstop service last week between Washington and Miami. Service to Jacksonville and St. Petersburg-Clearwater will be added later.

Douglas DC-6Bs equipped with radar and featuring two-abreast seating are being used on the daily coach flights. Flying time is about 3 hr., 25 min.

Northeast extended to Washington last November. It entered the competitive New York-Miami market in January. Philadelphia-Miami service was started Aug. 1 and New York-Tampa service Aug. 20.

New Electra Orders Raise Sales to 135

Lockheed Aircraft Corp. has made its first Electra sale to a U. S. local service carrier with an order from Pacific Southwest Airlines for three of the turboprops. Price with spares is $8 million and delivery is scheduled for November and December, 1959.

This sale along with that to Cathay-Pacific (see p. 45) brings total orders for the plane to 135. Last previous Electra order, covering three for Garuda Indonesian Airways, was announced in April.

Lockheed says no exact breakeven point for the plane has been established, but that it probably is within the 200-250 unit range.

Pacific Southwest plans to use its Electras in service between San Diego, Los Angeles and San Francisco. The intrastate carrier expects flight time from San Diego to San Francisco to be 71 min. with the turboprop.

Allison 501 Approved To Power Electras

Washington—Civil Aeronautics Administration last week announced the certification of the Allison 501-D13 turboprop engine for use on the Lockheed Electra transport.

Last month, CAA approved the Aeroproducts 606 four-bladed propellers with which the 3,750 hp. engines will be equipped. Prior to certification, the turboprop engine had compiled 80,000 hours of development time on test stands, 75,000 hours of experimental and service flight time and an additional 50,000 hours of testing of engine components.

In-Flight Phone Service Installed

Direct air-ground radio-telephone service, which enables in-flight passengers to be connected to any telephone in the nation or receive calls from any telephone, has gone into service on an experimental basis in the Chicago-Detroit area. If the current year-long feasibility tests prove successful, and sufficient channels in the crowded radio spectrum can be found, busy executives may find no respite from office problems even aboard an airliner cruising at 25,000 ft.

In current tests, conducted by Illinois and Michigan Bell Telephone Companies, 11 private and one government aircraft have been equipped with lightweight two-way radio telephone equipment. When a passenger in one of these aircraft presses a push-talk button on his airborne telephone, he quickly finds himself talking to a special "aviation operator" on the ground, gives his party's name or number.

Rates for the one-year trial service depend upon location of the aircraft and the party on the ground. For example, a call between an airplane over Milwaukee and a telephone in Chicago will cost $1.50 for the first three minutes. A call between a plane over Cleveland and a Chicago phone would be $2.15 for the first three minutes.

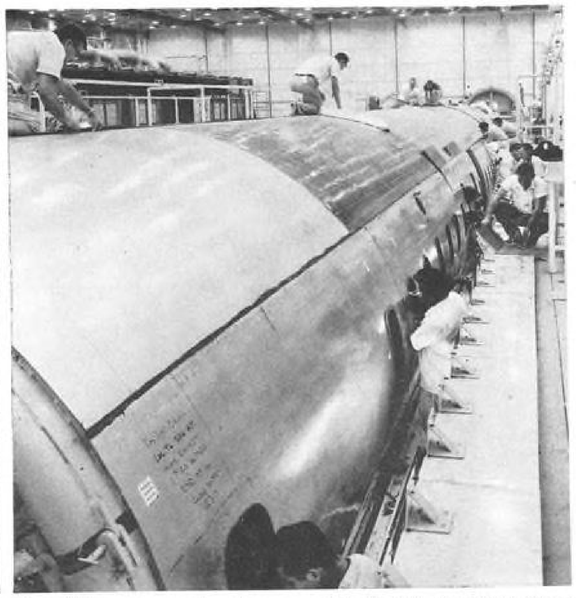
Airborne radio transmitter-receivers being used in the test have been supplied by A C. Spark Plug Division of General Motors and Motorola. Bendix Radio and Radio Corporation of America are expected to supply units for subsequent tests.

ATA Official Says CRAF Threatened

Atlantic City, N. J.—Potential of the nation's Civil Reserve Air Fleet is being threatened by "certain forces" now at work, Robert L. Turner, vice president-traffic, Air Transport Association, warned last week.

In a speech before the American Legion National Aeronautics Committee, Turner said the influences are:

- **Threat of government** in duplicating and paralleling routes being operated by the scheduled airlines.
- **Threat of continuously** rising costs of airline operations and necessary re-equipment programs, which, under what Turner termed the present regulatory climate in which the airlines must live, is eating away at the economic foundation of the entire air transport industry.
- **Threat of a continuing** State Department policy that is virtually "giving away" route rights and vital traffic areas to foreign airlines in direct competition with U. S. flag carriers.
- **Threat of Soviet Russia** which al-



Boeing, Douglas Readying First Jets for Airlines

Two of America's first jet airliners are moving along assembly lines in the West Coast plants of Boeing Airplane Co. and Douglas Aircraft Co. Boeing 707, at right on next page, is nearing completion, its engines and tail surfaces already installed. Plane will be rolled out this year, delivered to Pan American in late 1958. Above, Douglas workers at Long Beach shape fuselage of DC-8. Length of the fuselage is 98 ft., diameter is 12 ft., 3 in.

ready is the only nation in the world operating jet airliners on a scheduled basis and every day is becoming a stronger competitor for the world's air commerce.

Turner said that, if these forces continue to grow, they can shackle the ability and capability of the air transport industry to do the right kind of job if it is needed in an emergency. "They certainly can raise havoc with any program," he said, "and they can weaken the link of civil air transport in the air power chain."

The government is in the air transportation business with part of its Military Air Transport System, Turner said. However, he added that some government agencies, including the Defense Department, have recommended that certain of MATS transport operations be turned over to the civil airlines.

"This would encourage the airlines to continue their re-equipment and modernization programs and at the same time save the government money, because civil air transport in these specific areas is known to be cheaper than military air transport. Moreover, use of the airlines would relieve military personnel and funds for combat organizations which are starving for skilled personnel," Turner said.

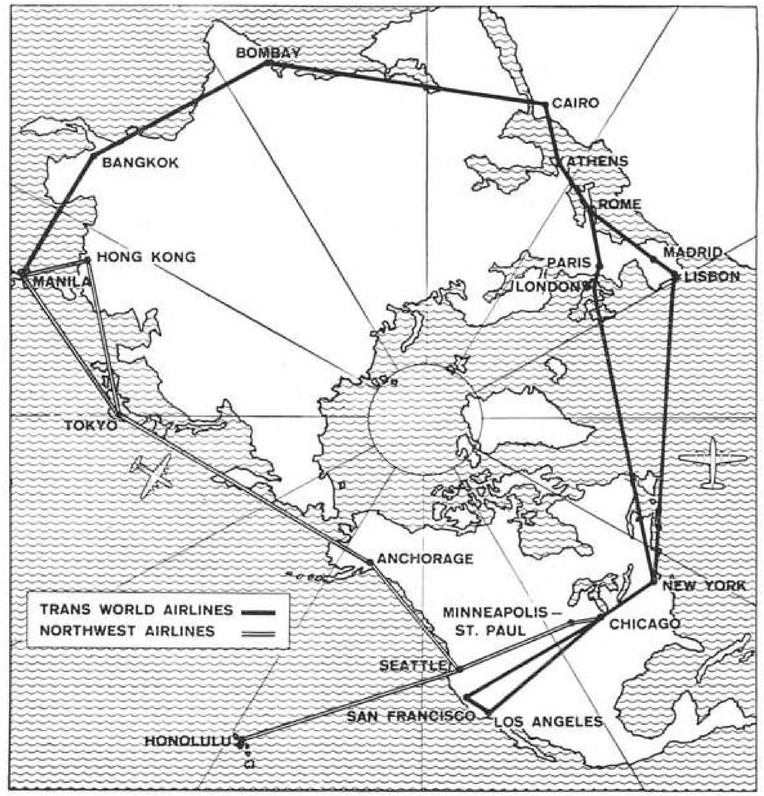
With regard to the economic status of the scheduled airlines, Turner told the group, a situation exists where an industry is literally "cannibalizing" itself. He said:

"The fact is more than 80% of airline net operating income in the past 10 years has been poured back into four re-equipment programs to bring the public the best possible service. And, the cost of everything the airlines buy and use, gasoline, aircraft, personnel, operating facilities, in the past 10 years has gone up at an alarming rate. But," he added, "the fares the airlines charge their passengers have remained almost level.

In fact, air transportation on the average costs less per mile today than it did in 1938."

Turner charged the government with assuming a role of "The Rich Uncle" toward foreign countries by allowing the foreign flag carriers to build up their airlines and penetrate the traffic areas of big U.S. cities at the expense of U.S. carriers.

"The Russian jetliners that landed here recently," Turner said, "may not be as economical or hold as much promise for the future as the jets we are building. But, we don't have any U.S.-built jet airlines flying in scheduled operations. The Russians do and have had for more than a year. And they already have announced newer and improved versions of the Tu-104 and a much larger transport, the Tu-110. Certainly, they mean business."



GLOBAL link of the new Northwest Orient Airlines and Trans World Airlines service will be at Manila.

Northwest, Trans World Plan Globe-Circling Service for Jan. 1

Washington—Two U. S. international carriers, Trans World Airlines and Northwest Orient Airlines, will join efforts to inaugurate a new around the world air route beginning New Year's Day.

A TWA Lockheed Jetstream and a Northwest DC-7C will take off from New York on Jan. 1 and head in opposite directions but both will have the same destination—Manila. The Trans World transport will go by way of Paris, Geneva or Lisbon, Madrid, Rome, Athens, Bombay, Colombo and Bangkok, while the Northwest aircraft will cross the U. S. to Portland and Seattle and, from there, fly over the Great Circle route to Alaska, Tokyo and Okinawa.

The two airlines will offer connecting services in Manila.

The only American flag carrier now offering global service is Pan American World Airways with routes stretching from New York to Europe, the Near and Far East and on to San Francisco and Los Angeles. However, the carrier does not traverse the U. S.

The TWA-Northwest hookup in Manila was made possible when President Eisenhower approved Civil Aeronautics Board recommendations extending Trans World Airlines from India and Ceylon through Bangkok to Manila.

The two carriers earlier were authorized to connect in Shanghai, but Communist occupation of that city halted plans for such service.

With the combined TWA-Northwest service, a passenger can travel around the world for as little as $1,364.30 in tourist accommodations or $1,877.10 first class.

Stopover at all points en route will be permitted.

Northwest provides daily flights from New York to Tokyo and three flights weekly from Tokyo to Manila. TWA schedules daily flights to Rome and Athens and will schedule two flights weekly on to Manila.

SHORTLINES

► **Northwest Airlines** is scheduled to begin nonstop New York-Seattle and New York-Portland service Sunday, using Douglas DC-7Cs. The flights will be operated on mixed tourist-first class basis. Northwest has taken delivery of seven of 14 DC-7Cs on order. The remaining seven will be delivered by the end of next April.

► **Gov. Foster Furcolo** of Massachusetts has signed a bill authorizing a bond issue of $15.5 million for construction of four hangars and an air freight terminal at Logan International Airport, Boston. Negotiations for lease of the structures, which will be self liquidating over a 25 year term, will be handled by the State Airport Management Board. There will be provisions for ground rental, amortization, interest on the unexpired balance and service costs. Hangars will be constructed for Eastern, National, Northeast and Trans World Airlines; the freight terminal for American. One state official estimates that the facilities will bring an annual profit of $225,000.

► **KLM, Royal Dutch Airlines,** will begin nonstop service from New York to Curacao on Oct. 11. In 1956, KLM made over 3,000 landings in Curacao, carrying some 120,000 passengers through the island airport.

► **North Central Airlines** carried 67,458 passengers in August, a record for the local service industry. The airline flew more than 900,000 miles over routes totalling 3,240 miles. North Central also set a daily local service record by carrying a total of 2,626 passengers on Aug. 16.

► **Frontier Airlines** established company records in August by carrying 22,300 passengers 5,861,000 passenger-miles, an increase of 21% in both categories over 1956.

► **Chicago Helicopter Airways** carried 7,140 passengers between Midway-O'Hare airports and the Chicago Loop, Meigs Field, in August for a company record. So far this year the airline has carried 28,295 passengers.

► **Los Angeles International Airport** handled 2,150,641 passengers during the first six months of 1957. The figure represents an increase in passenger handling of 18.7%. In the first six months, the airport also handled 39,404,239 lb. of air freight; 11,416,894 lb. of air express, and 20,758,205 lb. of air mail.

AIRLINE OBSERVER

(The following column was written by Aviation Week *Transport Editor L. L. Doty while attending the 13th Annual General Meeting of the International Air Transport Assn. in Madrid.)*

► Japan Air Lines plans to introduce the first of four DC-7Cs on order in March or April between Tokyo and San Francisco. JAL also has four DC-8 jet transports on order and expects to increase its jet fleet to a total of eight during the next 10 years. Seventy-five per cent of the financing program for DC-7s and DC-8s is being handled through the Export-Import Bank.

► **Aeroflot, Soviet-owned airline, was not represented at the International Air Transport Assn. general meeting although a Russian representative was present at last year's meeting in Edinburgh as the result of an invitation extended by Lord Douglas of Kirtleside, then president of the association. No formal invitation was extended to the Russians this year. However, Sir William Hildred, IATA director general, said that, if Aeroflot indicates its desire to join IATA, it will be "welcomed."**

► Carter Burgess, president of Trans World Airlines, was so impressed with the airline's international division during a recent visit to Paris, Zurich, Milan, Rome, Madrid, Lisbon and the Azores that he will pattern domestic operations on standards established by the international sector. Burgess also may import European chefs in an effort to improve quality of in-flight meal service on domestic routes.

► **British Overseas Airways Corp. will introduce turboprop Britannia 312s on its North Atlantic route during the first three months of 1958. First of the long-range aircraft was delivered earlier this month. Lack of trained pilots is the reason for delays in inauguration of transatlantic turboprop service which the airline had hoped to begin this fall (AW Jan. 21, p. 38). One crew has been trained by Bristol as the nucleus of the airline's flight training program on the 312s.**

► Air Finance Ltd., a British organization, has extended a loan of approximately $8 million to El Al Israel Airlines to help finance the purchase of three Britannia turboprop transports. The airline has been seeking foreign capital for some time since the Israeli government has been unable to offer financial aid.

► **Trans World Airlines has licked the language barrier in Spain by coining the nickname "Too-ah" to identify the airline and as an assist to Spaniards who would otherwise have difficulty in pronouncing the "W." The promotion backing the introduction of the nickname has been so successful that "Too-ah" spoken to the telephone operator will automatically connect you with TWA and cab drivers need no other address when told "Too-ah."**

► Middle East Airlines has begun a once-a-week all-cargo service on its two routes from London to Beirut via Milan and from London to Basle, Rome and Beirut.

► **Cathay Pacific Airlines has ordered two Lockheed Electra turboprop transports for delivery in June and August of 1959. Cathay Pacific with headquarters in Hong Kong will operate the turboprop throughout its major routes in the Far East.**

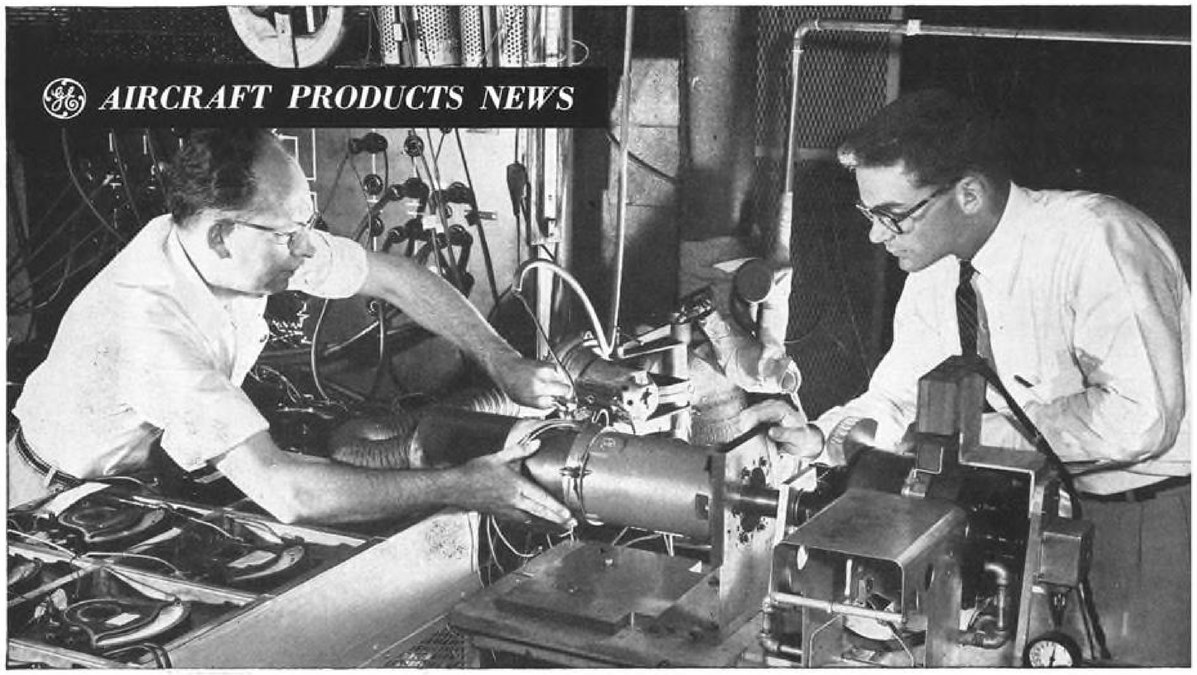
► International Air Transport Assn. will hold its 14th annual general meeting in New Delhi, India, where J. R. D. Tata of Air India International will take over as IATA president for the 1958-59 term. Meeting will be held in Tokyo in 1959. Date of the New Delhi session has been set for October rather than September because of the more favorable weather conditions in early fall.

► **Vote to transfer IATA headquarters from Montreal to Geneva was 30 to 29 in favor of the move with six members abstaining, but because of the small majority, the resolution was withdrawn by a European bloc of seven airlines which had sponsored the proposal.**

Airline Traffic — July, 1957

	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	638,148	463,507	67.9	1,550,059	570,084	6,994,738	53,627,252	58.6
Braniff	166,132	74,448	57.0	247,369	88,725	492,557	7,973,171	45.5
Capital	341,263	130,003	56.0	429,058	151,712	456,222	13,577,012	45.2
Continental	75,773	37,206	56.8	94,864	37,728	153,019	3,854,379	46.5
Delta	216,689	106,958	59.2	323,138	180,196	795,026	11,560,743	55.6
Eastern	646,219	355,452	61.69	819,595	350,000	1,483,087	36,842,226	45.54
National	114,659	72,266	64.1	245,189	41,916	435,952	7,701,959	53.5
Northeast	92,606	25,901	59.7	24,253	19,420	59,353	2,583,245	51.3
Northwest	128,651	95,080	63.6	390,413	166,425	828,342	10,518,072	54.2
Trans World	413,150	372,015	71.0	914,560	437,003	2,273,387	39,225,089	61.2
United	573,406	457,963	69.0	2,273,451	554,555	5,098,073	51,868,715	58.5
Western	122,919	65,330	64.1	240,694	73,005	247,566	6,810,715	57.4
INTERNATIONAL								
American	13,270	10,043	69.1	15,226	593	306,380	1,386,927	70.4
Braniff	4,344	9,039	56.3	15,927	.....	80,507	1,075,307	48.8
Caribbean-Atlantic	21,760	1,587	61.16	1,305	.....	3,491	171,979	66.68
Delta	6,075	6,892	60.7	6,806	.....	52,077	823,803	52.8
Eastern	35,067	47,021	73.34	81,375	.....	87,446	4,948,089	60.39
National	7,335	5,208	55.4	14,371	4,143	32,473	591,470	53.4
Northwest	17,542	27,240	65.2	933,481	16,811	600,723	4,432,110	*
Pan American								
Alaska	9,102	9,863	70.1	42,564	.....	291,621	1,331,936	57.5
Atlantic	115,784	154,522	66.7	179,529	.....	2,299,248	19,404,149	61.9
Latin America	130,445	146,409	74.2	386,249	.....	3,816,111	17,568,179	66.5
Pacific	27,492	101,933	77.6	896,933	.....	1,395,549	12,636,011	67.8
Panagra	12,268	15,170	58.6	63,632	.....	356,786	2,021,063	56.6
Trans World	32,191	86,352	66.1	759,372	.....	736,939	10,442,296	64.0
United	11,685	29,007	76.0	96,982	.....	66,588	3,117,526	71.3
LOCAL SERVICE								
Allegheny	43,874	7,737	50.4	8,389	12,677	15,733	774,984	45.4
Bonanza	13,431	2,868	44.3	3,576	1,973	7,210	289,085	42.5
Central	11,455	2,227	34.8	4,243	2,118	8,223	227,975	31.2
Frontier	21,161	5,495	56.7	15,541	7,234	67,412	617,056	66.9
Lake Central	13,992	2,201	34.3	3,066	13,033	.....	226,489	36.9
Mohawk*	.....	.....	.....	.....	.....	.....	.....	.....
North Central	61,754	10,331	47.4	21,636	27,863	.....	1,038,962	47.7
Ozark	35,178	5,873	41.1	11,036	44,776	17,321	604,290	42.9
Piedmont	37,414	7,932	58.3	12,672	7,772	16,324	796,810	57.4
Southern	18,412	3,328	38.9	8,842	9,832	.....	337,325	38.2
Southwest	30,206	6,436	55.7	7,865	4,582	7,162	633,282	53.5
Trans-Texas	22,140	5,056	40.7	12,923	7,049	26,195	528,806	40.8
West Coast	24,843	4,229	51.34	4,436	2,272	6,183	422,898	48.42
HAWAIIAN								
Hawaiian	43,903	7,054	59.4	3,397	.....	141,179	711,034	55.3
Trans-Pacific	19,380	3,523	61.1	1,191	.....	11,789	256,863	55.3
CARGO LINES								
Aerovias Sud Americana	.....	.....	.....	.....	.....	685,444	685,444	87.9
Flying Tiger	13,617	64,365	99.9	27,746	10,158	6,514,111	12,988,597	85.6
Riddle*	.....	.....	.....	.....	.....	.....	.....	.....
Seaboard & Western	7,713	29,788	100.0	.....	.....	1,689,929	4,668,740	81.4
Slick	5,723	30,162	95.01	71,810	33,324	4,368,624	7,489,951	83.03
HELICOPTER								
Chicago Helicopter	5,681	84.0	33.1	2,480	.....	.....	10,514	30.5
Los Angeles Airways	3,462	124	62.31	4,055	2,071	.....	17,949	66.75
New York Airways	9,100	165	42.1	1,849	994	615	19,213	45.4
ALASKA								
Alaska Airlines	6,049	1,787	48.4	32,056	.....	153,101	358,887	49.6
Alaska Coastal	6,491	559	63.5	3,327	.....	5,508	65,500	62.8
Cordova	19,748	5,048	55.2	42,691	.....	1,792,079	2,345,952	49.6
Ellis	8,187	446	57.6	2,105	.....	4,011	51,267	67.0
Pacific Northern	13,056	13,577	66.1	101,057	.....	312,290	1,878,142	69.7

*Not available.
Compiled by AVIATION WEEK from airline reports to the Civil Aeronautics Board.



General Electric Missile Alternators Feature Light Weight, Low Harmonic Distortion, Close Voltage Regulation

High accuracy and reliability under extremes of environment has been attained by General Electric alternators for missiles and advanced aircraft. A wide variety of package systems including alternator, regulator and exciter have been designed in ratings from 4 to 10 KVA, operating at speeds of 12,000, 24,000 and higher rpm and at 400-cycle frequencies and above.

Typical of these advanced systems is the 27-pound alternator shown on test above. Rated 10 KVA with an overload capacity to 13 KVA, this 12,000-rpm machine is coupled to the drive source through an external splined shaft. A wide variety of prime movers including d-c motors, hydraulic and air turbine drives can be used.

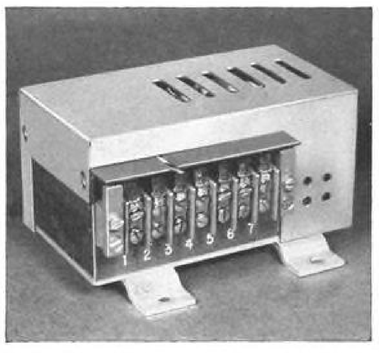
The 115/200-V, 400-cycle, 3-phase alternator has wound field construction, allowing close output voltage regulation under widely varying load conditions. The rotor is capable of withstanding 50% overspeed at temperatures up to 500 F. Total RMS harmonic content of the alternator output is less than 1% of fundamental.

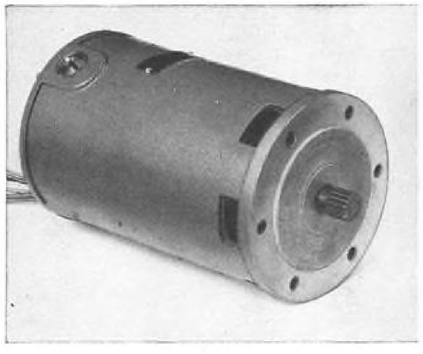
The machine's power factor rating is .80 and it has an efficiency of 85% at rated load. Forced air cooling of approximately five pounds per minute, resulting in a six-inch H_2O pressure drop at sea level, enables the machine to deliver rated output continuously from 0 to 80,000 feet.

Completely self-contained, this machine requires no external excitation power. The alternator and exciter are combined on a single shaft and enclosed in one compact package.

The 800-cycle exciter supplies power to the voltage regulator which is then fed to the main alternator field in varying amounts to maintain constant voltage output. The magnetic amplifier-type, voltage regulator is completely static and is also self-contained. It provides less than 2% voltage regulation over 0 to 10 KVA load, 11,500 to 13,000 rpm speed range and at temperatures ranging from −50 to 300 F.

For more information or assistance in solving your missile or aircraft electric power supply problems, contact your local General Electric Aviation and Defense Industries Sales Representative.





General Electric regulator (left) and alternator (right) combine to form a 30-pound power package rated at 10 KVA. The alternator is 9¼ inches in length and 6 inches in diameter. The voltage regulator is 5 inches long. Total RMS harmonic content of the alternator output is less than 1% of fundamental. The generator has an efficiency of 85% at rated load.

New, Self-Contained Missile Accessory Power System Gives Both Hydraulic and Electric Power

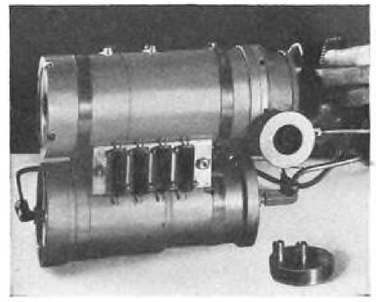
A completely self-contained, General Electric auxiliary power unit is now available to provide simultaneous hydraulic and electric power for missile systems. A current model based on this advanced design uses two alternators and a hydraulic pump to furnish 1000 watts of 400-cycle, 115-volt, 3-phase ac power; 100 watts of 2400-cycle, 115-volt, single-phase ac power and hydraulic pressure at 2200 psi and 4.75 gpm. Frequency control of both electric power systems is within ± 1% and voltage control within ± 5%.

A complete unit weighs 35 pounds or less and all components, including turbodrive and fuel tank, are contained within two cylinders, each 4½ inches in diameter and 13 inches in length. These cylinders can be mounted side by side or in-line.

A monopropellant fuel such as ethylene oxide spins the turbine wheel and provides the drive power for the alternators and pump. A cartridge ignition system activates the fuel and also provides a starting acceleration boost to bring the unit to rated speed and output within a half second. The fuel tank contains an integral pressure system utilizing hot gas from the decomposition chamber to activate a step piston. This eliminates the need for pressurization, pumps or plumbing external to the unit.

Fine frequency control is obtained with a load control loop consisting of a frequency detector, a loading alternator and parasitic loading resistance. Constant speed is maintained by placing a biasing torque on the turbine shaft to balance changes in load demands.

The advantages of this advanced missile APU can be easily applied to your particular problem. The modular design allows modification for a wide variety of applications by attaching matched hydraulic and electric components rated as required to a choice of turbodrives. Fuel tank size can be varied to provide operating cycles from 20 to 347 seconds depending on the turbine and output components used. For more information on this advanced missile power system contact your local General Electric Aviation and Defense Industries Sales Representative.



New, General Electric modular APU demonstrates an advanced design combining several electric and hydraulic power sources into one compact, completely self-contained unit. This particular version, with two electric power sources, weighs only 30 pounds, including fuel.

Whether 10 or 10,000 hours, General Electric pulse-forming network capacitors are engineered for the life span of your specific application. Thirteen-year accumulation of test data helps General Electric engineers meet your special conditions.

How 13 Years' Application Experience Can Help Solve Your Pulse-Forming Network Problems

Since 1944, General Electric has been designing, building and testing capacitor pulse-forming networks of practically every type. A wide variety of data and experience has been accumulated on temperatures, voltages, dielectrics and the other factors that affect service life and reliability.

Today, this wealth of accumulated data and experience can help solve your particular problems. General Electric pulse-forming networks can be designed and produced to meet service life requirements of 10 to 10,000 hours or more. Pulse width, rise time, number of pulses per second, ripple, and most other requirements can be met with solutions based on accumulated data and experience. Data on multiple width networks and size reductions based on forced air circulation is also available.

Quality manufacture gives General Electric pulse-forming networks the dependability required for missile applications. Capacitor sections are constructed of low-loss kraft paper and high purity aluminum foil. Inductance coils are wound on threaded forms for stability throughout the life of the unit. Highest quality mineral oil is used for impregnation. Strong, hermetically sealed cases help protect all components.

For more information on pulse-forming networks, networks proven in thousands of applications, contact your local General Electric Aviation and Defense Industries Sales Representative or write for bulletin GEA-4996, General Electric Company, Section 210-108, Schenectady 5, New York.

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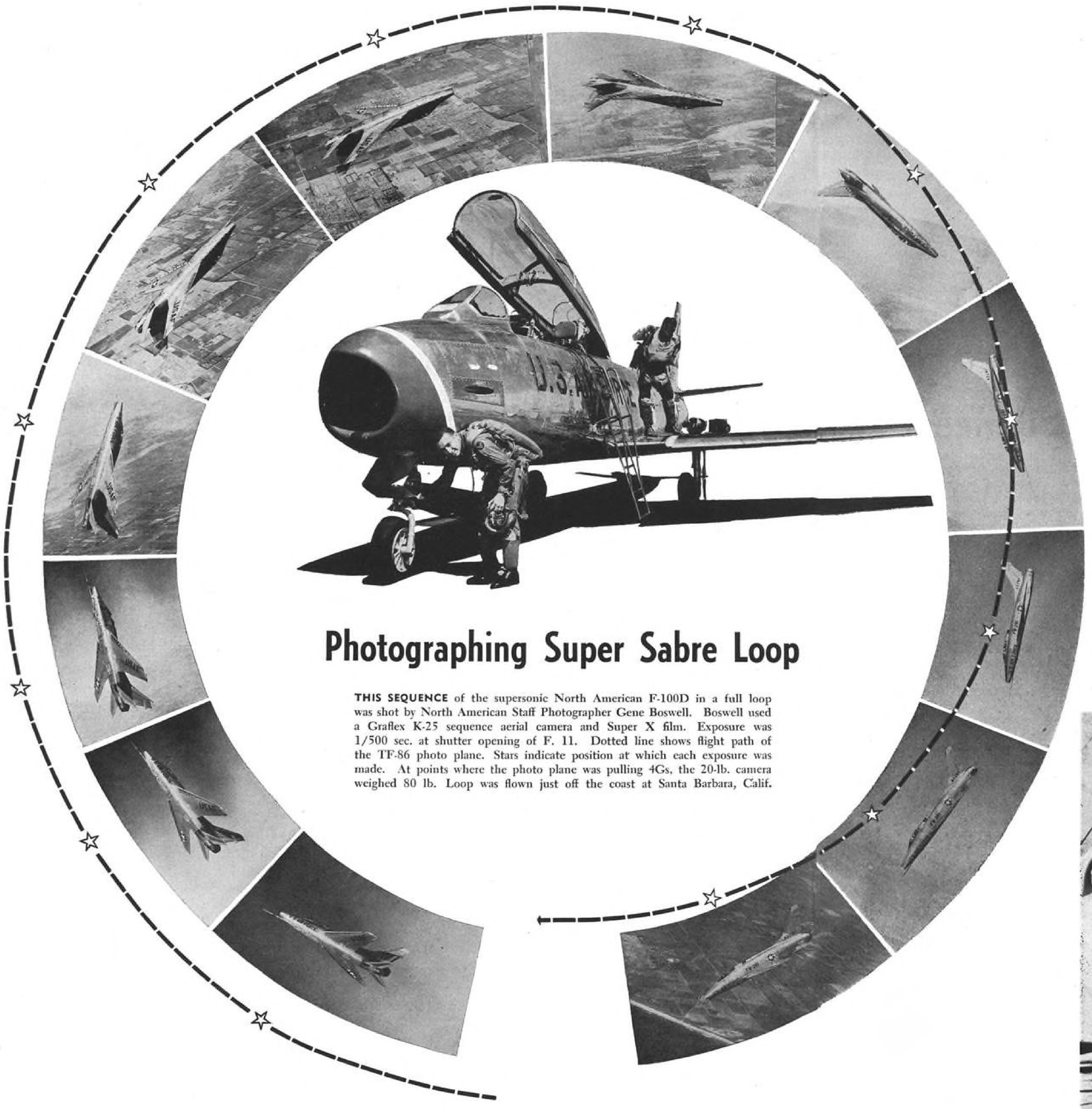
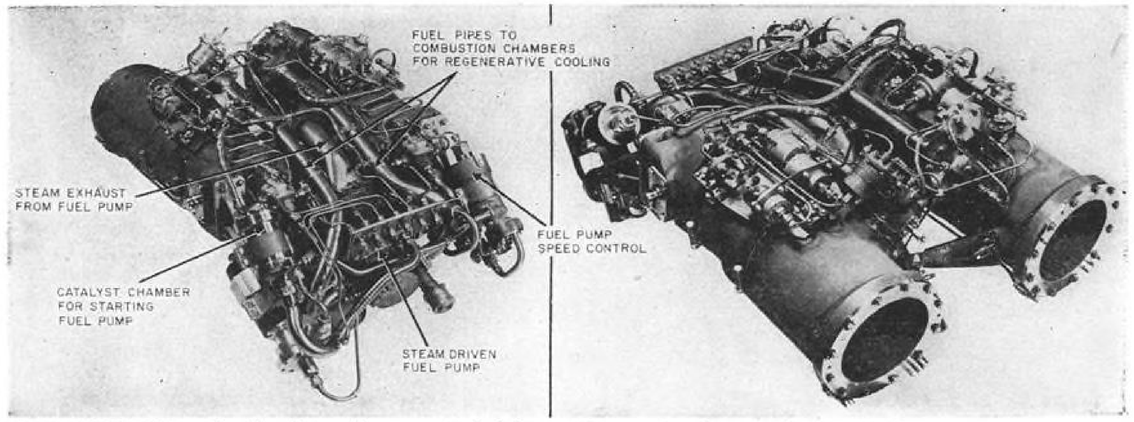


Photographing Super Sabre Loop

THIS SEQUENCE of the supersonic North American F-100D in a full loop was shot by North American Staff Photographer Gene Boswell. Boswell used a Graflex K-25 sequence aerial camera and Super X film. Exposure was 1/500 sec. at shutter opening of F. 11. Dotted line shows flight path of the TF-86 photo plane. Stars indicate position at which each exposure was made. At points where the photo plane was pulling 4Gs, the 20-lb. camera weighed 80 lb. Loop was flown just off the coast at Santa Barbara, Calif.

ENGINEERING Test Pilot Zeke Hopkins flew the F-100D (above) during the loop photographing mission. Gene Boswell (below) demonstrates the desired maneuvers for the loop pictures to Capt. Pat Hunerwadel, at right, and Hopkins. Capt. Hunerwadel, a USAF test pilot, flew the TF-86 Sabrejet camera plane. For best air-to-air photography, Boswell says, distance between aircraft should be 75 to 100 ft. Gap wider than 125 ft. is almost useless.



NAPIER SCORPION two-barrel rocket package mounts fuel lines and accessories above combustion chambers.

British Emphasize Reversers, Silencers

By David A. Anderton

Farnborough—More thrust more quietly and possibly reversed was the dominant theme of the engine display at this 18th Society of British Aircraft Constructors exhibition.

New Powerplants

Half a dozen new powerplants shown for the first time included:

- **Two 1,000 shp.** gas turbine engines developed as private ventures by Armstrong Siddeley Motors, Ltd.
- **Bristol Orion** supercharged turboprop rated at 5,150 ehp. for takeoff and completely cowled as a prototype aircraft installation.
- **Rolls-Royce RB. 108** turbojet with extremely high thrust/weight ratio, developed for vertical takeoff concepts including the Short SC. 1.

Demonstrated in the flypasts as well as on the stands were:

- **Thrust reverser** by Rolls-Royce designed for the Avon RA. 29 turbojets for de Havilland's Comet IV.
- **Corrugated nozzle** noise reduction units also by Rolls-Royce. Now a production item for the RA. 29s installed in the Comet IV.
- **Exhaust silencers** developed by Bristol Aero Engines, Ltd. for its Olympus engines now powering the Avro Vulcan bomber and shown on the Olympus Canberra flying test bed.

Both silencing units and the thrust reverser impressed observers with the apparent efficiency of their operations.

The new Armstrong Siddeley engines share common components wherever possible to cut down on development time and cost. Engines have a two-stage centrifugal compressor driven by a two-stage turbine, plus a single-stage power turbine driving either a rotor shaft or a propeller through the suitable reduction gears. Combustion chamber design is also common to both.

The P. 182 engine, for fixed wing installations, develops 1,075 eshp., says Armstrong Siddeley. Specific fuel consumption is down to 0.687 lb. per eshp. per hr., and the specific weight is 0.44 lb. per eshp. Maximum engine diameter is 30 in.

The P. 181 has been developed to drive rotary wing aircraft, and its output is 950 shp. Specific fuel consumption is higher at 0.75 lb. per shp. per hr., and specific weight is .50 lb/shp. Engine diameter is also 30 in.

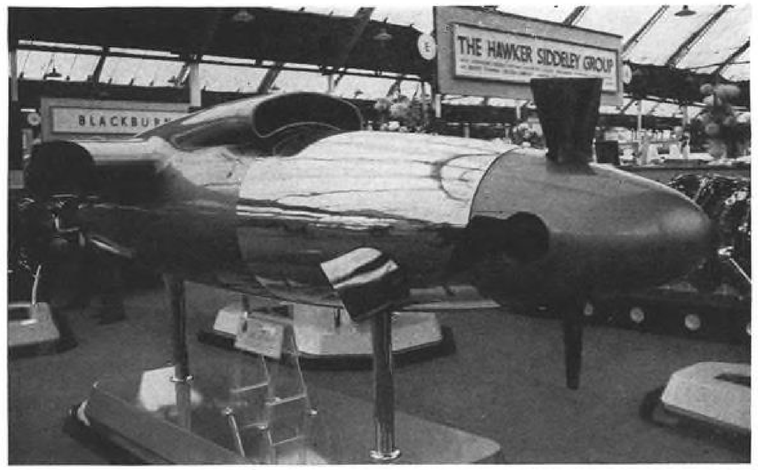
Reverser for Transports

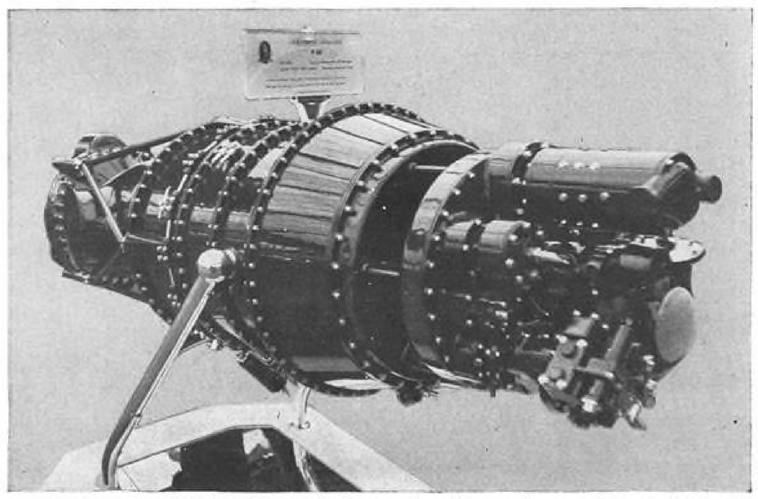
Rolls-Royce says its thrust reverser has been designed to fit on the Avons for DH Comet IVs and on the Conways for the Boeing 707. No weights, costs, or thrust reductions will be quoted by the company, but they confirm there will be some of each. The reverser consists of a pair of eyelids which fit flush against the walls of the engine tailpipe when not in use, and which clamp together when thrust reversal is desired. The closed eyelids divert the thrust exhaust blast out through slots at a forward angle. Slots can be arranged and angled to avoid blowing the heated gases on sensitive portions of the airplane.

The corrugated silencer nozzle developed for the Avons is based on the ideas of Rolls engineer F. B. Greatrex, who pioneered the idea of nozzles which increased periphery as a silencing technique.

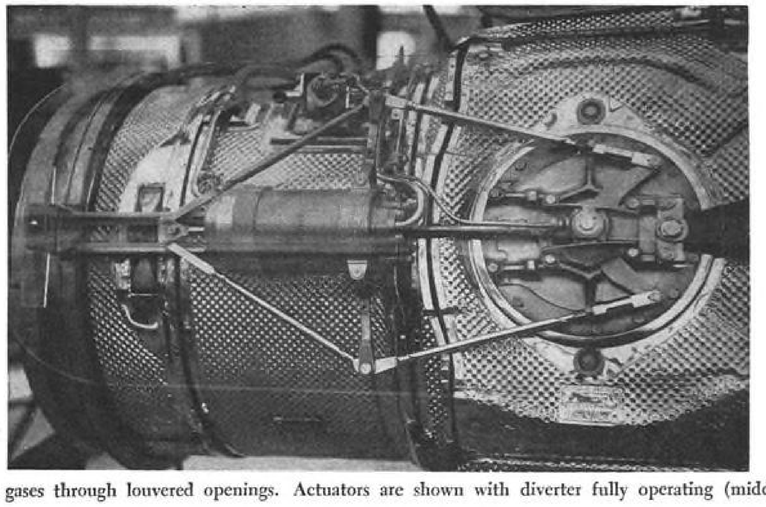
The silencer unit consists of six small triangular fairings inside the tailpipe. Their area is distributed to take the place of the propelling nozzle at the end of the tailpipe. Cooling air from the free stream is pumped through external holes by the ejector action of the exhaust.

Flown on the Comet III, these silencers proved that jet engines can be quieted. Compressor noise seemed to be louder on the approach, but this is an erroneous impression created by re-

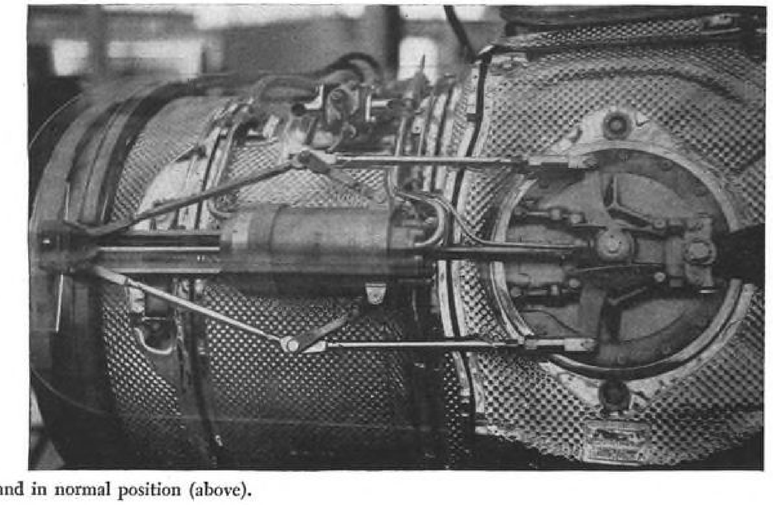


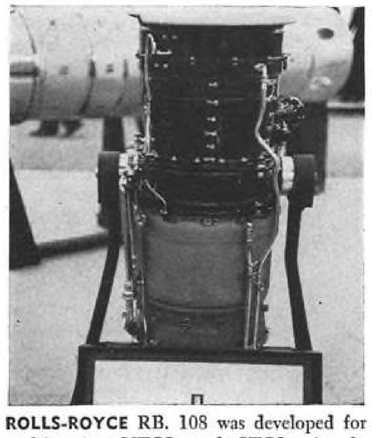


ARMSTRONG-SIDDELEY P. 182 for fixed wing aircraft in mock-up cowl (top) and P. 181 for rotary wing application (bottom). P. 182 delivers 1,075 eshp.; P. 181 output is 950 shp.

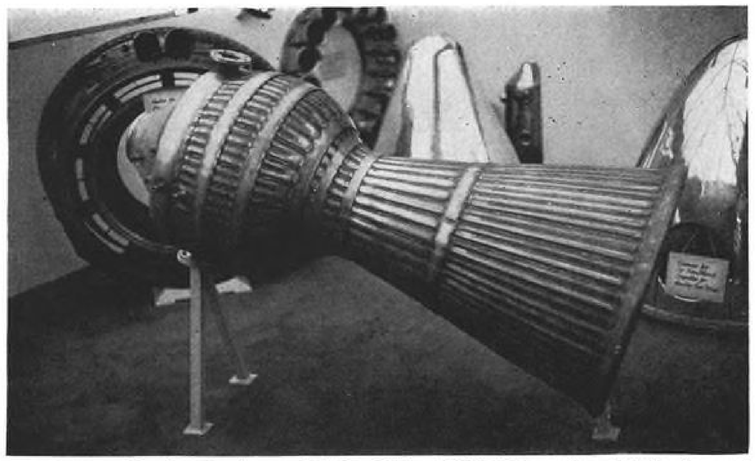


ROLLS-ROYCE thrust reverser diverts exhaust gases through louvered openings. Actuators are shown with diverter fully operating (middle) and in normal position (above).





ROLLS-ROYCE RB. 108 was developed for multi-engine VTOL and STOL aircraft. Five are installed in Short SC. 1 VTOL now undergoing tethered hovering tests.



TUBULAR combustion chamber used in Royal Aircraft Establishment's rocket development program.

duction of the tailpipe bellow which normally masks most of the compressor howl.

Once the airplane is abeam of an observer, he notices that the nose drops as suddenly as if the engine had been cut.

Helicopter Turbine

Napier's free turbine Gazelle gas turbine, flying in the Westland Wessex and shortly to be installed in the first prototype of the Bristol 192 military helicopter, has excited interest among technical observers. This engine has been running less than two years, and has run through three complete but unofficial type tests in succession. Thus the engine ran at full power for 150 hr. without removal from the test stand.

One installational advantage of the Gazelle is its adaptability to angularity because it can be placed in any position from horizontal to vertical. The Wessex installation inclines the engine 35 degrees from a horizontal reference. Bristol will place one Gazelle at 7 degrees and the other at 15 degrees from the vertical in the Type 198.

Napier's stand also showed a model of a Lockheed Super Constellation converted to use four of the company's Eland turboprop powerplants. Announcement of a contract between Napier and a major airline for such a conversion is expected to be made shortly. Meantime Napier has signed a contract with Real, the Brazilian airline, for conversion of three of its Convairs, with a promise of 17 more if the first three work out as expected.

Bristol proposes a complete installa-

Hispano Suiza Aircraft Guns

Hispano Suiza Type 825 30 mm. aircraft gun (middle) has muzzle velocity of 3,350 ft./sec., weighs 240 lb., including feed mechanism. Type 820, a 20 mm. gun, has muzzle velocity of 3,495 ft./sec. and weighs 145 lb. Firing rate of both is 1,000 rd./min.

tion of its supercharged Orion turboprop, weighing 3,200 lb. complete with oil tank, oil coolers and mounts. Takeoff rating of the engine is 5,150 ehp. Major design point is that the engine can deliver a 4,400 hp. takeoff rating at any altitude up to 15,000 ft. plus a constant 3,900 shp. for climb up to above 25,000 ft.

These engine developments, plus many different types now in production for either civil or military use, seemed again to underscore the technical competence of the British engine industry in comparison with the British aircraft industry.

Here on the stands observers could see a complete range of turbojet engines with a thrust ratio between the smallest and largest of about 70. From Blackburn Palas rated at about 400 lbs. thrust to the Orenda Iroquois at 28,000 lb. with afterburning, there are many intermediate thrust levels where a designer may settle for the engine of his choice.

There were engines like the DH Gyron and Gyron Junior designed specifically from the start as supersonic powerplants.

Show Rocket Engines

There were also the rocket engines—Napier's Scorpion twin-barreled installation for the Canberra, DH Spectre throttleable rocket for the mixed powerplant concept exemplified at this show by the Saunders-Roe SR. 53.

There was a single ramjet engine—the Bristol Thor—a pair of which propel the Bristol/Ferranti Bloodhound missile at speeds in the Mach 2.5 or 3.0 range. Blanked fore and aft by security, and covered with a totally wrong nose cone, the Thor configuration could only be guessed at. But reasonable guesses for its thrust would be about 8,000 lb. at its design Mach number.

This was the powerplant spectrum at Farnborough this year. As before, there were more engines than there were airplanes to use them or airplanes to take advantage of the advanced design characteristics. This is one of the ironies of Britain's airpower position.

Hawk's Rocket Motor Bears Wing Assembly

Huntsville, Ala.—New surface-to-air missile, the Hawk, more completely utilizes the advantages of a solid fuel rocket motor than any weapon that preceded it.

In the Hawk, the combustion chamber wall serves as the external skin of the missile and is also the load-carrying structure, with fittings for the direct attachment of wings, warhead, etc. This type of construction

brings the empty weight of the missile to a minimum.

The powerplant of the Hawk is distinct in that it contains two separate solid fuel charges in a single chamber. The first is the booster which burns rapidly to accelerate the missile to flight velocity quickly. The second is the sustainer which maintains flight speed. This innovation makes the Hawk even easier to handle than other solid fuel missiles because it eliminates the external booster unit.

The Hawk, which is a high performance low altitude system, is a joint development of Thiokol Chemical Corp., Raytheon Manufacturing Co. and Northrop Aircraft, Inc.

Stretchouts Leave F4H, F-101A, C, Unaffected

St. Louis, Mo.—Some figures for how defense cutbacks affect McDonnell Aircraft Corp. were given in a report to employes by President J. S. McDonnell. In the same message, McDonnell referred to the F-101C and RF-101C, a modified version of the Voodoo for fighter-bomber missions.

Neither the F or RF-101A and C nor the F4H-1 for the Navy has been stretched out or terminated, McDonnell said. The F3H Demon and F-101B programs have been stretched.

Navy ordered Demon deliveries reduced from 12 to 10 per month through February, 1958, and to 11 per month beginning in March, 1958, extending delivery of the last Demons on order from January to March, 1959.

USAF ordered deliveries of the two-seat F-101B reduced from 30 to 20 a month, extending last delivery date of F-101s on order from March to August, 1959. McDonnell said he expected additional F3Hs and F-101Bs to be ordered from Fiscal 1958 appropriations, extending delivery through 1959.

USAF said the F-101C modifications consist of strengthening wings, fuselage, etc. to prepare for the relatively more rugged mission of fighter-bomber. Strategic Air Command reportedly decided against using Voodoo as day fighter, with result that most will be modified to C configuration.

Conical Camber

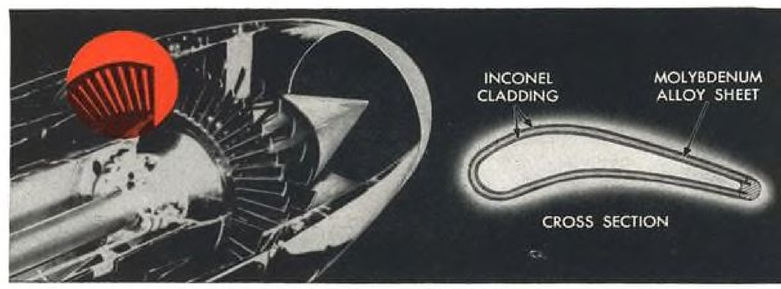
Farnborough—Conical camber leading edges have been added to both the Avro Vulcan B.MK.2 and the English Electric P.1A for flight evaluation of this NACA development. English Electric reports some improvement of performance in high altitude cruise conditions but believes other performance requirements could mitigate against its use on the production series.

Westinghouse metal miracles boost jet engine performance 15%

Turbojet "hot end" parts, made from clad molybdenum, are increasing jet engine efficiency up to 15% by permitting higher turbojet operating temperatures. Developed by Westinghouse research scientists, this new method of coating molybdenum to prevent high-temperature oxidation has proved successful during extended engine testing of "clad-moly" parts at temperatures above 2000°F.

Development of this protective coating—which remains intact and effective after molybdenum alloy sheets or shapes are formed into parts of complex shapes—is part of the advanced metals research program at Westinghouse. The Aviation Gas Turbine Division is helping to keep America strong by applying this coating and other new research developments to create better and better jet engines for the defense of America.

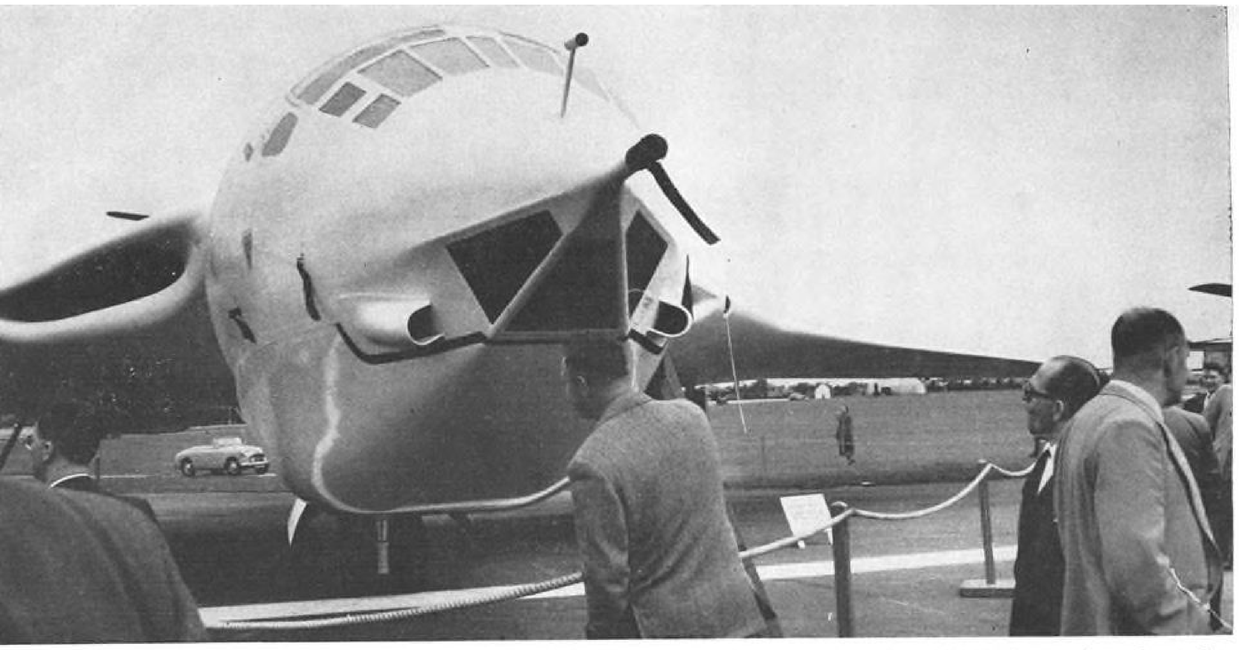
Take advantage of Westinghouse's ability to engineer, develop and produce equipment for America's defense. Contact your Westinghouse Defense Products sales engineer, or write: Westinghouse Electric Corporation, Aviation Gas Turbine Division, P. O. Box 288, Kansas City, Missouri. J-91057



The first stage turbine nozzle vanes (outlined in red) were chosen for initial testing as they are subjected to the highest temperatures and are most susceptible to thermal shock.

YOU CAN BE SURE...IF IT'S

Westinghouse

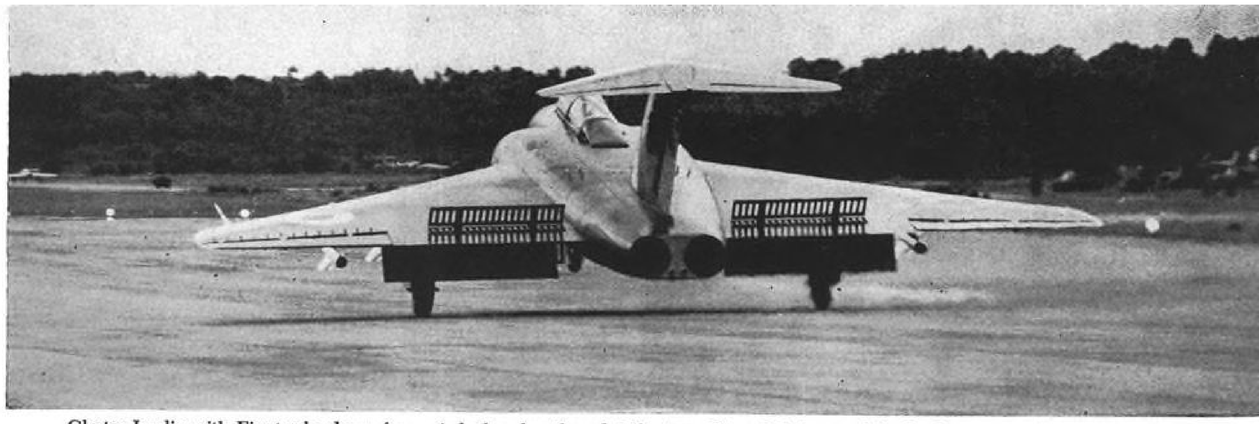


Handley Page Victor bomber despite its cluttered nose has exceeded Mach 1. Victor is in production and first squadron is expected to be formed late this year.

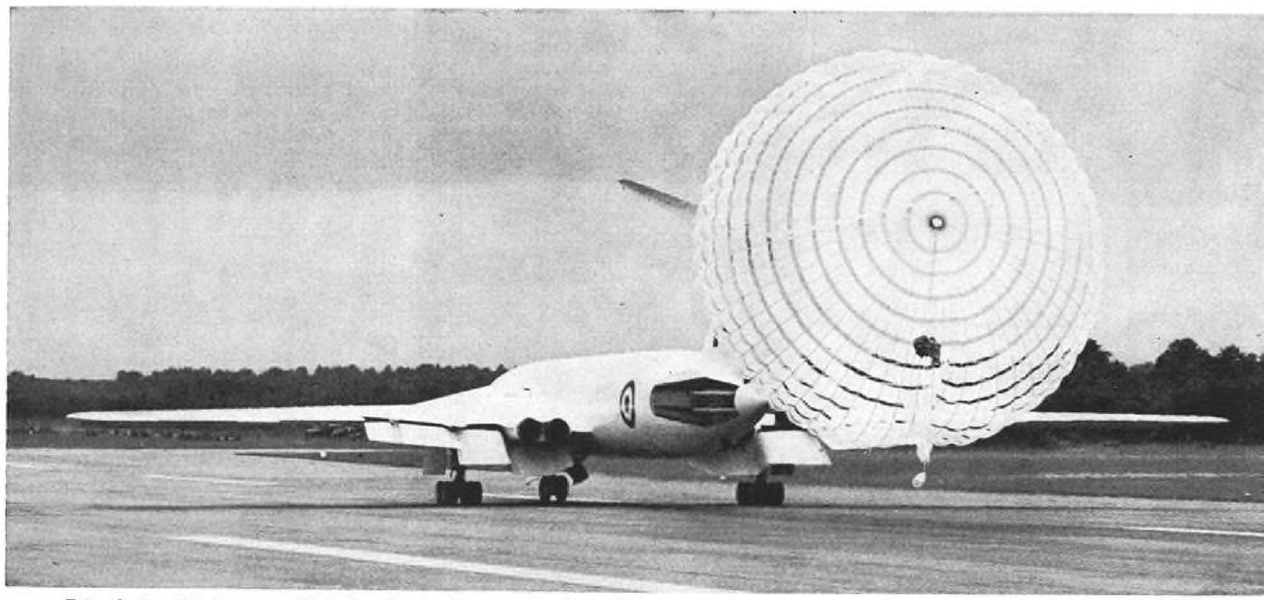
British Bombers, Fighters Exhibit Design Revisions

Avro Vulcan B. 1 has visual bomb-aiming position with blanked over window below cockpit. Crew entrance door also is exit for downward ejection seat. Vulcan is now in squadron service in one group of Bomber Command.

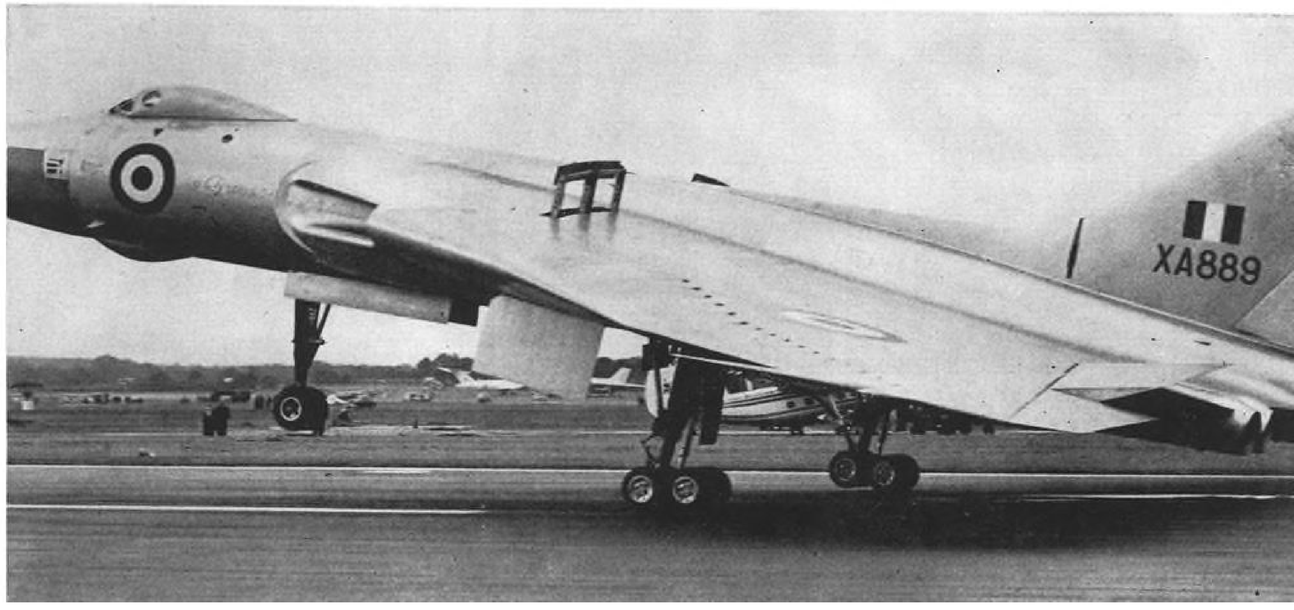
Hawker Hunter lineup (left) shows lipped tailpipe being tested as a possible configuration change on the near two. Wing-tip pod of Fairey Firefly target aircraft (right) carries five wide angle cameras to record hits and near misses of test rounds.



Gloster Javelin with Firestreaks shows fence air brakes, lengthened tail pipes. Plane is being used in development work.



Drag chute and brakes open, Victor bomber decelerates at Farnborough (above). Vulcan touching down (below) shows wing vortex generators, fence air brakes and elevator deflection. Conical camber curve is discernible about midway out on the wing.



Ground Test Load Cycles Called Invalid as Fatigue Life Measure

By Russell Hawkes

Los Angeles—Predictions of the fatigue life of an airplane in terms of hours or load cycles on the basis of ground tests were termed invalid by Emerson H. LaBombard, Douglas Aircraft structures engineer, in a discussion here before the Institute of the Aeronautical Sciences of the DC-8 fatigue resistance program. The jet transport is designed almost entirely by fatigue criteria and every piece of structure is physically cycled and over-designed relative to the static load levels.

LaBombard said Douglas has used a "comparative" fatigue testing technique to learn whether a specimen structural component will be satisfactory relative to some equivalent structure known to be non-critical. This is a traditional laboratory method of checking a test specimen against a control specimen of known characteristics.

Fruitless Effort

Douglas abandoned as fruitless the effort to set up approximations of the number of cycles or the amount of time required to make a component fail due to fatigue. LaBombard said that statistical scattering of test results now covers such a broad band that numerical approximations have little use. Precise quantitative application of test results should at least await the growth of much more experience in the field, he said.

Other objections to making quantitative applications of test data are the difficulty of analyzing a complex structure dynamically, especially under small loads and at low deflections, and the difficulty of duplicating actual flight loads. The only accurate way to get the equivalent of 10 years of flight loads would be to run 10 years of laboratory tests and it would call for extremely sophisticated equipment. Accelerated testing calls for a certain amount of cheating on loads and other conditions which may have unpredictable effects on results, LaBombard said, and in the acoustic frequency range it is nearly impossible to accelerate testing anyway.

Gen. Power Flight-tests B-58

Gen. Thomas S. Power, commander in chief of SAC, emerges from B-58 following test flight. Note size of disposable bomb pod slung beneath fuselage.

Critical Structure

Critical structure from the fatigue standpoint usually includes a joint of some kind. One form of the Douglas comparative testing method is to check such a structure against a similar unjoined structure. If it can withstand the same test for an approximately equal number of cycles, it can be considered non-critical. If fatigue cracks appear substantially before they do in the unjoined specimen, the part must be redesigned.

Another form of comparative testing used is to check a specimen against the equivalent unit in a proven airplane such as the DC-6. If each unit is tested at its appropriate nominal stress level, LaBombard feels it is reasonable to assume that a DC-8 specimen which matches the fatigue resistance of the DC-6 part will prove out comparably well in service.

This approach has known weaknesses. For instance, if a part has given trouble in the proven airplane and the equivalent part in the new airplane tests out better, it still is impossible to say the new part will not give trouble in service.

In such an ambiguous situation, some other approach must be used.

Statistical Validity

Any test, of course, must be repeated often enough to give some idea of its statistical value and validity. On the DC-8, the minimum number of tests on one type of specimen has been four and usually it is much higher. The proportion of the whole airplane to be used as a test specimen is a compromise. The advantages of the small specimen in ease of experimental control and low cost-time requirements for repetitions must be balanced against the advantage of getting a realistic interaction of parts in a large specimen.

Douglas has used a system progressing from very small components to very large ones. The greatest part of pressurized cabin structure testing on the DC-8 was done on 6 ft. x 10 ft. "coupons." A specimen of this size is large enough to include several segments of the "rip-stopper" fail-safe design.

This means that substantially all structural interactions can be present while cost and time required to build

the specimens still is within reason. LaBombard said that component testing on this scale is more applicable, less costly and less time consuming than tank testing an entire airplane. The main value of the full scale tank test is as proof of the validity of component testing.

Misused Term

LaBombard disapproved of the loose usage of the term "fatigue life." The term implies that there is such a thing as fatigue death in which the airplane suddenly becomes unflyable. He said there is no such thing, the Comet accidents notwithstanding. These were caused by explosive decompression initiated along fatigue cracks. Either explosion or fatigue cracking could have occurred alone, but a catastrophic failure due to fatigue alone is unlikely.

LaBombard suggested that fatigue life be defined as the number of hours logged on the airframe before the cost of repairing fatigue cracks makes the airplane unprofitable to operate. It should be regarded as a maintenance problem rather than a safety problem.

Explosion resistance and fatigue resistance in the fuselage are related design problems since they came together with the advent of higher pressurization levels in the high altitude turbine powered transports. The last generation of piston engined transports were inherently explosion proof because the internal-external pressure differential seldom exceeded 5.5 psi. and the normal structural strength levels exceeded the stresses imposed by that level of pressurization.

This is not true of the new jet transports. The DC-8 can have a cabin pressure altitude of 8,000 ft. at an external pressure altitude of 45,000 ft. This gives a differential of 12.33 psi.

The rip-stopper structure was conceived to limit the spread of local failures and prevent an explosive failure from gaining headway. It grew out of an NACA study showing that a structure would be non-critical at a specified ratio of skin area to frame area.

5,000 Ft. Blast Fence Erected by USAF

Jet exhaust deflector fence over 5,000 ft. long has been erected at Castle AFB near Merced, Calif. It deflects smoke, heat, flying debris, and to a certain degree, noise generated by jet aircraft exhaust.

Called Model CV 10-12 Jet Blast Screen, the fence is built in 10-ft. long, one-ton sections which stand 12 ft. high when erected at a 60 deg. angle to the horizontal exhaust blast. The 18 curved, lateral vanes in the fence turn the exhaust blast through 90 deg. into a vertical column of air.

Positioning the fence at a 60 deg. angle towards the aircraft allows unrestricted movement of the high velocity blast in an upward direction, thus eliminating pressure build-up in front of the fence which would cause blast spillage over and around the fence.

Fence is available in welded or bolted construction and can be supplied in various heights, depending on type of aircraft with which it is to be used. Screen was designed and engineered by Boeing Airplane Company and was fabricated by John Bean Division, Food Machinery & Chemical Company, San Jose, Calif.

Inlet Diffuser Reduces Liquid Rocket Dilution

A long standing technical problem limiting the efficiency of liquid fuel rockets using pressurized propellant tanks has been solved according to Rocketdyne officials.

Nitrogen gas normally is used to pressurize propellant tanks when pumps are not used in a rocket motor system. The gas at about 1,500 lbs. pressure mixes rapidly with liquid oxygen, a widely used oxidizer. The LOX is contaminated and its effectiveness greatly reduced. Large thrust losses are attributed to this contamination.

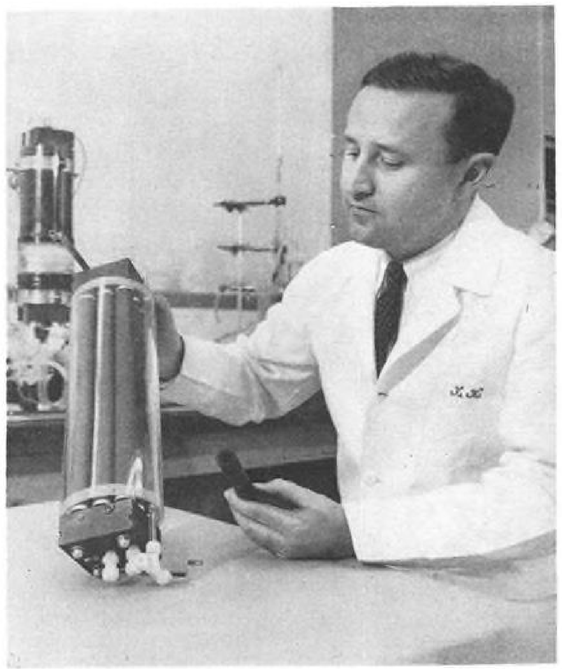
Stanley Greenfield, a Rocketdyne engineer, is credited with developing a perforated inlet tube which diffuses the nitrogen as it enters the LOX tank. Instead of mixing with the oxidizer it bounces against the top of the tank and then comes into contact with the LOX slowly. It is claimed that 10 to 20 times less dilution takes place and that the ranges of a missile using the system can be increased up to 30%.

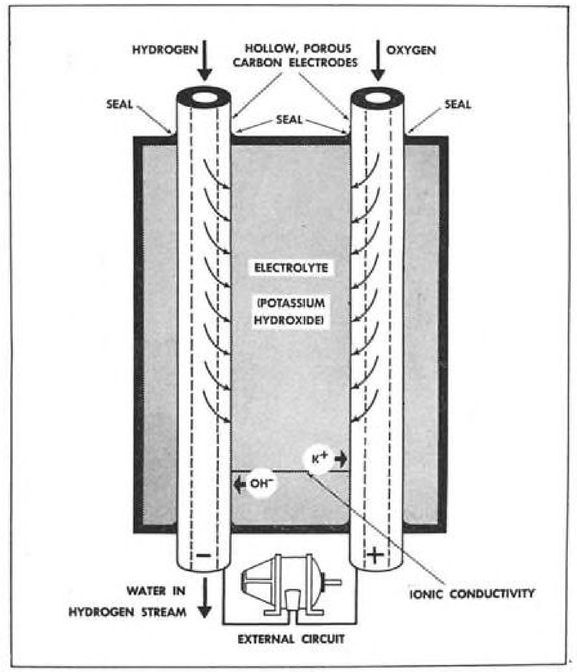
Automation Trend

Wright-Patterson AFB, Ohio—One of the things the Air Materiel Command must eliminate in the processing of data for a missile era logistics system is the human hand. It makes too many mistakes.

The flow of information from combat units to the manufacturer and back again must be as mechanical as possible, with an absolute minimum of writing, punching or other handling of papers and cards.

To achieve this, there must be a new degree of uniformity and simplicity in the designation of parts and components. There are known cases where the manufacturer's numerical designation for a unit contains more than 300 digits. Even a mechanical brain is not expected to handle this kind of information without complications.





NEW FUEL CELL, which directly converts hydrogen and oxygen into electricity without combustion or moving parts, operates at moderately low temperatures and at atmospheric pressure, unlike previous fuel cells. Device was developed by National Carbon Co.

Gases Provide Silent Power Source

By Philip J. Klass

Fuel cell which directly converts hydrogen and oxygen into electricity without combustion or moving parts, and operates at moderately low temperatures and at atmospheric pressure unlike earlier fuel cells, has been developed by National Carbon Co., division of Union Carbide Corp.

Hydrogen-oxygen fuel cell offers attractive advantages over engine-driven generators or storage batteries for certain military applications in or near combat areas.

Noiseless Unit

Unlike engine-driven generator, new fuel cell is noiseless, produces no telltale exhaust to give away its position.

For moderately high power loads of long duration, fuel cell and its hydrogen-oxygen supply may prove smaller, lighter than equivalent storage batteries. Furthermore, fuel cell can be instantly "re-charged" by replacing empty supply cylinders.

National demonstrated its new fuel cell last week at Army's Electronic Proving Ground, Ft. Huachuca, Ariz., using it to power Army's new portable radar used by infantry to detect infiltration of front lines.

Concept of the hydrogen-oxygen fuel cell dates back at least 120 years, and successful fuel cell was produced some 70 years ago. Interest then shifted to steam turbine/dynamo generator for producing electricity, has only recently been refocused on the fuel cell.

British investigations of hydrogen-oxygen fuel cells, begun around 1932 but interrupted by the war, were resumed at University of Cambridge in 1946, under F. T. Bacon. Russian activity is indicated by papers published in 1947.

In this country, Patterson-Moos division of Universal Winding Co., Jamaica, N. Y., is developing fuel cells, using Bacon principles, for undisclosed government agencies.

Several Advantages

Compared to previous hydrogen-oxygen fuel cells, National Carbon claims some advantages for its design, admits at least one disadvantage which may or may not be overcome.

National's fuel cell can operate at considerably lower temperature, 50-60C, compared to 200C or higher needed for previous devices. Furthermore, it can operate at near-atmospheric pressure whereas former fuel cells operated at pressures in range of 600-800 psi. (gage).

Company's Dr. George E. Evans, assistant director of research, says fuel cell can be operated with ordinary air and commercial-quality hydrogen, easing logistics problem, but at some sacrifice in output. Operation with air does not contaminate National's cell, Evans says; contamination reportedly was a problem with previous hydrogen-oxygen fuel cells.

Efficiency Evaluation

Volumetric efficiency (output power per unit of cell volume) in National's cell is only about 10% of that of the British and Patterson-Moos fuel cells, according to published data and figures quoted by company spokesmen. However, volumetric efficiency increases with operating pressure which indicates that National may be able to match the performance of other cells by operating at higher pressures.

Hydrogen-oxygen fuel cell is one of several types under investigation for direct conversion of chemical energy to electricity without combustion; others

PARTS-SERVICE DEPOTS EXPANDED BY PAC

Aircraft operators of private planes, executive transports, airlines—even military aircraft—regularly use Pacific Airmotive's unexcelled parts-service facilities across the Western States. PAC's large stocks of parts and accessories are warehoused at Burbank, Chino, Denver, Kansas City, Oakland and Seattle airports.

PAC operates maintenance and repair bases in many of these cities; and, in addition, supplies an ever-expanding network of satellite dealers with the world's leading lines of aircraft supplies and equipment. Through these dealers and PAC's complete inventories, aircraft operators in the West are assured of factory-authorized service and parts, backed by full warranty.

Among the corporate fleets that rely on PAC and its dealers for engine, aircraft and accessory supplies and maintenance are Sears Roebuck, U.S. Steel, Union Oil, Richfield Oil, and Bethlehem Steel.

CONTINENTAL AIR LINES JET ENGINES TO PAC – first domestic airline to get Boeing 707s powered with Pratt & Whitney J-57 jet engines has contracted with PAC for the overhaul and maintenance of these engines. PAC's already substantial experience in J-57 rework and maintenance was a major factor in Continental's decision to contract their jet engine overhaul rather than to set up their own J-57 overhaul shops at their new Los Angeles base. Thousands of valuable man-hours that would have been required to train personnel, plus the capital needed for special J-57 engine test and overhaul equipment, are thus saved by Continental.

JET ENGINE SHOP FACILITIES and a special engine run-in and test cell will be constructed by PAC to handle their enlarged J-57 overhaul programs.

Direct injection fuel pump test stand is typical of new equipment providing increased capabilities in PAC's accessory shop. Operators of R3350-powered Constellations and DC-7s such as Continental and Flying Tigers, look first to PAC for overhaul, calibration, and testing of these pumps.

PAC AT BURBANK continues to provide complete modification and remanufacture of executive and corporate aircraft. In addition, long-term overhaul contracts from commercial air carriers keep a continuous flow of engines going through PAC shops on a factory-production-line basis.

ENGINES ON LEASE are another feature of PAC's increasing service to local-service, trunk line, and executive aircraft owners. Through its newly formed subsidiary, Pioneer Aircraft Leasing Corp., PAC leases engines, major components, accessories and complete communications systems. Periodic maintenance and overhaul of this equipment is done in PAC's extensive Burbank shops.

Modification of Lodestars, service of multi-engine aircraft, manufacture of ground support equipment are only a few of the activities carried on at PacAero Engineering Corp., PAC subsidiary on Santa Monica Municipal airport.

PRODUCTION OF LEARSTARS – unquestionably the finest, most sought-after executive transport in the air today – continues at an increasing pace at PAC's PacAero subsidiary in Santa Monica. In addition, PacAero provides complete repair and maintenance service for Lodestar and Learstar owners.

Contact your nearest PAC facility for complete information on parts, accessories; engine, aircraft overhaul; executive aircraft modification; Advance Planning Service for control of parts and accessory inventories.

involve different materials. The hydrogen-oxygen cell basically is a reversal of the familiar process of electrolysis in which electric current (from external source) passes between two electrodes immersed in water. Electricity decomposes water, causing hydrogen to be released at one electrode, oxygen at the other.

In one configuration, hydrogen-oxygen fuel cell consists of two hollow porous electrodes sealed in container filled with electrolyte, usually potassium hydroxide dissolved in water. National uses carbon electrodes treated with special catalysts. Patterson-Moos and British reportedly use sintered nickel electrodes.

Hydrogen is piped into hollow center of one electrode, oxygen into other. Both gases diffuse through porous electrodes, react with the electrolyte to generate electrical (direct current) potential across the two electrodes and produce water (H_2O).

Deterioration Low

Unlike conventional batteries whose electrodes and/or electrolyte are slowly consumed or changed in the process of generating electricity, National says its fuel cells have operated for a year "with no signs of deterioration." Cells were operated on an eight-hour per day, five-day per week duty cycle.

Voltage generated across electrodes of a single fuel cell is about one volt, depending upon the cell efficiency and current being drawn. Voltage drops with increasing current (load). Although a number of fuel cells can be connected in a suitable series-parallel arrangement to produce wide range of voltage-current ratings, National says its device is

Airborne Charactron

Miniature version of Charactron cathode ray tube, suitable for displaying radar targets and data link information in the form of letters, numerals or symbols, has been developed by Stromberg-Carlson. New Charactron has five-inch face, measures only 17½ in. long, compared to 40-in. length of previously available 7-in. face tubes. Focusing is accomplished by internal electrostatic lenses, eliminating need for external focus and convergence coils. External deflection yoke is required to position characters on tube face. Characters are approximately 0.1 in. high.

Large Horizon Indicator

Five-inch attitude indicator (left), developed by Sperry Gyroscope Co. for Navy, provides unlimited freedom of roll and pitch maneuver, will operate reliably for up to 12 minutes after loss of electrical power. New Model H-10 has automatic gravity erections system plus a pilot-operated quick-erection provision. Gravity erection is automatically disconnected when bank angle exceeds six degrees to minimize turn errors. Indicator is hermetically sealed.

best suited for high current, low-voltage applications.

Electrochemical Reaction

The fuel cell's electrical energy is produced by the oxidation of hydrogen to form water. The potassium hydroxide in solution forms negatively charged hydroxyl ions (with extra electron) and positively charged potassium ions (short one electron). When hydrogen gas atom (H) diffuses through its electrode and comes into contact with the hydroxyl (OH) ion, they combine to form water (H_2O) and simultaneously release an electron.

This electron, and many others similarly released, flow out of the hydrogen (negative) electrode, through the load, to the oxygen (positive) electrode. Oxygen diffusing through this electrode picks up the incoming electrons and combines with water in the electrolyte to form negatively charged hydroxyl ions (with extra electron) which pass through electrolyte to the hydrogen electrode where the cycle is repeated. The potassium serves no useful function in the process except to provide the initial hydroxyl ions in the electrolyte.

Gas Recirculates

Hydrogen and oxygen not converted during initial passage through cell are recirculated after water (produced at hydrogen electrode by reaction) has been extracted from gas.

Any hydrogen peroxide (H_2O_2) formed at the oxygen electrode in the process of creating negatively charged hydroxyl ions represents a loss of efficiency in energy conversion. National reports fuel cell efficiencies range from 65 to 80 percent when operated at 50-60C temperature and near-atmospheric pressures. These efficiencies are com-

Gunsight Radar Checker

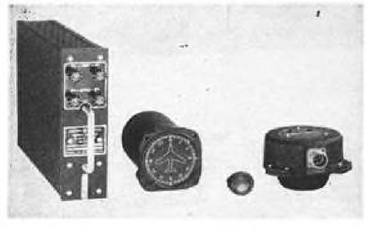
Accurate check-out of APG-30 gunsight (range-only) radar on Republic F-84F is performed by matching horn which directly samples signal transmitted from antenna mounted in air inlet. Model 650 horn, developed by The Narda Microwave Corp., Mineola, N. Y., replaces previous technique which extracted sample power from waveguide, did not give complete check on transmission line and antenna performance.

parable to those reported by British and by Patterson-Moos.

Once fuel cell has been brought up to required operating temperature by external source, heat generated by energy dissipated within the cell usually is sufficient to maintain this temperature. National's cell can be used to bootstrap itself up to normal operating temperature by short-circuiting the cell, but this may involve an initial warm-up time of several hours, Dr. Evans says.

Cell is not damaged permanently by accidental short circuits, according to Dr. Evans. If short circuit remains for extended period, it may produce more exhaust water than can be carried off, causing electrolyte dilution. This can be cured easily by replacing electrolyte.

At present the hydrogen-oxygen fuel cell does not appear to be a serious threat to turbine-generators or engine-driven generators for large-scale power stations because of present cost of producing hydrogen and oxygen. However, National scientists speculate that solar or nuclear energy may provide an economical means for decomposing water into hydrogen and oxygen which would then make the fuel cell a serious contender for many applications.



Light Gyro-Compass

Magnetically slaved directional gyro system, which weighs only 10¼ lb. provides synchro signals for operating up to three RMI indicators, has been developed by General Electric. System, which will be marketed for GE by Wilcox Electric Co., Kansas City, is type certificated by Civil Aeronautics Administration for airline use. It requires 17-24 watts of 115 v.a.c. and 14 or 28 v.d.c. power.

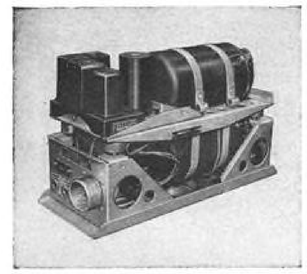
Expansions, Changes In Avionics Industry

Northrop Aircraft has set up new Nortronics division which will be responsible for company's expanding avionics development, manufacturing and marketing activities. Dr. William F. Ballhaus, vice president, has been named general manager of new division.

Other recently announced changes and expansions in the avionics industry include:

• **Kearfott Company's Western division** has opened new branch office in San Francisco. F. G. Bayerd is manager.

• **Daystrom Systems** division of Daystrom, Inc. will build 30,000 sq. ft. laboratory in La Jolla, Calif. (near



How Passive Refrigeration works in Honeywell components such as the autopilot sub-system shown here, is revolutionary in its simplicity. Around such sub-systems, Honeywell can put a jacket of special material which is solid at normal temperatures. At super heats, it becomes a semi-solid and soaks up the heat without changing temperature (heat of fusion). This keeps the operating temperature at a safe plateau in spite of transient super temperatures encountered at extreme speeds.

PASSIVE REFRIGERATION—

new shield against super heat

Simple, lightweight, non-mechanical—it keeps precision controls at peak performance for up to 30 minutes at ambient temperatures of 500 degrees.

It's hard to imagine a more powerful weapon in avionics' war on heat than a substance that cools with the simplicity of a cake of ice: self-contained, no moving parts, no auxiliary equipment to add weight to missiles and aircraft.

It is this principle of Passive Refrigeration (cooling without external power source) that Honeywell Aero engineers have put to work protecting components used in their advanced guidance systems.

With Passive Refrigeration these components are able to withstand temperature plateaus as high as 500° F! And in the near future you may find Passive Refrigeration cooling components in advanced interceptor aircraft and anti-missile missiles.

Passive Refrigeration is another example of Honeywell Aero's continuing contributions to the research, development and production of airborne systems varying from guidance to fuel management, from engine control to flight stabilization.

If you are working on projects where super heats will be encountered, perhaps Honeywell Aero has the answer to your problems. Honeywell's Aero engineering group is prepared to develop components or systems utilizing Passive Refrigeration for any type of missile, rocket or aircraft.
Contact Minneapolis-Honeywell, Aeronautical Division,
2600 Ridgway Road, Minneapolis 13, Minnesota.

Honeywell

H Aeronautical Division

San Diego). Occupancy is expected by early 1958.

• **Auerbach Electronics Corp.,** Narberth, Penna., is name of new firm which will specialize in automation and datamation systems. Company is headed by Isaac L. Auerbach, former director of special products division of Burroughs Corp.

• **Chicago Aerial Industries, Inc.,** has formed a Components division to manufacture and market precision electronic components. New division, headed by Gordon B. Baumesiter, will be located at 10265 Franklin Ave., Franklin Park, Ill., when new facility there is completed. Initial product will be a line of precision potentiometers.

• **Potter Instrument Co.** has opened new 50,000 sq. ft. factory and office building in Plainview, L. I., N. Y. on Sunnyside Blvd.

• **Systron Corp.,** maker of avionic instruments and automatic control systems, will build 15,000 sq. ft. plant in Concord, Calif.

• **Gibson Electric Co.** has moved manufacturing operation and offices from Pittsburgh to new 26,000 sq. ft. plant in Delmont, Penna., located on Old William Penn Highway.

• **Applied Science Corporation of Princeton** (ASCOP) has opened southwestern sales and service center in Dallas at 4918 Greenville Ave.

• **Lundy Manufacturing Corp.,** Glen Head, N. Y., has purchased **Ryan Industries** division of Detroit from Textron, Inc. New acquisition, which will operate as a Lundy division, manufactures countermeasures equipment.

FILTER CENTER

▶ **R-W Dons Other Hat**—Ramo-Wooldridge Corp., widely known for its role as technical director of Air Force ballistic missile program, is seeking to counter possible industry opinion that it intends to compete with aircraft manufacturers for missile prime contracts. R-W officials are visiting major aircraft companies to explain that company wants to work as a major avionics sub-system contractor. R-W is subcontractor to McDonnell Aircraft Co. on Quail, new counter-measures missile.

▶ **Promising New Radar Tube**—Helitron, new microwave tube which reportedly is five times more efficient than existing backward-wave oscillators,

less complex and only about half as costly to manufacture, has been developed by Dr. Dean A. Watkins of Stanford University's electron tube laboratory. Helitron has a two-to-one frequency tuning range, achieved with only a two-to-one voltage change. It can be designed to operate at frequencies from 200 mc. to above 10,000 mc., according to Dr. Watkins. Hewlett-Packard Co., Palo Alto, Calif., is slated to begin manufacture of Helitrons shortly.

► **DME-T Spec Issued**—Aeronautical Radio Inc. has released revised characteristic (No. 521B) for airborne distance measuring equipment-Tacan compatible (DME-T). New characteristic incorporates recently established standard VOR/ILS/DME-T frequency pairing plan. For copy, write Arinc, 1700 "K" St. N. W., Washington, D. C.

► **More Tantalum Coming**—Near-critical shortage of tantalum which has plagued capacitor manufacturers is expected to ease somewhat when new Fansteel Metallurgical Corp. plant near Muskogee, Okla. goes into production next month. New $6.5 million plant is expected to double company's current tantalum output.

► **Dollars For Ideas**—Lear, Inc., has set up new patent incentive plan for inventive employees which will give them a royalty when one of their patents is licensed to another company. In addition to $25 when employee files patent application and $50 when patent is granted, inventor will receive 10 percent of net cash royalties from outside licensee. When inventor's take reaches $5,000, his percentage is reduced on sliding scale. Minimum is 1½ percent, after total royalty of $20,000 is reached. Employee continues to draw royalties even if he leaves company.

► **Landing Increased**—Addition of computer to surveillance radar at Schiphol Airport, Amsterdam, and modification of the radar, is expected to enable controllers to increase the number of landings from 12 to 25.

► **Signed And Sealed**—Contract awards recently announced by avionics manufacturers include:

• **Laboratory For Electronics,** Boston, has received $4.5 million letter of intent to produce its AN/APN-105 Doppler auto-navigators for USAF's Air Materiel Command.

• **Cook Electric Co., Chicago,** will design and build mobile missile range instrumentation system for Navy's Air Missile Test program, Pt. Mugu, Calif., under $2.3 million contract. Work will be performed by Cook's Electronic Systems division, recently relocated in Skokie, Ill.

• **Servomechanisms, Inc.,** will build

barometric altitude controllers for Hughes Aircraft Co. on a $1.9 million contract.

• **Minneapolis-Honeywell** has received order for transistorized fuel-measuring equipment from The Martin Co. for use on its P6M-2 jet patrol bomber.

• **Collins Radio Co.**, Cedar Rapids, Iowa, has been awarded an $8.3 million contract by Canadian Department of Defense for production of AN/ARC-52 UHF airborne transceivers. Canadian version, to be called the ARC-552, will be produced in Collins' Toronto plant.

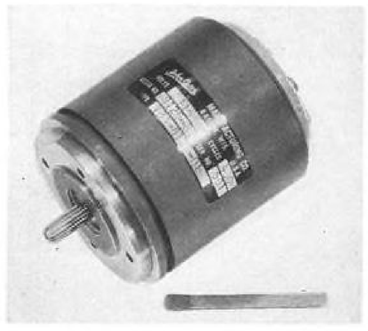
• **Hallamore Electronics Co.** has received $300,000 contract for closed-circuit television monitoring equipment to be used in testing rocket engines and missiles at Martin's Titan ballistic missile plant in Denver and the Army missile center in Huntsville, Ala. Contract provides for 24 systems at Denver, 22 at Huntsville, with cameras capable of withstanding rocket engine exhaust blast.

NEW AVIONIC PRODUCTS

Components & Devices

• **Bi-directional squaring mechanism** for use with mechanical and electro-mechanical analog computers weighs 10 oz. with aluminum casing, 20 oz. with steel casing. Two squaring units, with differentials, can be supplied as multipliers, using Gauss' Law of Quarter Squares. Squarer measures $3\frac{1}{8}$x$2\frac{7}{8}$x$\frac{5}{8}$ in. and multiplier 3 by 3 by 1 in. Manufacturer: Belock Instrument Corp., 111-01 14th Ave., College Point, New York.

• **Synchronous motor,** type 18-A-8125-01, is single phase two capacitor type operating on 400 cycles. Size 18 motor runs at 12,000 rpm. and has 0.85 oz. in. pull-out torque with 20 watt



power consumption. Unit can be connected as a two phase motor, as a single capacitor type, or as a capacitor resistor type, and is said to meet Mil-E-5272. It weighs 14 oz. and is furnished with pinion type shaft. Manufacturer: John Oster Mfg. Co., Racine, Wisconsin.

WHAT'S NEW

Publications Received:

Aircraft Mechanic's Pocket Manual—by Joseph A. Ashkouti—Pub. by Pitman Publishing Company, 2 West 45th Street, New York 36, N. Y. $3.75; 127 pp.

The available data has been prepared to explain why the various methods, processes and finishes are used in aircraft construction.

The Physical and Thermodynamic Properties of Helium—by Jesse T. Simmons—Pub. by Wm. R. Whittaker, LTD., 915 No. Citrus Avenue, Los Angeles 38, Calif. $10.00; 81 pp.

This report briefly summarizes currently available information in both tabular and diagrammatic form on the physical and thermodynamic properties of gaseous helium.

Physical Abilities to Fit the Job—by Bert Hanman—Pub. by Engineering Department, American Mutual Liability Insurance Company, 142 Berkeley Street, Boston 17, Mass. $2.50; 145 pp.

Written with complete manuals and forms telling how to determine each worker's physical abilities, and relate them to job requirements safely and productively.

Testing of Weighting Equipment—by Ralph W. Smith—Pub. by National Bureau of Standards, U. S. Department of Commerce, Washington 25, D. C. $1.25; 184 pp.

This publication is one of a series of handbooks designed to present in compact form comprehensive information relative to weights and measures supervision.

The Renegotiation Guide—Pub. Renegotiation & Termination Letter, 1420 New York Avenue, N. W., Washington 5, D. C. $25.00; 202 pp.

This guide makes available to defense contractors all of the important information and guidance, both official and unofficial, that has been produced over the past five years, beginning with the passing by Congress of the Renegotiation Act of 1951.

Inventors and Inventions—by C. D. Tuska—Pub. McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 36, New York. $3.75; 135 pp.

A manual that will encourage any reader's inventive tendencies, familiarize him with the psychology and methods of invention, and help him protect, patent, and market his inventions.

Bearing Design—by Dr. Donald F. Wilcock, and Dr. E. R. Booser—Pub. McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 36, New York. $12.50; 470 pp.

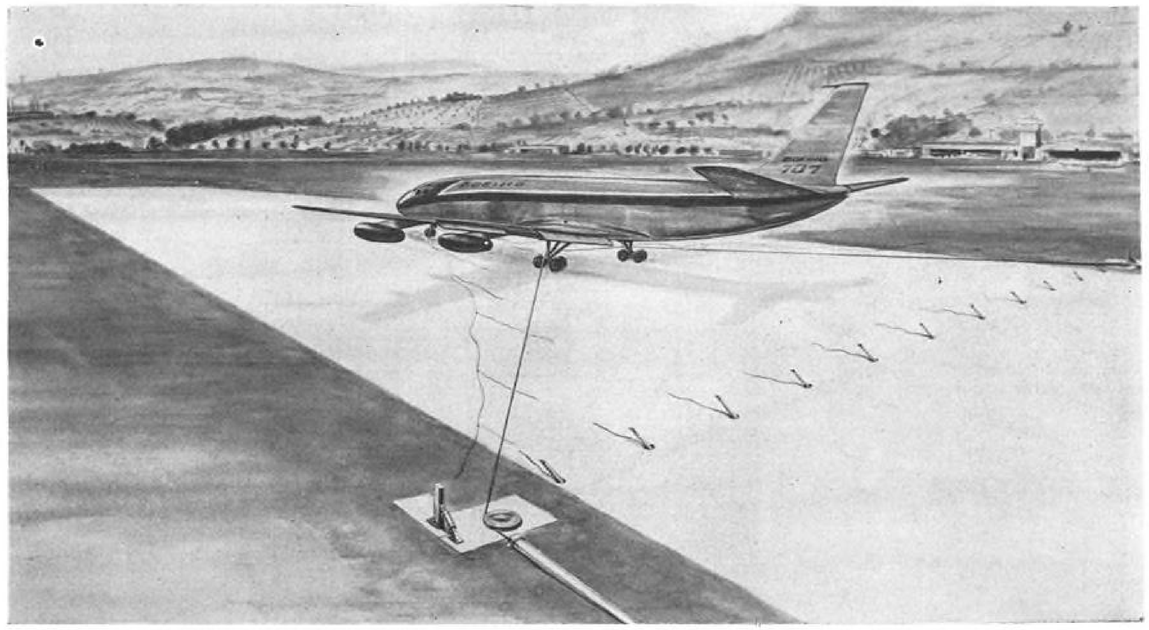
This book considers bearing design and application from three aspects: the design of the bearing; the materials from which the working parts of the bearing are made; and the lubricant used.

Basic Mathematics For Radio And Electronics—by F. M. Colebrook and J. W. Head—Pub. Philosophical Library Inc., 15 East 40th Street, New York 16, New York. $6.00; 359 pp.

The book deals with the basic principles of those branches of mathematics which many years of practical experience in radio and electronics have shown to be definitely necessary.

ASTM Standards on Petroleum Products and Lubricants—by ASTM Committee D-2—Pub. by American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa. $7.50; 1096 pp.

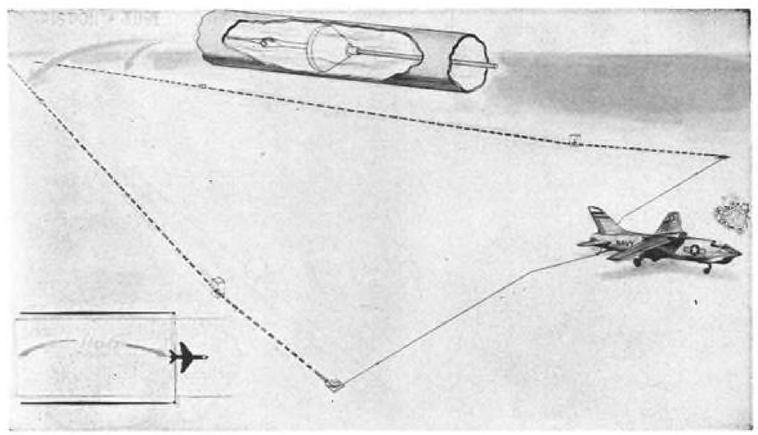
This publication includes tentative and standard methods of test, specifications, definitions of terms and classifications of petroleum products with related information, and proposed methods of test.



ARTIST'S CONCEPT of a jet airliner being stopped by an All American Model 56 overrun barrier and water squeezer.

New Runway Barrier Design Details

By George L. Christian



AAE'S Model 340 water squeezer arrester. Inset (top) shows piston in liquid-filled tube.

Woodbine, N. J.—Growing emphasis on runway overrun barriers for military—and possibly commercial—airfields is underlined by three recent barrier developments, primarily for military applications. The systems use entirely different energy-absorbing principles.

• **E. W. Bliss Co.** has developed an overrun barrier for installation at Van Nuys, Calif., Air National Guard field. Equipment is undergoing final tests prior to delivery, scheduled for Oct. 1. Arresting engines are relatively small devices, measuring 8 x 6 x 2 ft. They use a pair of B-52 brakes as energy absorbers. Two engines, each with a 20-million ft./lb. capacity, have been built for installation at opposite ends of the runway.

Bliss has also developed, under the trademark of Cataport, a fully integrated concept for boosting planes into the air, arresting them at land and trapping them in case they overshoot a runway.

The system is aimed at commercial and military airfields. Overrun barrier and a land-based, steam-powered catapult were recently demonstrated at Bliss testing facilities here at Woodbine Airport.

• **All American Engineering Co.** has installed one of its Model 340 arresting engines with an MA-1A barrier at an undisclosed airfield where it has been fully operational for over two months. Device uses the "water squeezer" principle—dragging a loose-fitting piston through liquid-filled tube—to absorb energy.

AAE has Model 340 arresting engines in full production. Company also has a contract to install a combination arresting gear and overrun barrier, using a water squeezer arresting engine, at Norfolk Naval Air Station.

All American recently held a round-table discussion with representatives of Civil Aeronautics Administration, Airline Pilots Association and the Port of New York Authority concerning the application of overrun barriers to commercial airports to determine how the overall problem should be attacked.

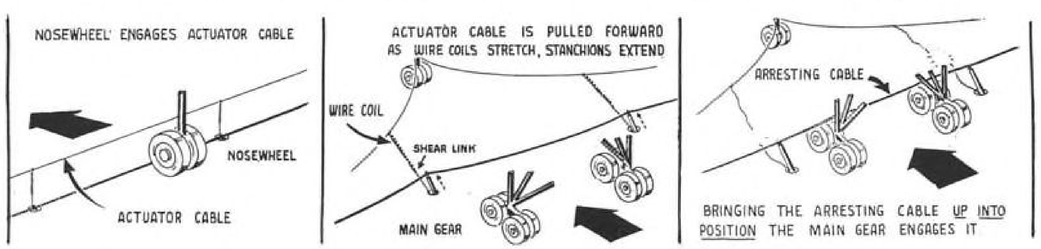
• **Van Zelm Associates, Inc.,** under a contract with USAF's Air Research and Development Command, has developed a heavy bomber overrun barrier. Installation is currently being made at Edwards AFB, Calif., and first tests are expected to begin by Nov. 1. Arresting engine design is based on the linear brake principle.

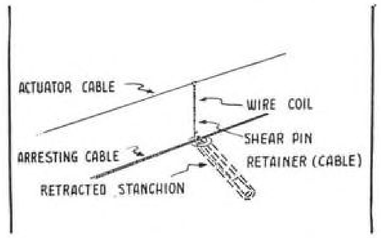
W. D. van Zelm, who heads the firm, told AVIATION WEEK that the arresting engine, with an energy absorption capacity of 100-million ft./lb., was the largest ever built in this country.

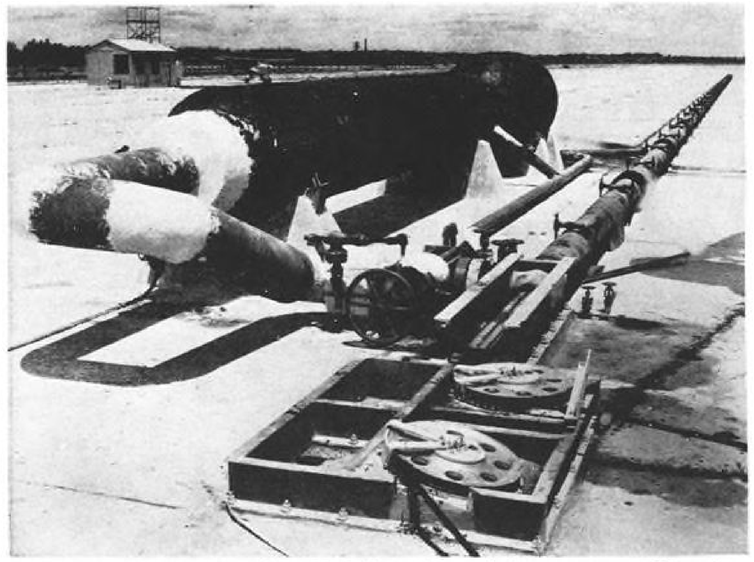
Barrier was designed to stop B-47s at a landing weight of 200,000 lb., an engaging speed of 110 kt. with a 1,000 ft. run-out.

Van Zelm said the barrier's arresting capacity was ideally suited for use with the DC-8 type commercial jet transport.

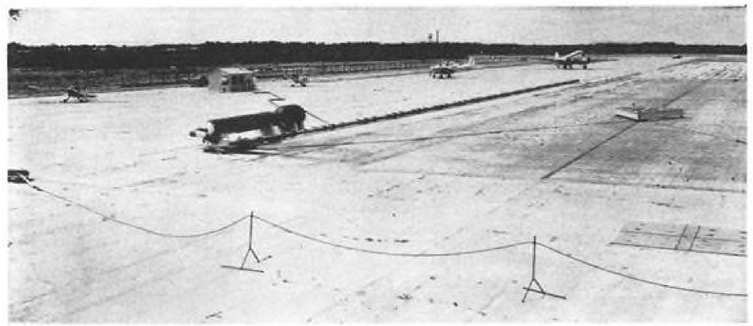
He has sub-contracted design and manufacture of a tail hook assembly kit to be attached to the back part of



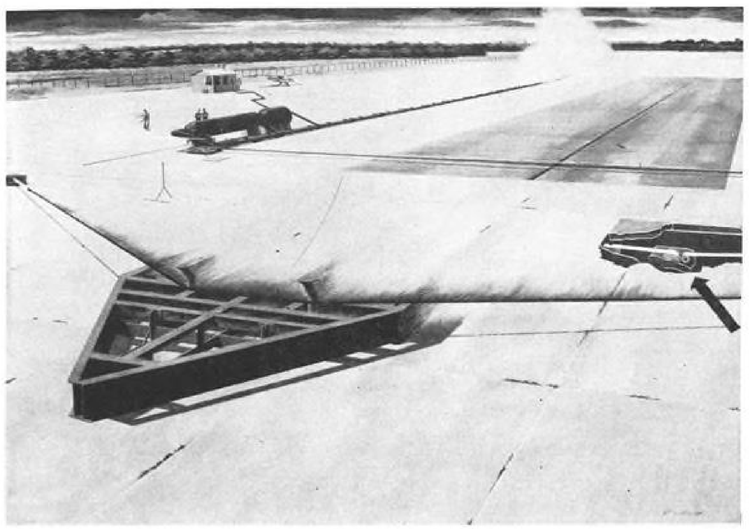




BLISS steam catapult at Woodbine, N. J. Accumulators (left) store steam to drive piston down long tube (right). Cable sheaves are in the foreground.



CATAPULT simulates a 20,000-lb. deadload launch. Arresting cable is in foreground.



ARTIST'S drawing shows deadload, having been launched by catapult at over 100 kt., being stopped by Bliss-developed overrun barrier. Arrow points to underground arresting engine.

the rear main wheel assembly of a B-47's bicycle landing gear. First kit will soon be delivered to the Air Force for installation on a B-47.

STOL vs. Cataport

An AVIATION WEEK sampling of transcontinental airlines' reaction to overrun barriers brought these opinions:

• **American Airlines**—A highly-placed company official said the airline is interested in overrun barriers, but under two conditions. One, they must be simple and relatively effective devices: two, they should be installed only on runways where overrun would be catastrophic to the aircraft and its passengers. He did not feel that barriers were justified on runways with adequate and safe overrun areas.

As to the eventual use of catapults and arresting gear to allow large aircraft to operate from short runways, he was not convinced. He felt that more feasible ways of attacking the problem, ones that would be more appealing to passengers, would be the development of STOL (short takeoff and landing) principles and perfection of boundary layer control to give large airliners safe short-field performance.

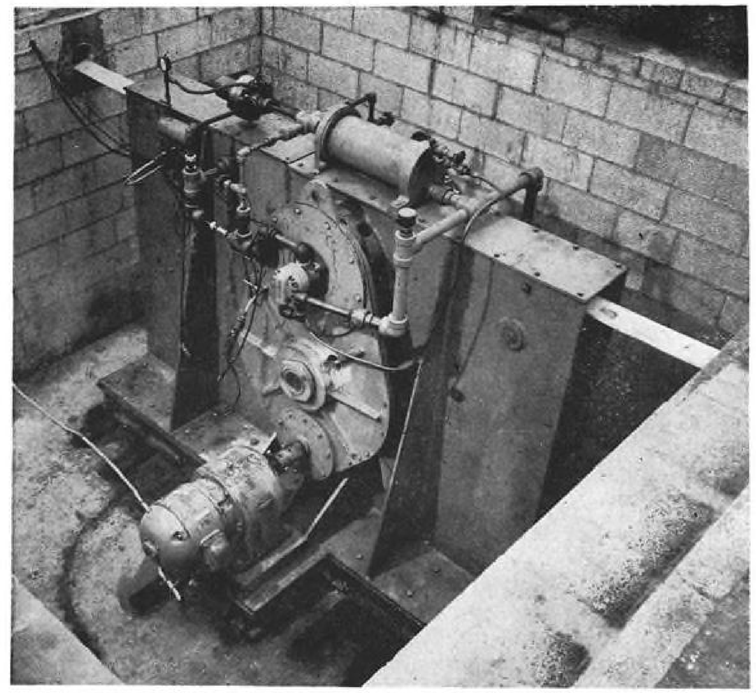
His lack of enthusiasm for catapulting and arresting transports was based on a feeling that passengers would come to fear, and therefore avoid, such devices.

• **Trans World Airlines**—An engineering department spokesman said that TWA "would like to see the development of an overrun barrier capable of stopping commercial transports . . . such a device could probably save some aircraft." He added, however, that barriers would be considered only for runways which had inadequate overrun areas or for short, cross-wind runways whose length might be critical for up-coming heavy transport planes.

He emphasized that the problem was one which no single airline could tackle individually. It is a problem which will require major airlines to agree on such matters as: which airports and which runways will need barriers; what type of barrier gear and arresting engines are the most effective and how is the equipment, if purchased, going to be paid for? He concluded by saying that "the entire question of overrun barriers for commercial use still needs a lot of development on an industry basis."

• **United Air Lines**—Carl Christenson, UAL's Director of Flight Safety, told AVIATION WEEK that "several proposals have been made to the airlines concerning overrun barriers, but the subject is larger than any one company and properly comes within the jurisdiction of the CAA.

"No national policy has yet been firmed up thus far, and before it can be, the following has to be determined:



BLISS arresting engine weighs 8,500 lb., is 8 ft. high and has 20-million ft./lb. energy absorption capacity. Circular reservoir at top feeds hydraulic motors driven by flat nylon tape (emerging from each side of the machine) through gear train. Motors apply pressure to B-52 brakes which stop plane. Motor at bottom resets barrier.

"Type of overrun barrier installation;

"How will it be controlled—by the pilot or by the control tower?

"Who will bear installation costs?"

Noise Reduction

One interesting remark made by an airline about catapults was that the device, by getting planes into the air quickly, could help immeasurably in alleviating the noise problem around airports.

A CAA official said his agency "has not yet formed any opinions concerning overrun barrier requirements for commercial aircraft."

Some conclusions reached at the recent All American Engineering-sponsored meeting, held at the company's test base at Sussex County Airport, Georgetown, Del., were:

• **Neither airframe manufacturers** nor airlines will allow any hardware to be hung on commercial airliners for the specific purpose of engaging an overrun barrier . . . engagement must be accomplished with aircraft remaining in their "as is" configuration.

• **Overrun barrier** should be simple, fool-proof, highly reliable, easy to maintain and unaffected by weather conditions such as dust, snow or sleet. Preferably, it should be so placed on a runway that it would be beyond the normal operating area. This would allow it to be kept constantly in the engaging position at the ready instead of having to be erected whenever an emergency occurred.

The various agencies represented at the meeting—CAA, PNYA and ALPA—agreed that, from an overall point of view, overrun barriers appeared to be useful devices to protect planes from damage in case of an aborted takeoff or an overshot landing.

They suggested that All American officials submit to them for study a proposal based on the latest operating figures and takeoff and landing weights of the largest commercial jets now being built.

Cataport Components

Three principal components (and stages) of Bliss' proposed Cataport are:

• **Overrun barrier**—Already developed for the military, Bliss technicians feel this will be the first of Cataport's three components to see civilian service. They say that such airlines as United, TWA and American have expressed interest in overrun barriers.

• **Arresting Gear**—Next step will be to install arresting gear which will "bring planes to a swift, easy stop in a fraction of the distance required with conventional braking methods. With catapult-assisted takeoffs, arresting gear will permit even large, heavy planes to

fly from vest pocket size airfields." Bliss says.

• **Catapult**—300,000 lb. plane, boosted by a catapult to 60-70 kt. over a distance of about 300 ft., would use half the runway an unboosted plane of comparable weight would require, according to Bliss engineers. Catapult's acceleration would impose .3-.4 Gs on plane's passengers which would be hardly perceptible and unlikely to provoke adverse reaction. Machine itself would be straightforward and simple, since it would need to generate a towing load of only 100,000 lb. Cost would be approximately $500,000.

Bliss spokesmen envision a new concept as compared to 5G carrier catapults, for catapulting commercial airliners. Catapult would be a continuous type.

Aircraft would be coupled to it automatically without requiring manual hook-up. Aircraft would taxi to the catapult, be coupled and launched without the passengers necessarily knowing what was happening. As soon as one plane was clear of the catapult, the next airliner would take its place and be launched without waiting for the catapult to be repositioned.

Simple Catapult

Bliss engineers demonstrated a steam catapult here recently—one they claim is the first to be developed in this country specifically for land use—and an overrun barrier using a Bliss-developed energy absorbing engine, or brake.

Both devices were demonstrated with a 20,000 lb. test vehicle which was launched twice by the catapult into the barrier at speeds of 98 and 110 mph. respectively.

Dominant design philosophy of catapult and brake alike was to keep it simple. Catapult is a slingshot-like device—made out of commercially available parts and operated by 2,000 psi. steam pressure.

Steam is provided by a standard, oil-fired steam generator manufactured by the Belser Boiler Corporation. Machine, which takes about one cubic yard of space, can produce enough steam to operate this particular catapult about once every 15 minutes. For the continuous type of operation envisioned for full-scale commercial use, a bank of these steam generators would provide the greatly increased power demand.

Steam is piped into two large accumulators where it is stored under pressure up to 2,000 psi. When catapult is fired, steam is released into a 340 ft. length of commercial, cold-drawn, seamless steel tubing 7½ in. in diameter. Steam pushes a steel piston, equipped with chrome-plated rings, down the cylinder to produce 16-million ft./lb. of kinetic energy.

Continuous steel cable is attached to the piston and runs over a pair of sheaves at the head of the catapult. From one of these sheaves the cable runs back to the test vehicle (or plane) several hundred feet down the test runway and back to another sheave directly across the runway from the head of the catapult. The cable is thus stretched in a big V with the apex at the test vehicle. From the far sheave, cable runs under the runway to the piston. When the catapult is fired, the piston hauls the two ends of the cable down the tube after it.

Smooth Acceleration

Steam is prevented from escaping from the mouth of the cylinder by a labyrinth seal. As the piston travels down the tube, the cable smoothly accelerates the test vehicle to the desired speed. No brake is required because the slingshot geometry of the catapult uses the moving masses of the cable towing system to generate its own braking forces. When test vehicle is launched from the catapult, cable is stretched taut between the two sheaves at opposite sides of the runway.

Thermal expansion causes the catapult cylinder to "grow" 8 in. per firing.

As a tug re-spots the test vehicle at the far end of the runway, the piston is returned to the firing end of the catapult cylinder by the cable.

Besides commercial and military airport potential, Bliss officials feel that their catapult has possibilities for use as an expeditionary catapult in semi-permanent installations.

The Bliss-developed arresting engine demonstrated at Woodbine—called a rotary friction energy absorber—is of compact design. Machine, which can absorb 18-million ft./lb. of energy, weighs 8,500 lb. and measures 6 x 8 x 2 ft. It is sunk in a large pit under the runway.

B-52 Brakes

Heart of the device is a pair of B-52 wheel brakes mounted on a common shaft on either side of a large drum. On the drum is double-wound a nylon tape 350 ft. long, 5 in. wide and ¼-in. thick. As the double tape comes off the large drum, it separates. One side goes directly to a sheave mounted above the engine at runway level. Other side runs over a smaller drum and then goes to a sheave at the other edge of the runway, directly opposite the first sheave. Then, both ends of the nylon tape emerge through slits in the runway and attach to a cross-runway cable corresponding to the deck pendant of a carrier arresting gear.

As the test vehicle hurtles into the cable, dragging it down the runway, the nylon tape is unwound from the drum. This drives two Vickers positive displacement, vane-type pumps which supply hydraulic pressure to the two brakes. These slow rotation of the drum and therefore retard the test vehicle (or plane).

As the tape plays out, it runs over an

"Erector Set" Maintenance Stand

This maintenance stand for Constellation/DC-6 and -7 type aircraft is handy for re-skinning, painting and other high fuselage work. It is built of Dexion slotted angle steel which can be assembled in almost any shape much like an erector set. Rubber casters give the stand mobility. Capacity is 900 lb., weight 1,500 lb. and dimensions are 28 ft. long and 16½ ft. high. Designed and manufactured by Lockheed Aircraft Service, Inc., stand is available at $562.00 FOB Ontario, Calif.

idler wheel, which actuates a special tension-sensing device. This acts to reduce retarding action by restricting the flow of hydraulic fluid to the brakes if the plane is decelerating too rapidly, and provides a constant runout action to keep Gs to a minimum. Put another way, the tension-sensing device automatically adjusts retarding loads imposed on an aircraft to the plane's engaging speed and will, therefore, stop planes of different weights, engaging at different speeds within the same approximate distance, within certain limits.

Because use of the barrier under normal conditions would not occur with great frequency, heat dissipation is no problem.

An electric motor rewinds the tape and resets the entire arresting system in about three minutes—a big improvement over having to reset the tons of anchor chain so often used to stop planes.

Nylon tape—Bliss addition to the arresting gear—damps oscillating cable loads set up by the impact characteristics of the cable arresting gear and keeps down peak-to-mean retarding loads.

The tape, made of sun-resistant nylon, was woven for Bliss by the Phoenix Trimming Co. of Chicago. It has a tensile strength of 55,000 lb.

The arresting engine demonstrated at Woodbine Airport was built for the Air National Guard and is designed to stop fighter-type planes (20,000 lb.) entering the barrier at 144 mph. in a maximum runout of 400 ft.

Company has also built a second arresting engine which uses a steel cable instead of the nylon tape because it requires a runout of 650 ft. which is not now practical for nylon tape.

Woodbine operation is under Bliss's Aircraft Launching and Recovery Equipment Department, with headquarters at Philadelphia International Airport.

All American Approach

Robert B. Cotton, All American vice president, said his company has been interested in the problem of overrun barriers since 1943. In fact AAE designed and built one for Washington National Airport in 1946, but it was not used.

Cotton told AVIATION WEEK that, "after many years of intensive development, AAE's ability to provide overrun barrier equipment for commercial jet transports is now a fact."

Two problems are involved in the development of a satisfactory overrun barrier: what type of energy absorber to use, and how to engage the aircraft.

Solution to the first question is fairly routine. Cotton feels that AAE has now come up with a simple, reliable,

inexpensive and proven answer to a commercial overrun barrier arresting engine—the water squeezer.

He also feels that All American's Model 56 barrier, used with the water squeezer, will provide airlines and airport operating agencies with a practical and sure way of avoiding a catastrophic overrun.

Although the current water squeezer Model 340 is designed to arrest planes weighing up to 34,000 lb. at maximum engaging speeds of 160 kt. (device has an energy absorption capacity of 36-million ft./lb. with a run-out of 1,000 ft.), Cotton foresees no problem in enlarging the basic engine to accommodate 200,000 or 300,000 lb. aircraft at engaging speeds of 75 kt. to over 100 kt.

Barriers Worthwhile

Engineers at All American are aware of the lukewarm attitude many U. S. airlines have taken toward overrun barriers. They know "the need for runway safety barriers for commercial jet transports has been questioned, especially in view of the use of reverse thrust equipment. However, the fact is that the Air Force, even with its effective drogue chutes, has elected to install barriers at most of its airports. Decision was based on the successful use of runway barriers since 1955. Barriers have saved millions of dollars and many lives for the military."

All American Engineering officials stress the fact that their overrun barrier should not be considered a necessary "crutch" for jet transport operation. They say, "its value as an added safety feature can hardly be questioned when it is realized that the prevention of a single overrun accident will more than pay for the complete overrun equipment, not to mention the possible saving of life . . . it would be a real pity if we have to wait for a fatal overrun crash to prove the point."

These officials propose that, wherever possible, barrier equipment will be installed on a runway's overrun, away from normal operating areas and thus will not interfere with normal plane circulation at an airport.

Water Squeezer

All America's water squeezer arresting engine has been used many thousands of times in service and is "the most extensively tested runway arresting engine in existence," according to company spokesmen.

It operates on the simple hydraulic principle of pulling a loose-fitting piston through two fluid-filled, tapered tubes. Advantages are: reliability, consistency of performance, simplicity and ease of maintenance. System has no controls. Decelerating load for the design airplane weight and speed range

is automatically controlled by programming the tubes' shape.

Model 340's energy absorber tubes are 920 ft. long; diameter varies from 7½ in. to 4¾ in. Tubes are normally buried underground on either side of, and parallel to, the runway. However, tubes may be laid at any desired angle to the runway if the parallel position is impractical.

If possible, tubes should be buried below the frost line so that water may be used as the fluid. Otherwise an anti-freeze may be used with no change in performance.

When a plane engages the water squeezer's pendant, or other engaging device, steel cables run around runway sheaves to the pistons in the underground tubes whose ends are above water level to keep them full. The loose-fitting pistons are pulled through the tubes with the liquid exerting a retarding force. Only a few gallons of fluid are lost at each engagement.

Consistency of the device is indicated by the fact that, on an existing arrester whose calculated run-out is 220 ft., planes with considerable weight variation (but within a given speed and weight range) have been stopped within one or two feet of the 220 ft. required.

Retrieving System

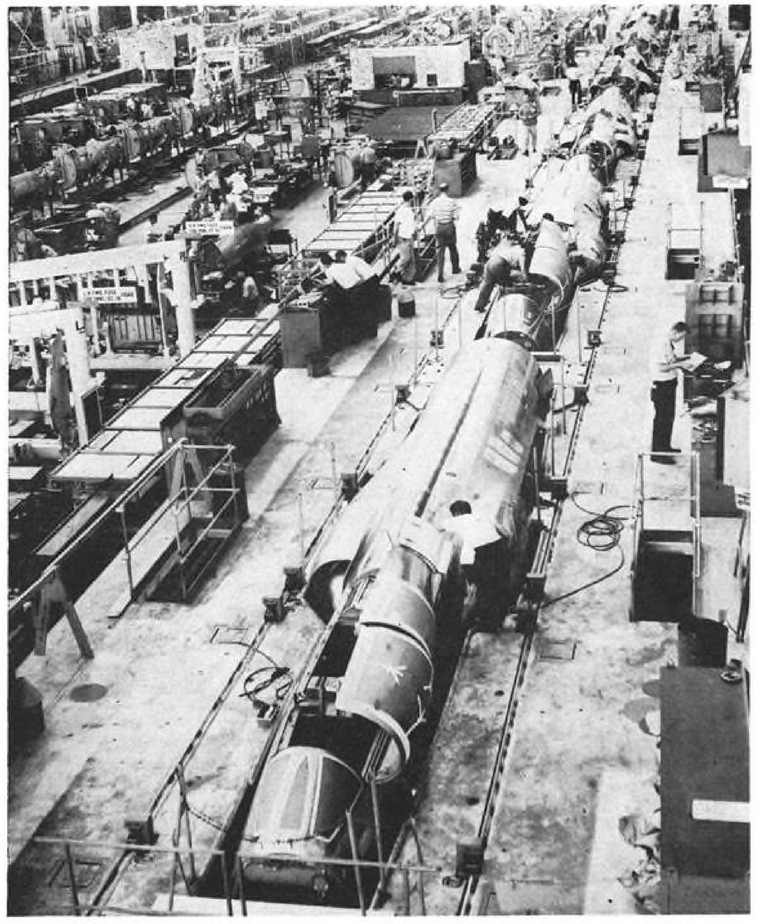
Water squeezers are provided with a simple and inexpensive retrieving system. A quickly detachable rope capsule is installed at the rear of each tube. During the arrest, the ½-in. diameter rope, which is attached to the back of the piston, pays out from the capsule. After the arrest, a jeep or truck pulls the rope to return the piston to its battery position. Rope is then detached and another capsule is attached for the next arrest. Normally, the retrieving operation takes about five minutes. A quicker retrieving system which reduces cycling time to 45 seconds can be provided.

All American's model 340-A3 water squeezer uses runway sheaves 250 ft. apart and has a 1,000 ft. run-out. Weight is about 40,000 lb. and cost is approximately $28,500 without an engaging means. Installation costs amount $12,500 and can be accomplished in about 15 days without deactivating the runway. Only maintenance required is periodic inspection of the cable and fluid level.

All American Engineering is also developing a friction-type emergency overrun barrier under contract with the Air Force. It consists of two sets of seven stainless steel ribbons piled one atop the other. Ribbons are 180 ft. long, 8-in. wide and .050 in. thick.

Each of the two sets of ribbons pass through a series of 448 braking surfaces mounted on two carriages which are dragged along the arresting engine by the plane being stopped. Called a "rabbit catcher," the device was demonstrated stopping an F-84G which was pushed down a 5,000 ft. runway by its own engine plus the kick of four RATO bottles. Engagement was made at 140 kt. at a weight of 23,500 lb. Plane was stopped in 889 ft. Energy absorbed by the device during that particular run was 20,270,000 ft./lb.

Plane was guided down the runway by a special rig riding in guide rails. Spoilers on both wings kept the plane from taking off.



F-104 Assembly Line

Lockheed F-104 Starfighter fuselage sections are lined up for mating in Burbank facility. After assembly, entire fuselage is moved by truck to Lockheed's Palmdale, Calif., plant for final assembly and flight testing.

Model 56 Barrier

Engineers at AAE, aware of the fact that airframe manufacturers and airlines alike are loathe to hang any hardware on commercial transports for the specific job of engaging barriers, have tried to design a system which would not require any special plane hardware.

Only structures on a plane strong enough to resist barrier retarding forces are the wings and main landing gear. Since engaging the wings is too cumbersome, AAE engineers concentrated on a system to engage the main gear and developed the Model 56 barrier.

The device is made up of an actuator cable, wire coils, lifter cable, telescopic stanchions, arresting cable and related components.

Telescoping intermediate stanchions are located 15-20 ft. apart across the beginning of a runway's overrun area and are retracted into the runway so that the tops are flush with the surface. Arresting cable is attached to the upper ends of the retracted stanchions by means of a release mechanism.

An actuator cable is tensioned about four feet above the runway directly over the arresting cable. A series of stretchable wire coils, having a 500% elongation factor, are attached on the upper

end to the actuator wire and on the lower end to lifter cables which are fastened to the intermediate stanchions.

The actuator cable is tensioned between two main stanchions, one on each side of the runway.

Operating Principle

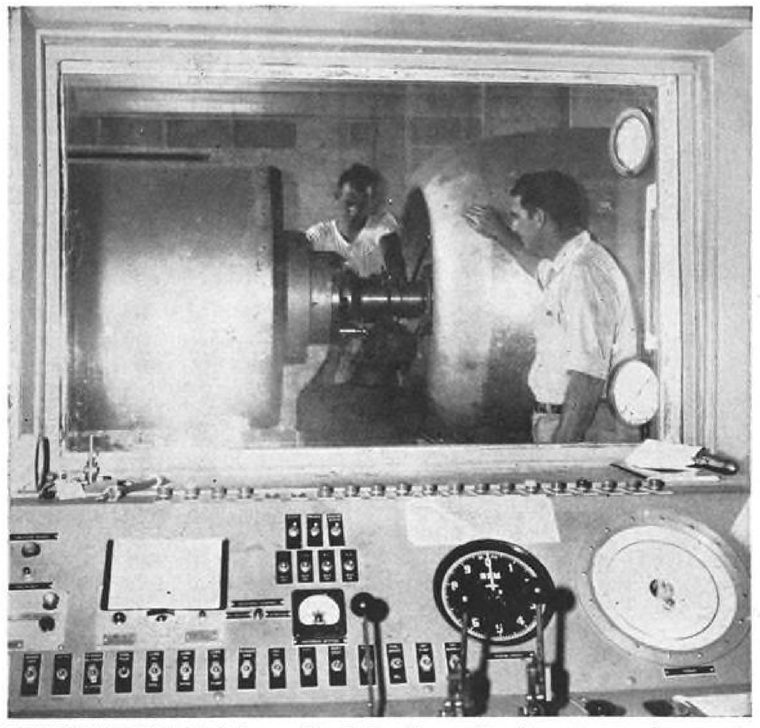
Here is how it operates:

Nose gear of an overrunning aircraft engages the actuator cable, carrying it forward. Wire coils attached to the actuator cable are stretched, putting sufficient tension on the lifter wires to pull the retracted stanchions up and into position. Stanchions lift the arresting cable to a height sufficient for it to clear the plane's main wheels and engage the main landing gear struts to arrest the aircraft. Nothing about the Model 56 barrier requires any special devices to be attached to the plane.

Cotton said that AAE is prepared to furnish a complete runway emergency barrier for an airplane weighing 250,000 lb. with an engaging capability of 120 kt., complete with Model 56 barrier and with guaranteed performance for 707 and DC-8 class aircraft, for approximately $95,000 F.O.B., Wilmington, Del. Installation costs are not included.

Overrun barriers, other than the currently-used anchor chain devices which require an inordinate amount of manpower and time to reset after once being used, seem assured from a military point of view.

Whether commercial airlines will follow the example of the military remains a matter of conjecture at this point.



BRANIFF MECHANICS link propeller shaft with coupling flange to new dynamometer at airline's Dallas overhaul base. Photo taken from control room.

Braniff Using Dynamometer

Dallas—Braniff Airways has installed a dynamometer-equipment test cell at its overhaul base here to modernize engine testing facilities.

Braniff made the switch to dynamometer engine testing because it is more efficient than the older propeller-type test cell, and because it is more accurate. New installation, built by Clayton Manufacturing Co., is designed to insure engine testing accuracy to one half of one percent.

Since power output of an overhauled engine can be quickly and accurately recorded on a torque meter in the test cell's control room, the airline's test operators no longer have to refer to charts, curves and complicated computations to verify engine performance.

Dynamometer makes testing quieter

and safer than the old propeller system, and efficiency is increased by the shorter hook-up time for the dynamometer. With prop testing, engine changes in the test cell took two to three hours, keeping the cell inoperative as much as 50% of the time. Dynamometer cuts engine mounting time to 30 minutes.

Braniff's new dynamometer is built for a life expectancy of 10,000 hours of repeated normal engine run-in cycles. It is housed in a 40-ft. square cinder block building at Braniff's Love Field maintenance base. When the airline's new maintenance base is completed here, the dynamometer will be moved to an underground test cell.

Liquefaction Reduces Bulk of Helium Cargo

Best way to transport large quantities of helium is to liquefy it at plants where it is produced and ship it by air or tank car to points where it is needed, according to Navy's BuAer.

Navy is critically concerned with the production and transportation of large quantities of helium because of its voluminous need of the gas for a variety of jobs ranging from inflating airships to missile use and welding applications.

At the recent 1957 Cryogenic Engineering Conference held at the Boulder, Colo. laboratories of the National Bureau of Standards, discussion revolved around railroad tank cars capable of transporting 60,000 liters (15,000 gallons) of liquid helium. Designs of the cars have been worked out at the Boulder laboratories.

Although liquid hydrogen, some 30F cooler than the −450F temperature of liquid helium (absolute zero is −459.6F), can be transported in a special container with no refrigeration unit required, liquid helium cannot. To move large quantities of the very cold liquid gas successfully, liquid helium vessel walls have to be designed to use liquid nitrogen (−320F) radiation shields (AW July 29, p. 88) which cut vaporization loss to less than 1% per 24 hour period.

With such additional cooling, very volatile liquid helium can be sealed in a transportation container for a three weeks' trip before pressure rises sufficiently to approach the tank's bursting point.

Opinion was expressed that it is technically feasible to liquefy helium economically with no new equipment development being required.

Dry Vacuum Achieved With Electronic Pump

A new high-vacuum pump which provides an electronic method for producing vacuum without the use of organic fluids has been put on the market by Consolidated Electrodynamics Corp.

Called Evapor-Ion pump, type EI-2000A, the unit can create a "dry" vacuum ranging from 10^{-4} to 10^{-8} mm. Hg.

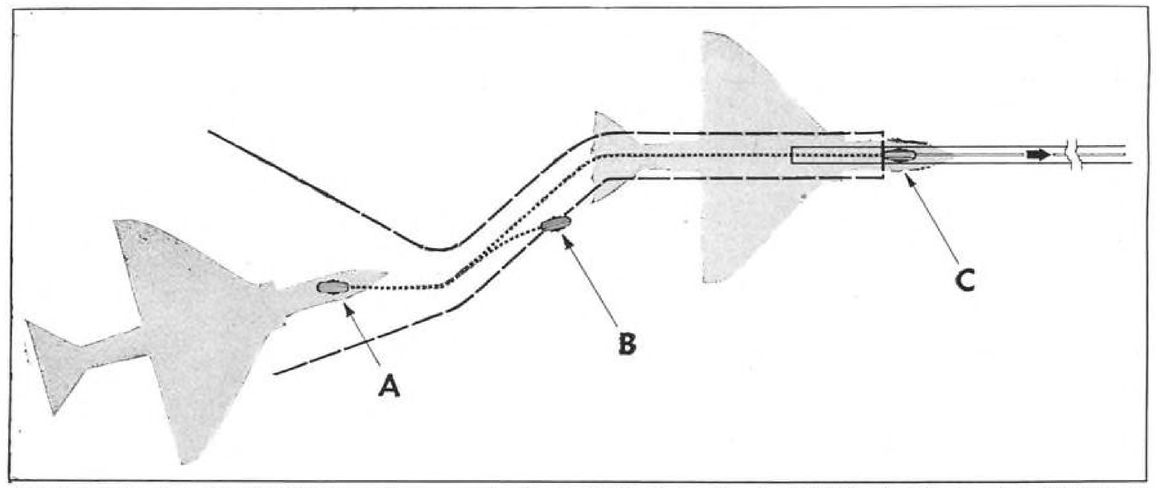
It pumps active gases by the gettering action of evaporated titanium wire and pumps inert gases by ionizing and burying them under a layer of titanium.

Continuous titanium wire evaporation is assured by an improved feeder mechanism. Operation is now possible for periods up to six months or longer without breaking vacuum for servicing.

This model Evapor-Ion pump has a pumping speed of 1,900 liters per sec. for nitrogen, 1,000 liters per sec. for oxygen and 3,000 per sec. for hydrogen, according to the manufacturer.

No refrigerated baffles or traps are required, nor is mechanical forepressure needed for continuous operation. Pump can run for six months or longer without breaking vacuum for servicing.

Manufactured by Rochester division, Consolidated Electrodynamics Corporation, 1775 Mt. Read Blvd., Rochester 3, N. Y.



DRAWING shows how Bliss' Taxi Guidance System would automatically direct plane to catapult shuttle. Aircraft enters slot at A, is steered and stopped at shuttle at C. If plane should turn out of slot, as at B, system automatically applies brakes.

Taxi Guidance System Steers Aircraft to Catapult, Stops It

Woodbine, N. J.—Taxi Guidance System designed to steer carrier-based aircraft quickly and automatically to the ship's catapults and stop them precisely in the correct position to be hooked on to the launching bridle and shuttle, is under development here by the E. W. Bliss Company for BuShips.

System is currently undergoing preliminary testing at Woodbine Airport by Bliss' Aircraft Launching and Recovery Equipment Department headed by J. J. Byrne, Manager. Project, which was started seven months ago, is scheduled for completion by the summer of 1958.

Commercial Uses

Taxi Guidance System promises to be a big improvement over today's method of spotting planes on catapults which requires a pilot to follow a line painted on the deck and obey additional guidance instructions in the form of hand signals given by plane directors standing nearby. With the system, the pilot merely starts taxiing in the general direction of the catapult. The system takes over, spots the plane and stops it, leaving the pilot to handle only power.

Bliss says that the system, when perfected, can be used just as well to guide carrier planes to other parts of the ship such as elevators or parking area.

From a commercial standpoint, Bliss thinks that the system could be useful in spotting commercial transports with precision in the congested ramp areas which so often slow plane movements around airline terminals.

The system's fail-safe feature, which automatically applies a plane's brakes to bring it to a full stop should it run out of its pre-set path, will be beneficial for military and commercial operations alike.

This is the principle behind Bliss' Taxi Guidance System:

On the deck (or ramp) are laid two wires which carry 24 v. a.c., 800 cycle current 180 deg. out of phase.

Attached to the plane's nose gear, or other appropriate structure, are two pick-up coils which continuously seek the null mid-point between the wires. As soon as the coils approach one or the other wires, they sense this fact and relay a signal to a control box. The box, in turn, actuates either brakes or nose gear steering through solenoid valves to correct the plane's deviation from its intended path.

If the plane's nose gear—and therefore sensing coils—runs outside of the slot prescribed by the wires, brakes are automatically applied and the plane stopped.

Also, when the plane reaches its desired location, the nose gear crosses the wire and halts the plane.

Experimental Model

Current Bliss experimental model of the system is installed on a T-28 loaned by the Navy. Deck wires are attached to a portion of a runway at the Woodbine airport.

In three successive demonstrations, TGS steered the T-28 neatly into the desired position and stopped it at the simulated end of a catapult painted on the runway.

Steering action tended to be jerky in spots. Bliss engineers explained that this was partly due to the developmental status of the equipment, and partly to the fact that the plane's right brake was sticking.

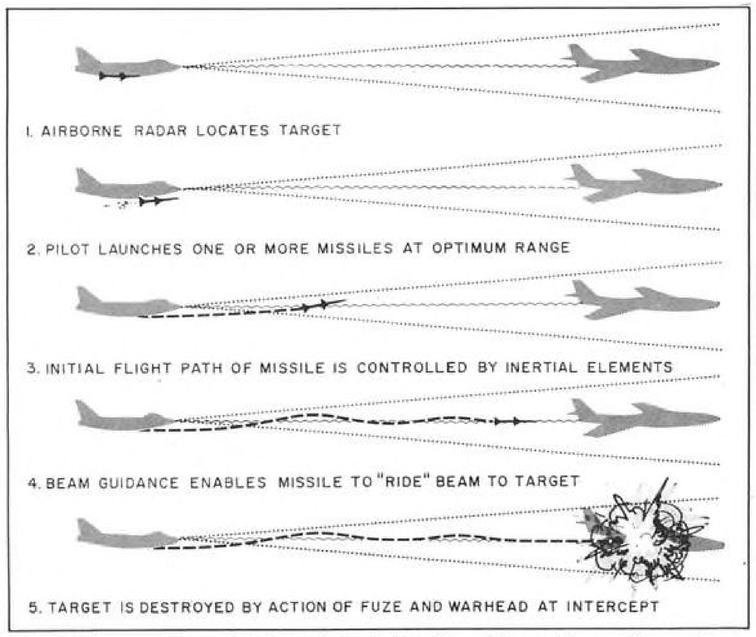
Another factor contributing to the slightly uneven steering action of the T-28 is that its prototype steering is accomplished through valves which pulse five times a second and actuate the brakes. Smoother operation of later equipment will be assured by use of proportional valves which will apply brakes or steer the nose wheel in direct proportion to displacement.

OFF THE LINE

First details have been issued by Britain's Royal Aircraft Establishment of a hydraulically-powered guided missile servo which operates at a pressure of 4,500 psi. and has a stall torque of 3,500 psi. Four of these servos are incorporated in a ring seven inches in diameter in a guided missile test vehicle for wing control surface operation. Features of the device are the high power output obtained from single stage hydraulic amplification and maximum speed of response of 1,200 deg./sec.

Hydraulic constant speed drive for 15 hp. aircraft alternators which can be used in reverse to drive the engine for starting when the alternator is energized as a starter motor has been developed by Integral, Ltd., Wolverhampton, England. The constant speed drive delivers a constant 8,000 rpm., held within 1%, with input speeds varying from 3,300-10,000 rpm.

Manhour Investment High on Sparrow I



SPARROW I employs combination of simple inertial and beam-riding guidance. Immediately after launching, gyros and accelerometers stabilize flight path and guide into radar beam of interceptor which is aimed at target. Once beam has been penetrated, receiver in the missile generates fly up, down, left, right signals to guide to beam center.

Great Neck, N. Y.—Nearly four million engineering manhours were expended over a 10-year period to bring Navy's Sparrow I air-to-air missile from initial concept to operational use.

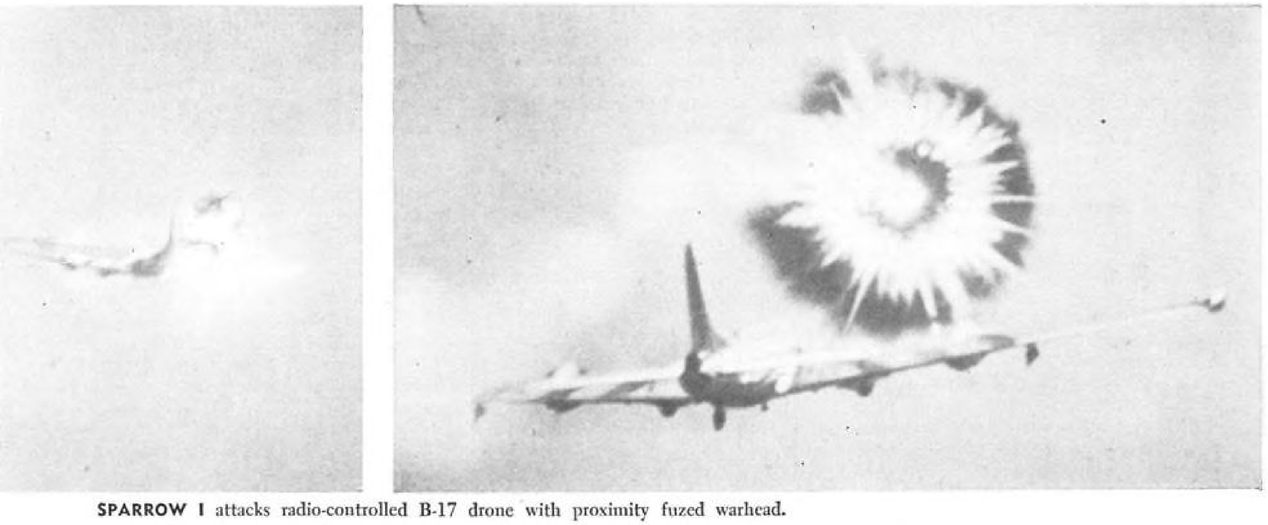
This figure is several times greater than figures for development of World War II bombers and early postwar jet fighters.

The high engineering manhour investment required to produce Sparrow I reflects the inherent difficulty of trying to produce the function of an automatic interceptor in a 12½ foot long, eight-inch diameter package. It also reflects the fact that 10 years ago there was little previous experience in the missile art and there were practically no available component parts or devices that were small enough and reliable enough for missile use.

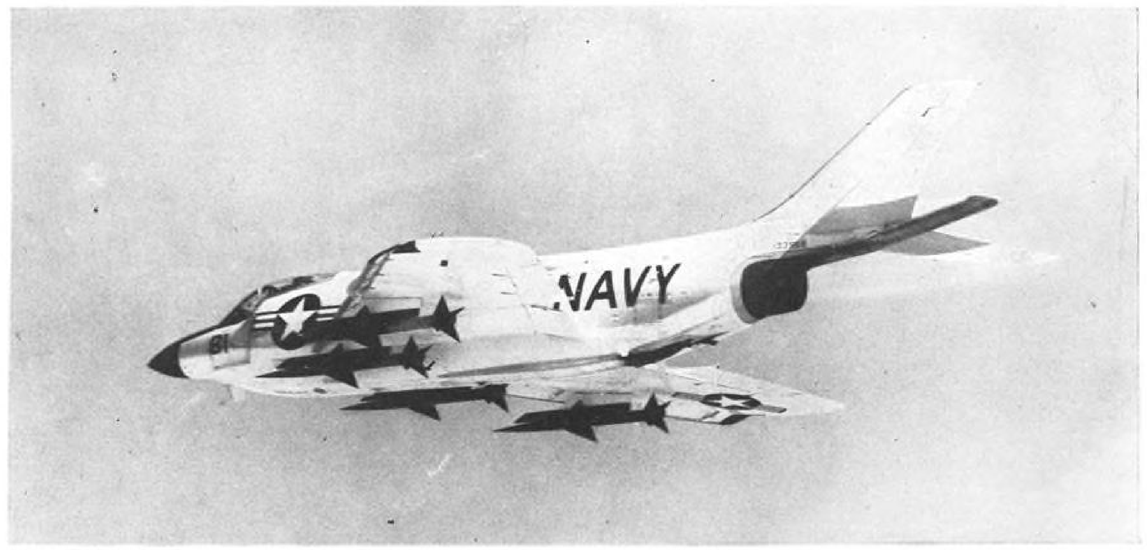
Appearance Deceiving

The Sparrow's small size and external simplicity are deceiving indications of the amount of effort required for its development and design. More than two million engineering manhours were expended by Sperry Gyroscope Co. in development and evaluation engineering.

This includes more than 100 prototype missiles built and flight tested between 1948 and 1951. (First air-launching from Navy aircraft was made in 1949, less than three years after project began).



SPARROW I attacks radio-controlled B-17 drone with proximity fuzed warhead.



FOUR SPARROW I's roost under wings of McDonnell F3H-2M. Missile is in use with Sixth Fleet.

Another 1.6 million engineering manhours were spent in bringing the Sparrow I into production, including such things as development of test equipment, integration of missile with the interceptor fire control systems with which it would be used. At least another 0.4 million engineering manhours were spent by major Sperry sub-contractors.

At the peak of the program, Sperry had about 300 engineers assigned to the Sparrow I.

The 12½ foot long, eight-inch diameter Sparrow I weighs about 300 lb., reportedly has top speed of more than 1,500 mph. It is carried externally under wings of Navy interceptors such as Douglas F3D-2M, Chance Vought F7U-3M and McDonnell F3H-2M.

Cruciform configuration, consisting of four fixed tail fins for stability and four variable incidence wings located near C. G. for control, permit up-down, left-right maneuverability without banking airframe.

Guidance System

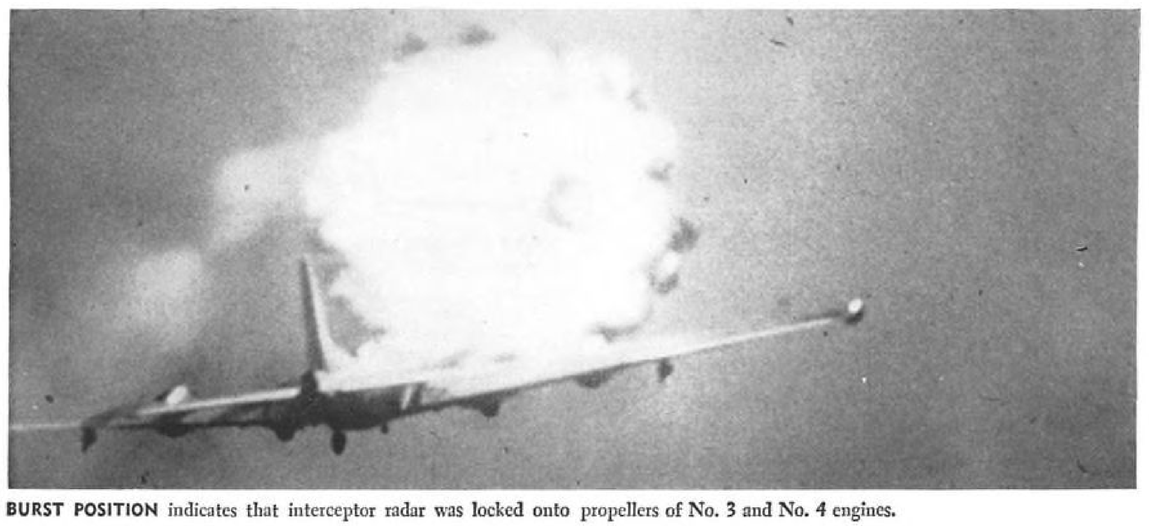
Interceptor's fire control system radar, which enables pilot to maneuver into firing position, also serves to guide the Sparrow I to the target. Immediately after launching, a simple inertial guidance system in the missile (consisting of multi-axis gyros and accelerometers), stabilizes missile flight path and brings Sparrow I into the beam of the interceptor's radar which is aimed at the target.

Once missile has entered interceptor radar beam, Sparrow's miniature radar receiver determines missile's position relative to center of radar beam.

The specific techniques employed to determine this displacement are not disclosed.

Computer circuits modify the missile displacement signal before it is used to operate solenoid valves which in turn control flow to hydraulic actuators. These displace variable incidence wings to direct missile toward beam center.

Beam rider technique used in Sparrow I generally is considered to be less



BURST POSITION indicates that interceptor radar was locked onto propellers of No. 3 and No. 4 engines.

accurate than self-contained radar guidance employed in Sparrow III. The reason is that beam rider guidance accuracy decreases as missile nears target, due to increasing width of interceptor's radar beam. Guidance accuracy of missile carrying own radar improves as it nears test.

Another disadvantage of beam rider guidance is the fact that interceptor must keep its radar trained on target until missile strikes.

However, beam rider guidance generally involves less missile complexity—an important consideration in small air-to-air weapons. Also, it is possible to employ more sophisticated anti-jamming techniques in interceptor's radar than in small missile radar, making the former less vulnerable to enemy countermeasures.

Propulsion and Warhead

Sparrow I uses solid-propellant rocket motor which, like the warhead, is procured directly by Navy from its manufacturers, later assembled into Sperry-built airframe at Naval field installations or aboard ship. The Aerojet-General rocket motor uses high-energy propellant consisting of concentric grains with plastic base.

Built-in oxidizing agent provides burning rate that essentially is independent of altitude.

Propellant is fired by electrically operated igniter, triggered from the interceptor cockpit. Safety and arming circuits permit live motors to be stored and handled safely at shore installations and aboard ship, Sperry says.

Warhead, which represents a significant portion of missile's weight and volume according to Sperry, includes usual safety and arming mechanism. Warhead fuze is presumed to be of the proximity type.

Reliability Program

Sperry Farragut Co., division of Sperry Rand, was organized in June 1951 to build, equip and operate a Naval Industrial Reserve Aircraft plant near Bristol, Tenn. to manufacture the Sparrow I. (The 537,000 sq. ft. plant was turned over to Raytheon earlier this year to build Sparrow IIIs.) Management and key engineering personnel from Sperry Gyro formed the nucleus of the Sperry Farragut operation at Bristol.

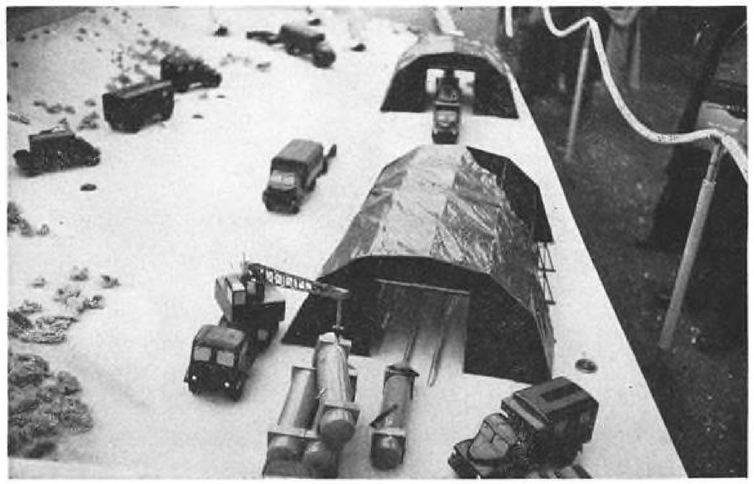
To achieve maximum reliability, 100

Sparrow Avionics

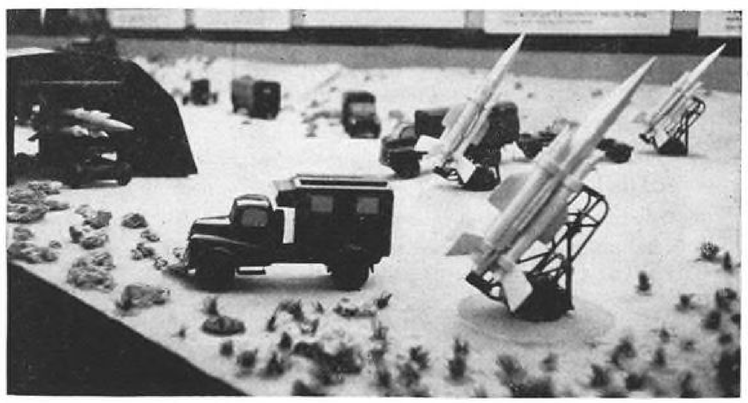
Avionic guidance and control equipment in the Sparrow I represents more than 75% of its total cost, with airframe and structure running about 12½%, propulsion about 6½% and warhead about 3½%.

Thunderbird Battery Model

Model field installation shows English Electric Thunderbird ground-to-air missiles on launchers with assembly and test shelters at rear and radar and control trucks at right. System was designed to use standard British Army trucks and vehicles and require a minimum amount of special equipment.



Missiles are delivered to assembly site in containers (above). After assembly and checkout, missiles are delivered by truck-drawn dolly to launchers (below). Model layout was shown at Farnborough. Thunderbird test missiles have been fired at Woomera, Australia testing area.



Bryan Leaves WADC

Baltimore, Md.—Maj. Gen. Thomas L. Bryan, Jr., who recently underwent major surgery and is scheduled for a long convalescent period, stepped down last week as commander of Air Research and Development Command's Wright Air Development Center at Wright-Patterson AFB, Ohio.

Gen. Bryan was replaced by Brig. Gen. Stanley T. Wray, former chief of the Electronics Defense Systems Division of the Air Materiel Command's Directorate of Procurement and Production in New York City.

Gen. Bryan is expected to return to full military duty immediately after his convalescence.

percent test-to-specifications was performed on all functional avionic components, such as resistors and capacitors. Every tube was subject to microscopic inspection and was electrically tested both before and after a combined burn-in and vibration cycle. Final inspection of assemblies was conducted on a 200% basis, with additional auditing by supervisors to check on inspector proficiency.

Sparrow Subcontracting

Punched-card reporting of field failures was combined with automatic data processing to rapidly localize and correct reliability problem areas.

Sizable portion of the Sparrow I production was subcontracted, Sperry reports, with more than 30% of dollar volume going to major subcontractors, another 15% going to various smaller vendors.

Sperry Rand Corp., which developed and produced Sparrow I, calls it "the first air-to-air guided missile in the nation's arsenal," a claim which might well be contested by the Air Force on basis of the Hughes Aircraft Co.-developed Falcon.

Sparrow I, which has been in operational use for several years, reportedly will continue in this status for at least several more years. Successor will be the Sparrow III, developed and produced by Raytheon.

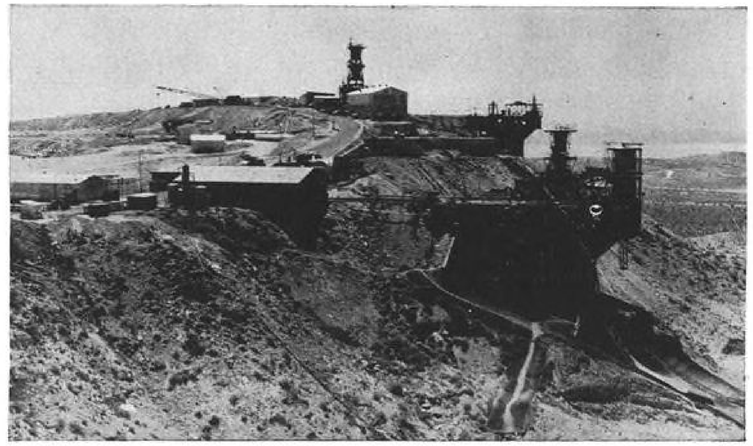
Air Force Activates First Missile Division

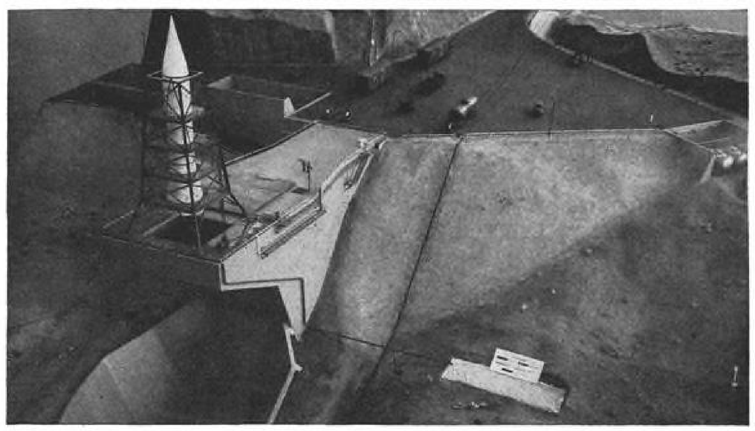
Cooke AFB, Lompoc, Calif.—Air Force has activated its first ballistic missile division headquarters here to plan and prepare for future operational ballistic missile units.

Designated the 1st Missile Division, the unit will have overall supervision of USAF's ballistic missile training program and will establish the initial operational capability of the missiles. Com-

Missile Test Stands

Stands on Leuhman Ridge, Edwards AFB, are used to static test complete intermediate range and intercontinental ballistic missiles. Note silhouette of missile on far cliff-edge stand (middle) and missile model (bottom) which resembles drawings of Convair Atlas.





Lacrosse Launcher

Lacrosse missile is shown mounted on 2½ ton Army truck. Axis of the missile is not in line with the axis of the launcher giving the missile a rolling moment when it is fired. Rolling is necessary during the first seconds of flight to counteract any instability caused by thrust misalignment.

mander of the unit is Col. William A. Sheppard.

Air Force previously announced the activation of the 704th Strategic Missile Wing at Cooke.

The Wing, along with other future units, will be directed by the 1st Missile Division.

Cooke itself will have the primary mission of training USAF ballistic missile units.

It will have an operational capability as a secondary mission.

New Facility Ready For Thor Testing

Washington—Static test firings of USAF's Thor intermediate range ballistic missile, which has failed in several actual launchings from Patrick AFB, Fla., will begin within the next few weeks at a new Air Force-Douglas Aircraft Co. facility near Sacramento, Calif.

Construction of the facility was begun last November and represents a joint USAF-Douglas investment of more than $6 million.

Elmer P. Wheaton, Douglas' chief missiles engineer, said the primary purpose of the test program will be "to reduce the necessity for the numerous and costly actual launchings" that otherwise might be required.

The Sacramento facility will become part of a Thor complex that includes engineering and fabrication of airframes at Santa Monica, Calif.; fabrication and testing of powerplants by Rocketdyne, a division of North American Aviation, at Santa Susana, Calif.; separate testing of the engine with various accessory components at Edwards AFB, Calif., and launchings from USAF's missile test center at Patrick AFB.

U. S. Air Force Photo

"Moby Dick" high altitude research balloon being launched from a special protective trailer at AFMDC. This balloon carries instruments up many miles. Small sized balloon alongside provides launch crew with information on surface wind velocity and direction.

CAB Revokes Pilot's Rating in:

Case of CAA Administrator vs. Specht

(Following is the full text of the CAB's opinion, order and dissent in the case of CAA against TWA Capt. Leonard J. Specht over violation of Civil Air Regulations [AW Mar. 18, p. 30]. *Capt. Specht's rebuttal is printed in full beginning on page* 121.)

This proceeding involves a complaint filed on Feb. 19, 1957, by the Administrator of Civil Aeronautics against the respondent, Leonard J. Specht, a TWA Constellation plane commander. The complaint alleges that respondent committed various violations of the Civil Air Regulations and demonstrated a lack of the qualifications required of the holder of an airline transport pilot rating, and requests suspension or revocation of such rating.

The violations alleged in the complaint arose in general out of the operation of a passenger-carrying aircraft under instrument flight rule conditions involving departure from an assigned altitude contrary to the terms of an air traffic control clearance. Respondent's answer in essence was that his departure from the assigned altitude occurred under icing conditions which justified the departure in the exercise of respondent's emergency authority. A detailed outline of the pleadings, together with the text of pertinent regulations and statutory provisions, is set forth in the attached appendix.

Initial Decision

After due notice, a public hearing was held before Examiner S. Thomas Simon. On the basis of the evidence before him, including the testimony of the respondent and the tape recording of the radio conversations between respondent and air traffic control before, during and after the episode, the examiner issued his Initial Decision. In it he found that respondent's conduct was not justified as an emergency measure and that violations of Sections 60.19, 60.21, and 60.12 of the Civil Air Regulations as charged in the complaint were established by a preponderance of the substantial, reliable and probative evidence.

The examiner specifically found: (1) that respondent irresponsibly exercised his emergency authority in truculence and anger in order to obtain a preferred altitude; (2) that respondent was not confronted by a severe icing condition and his action in leaving his assigned altitude was not justified by a situation which would reasonably lead him to believe that, unless he took immediate action, the safety of his aircraft, passengers, and crew would be endangered; (3) that, in performing his emergency maneuvers, respondent not only failed to exercise the highest degree of care as expected of an airline transport pilot but did not use even ordinary care and was thereby "careless" within the meaning of Section 60.12 of the Civil Air Regulations; (4) that respondent, on this occasion, failed to exercise the degree of responsibility, care and judgment required of an airline transport pilot; and (5) that the public interest requires the suspension of respondent's air transport pilot rating for a six-month period.

The Administrator and respondent have both appealed from the Initial Decision. The Administrator appeals from the examiner's failure to revoke respondent's airline transport rating, and respondent appeals from the findings of violation and the suspension imposed. Both parties have filed briefs in support of their appeals and reply briefs. The Board has heard oral argument, and the case now stands submitted for decision.

Upon a review of the entire record in the light of the contentions presented by the parties in their briefs and at oral argument, we find that the Administrator's appeal should be granted and respondent's appeal should be denied. We agree with and adopt as our own, except as modified herein, the findings and conclusions of the examiner in his Initial Decision.

Careful examination of all the evidence, including listening to the tape recording previously referred to, as well as reading the transcription thereof,[1] leaves the Board with no doubt that the examiner was correct in finding that, at the time respondent left his assigned altitude of 14,000 feet and commenced his climb on instruments to 18,000 feet through the 16,000 foot level which he knew was occupied by the unseen Capital Viscount, the impelling motive of respondent's action was not a belief that such action was necessary as involving a lesser risk than other alternatives, but rather was accumulating anger at being repeatedly denied a change in his assigned altitude while the Capital flight continued to block his ascent by occupying the level which respondent had originally requested and to which he believed himself entitled.

Detailed Analysis

The examiner's lucid and exhaustive analysis of all the pertinent facts and surrounding circumstances of record which dictate this finding need not be repeated here. During the several minutes of conversation preceding respondent's action, his growing anger was manifest, but at no time, though queried, did he mention icing. The abuse of the plane commander's emergency authority is serious, for such authority is intended for safety purposes only and cannot justify action not motivated by safety considerations.

[1]The transcription of the tape recording of the radio conversations between respondent and air traffic control before, during and after the episode, in evidence herein, was attached to the Initial Decision as an appendix.

Moreover, the examiner correctly found that, irrespective of the question of whether there was justification for leaving the assigned altitude, the manner in which that departure was accomplished was wholly unjustified and irresponsible. The examiner's findings of violations are clearly correct, as is his finding that, in regard to the incident here involved, respondent did not exercise the responsibility, care and judgment required of an airline transport pilot. Apart from the question of petitioner's qualification to hold an airline transport pilot rating, the examiner properly determined that a suspension was warranted.

Increasing Congestion

In view of the currently increasing congestion of air traffic and the necessity for taking all action reasonably designed to minimize collision hazards and to promote the over-all public safety, the large toll of life which would have been taken had the two aircraft here involved collided, the high degree of trust and responsibility imposed upon aircraft commanders and the necessity that it be faithfully discharged, and the deliberate and irresponsible character of petitioner's conduct, we would in any event have imposed a twelve months' suspension to impress upon respondent and other similarly situated pilots the necessity for compliance with the regulations and the observance of that degree of care and responsibility required of those persons to whom the lives of the traveling public are entrusted.

Further, our findings hereinafter made of lack of qualification for the rating now held by respondent are predicated upon a demonstrated lack of responsibility, care, and judgment, and an appropriate period within which respondent is precluded from exercising the privileges of an airline transport pilot rating is required before his present disability could be deemed by the Board to be rectified. Under these circumstances, we find that it would be contrary to the public interest to include in our revocation order a provision that respondent be permitted to be issued a new airline transport pilot rating prior to the one-year period specified in the applicable Civil Air Regulation.[2]

On the issue of respondent's qualifications to hold an airline transport pilot rating, raised by the Administrator in his complaint and the subject of his appeal seeking revocation, the examiner's discussion

[2]Section 21.21(b) of the Civil Air Regulations, 14 CFR 21.21(b), provides that:
"No person whose airline transport pilot certificate has been revoked shall apply for or be issued a pilot certificate of any grade or rating for a period of one year after the revocation, except as the order of revocation may otherwise provide."
Our order permits immediate issuance of a commercial pilot certificate for reasons hereinafter stated.

was brief. He found that respondent clearly failed, on this occasion, to exercise the degree of responsibility, care and judgment required of an airline transport pilot, but he did not find that respondent's conduct demonstrated a lack of these essential qualifications.

In reaching this result, the examiner referred generally to his observation of the respondent at the hearing, the circumstances in which the violations occurred, and respondent's age, experience and past record as offering assurance that respondent's derelictions are not likely to recur. In addition, the examiner suggested that the underlying explanation of respondent's conduct may have been a misconception which the examiner found respondent "obviously" harbored as to the primary function of air traffic control, in mistakenly believing that this function is chiefly to provide service to users of the airways rather than to prevent collisions between various aircraft in flight.

Reach Conclusion

We have carefully considered the examiner's findings in this respect, the evidentiary record, and the contentions of the parties relating thereto and to the appropriate order to be entered by the Board. We can reach no conclusion other than the one that respondent's conduct demonstrates that he presently lacks the degree of responsibility, care and judgment required of the holder of an airline transport pilot rating.

We recognize that in many instances conduct contrary to accepted standards involved in a single flight is insufficient grounds for revocation. But the conduct here involved far transcends the ordinary case, and is similar in character to other serious single actions which have demonstrated such a degree of irresponsibility and indifference to consequences as to require revocation. *In re Stead*, 1 C.A.B. 74 (1939); *Adm. v. Sisto*, 13 C.A.B. 125 (1948); *Adm. v. Bessey*, 13 C.A.B. 550 (1952).

The fact that respondent is an experienced and veteran pilot does not excuse his actions here or serve to demonstrate that he possesses the attributes required of a plane commander. Rather, a pilot such as respondent above all others should have been aware of the risks involved; his long experience should have made all the more plain to him the hazardous character of his action.[3]

We agree with the Administrator that "the type of failure portrayed by Captain Specht in this instance cannot be offset by the accumulation of several thousand hours in an aircraft."

The chain of events leading up to respondent's action was such as to have insured the bringing into play of whatever degree of responsibility, care and judgment respondent could muster. His preference for a higher assigned altitude than 14,000 feet existed prior to take-off.[4] He encountered repeated denials of his repeated requests for a higher altitude, and the aggravation which this continuing frustration generated in him became evident long before his action. During the same time, he was continuously aware of the general proximity of the unseen Viscount flying the same course above him, and the specific notion of climbing through its altitude had entered his mind at least a full five minutes before he did so.[5]

Thus all the elements which would have evoked the qualities required to exercise command responsibility were full-blown well before respondent acted. He was not caught unaware by a sudden unanticipated situation, and these qualities had every opportunity and reason to assert themselves. The only conclusion is that such responsibility, care and judgment as respondent possessed proved insufficient under the pressure of his anger, and that his failure to exercise them in the required degree was due to deficiencies in these respects. The record is devoid of any other explanation of what occurred.[5]

Dangerous Maneuver

Thus, in obvious anger over not receiving an altitude to which he regarded himself as entitled, respondent deliberately and unjustifiably climbed his aircraft through space known by him to be occupied by another airliner, and, as the examiner found, without exercising even ordinary care in the conduct of such a dangerous maneuver.[6] Respondent needlessly jeopardized the lives of approximately 40 persons aboard his plane, as well as of the occupants of the other aircraft. That this conduct demonstrates a lack of judgment and care is plain, and it was irresponsible to the extreme. The pilot who can control his plane but cannot control himself is not a safe pilot.

Safety Responsibilities

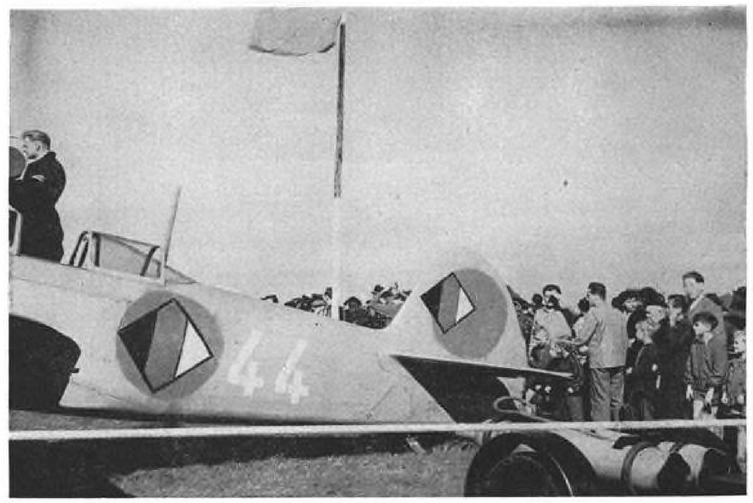
The Civil Aeronautics Act specifically enjoins the Board, in the furtherance of its air safety responsibilities, to act in such manner as to "assure the highest degree of

[3] We cannot accept the examiner's suggestion that respondent's actions may be explainable on the basis of a misapprehension on respondent's part as to the primary function of air traffic control. For one thing, respondent clearly was under no misapprehension as to the actual presence of unseen traffic above him. And surely respondent, as an experienced airline transport pilot, knew or should have known that the primary function of air traffic control involves the prevention of collisions between aircraft in flight, chiefly under instrument conditions. This knowledge is expected of all pilots in respondent's situation. Such an awareness is a matter of vital and increasing importance in view of the growing congestion of the airways and intensity of use of the available airspace, if the risk of an increase in collisions in flight is to be minimized.

[4] Although this preference had a reasonable basis in the meteorological forecast, that fact has no substantial bearing on respondent's later anger.

[5] There is no evidence that respondent was affected by illness or any other physical agent which might have caused a temporary diminution in his normal capacities.

[6] A detailed analysis by the examiner of the grossly careless manner in which respondent carried out his decision appears in the appendix, mimeo. pp. 45-51. It is clear that respondent knew of the continuing proximity of the Capital Viscount yet could not determine its position relative to respondent's aircraft visually and did not otherwise ascertain its relative position with acceptable precision. A discussion of the evidence as to the other means available to respondent for determining the Viscount's relative position appears in the appendix, mimeo. pp. 45-48. It is apparent that respondent not only did not but could not have determined the Viscount's relative position (except of course in terms of comparative altitudes, which his action equated) with acceptable precision under the circumstances, although as the examiner pointed out (mimeo. p. 49) he could have arranged with the Viscount captain to provide positive separation. Our only modifications of the examiner's discussion on this subject are minor: (a) in the reference to the rule of thumb calculation (mimeo. p. 47), we would substitute "approximately" for "at the most" before "one-half mile," and (b) we reject a literal reading of the statement (mimeo. p. 46) that respondent did not believe there was "any" risk of collision with the Viscount, since the conversations with air traffic control and especially his left turn from course immediately before climbing conclusively establish that he knew there was such a risk.



East German Emblem Revealed

East German black, red and gold insignia is revealed for first time on aircraft displayed at exhibition in town of Cottbus, 130 kilometers south of Berlin in Soviet zone.

Navy Gets First Production TT-1

First production Temco TT-1 Pinto, U. S. Navy's first primary jet trainer, is accepted by Dallas, Tex., BuAer representative. Several engineering changes, mainly internal, have been made in course of evaluating the private venture-built prototype. Nose gear doors now retract when gear is extended; doors remained open with gear down on X-model.

safety in air transportation."[7] The Board, in conformance with the Congressional mandate, has demanded that pilots who sit at the controls of passenger-carrying airliners exercise "the highest degree of care,"[8] and we have consistently taken the view that this standard assumes a high degree of responsibility, care and judgment by the pilot.[9]

Respondent's conduct demonstrates that he does not measure up to this standard and does not possess the attributes required of a pilot-in-command.[10]

Purpose

Our purpose here is to protect the public, and no other. We do not doubt respondent's technical ability to pilot an airplane, and believe that we can, consistently with our over-all duties and responsibilities, permit respondent to hold a commercial pilot certificate. Such a certificate will enable him to act as a co-pilot, under the supervision of other pilots-in-command, and our order herein makes provision for issuance of such a certificate.

There remain for discussion several additional contentions advanced by respondent on appeal. Respondent contends that the examiner erred in denying respondent's motion to dismiss at the close of the Administrator's case and in ruling that respondent was required to prove that his deviations were not in violation of Sections 60.2 and 40.360 of the Civil Air Regulations. Respondent argues on appeal, as he did before the examiner, that shifting the burden upon respondent to prove that he did not violate the regulations deprives respondent of due process and is contrary to the Board's Rules of Practice which require the Administrator to prove violations of the regulations by a preponderance of the evidence. Such a ruling, respondent insists, would nullify the emergency authority vested in airline transport pilots and would place an undue burden of proof on them.

Express Doubt

We are not persuaded that respondent's points are well taken, nor do we believe that the construction respondent places on the examiner's findings is warranted. The complaint alleged, *inter alia*, that respondent, by engaging in certain acts, violated certain Civil Air Regulations. Respondent, in justification of his actions, alleged as an affirmative defense that he was operating under his emergency authority and his deviations therefore were not in violation of the regulations, as charged in the complaint.

At the close of the Administrator's case, the respondent moved to dismiss the complaint on the ground that the Administrator had failed to prove that emergency conditions did not exist. The examiner found, on the basis of the record evidence and respondent's admissions, that the Administrator had proved a *prima facie* case, denied the motion and ruled that the burden of proving that the deviations were justified as an emergency measure, as claimed by respondent, had shifted to him.

The examiner adequately discussed all of respondent's present arguments and rejected them and there is little need for further discussion thereof. We are of the opinion that the examiner correctly ruled that the burden of coming forward with proof of the claim of justification became respondent's and that it was not necessary for the complainant to have negated this defense in order to prove a *prima facie* case.

This ruling is not inconsistent with the Board's Rules of Practice, for the Administrator was required to sustain and did sustain the ultimate burden of proof and persuasion on all the material issues, including those raised by the affirmative defense, on the record as a whole.

Even if we were to assume, *arguendo*, that the complaint was deficient, as alleged, we fail to see how respondent has been prejudiced or has been deprived of due process.

Certainly respondent had adequate notice that the question of the use of the emergency authority, as well as its reasonableness, was in issue, since he himself based his plea of justification on the exercise of such authority and introduced evidence in support of his defense.

Under the circumstances, we fail to see how the respondent now can properly claim deprivation of due process. Nor can we find any basis for respondent's claim that the requirement of proof places an undue burden on respondent or on other airline transport pilots, or that the practical effect of the examiner's ruling required respondent to prove that he did not violate the safety regulations by a preponderance of the evidence.

We think it is clear that the examiner properly held that the respondent need only show that his emergency action was reasonable and was a valid exercise of his emergency authority under Sections 60.2 and 40.360 of the Civil Air Regulations. Such a showing will result in corresponding findings, unless such findings are foreclosed, as they are here, by a preponderance of all the evidence pertinent thereto.

Cites Record

Respondent contends that the six-month suspension imposed by the examiner is too harsh and is inconsistent with the sanction imposed by the Board in cases involving a pilot who has had a long and blameless record of experience as an airline transport pilot.

Moreover, respondent argues, the evidence fails to show that he lacks the responsibility required of the holder of an airline transport pilot rating as charged in the complaint.

In support of this contention, respondent apparently takes the position that, having told air traffic control he was declaring an emergency and leaving his assigned altitude and going up,[11] it was reasonable to assume that the controllers would carry out their responsibilities to clear the airways and that respondent was entitled to rely on that assumption; that he cannot be found unqualified or lacking in responsibility because the controllers failed to discharge their responsibilities as required under the emergency procedure. Such a contention is clearly unsound and is an obvious attempt to shift the blame for respondent's conduct on others.

Controllers

As the Administrator points out in his reply brief and the examiner correctly stated in the Initial Decision, even if it could be assumed that the controllers failed to live up to their responsibilities on this occasion, which is not shown on this record, their conduct is not in issue in this proceeding and whether or not they were negligent does not condone nor excuse Captain Specht's actions or offset the lack

[7]Section 2(b) of the Act. See also Sections 2(e) and 601(b) of the Act.

[8]*Stead et al., Airman Certificate*, 1 C.A.A. 74, 84-5 (1939).

[9]*Stead et al.*, 1 C.A.A. 74 (1939); *Rentzel v. Sisto*, 13 C.A.B. 125 (1948) *Horne v. Bessey*, 13 C.A.B. 550 (1952).

[10]Since the record contains no substantial evidence from which requalification can be inferred, the deficiency as of the time of the episode imports the finding of present deficiency.

[11]Although respondent's counsel in his brief and at oral argument asserted that when respondent declared an emergency he stated he was going up, respondent actually told ATC: "O.K. I'm declaring an emergency and I'm leaving 14,000."

Changes on C-133 Configuration

Latest flight photo of the Douglas C-133 shows several changes from the original configuration. Wing which is set high was slightly faired into the fuselage on the first aircraft. Fairing has been modified so that it is as long as the landing gear bulges. Other additions are a cone behind the empennage and vortex generators on the wings outboard of the engine.

of responsibility, care and judgment demonstrated by respondent.[12]

Respondent also attacks the examiner's findings as being contrary to the weight of the evidence and based on "second guesses." In reviewing the allegations of error as to the sufficiency of the evidence, we find they are general in character and fail to specify any material or relevant evidence in the record which the examiner overlooked or ignored,[13] or which in any way detract from the reliability and substantiality of the evidence relied on by the examiner.[14] Respondent's arguments on appeal consist of little more than a resumé of the evidence presented by the respondent and the inferences adduced by respondent's counsel from such evidence, as well as his conclusions on the weight to be accorded respondent's testimony. The position taken by respondent's counsel on appeal is an apparent attempt to create the impression that respondent's version of incident, rather than examiner's, is correct, and that respondent's conduct was actually prejudged by examiner.

Respondent's Explanation

The respondent testified at the hearing on his own behalf and explained in detail the alleged emergency situation with which he was confronted. The examiner, who heard respondent's testimony and had an opportunity to observe his demeanor and manner of testifying, discounted the credence to be given to respondent's testimony. In reviewing the examiner's findings, this factor must be accorded substantial weight.

In any event, there is impressive evidence in the record upon which the examiner relied to support his rejection of respondent's explanation, and in addition his analysis of the explanation discloses in detail that it is implausible and full of inconsistencies. The statements made by respondent in his recorded conversations with air traffic control, as well as his messages to his company radio station,[15] stand uncontradicted on the record, clearly establish the motive for respondent's actions and negate any belated attempt on the part of respondent to claim that his emergency declaration was motivated by belief that the safety of his flight was imperiled by a potentially dangerous icing condition that required immediate action.

Supporting Evidence

The examiner's findings are supported by substantial, reliable and probative evidence and the respondent has presented nothing on appeal which would warrant a contrary conclusion. We therefore must reject respondent's contention that the findings of the examiner are not supported by the weight of the evidence.

We have considered the remaining contentions advanced by the respondent in support of his appeal and find that they are without substantial merit.[16] Upon consideration of the entire record and in view of all the foregoing we find respondent violated Sections 60.19, 60.21, and 60.12 of the Civil Air Regulations in the respects hereinabove set forth, that respondent lacks the qualifications required of the holder of an airline transport pilot certificate in the respects indicated above, and that such lack

[12]Apart from the issue of qualification, we cannot fail to note the contrast between air traffic control's commendable action in voluntarily giving respondent a specific reason (the traffic above) for not clearing him to climb and respondent's failure and refusal to give a reason for his request to climb. Air traffic control thus assisted respondent in providing him with information of value in the discharge of his command responsibility for the over-all safety of his flight, while respondent afforded air traffic control no information which might have served as a basis for action consistent with the interests of respondent and other traffic. This contrast underscores the soundness of the examiner's remarks as to the need for cooperation between pilots and controllers, a cooperation which implies the timely interchange of useful information to the extent the capacity of available communications facilities and other circumstances reasonably permit.

[13]Although respondent claims that the examiner, in reaching his conclusion that respondent was not confronted by a severe icing condition, failed to point out that the Viscount was at a different altitude and had anti-icing equipment whereas the Constellation is equipped with deicer boots, and that the examiner also failed to give sufficient weight to the fact that icing conditions prevailed in New York on the morning in question, a reading of the Initial Decision shows that these facts were noted and properly assessed by the examiner.

[14]In an effort to show the insufficiency of the evidence, respondent attacks the reliability of complainant's witness Mr. Holmes, an airways operations specialist in the Air Traffic Control Division of the CAA, who testified as to the duties and responsibilities of the Control Center, claiming that Mr. Holmes was no expert on emergency authority of pilots and that the examiner erred in relying on his testimony. However, there is no showing that the examiner relied on the witness's knowledge or lack of knowledge of procedures to be followed in emergency situations, and we do not so rely, nor is the question of Mr. Holmes' expertise on the subject pertinent to our findings in this case.

[15]Transcriptions of all of the radio messages between the TWA radio communications station at LaGuardia Airport and TWA Flight 19 during the period from 9:34 to 11:04 were identified and introduced in evidence by the Superintendent of Communications, East, for TWA.

[16]With regard to respondent's contention that the scope of Section 60.12 of the Civil Air Regulations is limited to the type of acts set out in the note to that section and is therefore inapplicable to the facts in this case, we find this proposition patently incorrect and frivolous. The instances listed in the note to that section are expressly characterized as "examples" of conduct which "may" fall within the purview of the section; they serve to enhance the guidance value of the section in promoting air safety; they are obviously not exclusive; and reference to the numerous Board decisions finding violations of Section 60.12 where the acts involved were not similar to the examples in the note is sufficient to answer respondent's contention. The examiner's findings of careless operation by respondent are clearly within the scope of Section 60.12 and are supported by substantial, reliable and probative evidence.

of qualifications constitutes cause which would presently justify the Administrator in refusing to issue to respondent a like certificate, and that the order of revocation set forth below is required in the interest of the public in the proper discharge of the Board's statutory duty to assure the highest degree of safety in air transportation.

Board Order

IT IS THEREFORE ORDERED:

1. That the order of suspension heretofore issued by the examiner herein be and it hereby is canceled;

2. That respondent's airline transport pilot certificate and airline transport pilot rating be and they hereby are revoked, such revocation to be effective on the fifteenth day after the date of adoption of this order: *provided*, that in lieu of such certificate and rating the Administrator be and he hereby is directed to issue respondent an airman pilot certificate with commercial pilot, instrument, airplane multi-engine land, and appropriate aircraft type ratings, and with such aircraft category, class, type or other ratings issuable under the provisions of Part 20 of the Civil Air Regulations as conform to such competence as respondent may have heretofore demonstrated or established;

3. That, except as ordered above, the appeals filed by the parties herein be and they hereby are denied.

Durfee, Chairman, Minetti and Hector, Members of the Board, concurred in the above opinion and order. Gurney, Vice Chairman, and Denny, Member, filed the attached concurrence and dissent.

/s/ M. C. Mulligan
Secretary

Dissenting Opinion

We concur with the findings of the majority that Captain Specht violated the Civil Air Regulations as alleged in the complaint. After careful review of the record, we are convinced that Captain Specht's conduct was irresponsible and did not reflect the level of care and judgment required of an air carrier pilot in command. However, we do not agree with the revocation sanction imposed by the majority. We do not believe the record establishes an inherent or continuing deficiency in judgment which should disqualify him from holding an airline transport pilot certificate. We see in Captain Specht's conduct a very serious error which calls for stern disciplinary action. In our judgment, suspension of Captain Specht's airline transport pilot rating for a reasonable time would constitute appropriate remedial and corrective action. Accordingly, we would have applied suspension rather than revocation in this case.

/s/ Harmar D. Denny
/s/ Chan Gurney

Appeal Cites Pilot's Emergency Authority

Respondent, Leonard J. Specht, by his attorneys, appeals from the Initial Decision of the hearing examiner issued May 15, 1957, and states in support thereof that the examiner erred in the following:

• **Examiner erred** in misinterpreting and misapplying the emergency authority vested in the pilot-in-command.

(A) The pilot's right to rely upon another who is in a responsible position and to assume that the other will act in accordance with his prescribed duties.

(B) The complainant has the burden of proof when the emergency condition is questioned.

(C) There is no requirement that the emergency be explained before the authority is exercised.

(D) The definition of the emergency condition and use of the emergency authority is fatal.

(E) The misapplication by the examiner of the authority puts a dangerous burden upon the pilots.

• **Examiner erred** in finding that the weight of the evidence favored the complainant.

(A) The review of the record as to facts is within the Board's power.

• **Examiner erred** in applying Civil Aeronautic Regulation 60.12.

• **Examiner erred** in denying respondent's motions to dismiss in that the Administrator was attempting to invoke a remedial section in order to enforce a penalty.

• **Examiner's penalty** is extremely harsh and inconsistent with prior Board practice.

• **Administrator has no right** to appeal under the Act.

Previous Proceedings

This proceeding arose out of an incident involving Captain Leonard J. Specht, pilot-in-command of TWA Flight 19 en route from New York, N. Y. to St. Louis, Mo. on Jan. 29, 1957.

The Administrator of Aeronautics on February 1, alleging his authority under Section 609 of the Civil Aeronautics Act, suspended the ATR of Captain Specht for a period of 30 days. (This was renewed for an additional 30 days effective March 1). The Administrator, again alleging jurisdiction under Section 609 of the Act, filed a complaint requesting the Board to suspend or revoke the ATR of the respondent. A trial was held by Hearing Officer Simon on March 19 and 20 in New York City and on March 22 and 23 in Kansas City, Mo.

The examiner issued his Initial Decision May 15, 1957, and this is an appeal from that decision.

The facts of the case are long and rather involved and the examiner in his 55-page opinion has covered them in substance as well as the appropriate CARs cited therein. It would serve no purpose to repeat them here.

Basic Error

The examiner's conception, interpretation and application of the emergency authority of the pilot-in-command is manifested in so many ways that it is difficult to categorize.

The first basic error violates standard hornbook law:

> A. A PILOT MUST HAVE THE RIGHT TO RELY UPON ANOTHER WHO IS IN A RESPONSIBLE POSITION AND TO ASSUME THAT THE OTHER WILL ACT IN ACCORDANCE WITH HIS PRESCRIBED DUTIES.[1]

The Examiner's opinion obliquely hints at this problem but he avoids facing the real issue squarely. The ANC Manual is cited but a very explicit, illustrated direction is omitted:

> "Procedures for the Control of Instrument Flight Rule Traffic 2.16 Emergency Procedures—
> "2.1600 General: The various circumstances surrounding each emergency situation preclude the establishment of exact detailed procedures to be followed. The procedures outlined herein are intended as a general guide to air traffic control personnel. Centers and towers shall maintain full and complete coordination, and personnel shall use their best judgment in handling emergency situations.
> "2.1601 Emergency Descent: Upon receipt of advice that an aircraft is making an emergency descent through other traffic, immediate steps shall be taken to minimize confliction with other aircraft. ATC personnel shall immediately broadcast by means of the appropriate radio facility or, if not possible, request the appropriate communications station to immediately broadcast the following: EMERGENCY TO ALL CONCERNED: EMERGENCY LANDING AT (Name of) AIRPORT. ALL AIRCRAFT BELOW (Number of) FEET WITHIN (Number of) MILES OF (Name of radio facility) LEAVE (Location) COURSE(S) IMMEDIATELY.
> "2.16010 Action by Pilot: It is expected that pilots receiving such broadcast will clear the specified areas, maintaining the last assigned altitude and stand by on the appropriate radio frequency for further instructions from the center or tower.
> "2.16011 Subsequent Action by Air Traffic Control: Immediately after such emergency broadcast has been made, the center or tower concerned shall forward further instructions to all aircraft involved as to additional procedures to be followed during and subsequent to the emergency descent."

Compare the dispatchers' duties in an emergency situation CAR 40.360 (b). The controllers testified and the radio transcription clearly supports that TWA 19 indicated that it was going to vacate 14,000 ft. to go up. Capital 31 expected this and also came in to the Center for instructions that were never forthcoming.

It is important to note here that there is no claim that the controllers did not receive the emergency declaration, rather the claim is that they did not believe Captain Specht.

If the pilots in an emergency cannot rely upon the controllers to use their best discretion and judgment to carry out their primary function of preventing air collisions, then air commerce is in a shaky anarchy.

Explanation Inadequate

As the examiner indicated, there was no adequate explanation of why the controllers did not take the necessary action to avoid this so-called "near miss." There were a number of ways to do this—not the least of which was to put both TWA 19 and Capital 31 into a climb.[2]

It is true the controllers in this instance

[1] Typical cases supporting this principle occur in automobile suits. Gross v. Gross 169 F2d 199, 202; Autrey v. Swisher 155 F2d 18; Campbell v. Kozera 63 F. Supp. 251, 252.

[2] There is no other aircraft in this sector at any altitude at this time. (Examiner's Opinion, p. 14).

Six of the Lockheed models now in flight test: T2V-1 jet trainer, WV-2 radar search plane, F-104 jet fighter, 1649 Starliner commercial transport, W2V-1 radar search plane, P2V-7 Neptune patrol bomber.

were hardly prone to give Specht assistance, but to permit the controllers to do nothing because of surprise, or because of disbelief based upon voice inflection, is a guaranteed road to disaster.

It behooves the Board to affirm its right to reliance and in doing so the basic allegation of the complaint (Paragraph 7 c and 8) that respondent was careless and that he lacked responsibility must fail. There is no doubt that the examiner's conclusion on this point was predicated upon TWA going through Capital 31's altitude. The point here is, and it is worth re-emphasizing, that Specht and every other pilot must have the right to rely that those in charge of traffic control will properly perform their basic duties and functions.[1]

B. The misappropriation of the emergency authority goes to the burden of proof.

We agree with the examiner that the regulations are not ambiguous to read. The emergency authority vested in the pilot is broad and discretionary. Admittedly it is important to air safety.[2] We disagree with the examiner when he states that CAR 60.2 and 40.360 manifest differences so that a violation of these Sections shifts the burden of proof of the pilot. Since the Board's inception, the burden of proof on these cases has always been with the complainant. There is nothing to support the examiner's "extraordinary" interpretation in the regulations themselves, or in the Board's practice.[3] And to accept the examiner's shifting of the burden of proof we would do violence to due process unknown in our present system. The examiner is ratiocinating, for this abrupt shift in proof is unusual. He states:

> "The burden of explanation rightly should rest upon the pilot exercising his emergency authority. In most instances in which it is used, he is in possession of all the facts. . . ."

Now of course this is true of a great majority of CAR violation cases. And isn't this congressional policy behind the Immunity Section—1004(i) of the Act? As it stands, this opinion can be read as shifting the burden of proof in which the Administrator desires to penalize or suspend a pilot for violations. The Board must reverse this situation.

C. The emergency need not be explained before the authority is exercised.

The third serious misapplication of the emergency authority probably does much to explain the examiner's severe penalty of Specht.

The examiner clearly has a misconception that a pilot is under a duty to explain why he is in an emergency and to inform all concerned of its nature and apparently he must do this before he invokes the power. The examiner seems to adopt Controller Boyle's idea that a "special reason" must be given. And Mr. Holmes, the Administrator's expert witness. It is true Mr. Holmes is talking about a pilot changing his altitude rather than an emergency, but Mr. Holmes, for all his expertise, is not familiar with the emergency authority of pilots.

There is no doubt that the examiner is very concerned for this failure to give a reason for the emergency. Regulations, of course, have no such requirement, and for good reason. If a pilot is made to explain every emergency situation to the Center (and if to the Center, why not Radar Departure, Dispatch, aircraft on other frequencies, etc.?), he not only loses valuable time but such a requirement would by necessary implication result in a divided responsibility in a situation where that is impossible. And, as demonstrated too well by the facts of this case, a pilot runs a risk of argument or disbelief or whatever, resulting in non-action on the part of the controller.

Reason Given

It is painfully evident that anything Specht might have communicated to the Center as to the "why" of his emergency would have been a vain and useless effort. Moreover, Specht and his co-pilot, Flight Officer Wear, both were firm in their testimony that they did inform the Center that ice had accumulated. The examiner to the contrary, communication was something less than perfect on this occasion. The error of the examiner here is in demanding a prior explanation of an emergency and, in the interest of public safety, the Board must correct this misapprehension.

The examiner has accepted the Administrator's interpretation that the emergency authority can be utilized only when it is demonstrated that immediate action was either imperative or wise. The examiner goes on to reject what he terms a "potential emergency." This, of course, is unrealistic and probably results from a lack of understanding of the pilot's position. This holding can only mean that the emergency authority is vested and can be utilized by the pilot only when there is an immediate necessity and, of course, in a good many instances this means until the worst has already happened. CARs 40.360 and 60.2 are fatally vitiated. The Board must not allow this misunderstanding to prevail.

Pilot Reaction

It is submitted that the examiner has radically altered, if not completely nullified, the emergency power of the pilot as it has been commonly understood. Yet he does not "seriously believe that a responsible airline pilot would hesitate to exercise his emergency power when it is called for" because of the reluctance of a pilot to be second-guessed. Here again, there is a sad lack of understanding.

In a life and death situation, reasonable men would not question that the pilot-in-

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[1]The fact that Capital 31's transcriptions to the Center at 1033 are indicative that he was ready for ATC to properly carry out their functions but, getting nothing from the Center, he began to take this situation into his own hands and propose to reverse course.

[2]The Examiner's statement is puzzling—if the emergency authority is some sort of a privilege or prerogative to be curtailed or lost, then the entire concept of flying the airways as we know it is radically if not completely changed and the "second-guessing" that the examiner stated is "groundless" is an intricate part of flying the airways.

[3]Our reading of the cases cited in FN #13, p. 8, is that they involved conditions of emergency rather than an emergency declared and received. Of course, the Administrator could not possibly allege and prove something he was not aware of. These cases are clearly distinguishable from the principal case on this ground alone. In *Rentzel v. Bridges*, SR-1986, Aug. 1949, the Administrator alleged in his Complaint a misuse of the emergency authority.

Bell 47H-1 Slated for Antarctic

Belgian expedition participating in the International Geophysical Year will use this three-place Bell 47H-1 in the Antarctic. Helicopter was purchased by Sabena World Airlines, which is leasing it to the government for the expedition. Shown in the aircraft are Sabena's Paul Dengis, left, and Bell test pilot Al Averill.

command would unhesitantly use whatever authority, power and take whatever action he felt was essential at the moment. That desperate situation is not the complete picture, however, and it is the fact brought out in the Specht case which illustrates the problem.

Realistically, when a captain-in-command is faced with a situation which is fraught with potential danger but nevertheless one in which he can, by taking an added risk or a little more chance, or depending upon his skill or hoping elements will stay with him for just a little while longer, then the crucial problem arises. Wouldn't a realistic appraisal of human nature demonstrate the reluctance of a pilot to take the emergency action or declare his emergency when he is going to be immediately faced with a suspension and a possible revocation of his right to his professional life? Isn't it particularly true that with this Initial Decision he is going to have the burden of proof, of explaining on the ground to others in authority who have the benefit of comfortable hindsight? Isn't this just the situation in which a pilot will be naturally reluctant to take the action that his skill and judgment calls for and prefer to conform to the book even to the extent of making a bad situation worse?

Disparate Conclusion

In addition, the examiner's conclusion cannot be reconciled with the joint briefs submitted by the Board and the Administrator in the case of *Allegheny Airlines et al v. Village of Cedarhurst*. 238 F_2 812 (C.A. 2nd 1956), wherein it was stated:

> Page 14
> "Compliance with the numerous and varying requirements which might be imposed by the dozens of communities that surround each major airport would be a physical impossibility for the pilot. Moreover, as the uncontroverted evidence in the record shows, the *additional burdens on the pilots would lessen, not enhance, the safety of aircraft operation.* Obviously no such result was contemplated by the Congress."
> Page 32
> "As the record clearly shows, *such a division of regulatory responsibility, from the practical standpoint of the pilot, would impede, rather than promote air safety.*"

If the restriction to an air traffic pattern at one airfield (or at many airfields for that matter) seriously burdens the pilot's safety performance, then it is a *fortiori* that an additional burden on the pilot, brought about by the tactics of summary suspension, punishment and possible revocation in which the pilot has the burden of proof, will likewise seriously affect and impede his safety performance.

A realistic appraisal of the facts and a customary statutory construction of the emergency authority sections of the Regulations will not permit the examiner's conclusion on this crucial issue to stand.

Erroneous Theory

We submit that the Administrator's case and the examiner's acceptance of it is predicated upon an erroneous theory. Throughout Mr. Zartman's cross-examination of the pilots, he emphasized the issue of control and engine performance of the plane, but Specht was very clear and concise that the reason for his emergency was the rate of accumulation of the ice. It was this potential danger that was his concern; in a matter of a few minutes the ice had reached the point where if something went wrong there would be serious, if not fatal, trouble such as engine failure, ice breaking off unevenly resulting in loss of control—then, of course, the Administrator would have his case and then, of course, it might very well have been too late. This conscientious anticipation was the serious concern of Specht and one that the Administrator does not allow for.

Now the examiner's thought that Specht should have explored the possibility of descending and should have attempted to find out what lower altitudes were free of ice is the ultimate in "second-guessing." Captain Specht did consider this possibility and rejected it for the patently clear reason that he would have been going down to the very place where he was picking up the precipitation. The emphasis on the possibility that some warmer pockets existed below is to suggest that Specht go on a scouting expedition. In his words "this was no time for experimenting." Under these circumstances the Board might well consider it in the public interest to strike this part of the examiner's opinion.

Icing Conditions

As we stated before, if Specht were to wait until something went wrong (supposedly this would meet the Administrator's definition of an immediate emergency), catastrophe would be inevitable—Specht could not descend because of the extreme likelihood that the icing condition would have been worse. If he lost an engine or the ice broke off unevenly or the plane became uncontrollable a climb would have been impossible. Here it would be not unreasonable to assume that the tone of his voice might express a mood something less than well satisfied. But, although the "*non-sequitur*" gave the examiner a rude shock, the evidence is lacking that the shock would have been sufficient to alert the controllers to do anything. Regardless, TWA 19 would have been helpless.

Public safety has indeed reached a precarious position as the result of this case as it now stands.

This brings us head on to the examiner's lack of belief in the fact that an emergency existed. We will not now discuss the "irrefutable and decisive evidence" of the radio transcriptions, but only the testimony of Specht under oath at the hearings. A reading of this testimony indicates that Specht was completely candid. He responded to all questions asked, even during heated (and sometimes confused) colloquy of the counsel and the hearing officer.

Integrity

The impeachment by Administrator's counsel did nothing to harm the integrity of the witness. Indeed a reading of that cross-examination does not reveal it was motivated to affect integrity. The examiner's opinion points out inconsistencies. By and large they are very minor in nature, and the only one quoted from Specht's testimony is in reference to the amount of ice on the plane. The quotations in the opinion occur in the record. A look at the answers in their context do not disclose the serious inconsistencies claimed; in the first

statement the witness is referring to ice on the leading edge; the second was in response to "would you regard the craft as having a load of ice" (the "it" in Specht's answer obviously refers to the entire aircraft).

The examiner's additional support for his conclusion on this score is obscure and untenable and strongly manifests the "second-guessing" that he assured us would not exist. All in all, the examiner's opinion is the best evidence of second-guessing we could present.

There is accusation in reference to the failure to obtain the amended clearance, yet this is not sufficiently alleged in the complaint nor was it part of the Administrator's case. In a footnote it is stated that this failure is an indicaion of Specht's lack of concern for other aircraft. The rules pertaining to VFR conditions are familiar to the Board. The confusing point here is that earlier the opinion states there was no other aircraft in the area. The tape transcription and the record fully support this.

Opinion Unclear

It is not clear why the opinion is concerned with the fact that Captain Specht was exercising his captain's authority and responsibility and the fact that everybody was doing his job (incidentally the fact that Specht had confidence in the abilities of his crew).

We've earlier discussed the misunderstanding involving the engine and plane performance and total ice as opposed to the possibility of engine failure, lack of control and the fast rate of ice accumulation. We won't repeat the argument here—fortunately Captain Specht and his crew and passengers are not black statistics today because Specht had the conscientious sense to anticipate these dangers. The assistance, or lack of it, from the Center has also been separately considered. Actually there is no little difficulty in assessing this Initial Decision because of numerous points in the opinion where evidence,[4] accepted by the examiner, could only come from the pilots involved. In fact the 55 pages plus the appendix are fairly superfluous if the emergency condition is not to be believed.

In point of fact, in order to properly vindicate the conclusion, it is necessary to reject the testimony of every pilot and co-pilot including the complainant's own witness, Captain Murphy. This would be a serious affair and it has not been done. Therefore, we suggest a reading of this testimony will completely exonerate Captain Specht's actions. In doing this it will become apparent that a full disclosure has been made. If evidence was to be manufactured why not describe the plane as uncontrollable, invent an engine failure, why confess that the infra-red windshield heaters[5] might not be on?

On Instruments

But this is not enough—in order to support this finding we must consider the uncontroverted fact that Specht was completely on instruments. In addition, it is known (and uncontested) that at least from Erie (if not sooner) to Cleveland and westward the weather fronts would slope quite rapidly to 10,000 ft. and from Cleveland west they would become broken with thin layers on into St. Louis. We also know from 16,000 ft. up there were severe—up to 100 knots—headwinds. The distance from Wilkes Barre to Erie is approximately 217 miles or roughly about 55-65 minutes flying time. To support this finding it is essential to assume that Captain Specht, a senior air line pilot, 17 years with TWA, with a total of some 14,500 hours and 2,000 instrument hours, did not want to fly an additional hour on instruments and instead preferred to go up to an altitude with extreme turbulence. There are several omissions from the opinion that give some concern.

The Administrator's witness, Captain Murphy, who is certificated and has flown both the Lockheed Constellation and the Viscount, testified that his plane, a Viscount, has heat in the wings and that ice is not much of a problem as it is on the aircraft (a Constellation) with de-icer boots. The examiner stated that Capital 31 encountered a very negligible amount of ice, but he failed to point out that, in answer to his own question, Murphy had his heated wing and anti-icing equipment on.

Reports Lacking

Of course the major reason why Capital 31 did not encounter the icing conditions is

[4]Actually the examiner's observance of respondent at one point elicits favorable consideration.

[5]Certainly the windshield matter has been exaggerated all out of proportion. It is stated that TWA 19 was without forward visibility. Under these circumstances what conceivable advantage would there be clearing the windshield?

because it was at the altitude which was free of that weather condition and TWA 19 was not. The examiner states there were no reports of icing at any altitude that morning. Weather phenomenon as it is, this is not relevant unless the record reveals (and it does not) that trips were being dispatched at the time and altitudes that Specht was flying. The fact is, icing conditions were present over the entire area and their flight plan and log sheets are amply supported not only by both Wear's and Specht's testimony but Controller Oldfield himself told us that his car slipped off the road that morning and that he had to continue to work via train.

Examiner Hesitated

And other flights had reported ice in that area, although the examiner had considerable hesitancy about admitting this information.[6]

The Administrator made no effort to plead these facts and with all their own available records and those of the Weather Bureau it would have been a relatively simple matter for the Administrator to show that the ice was not in the area. Perhaps this explains a tactical reason for the Administrator not alleging that there was no emergency condition (as they did in *Rentzel v. Bridges*, SR-1986, Aug. 1949). This tactic must fail.

Errors in Record

Now there are, we submit, more errors in this record than there are pages to the Initial Decision. The matter will be confined to the larger issues that most vitally concern air safety. But consider two more points briefly:

- **There is no support** in the record to sustain the finding of "In this case there was no failure of communication. . . ." The Administrator never claimed this, the testimony of Wear, Specht and the Administrator's own witness Captain Murphy never heard the declaration of emergency although he was flying in the same sector. The tapes —even today—have several important unreadable parts.
- **It was error** to accept the Administrator's expert—a Mr. Holmes—whose testimony was relied upon by the examiner. Anyone claiming authority on airway communications who can't give a better explanation of the pilot's emergency authority than Mr. Holmes did is completely useless as to probative evidence.
- **It was error** to accept the numerous transcription remarks and the examiner's conclusions from them without putting them into the entire picture and in the conditions in which they were uttered.
- **"Second-guessing"** as to time and space is refuted by the fact that Specht's calculations were correct in each and every respect.
- **Order of proof** of submitting complainant's Exhibits 1 through 5 impeded the fair conduct of the trial. Exhibits that were used by the examiner for impeachment purposes were introduced at the very outset of the trial and never were properly presented for the purposes used.
- **"Brief digest"** of ANC procedures by

[6]The same arguments would be made as to the transcription tapes themselves which were changed as the case progressed (see Exhibits in Docket 8600; note Zartman's statement Tr. p. 132 and discussion Tr. pp. 28, 37).

the examiner is not clear as to its meaning and citations are not given.

Review

Presumably a trier of fact rests his findings upon his observations of the demeanor and decorum of the witness during his testimony on the stand, the conclusions on appeal are generally sustained. This of course is another way of saying that Specht perjures himself at the hearing. However, the examiner is extremely careful in avoiding this matter. On the contrary there is nothing suggesting any lack of demeanor or believability of Specht and necessarily First Officer Wear and to a lesser extent, Flight Engineer Leslie. In fact the examiner puts much credence in his observations of Specht. Of course those observations were made at and during the trial. His decision, when carefully examined, does not rest upon Specht's credibility but on something the examiner calls "believing himself (meaning Specht) to be under provocation."

The true basis of examiner's decision is the "irrefutable and decisive evidence . . . found in the conversations between Captain Specht and the Center which transpired at the time of the episode and which faithfully record the words and moods of the parties . . . However revealing these transmissions may appear in cold type, they cannot reproduce either the manner in which they were delivered nor the *tone of voice* employed.

Hearing his words and the manner in which they were delivered makes it manifest that Captain Specht was truculent and in an angry mood. There is no suggestion whatsoever in his utterances that Captain Specht was in an emergency situation or had any other purpose than to obtain a preferred altitude."

Prejudgment

The examiner goes on at some length in a vein which would but rest his conclusions as a trier of fact except for one small oversight. This oversight is so strong that it can leave but one conclusion. Because of the emotions, pressures, litigation and concomitant publicity which involved the facts of this case, the examiner prejudged the issues and perhaps unconsciously reached a conclusion which makes his entire opinion, even allowing for the misunderstanding, a complete rationalization. The oversight is that a learned examiner had never heard Specht on a tape transcription previously and, lacking that, he had no criterion in which to judge a "mood and tone of voice of the transcriptions herein."

This is not to condone the acceptance of the determinative tone of voice or mood on at least a twice removed tape recording with the concurrent and electronic reception difficulties that will determine the state of mind of a pilot in an emergency situation.

Again, a realistic view would not expect a conscientious pilot as Specht, in the situation in which he was in, to be in a "bells are ringing" mood. The situation was bad and was getting progressively worse.

He was getting not help but only confusion from the Control Center. The tapes are a part of the record. The Board is free to listen to them and we suggest that a hearing of these tapes will indicate that Specht was speaking in a steady low

voice and the excited, almost feverish, pitch was that of Controller Boyle from the La-Guardia Center.

Right to Rely

If Specht could not go down his only alternative was to go up. Now 60.12[7] is illustrated by four examples of which possibly (c) or (d) are applicable. But (c) cannot be used here as this was not lack of vigilance on the part of the pilots. They had every right to rely upon the Control Center to carry out their primary function of clearing the airways. Example (d) refers to passing and it could not be extended to cover the facts before us in view of the specific regulation (60.15) covering close proximity that creates a collision hazard. Captain Murphy in Capital 31 is the Administrator's only direct evidence in this case. There is nothing from that to even hint in any way that Murphy had to alter his position of flight when TWA 19 came through 16,000 ft. While Murphy stated on the radio transcript that TWA 19 wasn't more than a mile away, it wasn't close enough so that any of the markings on the plane could be seen.

The Administrator, by not alleging a violation of 60.15, has confessed he would have been unable to prove the close proximity of an aircraft that would create a collision hazard. Certainly this is not the proceeding to allow indirectly what cannot be done directly.

Although the Court of Appeals for the District of Columbia has given the Board the right to penalize pilots for violations of CARs under the jurisdiction of Section 609, it is our understanding that the matter has never been properly presented nor argued before this forum. The question of law, although not finally settled, should perhaps be argued elsewhere.

This Board might well consider the effects upon its other remedial functions as well as its statutory duty which promote highest degree of air safety. On this matter of policy we feel the Board of its own initiative should decline to hear penalty violation cases because of the desirability of a spirit of helpful mutual cooperation between the men who fly the nation's airways, and the agency entrusted with promulgating air safety. We submit that the present penalty procedure does not help to promote this hopeful atmosphere.

In other words, it is difficult as a practical matter to hold the olive branch in one hand and a hatchet in the other. This Janus concept is bound to burden the Board in its primary remedial functions.

We would further suggest that the Board reconsider and require an examination of the airman when there is a question as to his qualifications or abilities. This seems to us to be fundamental, otherwise there is very little sense in examining them for their first application for a Certificate as well as the semi-annual checks that they must take thereafter.

Penalty Harsh

If we accept *arquendo* all of the findings and conclusions of the Initial Decision, we suggest that under these circumstances there

[7]We are referring here to 60.12 as of January 29, 1957. It was subsequently changed on February 20, 1957 and April 10, 1957.

Fifth Iberia Super G

Iberia Spanish Airline's order of five Lockheed Super G Constellations has been completed with delivery of the "Palos de Moguer," named after a ship in the second expedition of Columbus. Other Iberia Super Gs also bear names of the explorer's ships. Plane will be used in transatlantic service with scheduled time of about 11 hr. Madrid-New York.

is a harsh and burdensome penalty that is completely out of line with the facts involved. It also is not in keeping with the Board's long practice (which we have been led to believe is a very important concept of the Board). With one single exception, we are unaware of analogous factual situations where a penalty as severe as the one that has been imposed in this case.

Also, there is strong indication that Specht wasn't given the benefit of his clean slate.

We are unable to find statutory authority for the Administrator of Aeronautics to appeal a case by the Board's examination. We believe the principles of *Lee v CAB*, (C.A.D.C.) 225 Fed. 2d, 950 are applicable here as well as the analogy that it is basic in criminal law that the prosecutor cannot appeal, particularly in a case where he has already prevailed to the extent of a severe six month's sanction.

Conclusion

We regret that time has not permitted us to probe the many issues involved here with the detail we believe essential. The request for an extension of time for this brief to July 1 was not a matter of expediency but necessity. Nevertheless we submit that the urgent errors have been demonstrated and as the Board reads this entire record with its usual judicious concern there is no doubt that the complaint against Captain Specht will be dismissed.

It is essential that the misconstruction and misapplication of the emergency authority be corrected. When this is done and the principle of reliance is re-established and the burden of proof is in its customary position and the entire factual picture is calmly put in its necessary perspective, then it will become quite obvious that Captain Specht took the one and only action open to him.

The Initial Decision, therefore, should be reversed and vacated and Captain Specht's record must be cleared.

We believe that the intricacies of this case can be fully presented only by oral argument and we request a hearing before the full Board.

Respectfully submitted,
GEORGE F. ARCHER
Attorney for respondent.
Leonard J. Specht

Carrier Accident Rate Reaches Record Low

Washington—Navy's major accident rate in carrier landings reached an all-time low of .97 per 1,000 landings in Fiscal 1957, compared to 1.75 for the previous year.

Navy called this drop of almost 45% "the major advance in aviation safety in recent years." Angle deck and mirror landing system received most of the credit

Overall major accident rate also hit a record low—3.06 per 10,000 flying

hours as compared with 3.33 in Fiscal 1956 and 3.80 the year before.

Fatalities totaled 349 for Fiscal 1957, a 15% drop from 410 in Fiscal 1956. This is a rate of .83 fatalities per 10,000 flying hours.

Total of major aircraft accidents was 1,298, a 10.3% drop from 1,448 in Fiscal 1956.

Major contribution of angle deck and mirror landing system were evident in a breakdown of figures for carrier landings. Rate for angle deck carriers was .97 per 1,000 landings—the same as the overall figure for all carrier landings. Rate per 1,000 landings on axial deck carriers was higher —1.1. For landings in which the mirror system was used, rate was .79. Without the mirror, rate was 1.1. Mirrors are used only on angle deck carriers.

In addition to angle decks and the mirror system, Navy credits its intensive safety campaign for decreased accident rates and points out that record lows have been achieved in spite of continued loss of experienced personnel and increasing complexity of aircraft.

Even though accidents are down, higher cost of more complex aircraft is being felt severely. Total dollar loss per year from accidents is now running about $287 million, up from around $235 million a year ago.

Average cost per crash is approximately $221,000 for Fiscal 1957, compared to approximately $160,000 for Fiscal 1956.

Roughly half of the accidents occur on landing; a little less than a quarter in flight; slightly more than 10% on takeoff. Other classifications, in order, were taxiing, wave-off, auto-rotation, engine run-up and undetermined.

In bailouts, 90% of the pilots survived ejections below 400 kt., and 55% survived when the speed was over 500 kt. Breakdown by altitude shows 96% survived ejections above 5,000 ft. and 7% survived ejections below 1,000 ft.

Human error played some part in 51% of the fatal accidents for which a cause could be determined. Total of 240 accidents in Fiscal 1957 killed 342 military and seven civilian personnel. Cause was undetermined in 102 of the 240.

Pilot error was listed as the primary cause in 94 of the 240 accidents, or 39%. Pilot error also was secondary cause or a contributing factor in 13 others.

Material failure or malfunction was blamed for 37 fatal accidents, with personnel error contributing to 19 of these. Weather was the primary cause of only 2 accidents, and secondary cause in 11 others. Four were blamed on supervisory personnel.

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Dynamic changes — revolutionary new aircraft and powerplant design; rapidly increasing developments in missiles, avionics, rockets, ramjets, chemical and nuclear powerplants; new technology, materials and hardware, shifts in manufacturers and personnel; new buying techniques — call for the utmost attention from engineering-management, purchasing and military people. Published annually in December, AVIATION WEEK Buyers' Guide *is* depended on throughout world aviation as the only source satisfying the need for full-scale, up-to-the minute answers to year-round purchasing problems.

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AVIATION WEEK editorial teams throughout the U.S. and abroad are now gathering the many thousands of vital purchasing facts that will be included in the over 594 pages of the 1958 BUYERS' GUIDE EDITION. Information-gathering questionnaires are being sent to all aviation manufacturers and suppliers in the U.S. and Canada.

Sections on aircraft, missiles, avionics, supporting equipment, nuclear systems and airline and airport equipment will contain over 50,000 manufacturers' product listings. Latest Air Force, Army and Navy and Airline procurement practices — where to go, whom to see — will be reported in characteristic AVIATION WEEK detail. Special features will include a manufacturers' index, an all-inclusive product index and a comprehensive listing of aviation distributors. These together with many other features assure the greatest possible year-long usefulness for the 1958 BUYERS' GUIDE.

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AVIATION WEEK Annual Buyers' Guide Edition reaches aviation's largest audience of engineering-management, purchasing, independent research and military people — over 66,186 paid subscribers* throughout the U.S. and 88 different countries. Additional circulation is gained through domestic and foreign extra-copy orders from industry, military and scientific institutions.

Sectionalized Format permits advertisers to position advertisements in the appropriate aircraft, missile, avionics, supporting equipment, nuclear system or airline and airport equipment section. Last year's Buyers' Guide carried over 230 advertisers.

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In addition, advertisements keyed to reader service cards make it quick and easy for buyers to request additional information about products and services advertised.

Year-round selling power and impact of 1957 Buyers' Guide advertising are shown by the over 10,000 reader inquiries received during the 1st six months 1957 from engineering-management, purchasing, and military people throughout the U.S. and abroad. (And they still keep streaming in.) Depth coverage of manufacturers is clearly indicated by the large number of reader service cards coming from vice presidents, purchasing agents, Senior Project Engineers, Design designers, structure, avionic and missile engineers etc., all with the same contractor.

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AVIATION WEEK

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The computer programmer we presently seek could not fail to be stimulated by (1) work involving the construction of broad mathematical models of complex situations for simulation purposes on a 704 digital computer, and by (2) colleagues with considerable attainments not only in mathematics but in systems engineering, psychology, cybernetics, and sociology.

THE ELEMENT OF ENVIRONMENT

To qualify, at least one year's solid experience in high-speed digital-computer programming is required, plus conceptual and logical capacities of a high level. A degree in mathematics or science is necessary. Call collect or write for more information.

System Development Division

The Rand Corporation

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11-9

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Wanted—Experienced Bell helicopter pilots for foreign or domestic assignments. Write Kern Copters, Inc., P.O. Box 186, Sta. B., Bakersfield, California.

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Responsibility seeking pilot with ATR, AS&MEL&S, FI & helicopter ratings desires position in light-medium twin operation with financially sound and progressive company. Administrative and executive experience. Strictly professional. Resume upon request. PW-6108, Aviation Week.

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Qualified Communications—Electronics Superintendent

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Vice President Operations, Bonanza Airlines, Inc, P. O. Box 391, Las Vegas, Nevada

To forward-looking engineers and scientists of all disciplines

Dr. Leverett is Manager of the Development Laboratories at the G-E Aircraft Nuclear Propulsion Department in Cincinnati, Ohio.

"The technical difficulty of the task of developing nuclear propulsion systems for aircraft—and the military value of the result—combine to form a challenge which is, in my opinion, unmatched," says Dr. M. C. Leverett of the General Electric Company.

THERE IS SCARCELY a single type of aircraft propulsion machinery which has not been proposed for incorporation in a nuclear power plant for aircraft.

The requirements of small size and high-power density in a reactor installed in aircraft push the heat-transfer designer to the limit of his knowledge. New developments in materials for shielding are essential—and for electronic components capable of withstanding the extreme temperatures and nuclear radiation involved. These are, of course, merely broad indications of the many intricate problems faced by scientists and engineers at the Aircraft Nuclear Propulsion Department of General Electric.

Today much progress has been made at ANP. The propulsion system has been determined—a TURBOJET DIRECT CYCLE SYSTEM (see diagram below). The feasibility of this system has been demonstrated at ground tests conducted at the National Reactor Test Station near Idaho Falls, Idaho.

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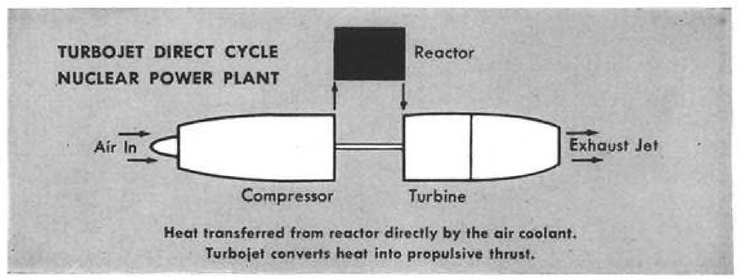

Heat transferred from reactor directly by the air coolant.
Turbojet converts heat into propulsive thrust.

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The Nuclear Engineering Master's Degree Program helps you acquire or augment skills and knowledge essential to the aircraft nuclear propulsion program. 100% Tuition Refund is provided for graduate courses at the University of Cincinnati.

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GENERAL ELECTRIC

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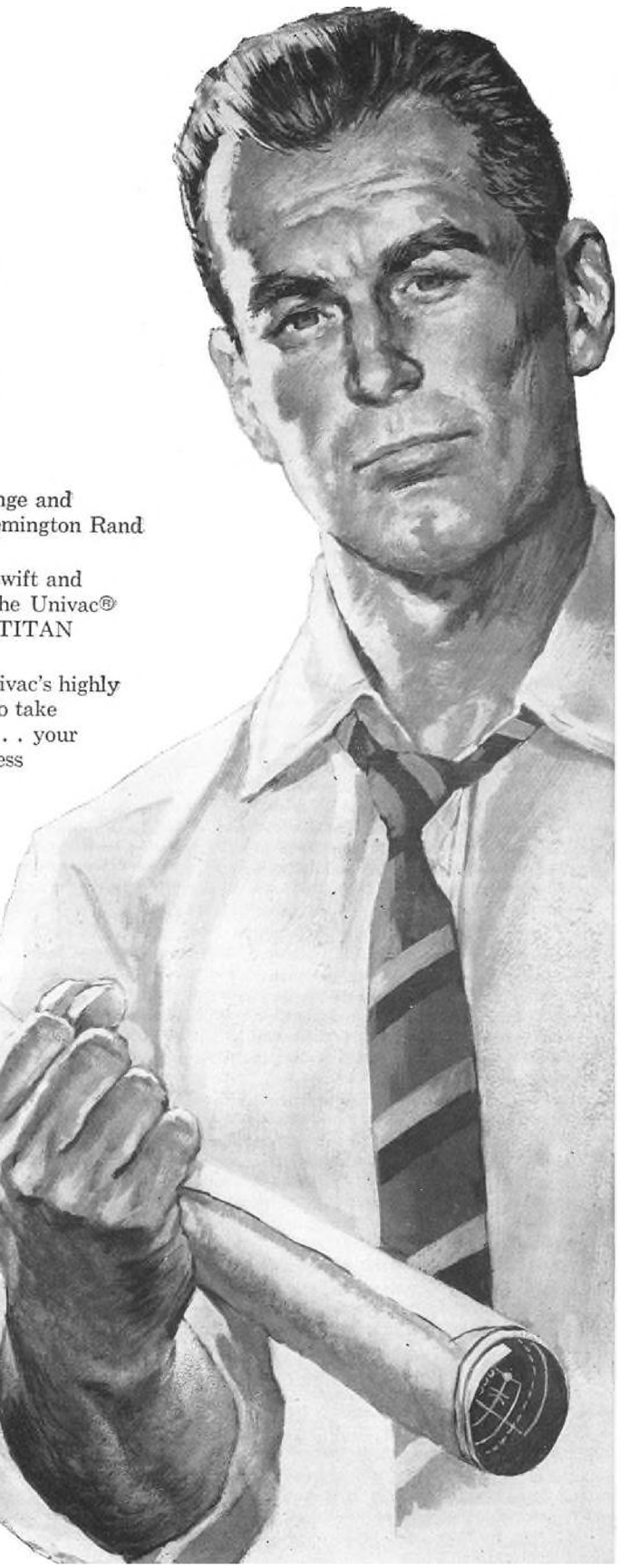

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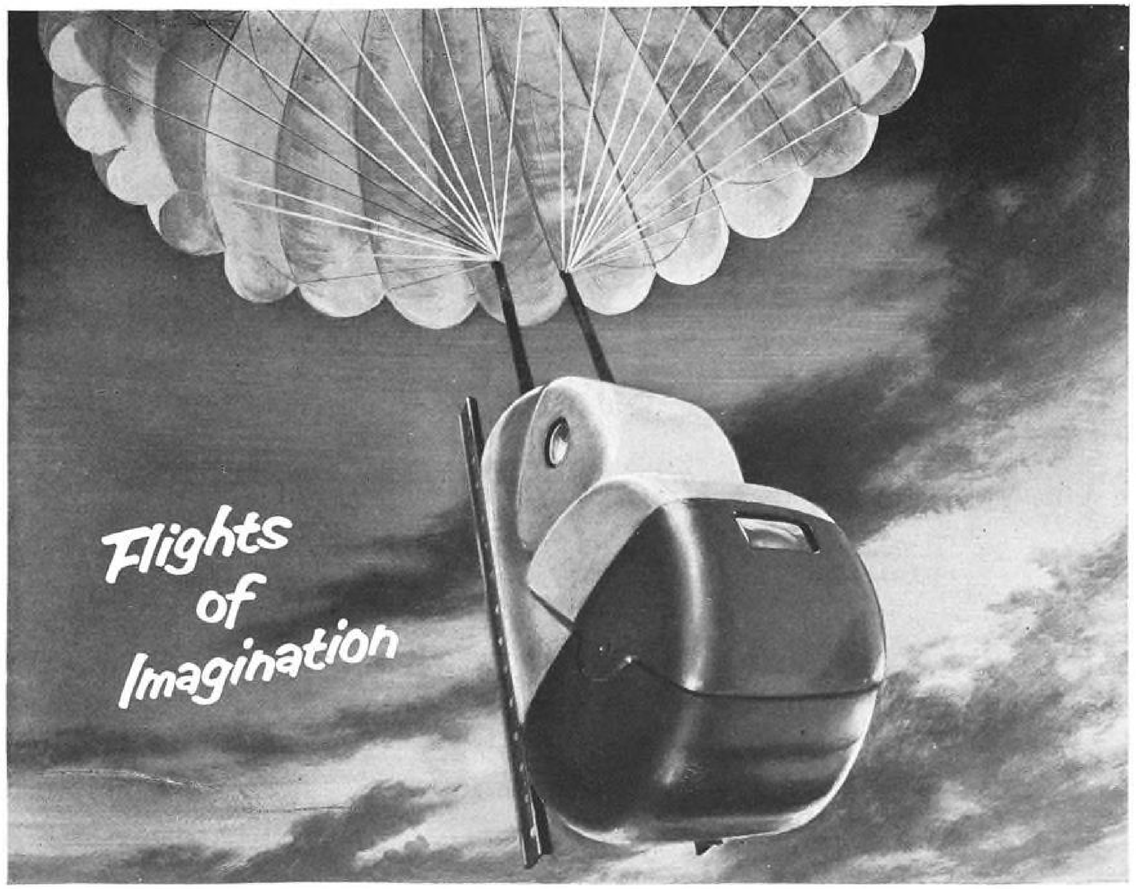

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Here's a good example of what imagination and enterprise can do—given the opportunity that's offered bright young engineers at Goodyear Aircraft.

Above you see an escape device. It enables pilot and crewmen to leave an aircraft in distress—even while flying at supersonic speed—then float safely to earth in a watertight, airtight capsule.

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Cessna

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RW-6121, Aviation Week
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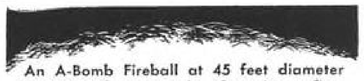

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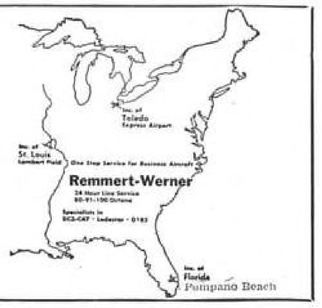

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ADVERTISERS INDEX

LETTERS

Navy Comment

Mr. H. L. Moxham of NAA is entirely too modest in his "soft-shell" of his company's products (AW Sept. 2, p. 118). He neglected to expound the outstanding characteristics of the AJ, for example. I would like to extend my sincere appreciation for all of the experience I obtained in handling airborne emergencies in that abortion. After flying the AJ, nothing scares me!

I have flown all of the Fury series, and have enjoyed their handling characteristics. However, the FJs have their faults, too. I don't want to embarrass anyone with too many details, but I will admit that there were many times after a particularly trying combat flight I was happy that the "old dependable F9F" strapped to my posterior didn't come unhinged when I pranged it on the carrier deck a bit more severely than certain other airplanes could take.

When I first read Mr. Moxham's letter I wondered what prompted such an outburst, but then I realized that he has undoubtedly been a Field Rep in Corpus Christi too long and has acquired the habit some Texans have of putting one's mouth where his performance should be.

Mr. Moxham neglected to ask the engineers at Ft. Worth to slow down a bit with their Hustler while the paper A3J becomes an operational piece of hardware. After all, Convair, you're not supposed to be anywhere but in the "trail" position to satisfy Mr. Moxham! And, as he predicts, your plant may list to port, but it will only be because of the hot air sweeping in from Corpus Christi.

Perhaps the Convair engineers will want to visit Corpus Christi and strap a pod under the belly of Mr. Moxham, then launch him! He is already supersonic with his sales talk. However, he had better watch out for the airplanes from Bethpage, St. Louis, Dallas, Ft. Worth, San Diego, Los Angeles, Burbank or Seattle that haven't received the word that they aren't supposed to be flying so high and so fast!

NAVAL AVIATOR
China Lake, Calif.

Reply to Colonel

In reply to Col. McCrary's letter in the Aug. 19 issue of AVIATION WEEK, all I can say is that his viewpoint is just about what I'd expect from some "armchair" Colonel in some little office in the Pentagon or closet located next to the Joint Chiefs of Staff.

Please don't write too many letters to your Congressman, Colonel, for by now you must know things like this could boomerang, and that might prove embarrassing.

In regard to doing something for your country, Colonel, why leave that swivel chair and fight for something this country really needs, like service unification. I mean the *real* thing, not something the military just pays lip service to. If you have enough fortitude for this you might even get reassigned to Panama with "Martyr" Nickerson. This advocating of unification would also save us other taxpayers quite a bit of money. Going one step further, it would also help to stabilize the aircraft industry to the point where we could give you more for your money through non-duplicated projects and still figure on having a job for several years. As it happens now we are in a state of confusion, cut-offs, cutbacks, etc., simply because each service has its special "pet" weapon systems with no thought of broadening its programs to include joint service research and development.

As far as security leaks go, Colonel, it seems to me AVIATION WEEK only publishes what has been common knowledge around the hotel bars of L. A., Dayton, and Washington. One example in point: last Monday's L. A. Times published a beautiful picture of the Navaho missile with booster right out of the handbook. So far as I know AVIATION WEEK hasn't even published a sketch of the missile. Better contact Marvin Miles of the Times, Colonel and see how this security leak developed.

Before I close, Colonel, here's a little Christian advice to you. Take a trip around the industry you are knocking so hard and see for yourself the real story and get the facts first hand. I think you'll meet many people out in the industry doing a damn good job with what they have to put up with.

MILTON J. PLOMER
Lakewood, Calif.

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. 42nd 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.

Colonel's Critic

The irritating letter you bravely printed in the Aug. 19 issue as an "Army Man's View" (p. 166) is an interesting example of contradictions which could be expected from the cloudy policy-making region known as the Pentagon.

It would be interesting to hear our "dear Colonel" explain how our country, which he places first, can be expected to survive a war without the aircraft industry. Perhaps he is still in the days of the cavalry. Allowing the industry to die on the vine sounds more like "my pocketbook" is first.

The description of the publication of security matters sounds like it came from the "Ostrich with Head-in-Sand School" which AVIATION WEEK has valiantly tried to awaken.

However, the statement that really aroused my ire was the "non-Christian attitude." I don't believe a real Christian would stoop so low as to drag religion into a barb against a publication which is trying to keep America safe in spite of itself. Let us not debase Christianity by using it lightly.

In the Colonel's defense—in case his superiors take him to task for his public faux pas of Pentagon planners—is the fact he did make one true statement. I agree that AW could not understand "this point of view" —who could?

I have informed my Senators that recent Washington decisions made in the interest of tax savings are not in the best interest of our country. I suggest that AW could make a noteworthy contribution to our nation's future by asking all aviation enthusiasts to write their congressmen demanding a stop to the present national suicide called "budgeting." National safety should be above party politics and selfish interests such as taxes. I have yet to hear a real military planner say our armed forces were overly prepared. A reduction in defense spending should not even be considered until world disarmament can be a reality.

A. KEITH SMITH
Fullerton, Calif.

P6M Comments

I would like to correct some impressions which may be gained from your review of my paper "The SeaMaster, Its Development and Some Considerations From the Accidents" which was presented at the IAS Naval Aviation meeting in San Diego and reviewed in your Aug. 12 issue ("Navy Indicates Need for 'True' Seaplane," p. 32, 33, 34):

- **Essential safety of flight** nature of the synthetic feel system for a fully powered longitudinal control system was established to our satisfaction in the investigation of the first accident, through simulator tests in the laboratory. We did not prove a feel system failure occurred prior to the accident resulting in the loss of Ship 1.
- **Feel system** malfunction was not associated with the loss of Ship 2, which was lost due to an overpowering of the stabilizer actuator by aerodynamic hinge moments with the special configuration of locked elevators existing only on this particular flight.
- **Normal acceleration** due to hull drag in the Ship 2 accident was approximately 3 Gs, rather than 6 Gs, as reported.
- **Basic nature** of the longitudinal feel system for the P6M will continue unchanged; it remains a "q-spring" type of feel.
- **We believe** that close monitoring of flight test hinge moments of power controlled aircraft is of paramount importance, particularly if the design margins must be kept small in the interest of design efficiency.
- **Margin of safety** mentioned in the AVIATION WEEK review is not smaller than other military aircraft of its type; in fact, the P6M is designed to a higher load factor than is normal with this type aircraft.

I trust these comments will provide answers to the questions which may have been raised by the review of my paper presented in AVIATION WEEK.

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