JANUARY 23, 1956

50 Cents

AVIATION WEEK

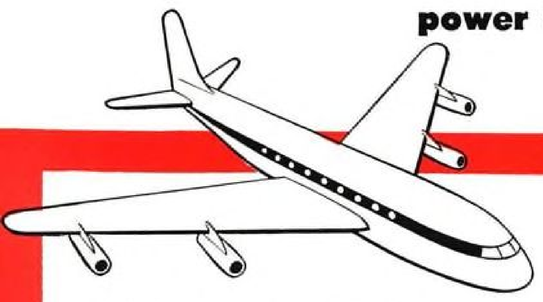
A McGRAW-HILL PUBLICATION

Navy's Crusader: Thousand-Mile Per Hour Fighter

Defense Budget Stresses A

8 reasons why engineers chose constant frequency A-C power for new jets...

SUNDSTRAND



Recently, a staff of engineers was asked to analyze *all* types of electrical systems available and to prepare recommendations on the best system for a series of new jet tankers and transports. Of all constant frequency systems, of all other types of systems, the Sundstrand-driven constant frequency a-c system rated highest for these eight major reasons:

1 Reserve and Reliability—Sundstrand's constant frequency a-c system meets all reserve and reliability requirements.

2 Less Weight—constant frequency a-c power means savings of several hundred pounds of weight. These savings accrue in generation, distribution, conversion, and utilization.

3 Greater Growth Capacity—initial installation provides substantial load growth capacity, with further growth capacity available through the addition of another drive-alternator unit.

4 Full Power—full rated electrical system power, plus overload capacity, is available from engine idle to full thrust.

5 Greater Fault Clearance Capacity—faster clearing, less structural damage where faults occur.

6 Simpler System—power generation system has only three pieces of rotating equipment having brushes, commutators, and regulators—means less maintenance.

7 Fewer Types of Power are required, resulting in less confusion, simplified training, smaller stocks of equipment.

8 No Beat Frequency between inverters and alternators to cause unsatisfactory operation of certain equipment. The Sundstrand-driven system is the only one in which alternators can be paralleled.

Get the complete story on how the Sundstrand-driven constant frequency a-c system proved itself superior to all other types. Let us help you make an analysis of your power requirements. Phone or write our home or district office.

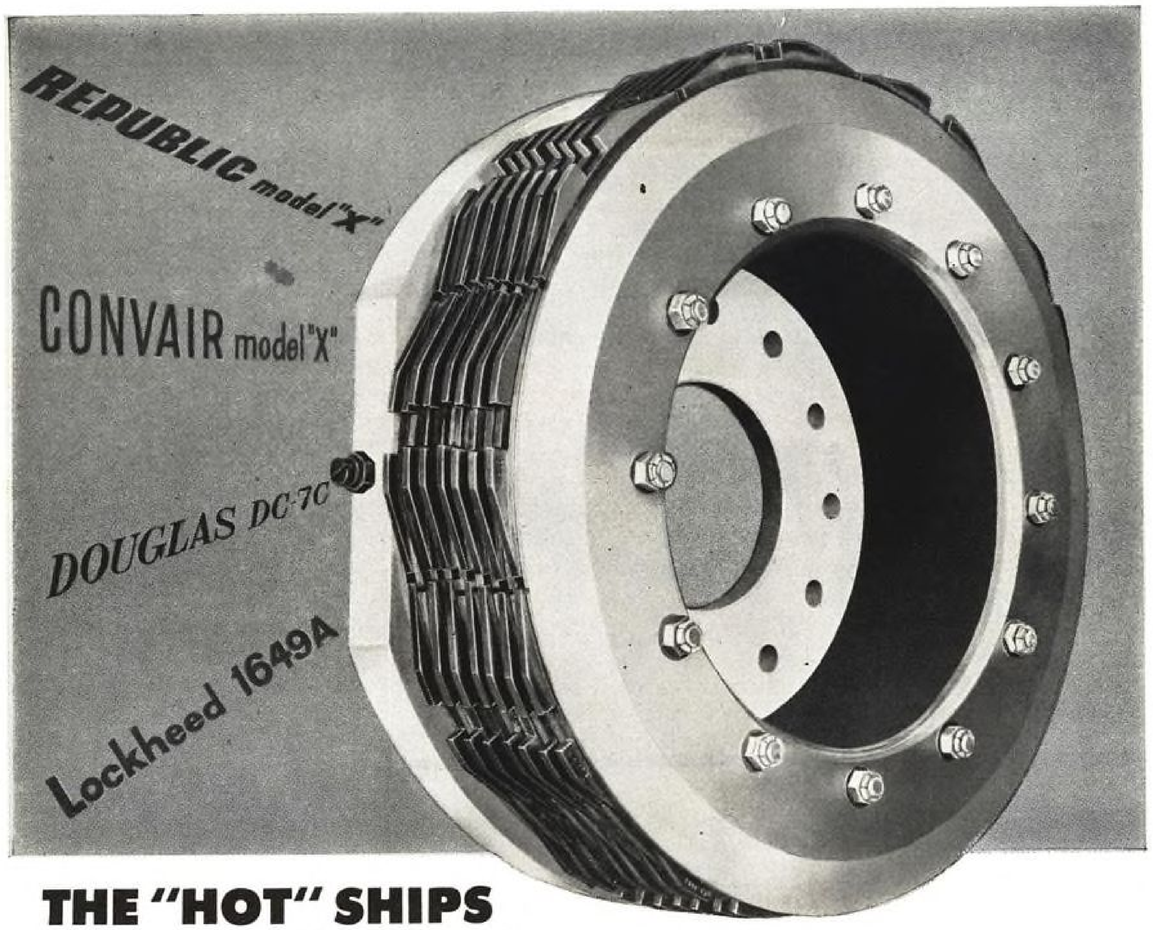
WANTED!
... mechanical and hydraulic engineers!

Join an organization with a future, offering challenging opportunities and salary commensurate with your ability. Write today to our Personnel Department in Rockford, giving resume of your qualifications. Replies will be held in strict confidence.

SUNDSTRAND AVIATION

Division of Sundstrand Machine Tool Company, ROCKFORD, ILLINOIS • Western District Office: Hawthorne, California

CONSTANT SPEED DRIVES • AIRCRAFT ACCESSORIES



THE "HOT" SHIPS —THE BIG SHIPS

are choosing the super-brake with the built-in "heat sink"

—the NEW Goodyear TRI-METALLIC BRAKE!

It comes as no surprise that many of tomorrow's big and fast-flying aircraft are selecting the brake which gives up to *50% increase in absorption of kinetic energy per pound of brake.*

And so it is with the new Douglas DC-7C, Lockheed's Model 1649A and several new military planes on which model numbers have not been released.

Each of these aircraft specifies the new Goodyear Tri-Metallic Brake—the brake in which *the lining*, as well as its mating member and the brake structure itself, acts as a highly efficient "heat sink."

This increased heat absorption capacity per pound of brake is due to the fact that Goodyear has been able to combine the famed disc-brake efficiency with a new metallic lining material *—a non-insulating lining which operates at temperatures up to 70% higher than other designs of this type!*

The simplicity of design of the Goodyear Tri-Metallic Brake gives a spectacular reduction in number of parts—over 200 parts less than in other brakes of comparable capacity. This means greatly reduced inventory and maintenance man-hours.

If you are designing a new aircraft—if your brake problem would be simplified by these qualities—then by all means get the facts on this new brake. Write: Goodyear, Aviation Products Division, Akron 16, Ohio, or Los Angeles 54, California.

FACILITIES + ABILITIES = EXTRA *plus* IN PERFORMANCE

AVIATION CALENDAR

Jan. 30—AC Spark Plug Clinic, sponsored by Airwork Corp. and Southern Airways Co., Southern Airways, Atlantic Municipal Airport, Atlanta, Ga., 2 pm.

Jan. 30-31—Industrial Economics Conference, Statler Hotel, Los Angeles.

Jan. 30-Feb. 3—American Institute of Electrical Engineers, winter general meeting, Hotel Statler, New York, N. Y.

Feb. 2-3—National Symposium on Microwave Techniques, sponsored by Institute of Radio Engineers' Antenna & Propagation Group and Theory & Technique Group, Philadelphia.

Feb. 7-9—Society of the Plastics Industry, 11th annual Reinforced Plastics Div., conference, Chalfonte-Haddon Hall, Atlantic City, N. J.

Feb. 16-17—Transistor Circuits Conference, University of Pennsylvania, Philadelphia. Sponsored by Institute of Radio Engineers, American Institute of Electrical Engineers and Univ. of Pa.

Feb. 22-24—Fifth Annual Ohio-Indiana Agricultural Aviation Conference, Ohio Union, Ohio State University Campus.

Mar. 6-8—Fourth Annual Air Line Pilot Association, Air Safety Forum, Shoreland Hotel, Chicago.

Mar. 14-16—1956 Aviation Div. Conference of the American Society of Mechanical Engineers, Beverly-Hilton Hotel, Los Angeles, Calif.

Mar. 19-21—Society of Automotive Engineers, national production meeting and forum, Hotel Statler, Cleveland, Ohio.

Mar. 19-22—Institute of Radio Engineers, national convention, Waldorf-Astoria Hotel & Kingsbridge Armory, New York.

Apr. 9-12—Society of Automotive Engineers, national aeronautic meeting, aeronautic production forum and aircraft engineering display, Hotel Statler, New York, N. Y.

Apr. 10-11—Symposium for Management on Application of Analog Computers, sponsored by Midwest Research Institute, University of Kansas City, Kansas City, Mo.

Apr. 18-19—First Annual National Industrial Research Conference, sponsored by Armour Research Foundation of Illinois Institute of Technology, Hotel Sherman, Chicago.

AVIATION WEEK • JANUARY 23, 1956

Vol. 64, No. 4

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Queen of the Pusher Pilots

Ruth Law, the fifth woman to hold a pilot's license, learned to fly in 1912. She soon proved she could fly as well as most men; indeed, she competed with men in the aerial contests of the time.

With her many sensational exhibitions, Ruth Law earned the right to be called America's greatest woman stunt flyer. She was the first woman on record to perform the daring aerial loop-the-loop. In one of her exhibitions of night flying, she flew around the Statue of Liberty with the word LIBERTY spelled out in lights on the lower wing of her plane.

In 1916, Ruth Law flew non-stop from Chicago to Hornell, New York—a distance of 512 miles, to establish a new world's record. She accomplished this in a pusher plane, and her flight was a truly great achievement at that time. From Hornell, she continued on to Binghamton and New York City, for a total distance of 884 miles in less than nine hours.

Actionflex in Action

Fiberglass-Silicone

Memo

To: Chief Engineer, Plant No. 4

From: Field Engineering Office

Subject: Actionflex Field Report #55-137

Problem: Develop Actionflex hose to replace rubber-compound hose carrying hot air which showed extremely brittle characteristics after extended use due to high ambient temperatures, and cracks and leakage due to tight (approximately 4") bend radii. Assembly required replacing after 50 engine hours.

Solution: Actionflex engineered a fiberglass-silicone hose with wire support that would not delaminate under ambient temperatures induced, and that would not collapse when down to 4" bend radii.

Result: Initial Actionflex assembly immediately solved problem, assembly life lengthened to 500 engine hours. Further Actionflex engineering design lengthened assembly life to 1000 engine hours, and reduced cost of the assembly by 1/3.

Actionflex field engineers are helping airframe and engine manufacturers solve equally difficult problems in tube, duct, hose and sleeve assemblies with tough and durable Actionflex fiberglass-silicone laminations. Call on your nearest Actionflex representative for complete information.

Teflon*

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Check the class of service desired; otherwise this message will be sent as a full rate telegram
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WESTERN UNION
W. P. MARSHALL, PRESIDENT

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Send the following message, subject to the terms on back hereof, which are hereby agreed to

NEW EXCLUSIVE ACTIONFLEX PROCESS PUTS A BIG PLUS FACTOR IN FLUOROCARBON HOSE ASSEMBLIES. FIFTY PER CENT MORE FLEXIBILITY. ALL DIAMETERS UP TO TWELVE INCHES. PRECISION CONTROLLED I.D. AND O.D. FULLY CERTIFIED BY INDEPENDENT TESTING LABORATORY TO TEFLON MIL-H-5511A. WRITE OR WIRE FOR FULL INFORMATION.

*Teflon is the registered trade mark of DuPont tetrafluoroethylene.

ACTIONFLEX Division, ORCHARD INDUSTRIES, INC.
Hastings, Michigan

Actionflex Fiberglass-Silicone
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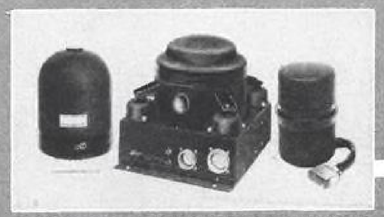
Actionflex Teflon
TUBES • HOSE • LINES • DUCTS • BELLOWS

serving industry through

coordinated precision technology

GPE



Kearfott gyros; used for stabilization or guidance in the majority of aircraft and missiles in production today. Vertical, directional and rate-integrating gyros shown.

Link Aviation F-89D; jet flight simulator duplicating exactly cockpit of the F-89D interceptor; Link simulators for more advanced planes may not be shown.

Automatic Airborne Navigation System; a product of the coordinated techniques and resources of General Precision Laboratory Incorporated and other GPE Companies.

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One of a series telling how the producing companies of General Precision Equipment Corporation are contributing to America's progress.

AVIATION

is one of more than a dozen major industries many of whose needs are anticipated and met by the research and development activities of the producing companies of General Precision Equipment Corporation. The highly advanced aeronautical products and systems manufactured by the several GPE Companies which devote substantial resources to progress in this field are responsible for conspicuous advances in aviation and are setting new standards of performance.

The skills and resources of the producing companies of General Precision Equipment Corporation form the building blocks of GPE Coordinated Precision Technology. Through this basic GPE operating policy, each company's specialization in its areas of competence is supplemented by the resources of other GPE Companies, wherever relevant. An outstanding example of GPE Coordinated Precision Technology is the recent achievement of quantity production of the most advanced automatic airborne navigation system known. This system is the successful culmination of eight years of intensive research and development activity centered in General Precision Laboratory Incorporated and supported by the facilities and personnel of other GPE Companies.

This mutuality of ideas, techniques and tools, so effective in solving aviation problems, has likewise resulted in a diversified line of precision equipment of superior design and performance which has wide application over an extensive range of other industries.

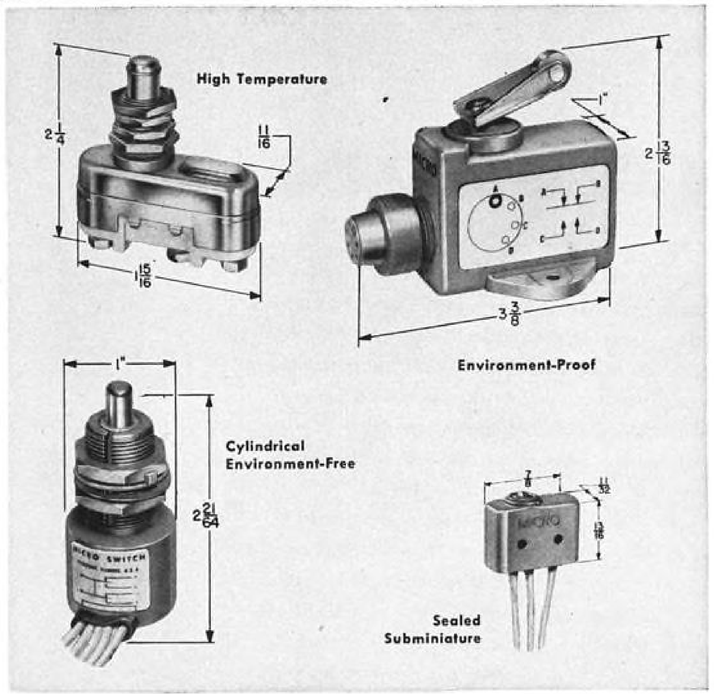
A brochure descriptive of GPE Coordinated Precision Technology and the work of the GPE Companies is available. Address your request, or inquiries on specific problems, to:

General Precision Equipment Corporation

92 GOLD STREET, NEW YORK 38, NEW YORK

MICRO *precision switches*

...THEIR USE IS A PRINCIPLE OF GOOD DESIGN



A continuous flow of Precision Switch developments anticipate aircraft design needs

The chief function of MICRO SWITCH Engineering, both at the factory and in the field, is to be ready with the most dependable, most reliable precision switches for every aircraft design requirement.

Shown here are just a few recent developments that designers have found useful in a wide variety of applications as components for airborne equipment. Each is one of a "family" of switches to best meet specific needs. For more complete information get in touch with your nearest MICRO SWITCH branch office.

The Sealed Subminiature Switch is the smallest, lightest weight switch of this type available. It is completely sealed and designed to give trouble-free operation in a temperature range of from minus 65 degrees F. to plus 180 degrees F.

Cylindrical Environment Free Switch is a compact, completely sealed cylindrical shaped switch for use on landing gears, flaps or other exposed locations. It is equal in performance and has more versatility than switches several times its size and weight.

The Environment-Proof Switch shown is completely sealed and contains an inert gas to prevent atmospheric changes or severe environmental conditions from affecting switch operation. This switch is interchangeable with AN-3217-1 and AN-3217-2.

The High Temperature Switch operates satisfactorily in a temperature of from minus 50 degrees F. to plus 1000 degrees F. It has been found valuable as an aircraft component for use in extremely hot locations such as close to the afterburner in jet engine planes.

Electrical Ratings of switches shown

SEALED SUBMINIATURE:

30 volts d-c, 3 amperes inductive, 4 amperes resistive; maximum inrush is 15 amperes.

CYLINDRICAL ENVIRONMENT-PROOF:

Rating at 30 volts d-c.

INRUSH:

24 amperes, normally closed and normally open.

AT SEA LEVEL:

4 amperes, motor and resistive; 3 amperes inductive.

AT 100,000 FT.:

4 amperes, motor and resistive; 2 amperes inductive.

ENVIRONMENT-PROOF:

Rating at 28 volts d-c.

15 amperes resistive, 10 amperes inductive, 5 amperes lamp load, 10 amperes motor load.

Rating at 115 volts a-c and d-c.

10 amperes a-c or 1 ampere d-c resistive; 10 amperes a-c or .5 ampere d-c inductive; 6 amperes a-c or 1 ampere d-c lamp load, 6 amperes a-c or 1 ampere d-c motor load.

HIGH TEMPERATURE:

At 700°F

5 amperes (resistive) 28 volts d-c.

At 1000°F

2 amperes (resistive) 28 volts d-c.

MICRO SWITCH

A DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR COMPANY

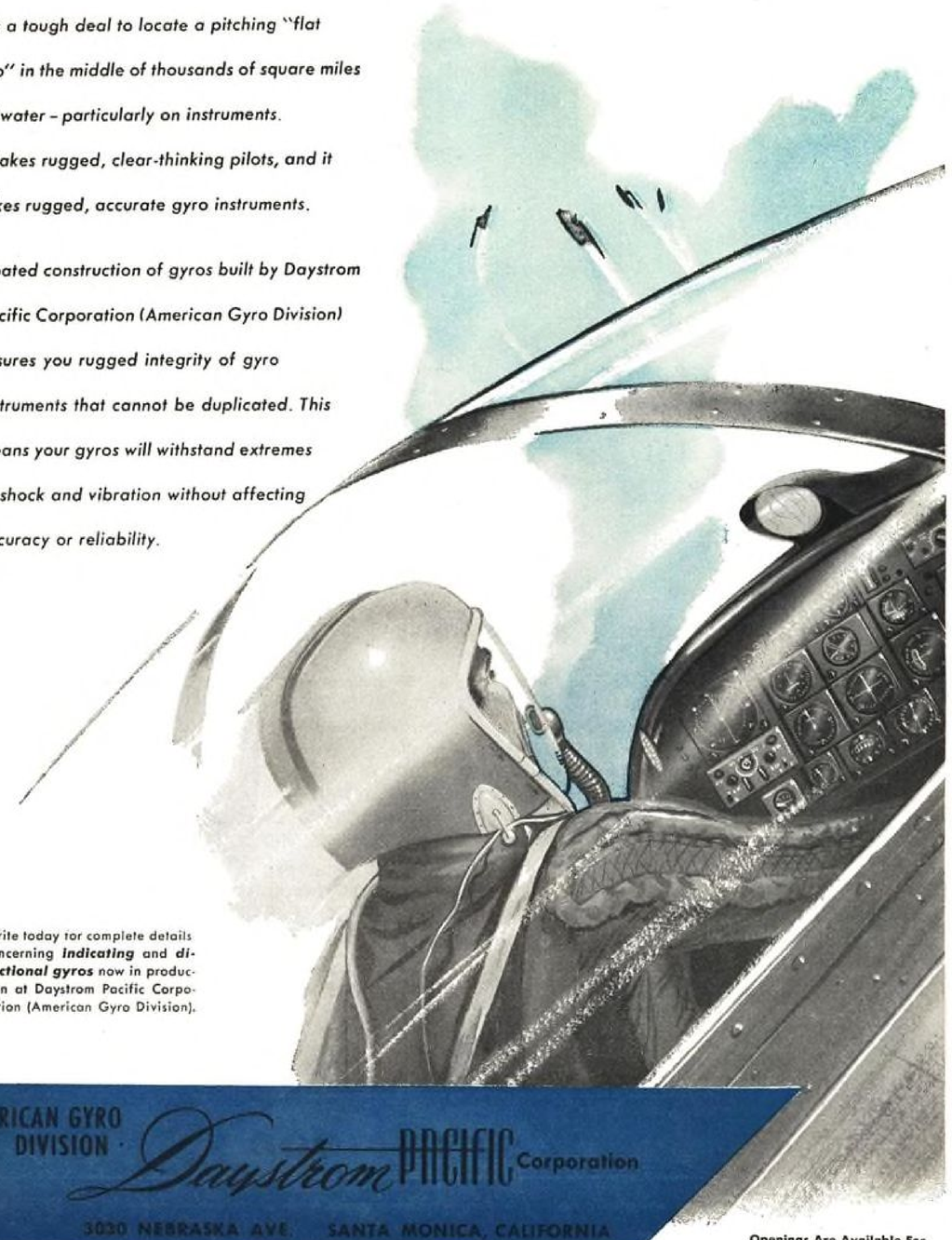
In Canada, Leaside, Toronto 17, Ontario • FREEPORT, ILLINOIS

floated gyros

bring 'em back alive

It's a tough deal to locate a pitching "flat top" in the middle of thousands of square miles of water – particularly on instruments. It takes rugged, clear-thinking pilots, and it takes rugged, accurate gyro instruments.

Floated construction of gyros built by Daystrom Pacific Corporation (American Gyro Division) assures you rugged integrity of gyro instruments that cannot be duplicated. This means your gyros will withstand extremes of shock and vibration without affecting accuracy or reliability.



Write today for complete details concerning ***indicating*** and ***directional gyros*** now in production at Daystrom Pacific Corporation (American Gyro Division).

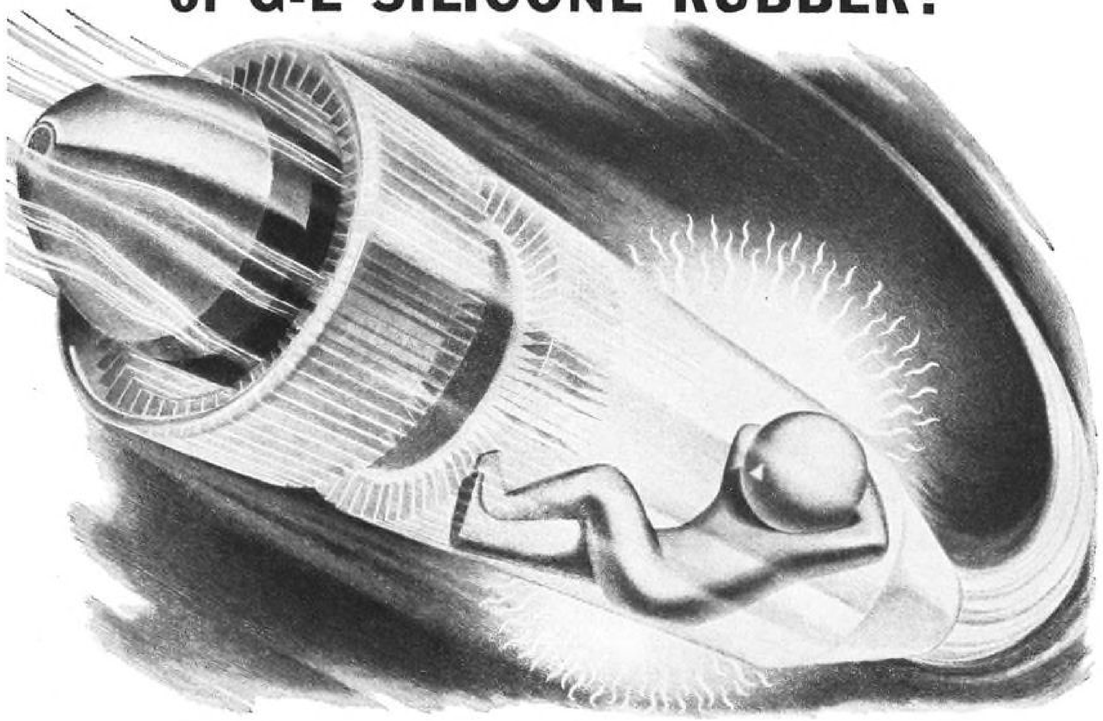
AMERICAN GYRO DIVISION · Daystrom PACIFIC Corporation

3030 NEBRASKA AVE. SANTA MONICA, CALIFORNIA

CONTROL SYSTEMS, STABLE PLATFORMS, MINIATURE AND SUB-MINIATURE RATE GYROS, VERTICAL GYROS, FREE AND DIRECTIONAL GYROS, ACCELEROMETERS, INTEGRATION, INTERVALOMETERS, POTENTIOMETERS, SYNCHROS, RESOLVERS, SENSING AND ACTUATING COMPONENTS.

Openings Are Available For Highly Qualified Engineers

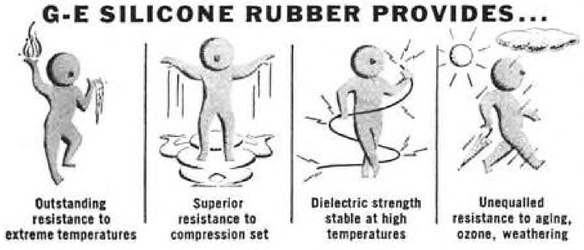
How can you benefit from the AMAZING HEAT RESISTANCE of G-E SILICONE RUBBER?



Serviceability up to 600 F is one of the amazing characteristics of General Electric silicone rubber that makes it ideal for a host of applications. For example, it's being used for aircraft ducting and oven door seals where *intermittent* temperatures of 600 F are encountered. It provides *continuous* operation at 300-500 F as seals and gaskets in jet and diesel engines, clothes dryers, electric cookers, steam irons, and heat sealing equipment.

Where can YOU use G-E silicone rubber? There's a class for almost every requirement! For example: Class 300 offers the best recovery after compression of *any known rubber!* Class 500 provides flexibility at *—120 F below zero!* G-E silicone rubber is classified according to dominant property for easy selection and specification.

G-E SILICONE RUBBER PROVIDES...



Outstanding resistance to extreme temperatures

Superior resistance to compression set

Dielectric strength stable at high temperatures

Unequalled resistance to aging, ozone, weathering

G-E silicones fit in your future

GENERAL ELECTRIC

SEND FOR A FREE "LIGHTNING SELECTOR"—TODAY!

Silicone Products Department
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Section 61-1E
Waterford, New York

Please send me technical data on G-E silicone rubber, including a free "Lightning Selector" and up-to-date list of fabricators.

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IN CANADA: Mail to Canadian General Electric Company, Ltd., Toronto

For longer life in rugged duty... Air Force work horses now depend on Cline's wide-frequency-range

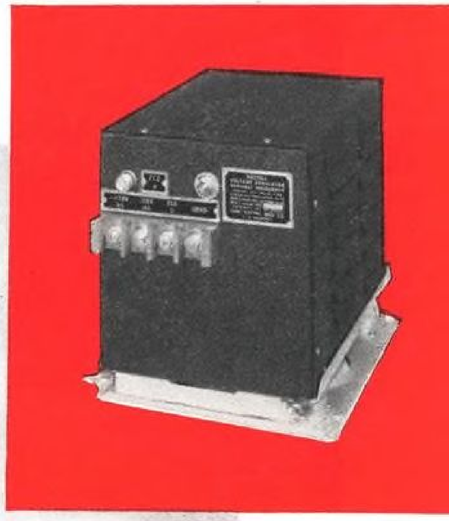
EXCITER VOLTAGE REGULATORS

The USAF B-1 alternator used on T-29, C-97 and C-124 aircraft is now controlled by Cline's Wide-frequency-range (380-1000 cycles) *Magnetic Amplifier Exciter Voltage Regulator.*

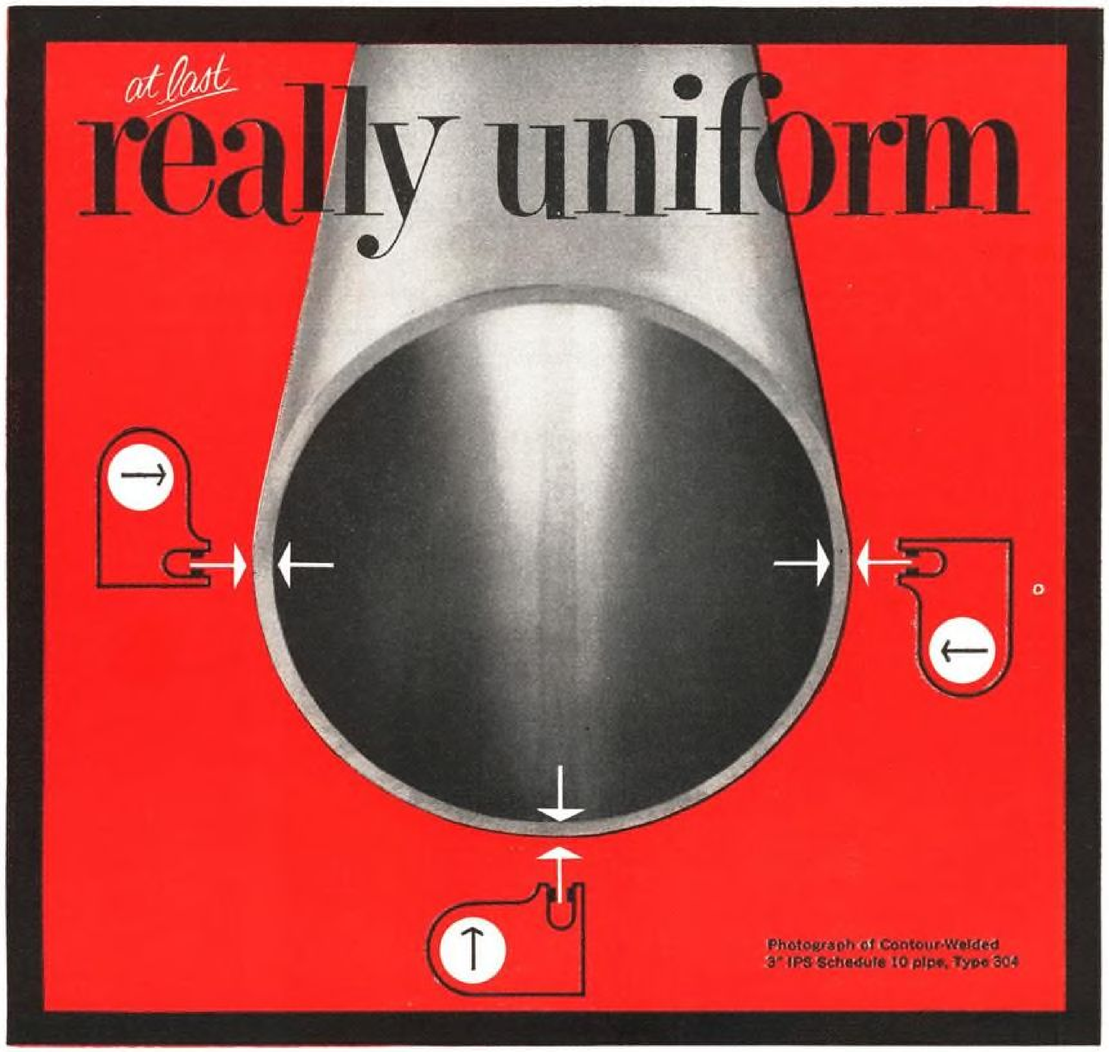
Most of the Magnetic Amplifier Voltage Regulators flying today are Cline-built. Each regulator has logged far more hours of trouble-free flying time than any other aircraft voltage regulator.

Cline's new Exciter Voltage Regulator has not only proved itself but, along with Cline's *Magnetic Amplifier Speed-Positioning Devices,* has proved Cline's ability to handle other complex electronic control problems.

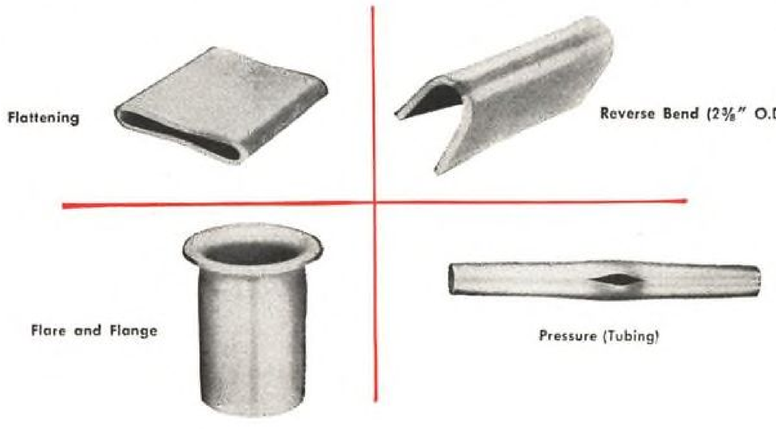
Our design staff will be happy to confer with you on your control problems.



AIRCRAFT PRODUCTS DIVISION
CLINE ELECTRIC MANUFACTURING COMPANY
3405 West 47th Street • Chicago 32, Illinois



CONTOUR-WELD PIPE...BEST BY ANY TEST YOU CAN NAME



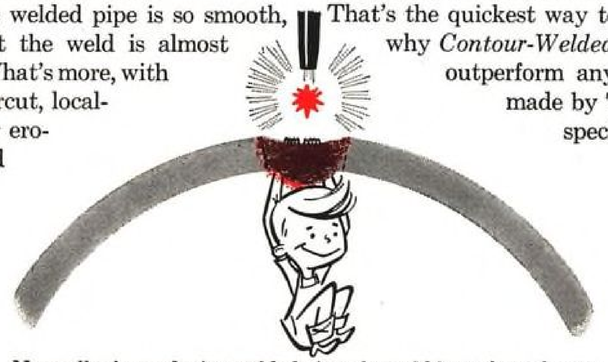
stainless pipe

...by Trent's new Contour-Weld process

Trent's new, patented *Contour-Welded*® stainless pipe and tubing gives you all the uniformity of wall thickness you'd expect in welded pipe and tubing – plus equal uniformity in the weld zone itself.

This new-type welded pipe is so smooth, so uniform, that the weld is almost imperceptible. What's more, with no bead or undercut, localized corrosion or erosion is eliminated ... physical properties are better than those of any other pipe, welded or not.

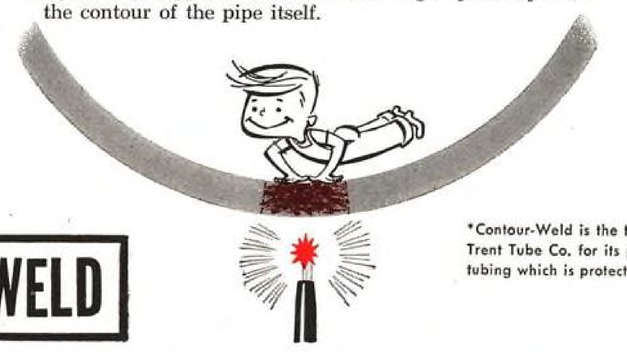
But try Trent's new *Contour-Welded* pipe or tubing yourself. As a matter of fact, ask for a sample – and give it any test you like. That's the quickest way to see for yourself why *Contour-Welded* pipe and tubing outperform any other. And it's made by Trent – tube mill specialists.



Normally, in producing welded pipe, the weld is made at the top. But gravity plays a nasty trick. It tugs at the fluid metal in the weld zone, pulling it down toward the middle of the pipe. The result, particularly in the heavier gages, is a perceptible bulge where it hurts the most—right on the I.D. surface. If you try to get rid of the bulge—at fair cost—the metal is undercut—and corrosion and erosion start there.

Why Trent's Exclusive *Contour-Weld* Process Means Smoother Welds...

But Trent put a stop to that—simply by going into partnership with gravity. With their exclusive *Contour-Welding* process, they weld at the bottom—and gravity works for them. For then, the bulge is in the opposite direction—blending in perfectly with the contour of the pipe itself.



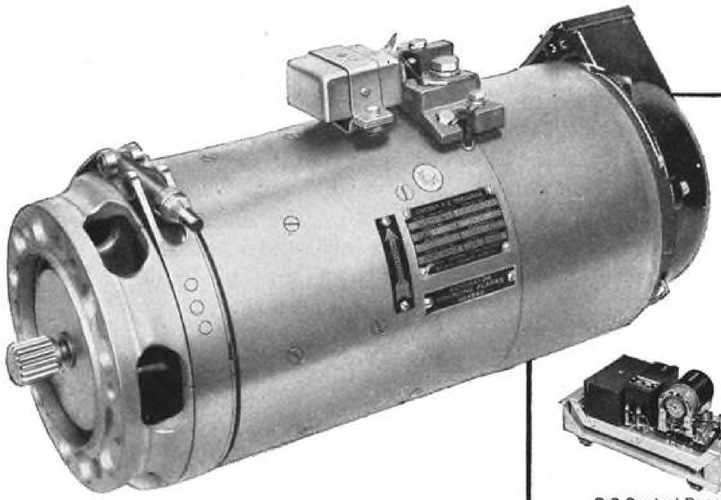
TRENTWELD

*Contour-Weld is the trade mark of the Trent Tube Co. for its process of welding pipe and tubing which is protected under U.S. Patent 2,716,692.

STAINLESS STEEL TUBING

TRENT TUBE COMPANY, GENERAL SALES OFFICES, EAST TROY, WISCONSIN (Subsidiary of CRUCIBLE STEEL COMPANY OF AMERICA)

Bendix Red Bank OFFERS A COMPLETE LINE OF DC GENERATORS



PLUS THIS PROTECTIVE AND CONTROL EQUIPMENT FOR DC SYSTEMS

B-3 Control Panel

Generator Control Panel

Overvoltage Protector

Line Relay

Feeder Circuit Breaker

Voltage Regulator

Fault Detector Panel

AIRCRAFT-ENGINE-DRIVEN DC GENERATORS FOR 30 VOLT SYSTEMS

Type No.	Nominal Rating Amps.	Speed Range RPM	Altitude Ft	Approx. Weight Lbs.	Designed to Gov't Spec.
30E01	50	2200-4500	20,000	24	M-2, M-3
1345	50	4000-8500	30,000	14.25	
30E22	50	4000-8500	30,000	16.25	
30E14	75	4000-8000	25,000	24.5	N75-2RA
30E16	100	2500-4500	50,000	40	52B6588
30E20	150	4000-8000	65,000	45	
30E17	200	2870-8600	Ground Power	40	
30E07	200	3000-8000	50,000	45	AN-3632
30E18	200	4000-8000	50,000	38	MS-25009
30E19	250-350	1600-7500	Ground Power	98	
30E02	300	3450-8500	25,000	64	
30E15	300	4000-8000	50,000	50	AN-3623
30E05	400	3000-8000	50,000	68	AN-3634
30E10	400	3100-8000	60,000	67	AN-3624
30E11	500	4000-8000	50,000	75	
30E13	500	3500-8000	50,000	86	

WITH a full line-up of DC Generators, together with all the protective and control equipment to go with them, Bendix Red Bank can supply the most efficient answer to your DC system needs. Whether for use on new or on existing aircraft, Red Bank DC units are designed for maximum reliability, minimum size and weight, and maximum installation and servicing ease. For complete information, write RED BANK DIVISION, BENDIX AVIATION CORPORATION, EATONTOWN, N. J.

Bendix Red Bank Division of Bendix Aviation Corporation
EATONTOWN, N. J.

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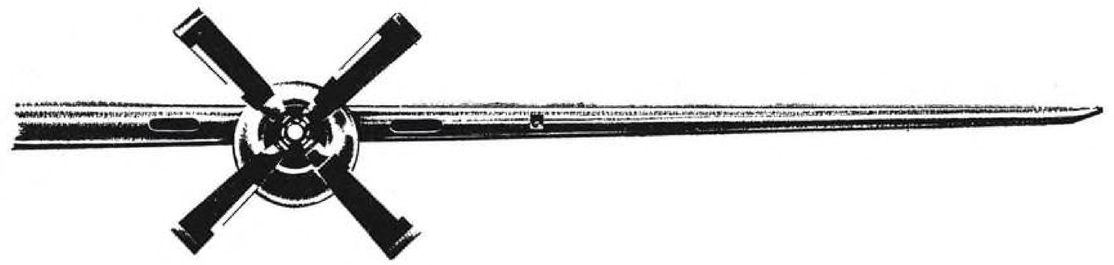

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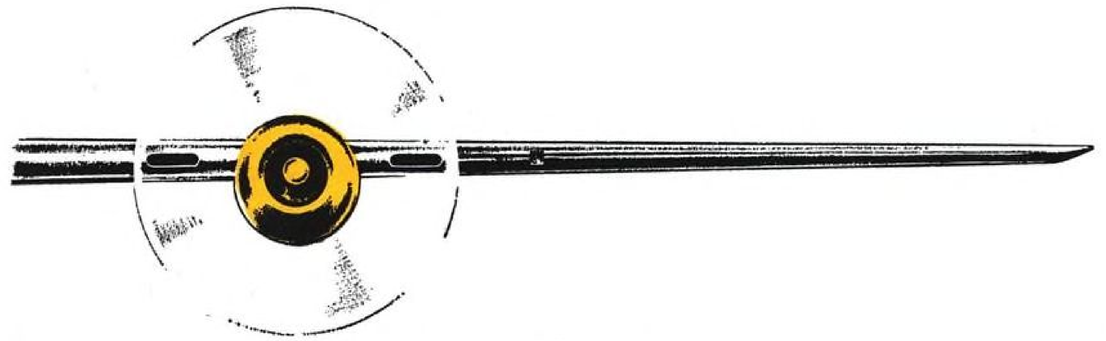

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COVER: Chance Vought's F8U-1 Crusader has flown at 1,050 mph. Application of Richard Whitcomb's area rule (AW Sept. 12, p. 12) is less obvious on the Crusader than on the pinch-waisted Convair F-102A and Grumman F11F-1. Additional details on the Navy carrier fighter are on p. 29.

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EDITORIAL

The New Airpower Fraud

The Fiscal 1957 airpower budget presented to Congress last week is deceptive. Although the Defense Department budget shows increases both in new obligational authority ($2.5 billion) and in expenditures ($1 billion) for Fiscal 1957, it falls miserably short in meeting the real needs of military airpower in the critical areas of research, development, production and maintenance. Evaluated on the scale of current international problems, the Fiscal 1957 budget imposes artificial limitations on the growth of airpower that are as bad as those in the now infamous Fiscal 1950 budget of Louis Johnson, Defense Secretary of the Truman Administration. It is significant to remember that Johnson's airpower budget that was once billed as adequate for our defense needs and as "cutting the fat but not the muscle," strongly encouraged the Communists to launch their Korean aggression and sent us into that bloody fray woefully weak in the air.

If the Fiscal 1957 airpower budget is approved by Congress without change, it will serve notice to the Communists that our military airpower is again on the decline and that our policy of massive retaliation is being built on bluff and bluster rather than superior weapons. This airpower budget submitted by the executive branch of the Government will mean that American airpower will lose further ground in its technological race with the fast growing Communist air forces. If the trends it initiates are continued, American airpower will not only fail to improve its present slim margin of superiority over the Communist air fleets but will not even maintain its present position.

For this Fiscal 1957 defense budget is not a budget of airpower progress, as billed by Defense Secretary Wilson, but a budget of airpower stagnation followed by inevitable retrogression.

There are three principal areas in which this airpower deception is being perpetrated:

• **First**—Stretchout of current aircraft production is being continued by a limitation on expenditures. This means that the modernization rate of the combat units is being artificially retarded and that the aerial weapons in our usable arsenal will be deliberately kept closer to the beginning of their obsolescence curve.

• **Second**—The fallacy of the constant level of funds for research and development that is adopted again in this budget (AW Jan. 2, p. 13) will mean that our technical pace will not be appreciably accelerated and will certainly lose more ground in the race with the Russians.

• **Third**—Funds for procurement of new aircraft have been cut substantially for the Air Force so that only 1,900 new planes can be contracted for during the next year. This is a bare few hundred more planes than those lost every year through normal operational attrition. It is about 1,400 planes short of what USAF estimates it needs annually merely to maintain and modernize its authorized 137 combat wing strength.

Censorship imposed by top-level Defense Department officials in the guise of military security has carefully concealed the real problems facing the Air Force in particular and our military airpower in general.

For example:

• **Nearly one-third of the fighter strength** of Tactical Air Command is grounded due to lack of qualified maintenance personnel. Strategic Air Command has quantities of bombers grounded for the same reason, although it has not been hit as hard as TAC.

• **Strategic Air Command** is rapidly losing its intercontinental atomic attack capability as the B-36, only bomber in the U. S. arsenal with genuine intercontinental range, is sliding rapidly down the obsolescence curve. SAC is now essentially a medium-range force relying almost entirely on B-47s that require multiple aerial refueling from relatively-slow KC-97 tankers at low altitude to operate against the Russian heartland even from foreign bases. General LeMay's program to re-equip SAC as fast as possible with longer range B-52s and its KC-135 jet tanker companion have been junked by the Fiscal 1957 airpower budget. For the next several years, the retaliatory power of SAC will be significantly curtailed by this production stretchout, and its future power will be delayed by the research fund ceiling.

• **USAF's expansion program** to 137 combat wings by the end of Fiscal 1957 is programmed on such a thin financial base that it will not actually have the full strength of combat-ready wings now scheduled for that date. USAF is rapidly reverting to its 1950 dilemma of organizing "paper" understrength wings to provide an illusion of meeting its program when in fact its real combat strength is not increasing.

In presenting this airpower budget to Congress, Defense Secretary Wilson testified that:

"Nothing has occurred in the international situation during the past year which would indicate the necessity for any major change in these policies and concepts."

Yet, during the past year, all of the responsible leaders of the Air Force including its Chief of Staff, General Nathan Twining; his vice-chief, General Thomas White; USAF Secretary Donald Quarles; the Assistant Secretary for Research and Development, Trevor Gardner and Lt. Gen. Thomas Power, commander of the Air Research and Development Command (see page 31), have all publicly warned that the tremendous technical progress made by Russian airpower poses one of the gravest challenges ever faced by this nation.

In the face of this glaring contrast between the urgent warnings of the top military airpower leaders and the bland complacency expressed by Defense Secretary Wilson and his Fiscal 1957 Defense Department program, Congress should make the most strenuous efforts to determine our genuine airpower problems and examine them in minute detail before reaching a verdict on this vital budget.

We can expect a barrage of official propaganda to support the Fiscal 1957 defense budget combined with ruthless attempts to suppress its critics among responsible military leaders.

But we are reaching a critical point in the technological race with the Russians for superior weapons. The stakes in the race far surpass a political victory or a military promotion. This is a time for men's consciences to speak out before the airpower budget fraud becomes a fact.

—Robert Hotz

WHO'S WHERE

In the Front Office

Adm. Albert G. Noble, (USN, ret.) executive vice president, Vitro Corporation of America, succeeding **George White,** resigned.

Dr. Louis G. Dunn, vice president, Ramo-Wooldridge Corp., Los Angeles, Calif., joined the firm in 1954, coming from the Jet Propulsion Laboratory at California Institute of Technology, where he was director and in charge of Corporal missile development.

George W. Sarbacher, president, National Scientific Laboratories, Inc., Washington, D. C., formerly vice president of the firm.

Donald W. Smith, president, Kearfott Co., Inc., Little Falls, N. Y., succeeding **Hermann G. Place,** who was also board chairman. **Wladimir A. Reichel,** vice chairman-executive committee; **Frederick D. Herbert, Jr.,** financial vice president; **Herman Shuart,** engineering director; **Andre W. Reichel,** sales and service director and **Austin C. Bescher,** production director.

Donald B. Nason, vice president-director, government products engineering, Crosley Division, Avco Manufacturing Corp.; **W. R. Lawrence, Jr.,** manager of the Nashville, Tenn., plant.

Honors and Elections

George A. Delaney, chief engineer, General Motors Pontiac Motor Division, 1956 president of the Society of Automotive Engineers. Vice president-air transport, **J. T. Dyment,** engineering director, Trans-Canada Air Lines; vice president-aircraft, **F. O. Hosterman,** chief sales engineer, Weston Hydraulics, Ltd., and vice president-aircraft powerplant, **A. L. Pomeroy,** associate director, staff research and development, Thompson Products, Inc.

W. S. Mount, Socony Mobil Oil Co.'s Aviation Department manager, has been elected 1956 chairman of the Aviation Technical Service Committee, Division of Marketing, American Petroleum Institute. **Livingston T. Rumsey,** Standard Oil Co. (Ohio) manager of aviation and Solvent Sales Department, has been chosen vice chairman of the new group, succeeding Mount.

Dr. Ruben F. Mettler, director, advanced systems planning, Ramo-Wooldridge Corp., Los Angeles, Calif., has been named one of the "ten outstanding young men of 1955" by the U. S. Junior Chamber of Commerce.

Changes

R. E. Small, former manager of managing for General Electric Co.'s Jet Engine Department, is manager of GE's new turbojet technical sales office in Paris, France.

William L. Mustard, field service manager, Link Aviation, Inc., Binghamton, N. Y.; **Edward C. Greuling,** district manager, Dayton, Ohio.

Harold Wells, chief engineer, aircraft hydraulics engineering group, Bendix Products Division, Bendix Aviation Corp., South Bend, Ind.

(*Continued on page 60*)

INDUSTRY OBSERVER

► Douglas Aircraft has received an Air Force contract to develop an intermediate range ballistic missile. USAF still has prime service responsibilty in this field covering ranges up to 1,500 miles in addition to its intercontinental ballistic missile program. The joint Army-Navy intermediate missile development team will function as a second source for this type weapon.

► **Production of the Boeing B-47 Stratojet has fulfilled all Strategic Air Command requirements with a surplus of these bombers now being diverted to Tactical Air Command. TAC B-47s will be equipped with "buddy" system aerial refueling kits that will make them convertible to tankers for TAC fighters and other bombers. TAC still is using obsolete KB-29 tankers for its jet fighters although a KB-50 program is under way.**

► Two-stage rocket vehicles, composed of Deacon and Loki solid-propellant rockets, have been fired successfully in the Arctic as part of Navy's upper atmosphere program.

► **Cancellation of some Short Seamew anti-submarine planes ordered for the Royal Air Force is "under consideration" by the Ministry of Supply. The order involves about $8,400,000, and the manufacturer had expected further larger orders. The pilots complain that the aircraft is too slow.**

► The Ford Motor Co.'s Aircraft Engine Division, Chicago, Ill., has been awarded a $6 million Air Force implementation contract for production of the Pratt & Whitney J75-F-9 turbojet engines. Ford manufactures the Pratt & Whitney J57.

► **Main problem in modifying the military cargo version of the Lockheed C-130A to meet civil air regulations involve stronger landing gear, more flaps and a fuel dump system.**

► Aviation Corp. (AVCO) Advance Development Division is now working on the nose cone problem for the Air Force's intercontinental ballistic missile program.

► **Pratt & Whitney T34 turboprop engines are getting their first real operational experience on two C-97s operated by Military Air Transport Service at Kelly Field, Tex. The two T34-powered Stratofreighters will soon be joined by two Lockheed Constellations also powered by the T34. This version of the Constellation has a speed of more than 400 mph. and is the fastest transport type aircraft now flying with the exception of the turbojet-powered Boeing 707.**

► The Russian twin-jet TU104 transport will be put into commercial operation sometime this month or next, according to Gen. Nikita A. Sakharov, director of civil aviation for the USSR. The planes, Sakharov said, will fly 500 mph. at altitudes exceeding 36,000 ft. TU104s and twin-jet Il28s already are making training flights over segments of the Aeroflot system, carrying mail and matrices for the Russian newspaper Pravda.

► **Production models of Republic's F-105 twin-jet fighter bomber are scheduled to get Pratt & Whitney Aircraft J75s. The first aircraft, which crash-landed at Edwards AFB last November after failure of the uplock in the right main landing gear (AW Jan. 16, p. 32) was powered by two P&W J57s. Originally the plane was slated to get Allison J71s.**

► Significant new technique for making silicon and germanium transistors developed by Bell Telephone Laboratories opens the way for high-frequency applications never before possible. Diffusion process reportedly makes it possible to produce broad-band transistors with an amplification of 100 over a 20 megacycle bandwidth with a cutoff frequency of 500 to 600 mc.

► **Latest Northrop high-speed sled, developed for aero medical tests at Edwards AFB, recently reached a speed of 995 mph. in an unmanned run. Lt. Col. John P. Stapp estimates that the new sled will attain speeds of 1,300 mph. when the 1,500 ft. addition to the 3,500 ft. track is completed in April.**

Washington Roundup

Profit Investigation

The prospect is that the opening of public hearings on military aircraft profits before the House Armed Services Investigating Subcommittee will be delayed until next week.

Airframe manufacturers are expected to be called first, then engine companies, and then major subcontractors. An executive session of the subcommittee, headed by Rep. Edward Hebert (D.-La.), will decide companies to be called and the procedure to be followed at the hearings. Rep. Carl Vinson (D.-Ga.), chairman of the Armed Services Committee, and Rep. Dewey Short (R.-Mo.), ranking Republican, are ex officio members. The hearings are expected to last at least a month.

Semmes to CAB?

Gen. Harry H. Semmes (U. S. A. Ret.), a Maryland Republican, appeared last week to be the White House choice to succeed Ross Rizley as chairman of the Civil Aeronautics Board. A patent attorney in Washington, Semmes was a darkhorse candidate for the Board post until the Republican National Committee was asked to clear him and a security clearance was initiated. Both Republican Maryland senators, James Beall and John Butler, were advised that Semmes was under consideration for a CAB appointment, as was Rep. DeWitt Hyde (R.-Md.). It is expected that the nomination will go to Congress simultaneously with the appointment of Rizley as a judge.

Visits to Russia

There is growing hope that administration complacency about Russian technological capability will be jarred as a result of the recent era of good fellowship and exchange of visitors with this country. Top Air Force officers and research experts such as Lt. Gen. Thomas S. Power (page 31) have been frustrated in their efforts to make the point that the Reds have this capability and it is growing fast despite the fact that most Russians don't drive a Chevrolet sedan.

Recent returnees from a tour of Gorki, Stalingrad and Leningrad are three members of the American Society of Mechanical Engineers: Nevin L. Bean of Ford Motor Co., Dr. Weldon H. Brandt of Westinghouse and Dr. Albert C. Hall, research vice-president of Bendix Aviation. They have reported their observations to the State Department, and these include:

- **Russia's technologists** are highly qualified and for high-priority projects are granted anything they need in staff and facilities, insuring fast development.
- **A digital computer,** comparable to some complex American types, was conceived and built in 2½ years. The Americans, familiar with this equipment, were highly impressed by the accomplishment.
- **Semi-automatic lathes** are being built in Russia on a moving assembly line at a rate of 50 a day. American output is 1,000 a year.
- **Russian workers,** both technological and in industrial plants, display a high level of skill and enthusiasm. They have a good incentive system, 25 to 40% bonuses for production records, and "Socialist competition" between factories, with cash rewards for performance.
- **In addition to computers** and machine tool design, most impressive performance was in a ball bearing plant that is as good as any in U. S. Management and technical direction is excellent.
- **Of 1,700,000 Russian students,** over 800,000 are following technical and scientific courses.
- **In the technology race,** the United States "cannot afford to be complacent."

'Constructive' Information

Defense Department's policy of releasing only information it judges "constructive" is meeting increasing congressional opposition. At a congressional hearing, it was staunchly defended by R. Karl Honaman, former Deputy Assistant Secretary of Defense for Public Affairs.

Rep. John Moss (D.-Calif.) challenged the position that it is not "constructive" to release information on the differing views of the services.

Honaman explained: "The main thing to be done with differing opinions is to give them free play in the discussions in the Department in developing policies. Policies are to be beaten out of a lot of different points of view. But after they have been beaten out and become the policy, there can be very little purpose served in airing those things to the public."

He added: "There have been occasions when information that was prepared within the departments, because of the rivalry and the competition between the various branches of the services, there is sometimes reflected discredit upon a sister service . . . and such statements . . . could mislead and possibly alarm the public if they accepted the discredit for one of the services."

Rep. Clare Hoffman (R.-Mich.) was skeptical that Defense Department would consider information disclosing the "waste of taxpayers' money" as "constructive."

Honaman said that it "might" be considered constructive to have such information known "because it would put us back on our toes."

Insisting that there is a free-flow of information from Defense Department, Honaman explained: "I have not experienced any instance in which information was requested and not supplied, except where such information in the opinion of responsible persons was considered of a nature which would jeopardize the security of our country or would violate statutes of directives of higher authority."

Meanwhile, Philip K. Allen has been named acting Deputy Assistant Secretary for Public Affairs in the Defense Department, filling the position vacated Jan. 1 by Honaman. Allen was moved from a post as executive assistant to Robert T. Ross, the Assistant Secretary for Legislative and Public Affairs.

Allen has been aide to Ross since last April. Like the Assistant Secretary, he is a Republican and served for two years as Chief Clerk of the Senate Armed Services Committee.

Independent CAA

House Commerce Committee is not inclined now to act on legislation providing an independent Civil Aeronautics Administration. Rep. Oren Harris (D.-Ark.), chairman of the Subcommittee on Aviation, states that his group will probably wait—until and if—the Senate passes the measure, introduced by Sen. Mike Monroney (D.-Okla.). A companion to the Monroney bill, though, was introduced on the House side by Rep. Percy Priest (D.-Tenn.), chairman of the committee.

—Washington staff

President Seeks $8 Billion for Aircraft and Missile Procurement

Fiscal 1957 budget calls for substantial missile increase, reflects changing character of air weapons.

By Claude Witze

Washington—President Eisenhower's Fiscal 1957 budget seeks $6.8 billion for aircraft and $1.2 billion for guided missiles, the first financial manifestation of the changing character of air war and the American aircraft industry.

It is estimated that Fiscal 1956 orders will come to more than $8 billion for aircraft and about $790 million for missiles.

The decision to increase missile expenditures indicates a growing trend to unmanned weapon systems as swiftly as technology will permit.

The President's message made it clear that conventional weapons—and conventional war—are on the way out.

In addition to missiles, it gives added emphasis to nuclear weapons, nuclear-powered aircraft and nuclear-powered warships.

Budget request of the Atomic Energy Commission includes $74.6 million for work on the aircraft propulsion reactor program, substantially more than the 1956 estimate of $47.5 million and the 1955 expenditure of $22.5 million on the same project.

Total Defense Department budget for Fiscal 1957, as presented to Congress, calls for expenditures of $35.5 billion, up from an estimated $34.6 billion for the current fiscal year.

Of the 1957 total, the Air Force seeks $16.5 billion, the Navy $9.6 billion and the Army $8.6 billion. All three services want an increase over their 1956 spending, with the biggest jump—about $675 million—requested for USAF.

The President stressed in his budget message the declining importance of conventional weapons.

"Expenditures for ammunition, combat vehicles, trucks and other major equipment items," he told Congress, "will continue to decline because our requirements have now been met in large part."

Electronics Stable

For other industries, particularly in the aircraft and related fields, the budget included these prospects:

- **Procurement of guided missiles** will be the highest in history, up one-third over 1956 and double the amount for Fiscal 1955.
- **Accelerated production** will be continued on the Boeing B-52 long-range jet bomber, the McDonnell F-101 and Lockheed F-104.
- **Expenditures for electronic** equipment will be more than $500 million.
- **Navy's shipbuilding program** will continue at a slightly higher level, with emphasis on modernization of World War II vessels. Funds are sought for a sixth Forrestal class carrier, more nuclear-powered submarines, guided-missile destroyers and frigates and an experimental nuclear-powered cruiser.
- **Defense public works** projects will include more Nike antiaircraft missile sites, work on the Distant Early Warning line and air bases for both Navy and Air Force.
- **Research and development** will require spending of $1.4 billion, up about $100 million. Of the total, about $312 million will go for work on aircraft and $224 million into improved missiles. Another $150 million is sought for research and development facilities, with the Navy tripling its request, from $10 million for this purpose in 1956 to $30 million for next year.

Research Returns

On the subject of research and development, a topic of intense interest in view of recent advances in the Soviet Union, the President told Congress:

"Major emphasis will be placed on projects related to guided missiles, continental air defense, and to the application of nuclear energy for the propulsion of aircraft and ships.

"It is my belief that increased returns in military research and development can be obtained through a relatively stable program at approximately the present level which can utilize effectively our scientific and technological resources.

"Military research and development now engages a substantial proportion of the scientists and engineers employed in research and development in the nation. Care must be exercised in selecting the projects to be supported and effort must be concentrated on those of high priority."

The White House program to keep research and development at "the present level" follows Pentagon policy but is contrary to a recommendation of the Hoover Commission task force that there be a greater effort in the field of basic research.

Another sign of the administration's economy effort was seen by observers in the provision of $3.9 billion for operations and maintenance, up slightly from the $3.5 billion estimated expense in Fiscal 1956. USAF strength today is 127 wings and it is scheduled to reach 137 by June 30, 1957.

Maintenance Problem

Reports in the capital last week confirmed AVIATION WEEK's recent account (Dec. 19, p. 14) of a serious maintenance skill shortage to keep modern weapon systems in operation. Sen. Stuart Symington (D.-Mo.) former USAF secretary said reports that almost a third of the Tactical Air Command's fighters are grounded by lack of adequate maintenance bear out warnings issued in 1953 by the late Gen. Hoyt Vandenberg, then USAF Chief of Staff.

On the side of personnel, USAF will have 936,000 on active military duty when it achieves its goal of 137 wings in 1957. As of June 30, 1956 there will be 916,000 in USAF.

Missile Program

Defense Department officials disclosed that the following missile programs were being funded from Fiscal 1956 and 1957 procurement funds.

AIR FORCE

Boeing: Bomarc, surface-to-air.
Bendix: Talos, surface-to-air.
Hughes: Falcon, air-to-air.
Bell: Rascal, air-to-surface.
Martin: Matador, surface-to-surface.
Northrop: Snark, surface-to-surface.
North American: Navaho, surface-to-surface.
Convair and Martin: intercontinental ballistic missile.

NAVY

Convair: Terrier, surface-to-air.
Bendix, Talos, surface-to-air.
Sperry: Sparrow, air-to-air.
Chance Vought: Regulus, surface-to-surface.
Fairchild: Petrel, air-to-water.
Philco: Sidewinder, air-to-air.

ARMY

Douglas: Nike, surface-to-air.
Firestone: Corporal, surface-to-surface.
Chrysler: Redstone, surface-to-surface.

Total guided missile expenditures by the three services in Fiscal 1956 are estimated at $917 million with about $1.3 billion scheduled to be spent for new missile procurement in Fiscal 1957. Defense officials said about $250 million of research and development funds were earmarked for the missile program. This breaks down to $100 million for USAF; $75 million for Navy and $75 million for Army.

Key Military Aviation Programs For Fiscal 1957

Here are details on the program of the military services for ordering aircraft, missiles, electronics and related equipment for Fiscal 1957. Included are funds for overhead expenses.

Funds the services will have for placing new orders include money requested for Fiscal 1957 and residue funds appropriated for previous years.

(In Millions)

	FY 1955 (Actual)	FY 1956 (Estimate)	FY 1957 (Estimate)
AIR FORCE			
Procurement Programs:			
Aircraft, Engines, Parts	$2,490	$6,266	$5,203
Guided Missiles	501	605	1,041
Ground Communication Electronic Equipment	424	399	459
Research and Development Programs:			
Aircraft	162	177	154
Guided Missiles	83	88	46
Ammunition	23	14	9
Military Sciences	50	59	62
NAVY			
Procurement Programs:			
Aircraft, Engines, Parts	2,306	1,772	1,749
Guided Missiles and Target Drones	72	184	173
Training Equipment	16	22	14
Aircraft Modernization	19	77	37
Ground Electronic and Detection Equipment	19	36	27
Research and Development Programs:			
Aviation	164	186	182
MARINE CORPS			
Procurement Programs:			
Ammunition and Guided Missiles	112	174	96
Electronics and Communication Equipment	16	31	30
ARMY			
Procurement Programs:			
Ammunition and Guided Missiles	1,267	849	981
Research and Development:			
Aircraft	8	17	19
Guided Missiles	68	95	79

Here are some other facts on the strength of the armed forces as disclosed in connection with the new budget:

- **Of its present 127-wing strength,** USAF has 114 combat and 13 troop carrier wings. On June 30, 1957 it will have 137 wings, 126 combat and 11 troop carrier. Active aircraft inventory now probably is about 25,000 and will hit 26,736 when the 137 wings are complete.
- **Navy's air strength** will remain steady at 17 air carrier groups but the number of carrier anti-submarine squadrons will grow from 19 to 31 between now and June 30, 1957. The number of marine aircraft wings will remain constant at three. Total Marine and Navy personnel today is 870,000. By the end of Fiscal 1957 it will be 868,958. The number of warships will be increased from 403 to 411, aircraft from 12,548 to 12,576.
- **Active Army personnel** will remain constant in Fiscal 1957 at a little over 1 million. The active aircraft inventory will shift slightly from 3,534 to 3,954. While the Army is expected to spend about $110 million on aircraft in Fiscal 1957, the service is not requesting any new obligational authority.

Wilson's Views

By the end of Fiscal 1957, both USAF and the Navy will be almost entirely converted to jet aircraft for combat purposes. The procurement program will provide about 1,500 new planes for Navy and 1,900 for USAF.

Further facts about the Defense Department program were given to the Senate Armed Services Committee by Secretary Charles E. Wilson:

- **Air defense squadrons,** already jet equipped, will receive "substantial numbers" of supersonic aircraft. The number of interceptors equipped with Falcon air-to-air guided missiles will be "substantially increased." A "number" of B-36 Strategic Air Command wings will convert to B-52s during the year.
- **The Navy will convert** 10 more ships for radar picket duty in the continental defense system and will commence conversion of five more light cruisers and one more submarine to guided missile armament and one escort carrier to a helicopter assault ship.
- **The conversion** of one infantry division will increase the number of airborne Army divisions to three. The new division will engage in special experiments with new organizations, tactics, and weapons.

"An increasing number" of Army anti-aircraft battalions will be converted from guns to Nike guided missiles.

CAA Budget

A record $202,618,000 budget has been requested for the Civil Aeronautics Administration for the fiscal year 1957, with the major emphasis on expansion of the traffic capacity of the Federal airways system. The request is approximately $40 million more than the appropriation for this fiscal year.

The big increase in the CAA budget is in funds for the establishment of air navigation facilities. The new figure is $40 million, an increase of $24 million. President Eisenhower said such an appropriation, for installation of greatly improved air navigation and traffic control facilities, will be a step in meeting the immediate problem of serious traffic congestion.

"In addition to the expenditures to expand the capacity of the airway system, expenditures for operating the present airway system must rise substantially to handle the expanding traffic, to operate new facilities provided under previous appropriations, and to take over from the Department of Defense the costs of operating certain radar installations serving common military-civilian needs," the President said.

At the same time, President Eisenhower endorsed the report of the Bureau of the Budget on Aviation Facilities (AW Jan. 16, p. 26). He said:

"To keep pace with further advances in aviation, I shall shortly initiate a comprehensive study of the nation's long-range needs for aviation facilities.

"This study will take into account both civil and military needs to avoid costly duplication of equipment and systems. I shall expect it to point the way to the development, installation and operation of the most efficient and economical air navigation system within

Aircraft and Related Procurement Funds

(In Millions)

	New Money			Expenditures		
	FY 1955	FY 1956	FY 1957 Request	FY 1955	FY 1956	FY 1957
Air Force	2,760	6,283	5,800	6,959	5,988	6,107
Navy	1,973	912	1,738	1,835	1,775	1,800

the capabilities of our technology."

Major projects in the $40 million request for air navigation facilities are:

- **Increased radar** for traffic control.
- **Expanded communications capacity** in control towers and centers.
- **Additional VHF radio ranges** to provide multiple airways.
- **Procurement of five** transport class aircraft (Convairliners) for improved flight inspection of navigation facilities.

The increased budget is part of CAA's newly developed installation program for the period 1957 through 1961 (AW Nov. 14, p. 141). The five-year program, approved by the Air Coordinating Committee, is designed to provide facilities needed to meet current and future demands on the airways system.

CAA's share of air navigation development, which is administered by the Air Navigation Development Board, has been set at $2 million, or double the current appropriation.

ANDB's major emphasis in 1957 is to be placed upon air traffic control aids, with $1,290,000 allocated to this activity. Other research and development activities on airways facilities—systems engineering and air navigation—also will be doubled.

The operation of CAA has been budgeted for $128,500,000, which is an increase of $21,750,000. Part is to provide for an additional 1,600 employes.

Largest program in the operation category is the Federal airways. The budget for this function has been increased to $111,099,000. The additional funds are required for three reasons:

- **Greater workload** resulting from increased traffic.
- **Operation** of new facilities.
- **Operation** of traffic control facilities formerly financed by USAF and Navy.

Operation of the Office of Aviation Safety is programmed at $13,688,000 and administration of airport aid is set at $3,713,000.

An appropriation of $30 million is requested for the airport aid program, which is an estimate of what will be needed to liquidate obligations incurred.

In Fiscal 1956 grant funds authorized totaled $62.5 million. It is estimated that grants-in-aid for airports will rise to $75 million in 1957 and expenditures will be $50 million.

Civil Aeronautics Administration

(In Millions)

	FY 1955 (Actual)	FY 1956 (Estimate)	FY 1957 (Estimate)
Administration/Operation			
Airways	90	99	111
Safety	13	14	14
Airports	2	3	4
Establishment of Air Navigation Facilities and Contract Liquidation	5	23	40
Grants-In-Aid for Airports and Contract Liquidation	22	27	30
Washington National Airport and Alaska Airports	2	6	2
Air Navigation Development	1	1	2
TOTALS	131	164	202

Civil Aeronautics Board

Appropriation Request	48.9	52.5	20

National Advisory Committee For Aeronautics

(In Millions)

	FY 1955 (Actual)	FY 1956 (Estimate)	FY 1957 (Estimate)
Administration	51.5	59.8	64.7
Construction:			
Aerodynamic Research	6.8	4.4	6.5
Powerplants Research	.9	6.3	7.8
Aircraft Structural and Operating Problems Research	3	1	1.2

CAB Budget

Budget proposals for the Civil Aeronautics Board show a dramatic decline in subsidy needs and a slight increase in administrative funds.

In his message to Congress, President Eisenhower attributes the subsidy cuts to rising profits of the carriers and continued CAB vigilance in keeping subsidy rates at the lowest possible level.

Subsidy payments to the carriers will amount to about $34.4 million in Fiscal 1957. The $20 million appropriation request will be supplemented by more than $14 million in funds carried over from previous appropriations.

The budget allocates $4.7 million to the Board to pay salaries and expenses. This amount is a slight increase over the current appropriation of $4.125 million, which will be increased this year with a supplemental appropriation request for $270,500.

Payments to most classes of carriers are estimated at about the same in Fiscal 1957 as they are in the current fiscal year. The exceptions are transatlantic and transpacific operations where substantial subsidy cuts have resulted in a reduction of total payments.

NACA Budget

The National Advisory Committee for Aeronautics is asking $64.7 million for salaries and expenses in its Fiscal 1957 budget, an increase of about $4.5 million over Fiscal 1956, and $15 million for construction, an increase of about $2.5 million over Fiscal 1956.

NACA's construction request provides for new facilities at Langley and Ames Laboratories for research in the problems of flight at hypersonic speeds, and the modernization of two existing wind tunnels at those laboratories. Additions will be made to the propulsion systems laboratories at Lewis Laboratory to permit research under higher altitude conditions and utility improvements for handling combustion waste products. Amount to be obligated is $6.8 million at Langley, $935,000 at Ames and $7.8 million at Lewis.

Vought's Crusader Design Meets Navy's High Performance Criteria

By David A. Anderton

The best possible aerodynamic performance was one design criterion for the Chance Vought XF8U-1 Crusader. Navy requirements for high rate of climb, extreme altitude capability and level-flight supersonic speed dictated that the company pull out all the aerodynamic stops.

The carrier-based design, already capable of speeds in excess of 1,000 mph., has benefited greatly from extensive transonic testing in the tunnels of Cornell Aeronautical Laboratory and the National Advisory Committee for Aeronautics.

The F8U Crusader is now in production at the Vought plant in Dallas, Tex. Final payoff for the hours of intensive design and development has been announced in the President's Fiscal 1957 budget message: ". . . There will be substantial procurement of the Navy's new supersonic F8U."

These specific advanced aerodynamic features characterize the Crusader:

- **Area-ruled fuselage,** contoured by an extension of the simple transonic theory developed by Richard T. Whitcomb of NACA's Langley (Va.) Laboratory.
- **Variable-incidence wing,** for high lift during approach and landing.
- **Low-slung horizontal tail,** to counteract pitchup tendencies of the airplane under high angle-of-attack conditions.
- **Large vertical tail,** to insure ample directional stability at high speeds.
- **Mid-span aileron controls,** to minimize torsional deflections in the thin, swept wing.

Basic formula for the Crusader was high power, light weight and low drag. Vought designers chose the Pratt & Whitney J57-P-4 engine with afterburner as the powerplant, and designed around it a lightweight airframe with every aerodynamic feature carefully selected for optimum performance.

The Crusader's wing is of low aspect ratio, very low thickness ratio—approximately 5%—and about 40-deg. sweep. It is high-mounted on the fuselage and has a small amount of negative dihedral for improved lateral stability.

Outboard panel of the wing, which folds upward for carrier storage, has a leading-edge extension. Purpose of this feature is to generate a vortex; at high angles of attack, the inboard edge of the extension sheds a vortex which sweeps the wing behind it clear of boundary layer and delays tip stall.

Ailerons are mounted inboard of the outer panel, to reduce torsional deflections and the possibility of aeroelastic effects on the thin wing. The entire leading edge of the wing seems to act as a droop-snoot flap.

Fuselage of the Crusader was laid out by the area rule procedure to obtain an optimum fineness ratio and area distribution. Contouring of the plane is not as apparent as it is on the Convair F-102A or the Grumman F11F-1. This is because of the aircraft's rectangular cross-section and the particular conditions for which the area rule was applied.

An underslung jowl inlet for the J57 is hung under the Crusader's nose. Ducting runs aft under the pilot's floor to the engine, mounted above the landing gear well.

With no room in the wings to store fuel, all tankage in the XF8U is in the fuselage ahead of the engine.

Sections of the rear and middle fuselage around the powerplant installation are fabricated from titanium alloy for strength and lightness at the high temperatures found in those two areas.

Fairings for four cannon are mounted in pairs on either side of the fuselage nose just below the cockpit. Presumably these are for the standard Navy armament of four 20-mm. rapid-fire cannon, although other cannon under development may replace these at a later date. It is reasonable to assume that the Crusader will also carry air-to-air missiles.

Cockpit layout and detail design follow current Navy ideas and practice. The ejection seat is a lightweight unit built by Chance Vought and adapted from the Douglas Aircraft Co. design used in the A4D Skyhawk.

Approximate dimensions for the Crusader are: length, 58 ft.; height to tip of vertical fin, 18 ft. Maximum depth of the fuselage is about seven feet and the wingtips clear the ground by six feet.

Obligation Status

Air Force's schedule calls for the letting of aircraft and related procurement contracts at a record rate of $1 billion monthly during the last seven months of Fiscal 1956—from December through June.

The annual budget calls for USAF obligations for aircraft procurement of $6.9 billion during Fiscal 1956. During the first five months, cancellations exceeded new obligations by $273 million. This makes a total of $7.1 billion for the seven following months.

USAF had $10.9 billion in unobligated aircraft procurement funds on hand, as of Dec. 1.

Navy's obligations for aircraft and related procurement totaled $414 million during the first five months of Fiscal 1956, an average rate of $83 million monthly. To meet its program calling for obligation of a total of $2.1 billion during Fiscal 1956, Navy would be required to obligate $1.7 billion during the December-through-June period, or at an average monthly rate of $240 million, almost three times the rate during the first five months.

Navy had $3.8 billion in unobligated aircraft procurement funds on hand, as of Dec. 1.

Final Tests for SAGE

Lexington, Mass.—Final evaluation tests on a "little SAGE system," prototype of a proposed nation-wide network of 32 automatic data processing centers designed to greatly increase U. S. air defenses, should be completed here this summer.

This was disclosed as the Air Force partially lifted the wraps on the SAGE (Semi-Automatic Ground Environment) system and the Massachusetts Institute of Technology's Lincoln Laboratories, which headed the development of the multi-billion dollar air defense network under joint Army-Navy-USAF sponsorship. The scope of the task, and the number of large industrial firms participating, give the SAGE program a resemblance to the World War II Manhattan project which developed the atomic bomb.

First production prototype of the large digital computer, which forms the heart of the SAGE system, is presently undergoing shake-down tests here as part of "little SAGE," called the Cape Cod System, consisting of a long-range radar and smaller gap-filler radars, each of which automatically transmits its data to the computer.

A detailed report on the SAGE system and how it operates will appear in next week's issue of Aviation Week.

Boeing Appeals Renegotiation Ruling, Criticizes Board Action

Seattle—Boeing Airplane Co. will appeal to the U. S. Tax Court the renegotiation Board's determination that $9,822,340 must be refunded as excessive profits from 1952 earnings.

Boeing contends that the net refund after taxes should be $2,950,000, and that a projection of the Board's findings would result in total refunds of about $7 million for 1953 and 1954 combined and no refund for 1955.

J. O. Yeasting, Boeing vice president-finance, said the Board's determination is not consistent with the Renegotiation Act and is not supported by the facts and reasons the Board furnished the company.

Net Worth Emphasis

Yeasting was critical of the Board's emphasis on net worth.

"In the opinion of Boeing management," he said, "the 'return on net worth' criterion for evaluating reasonableness of earnings was the controlling factor in the Renegotiation Board's determination. This criterion, as used in the renegotiation process, is merely a statistical computation of the return (earnings) realized on book net worth and does not measure the reasonableness of the price of articles furnished the Government. Further, it in no way gives consideration to the efficiency of contractors or their contribution to the defense of the nation."

Boeing's 1952 earnings, Yeasting said, represented only a return of 2.28% on sales and after renegotiation this was reduced to 1.89%. A net return of 5 to 6% on sales was realized by the manufacturing industry generally. He said the earnings before renegotiation were well within the profit framework established at the time the contracts were negotiated with Government procurement authorities.

Yeasting warned that the Board's determination, if sustained and indicative of the future determination pattern, may seriously affect Boeing's ability to go forward with planned facilities expansion and research and development programs.

Air Force has strongly urged the aircraft industry to finance a substantially greater portion of its facility and research needs.

The Boeing official said the 1952 earnings were reasonable under all renegotiation concepts. A sizeable portion of Boeing's earnings were due to fixed price contracts with incentive provisions.

"A determination of excessive profits, when efficient, economical, on-schedule production has been demonstrated, and the Government has been furnished a quality product at a reasonable price is not consistent with the intent or objectives of incentive contracts," Yeasting said.

Damage to Incentive

"If the board's action is allowed to stand, it will deprive the company of the entire amount which was specifically earned in 1952 as a reward for efficient cost performance on incentive contracts. Also, it will go far in removing the element of incentive which is so important to the American way of doing business.

"It does not appear desirable, in the light of the overall objective of obtaining more defense per dollar, to destroy incentives that invariably lead to lower prices to the Government," he said.

Nuclear Power, ICBMs Top Industry Problem

Washington—Most pressing aeronautical problems are those associated with nuclear power for aircraft and the intercontinental ballistic missile, National Advisory Committee for Aeronautics said in its 1955 annual report.

"Indeed, our national security may well depend on the intensity and competence of our research to solve such problems," said Dr. Jerome C. Hunsaker, NACA chairman.

"There is evidence to indicate that our present position of leadership in the air has been challenged by a potential enemy. To maintain, at manageable cost, the necessary air power of requisite quality demands continuous research to anticipate the requirements of tomorrow's weapons," he said.

Highlighting progress made during the past year, the annual report singled out the area rule contribution of Richard T. Whitcomb, of the NACA's Langley (Va.) Laboratory staff.

Research programs of the past year were largely concentrated on solving in a practical manner the scientific problems of supersonic flight. "Application of the new knowledge has been dramatically successful in some important instances," Hunsaker said, "but the unknown is still of vast extent."

In aerodynamic research, stability and control have continued to take a large share of the research scientists' time. Increased use of ground and flight simulators and electronic computers has supplemented wind tunnel and flight test studies of the stability parameters.

On the other side, new and improved theoretical and analytical techniques have aided the estimation of acrodynamic information.

In propulsion, NACA is studying families of aircraft engines using chemical and nuclear fuels. Piled on this program is a number of current studies aimed at improving the performance of engine-aircraft installations. The general problem is one of finding solutions to the problems of lightweight, high-thrust engines of high efficiency.

In structures, NACA is working in the major areas of structural safety. Increases in airplane performance have accentuated the importance of choosing the right materials to withstand both the loads and the temperatures of high speed flight.

". . . With each advance in speed, problems requiring scientific investigations multiply, become more complex and difficult, and their study and solution more costly. The potential advantages to the cause of world peace if America first solves these problems are obvious," the report said.

Red Gains Threaten 'Deterrent Force'

Gen. Power, ARDC chief, warns of 'very real danger' that Red advances could put U. S. 'at their mercy.'

LT. GEN. THOMAS S. POWER

New York—The "real and immediate" threat that Soviet technological advances will leave the United States at Russia's mercy, wiping out the advantages of our current deterrent force, is today's major concern of the U. S. Air Force.

Lt. Gen. Thomas S. Power, chief of the Air Research and Development Command, in one of the strongest statements on the subject delivered by a USAF officer since Russia demonstrated vast aeronautical advances in 1955, said last week at a National Security Industrial Assn. meeting that:

"The problem is no longer obscure to us, for the Soviets have brought it to the attention of the world during their air shows and by the recent explosion of a very potent nuclear weapon.

"They have chosen to enter the race for technological supremacy of the world—a race into which we have been forced by necessity."

Gen. Power said it is typical of the American way that we are developing weapons only to deter a potential aggressor "by this show of force" but emphasized that the security gained this way "is an uneasy one."

'At Their Mercy'

He said emphatically that the United States has used qualitative superiority to maintain "security by deterrent force." He is confident we still have this superiority in most fields.

"But," he declared, "there is every indication that the Soviets—the principal threat to our security—are making every effort to not only catch up with us but to surpass us. With both quantitative and qualitative superiority on their side, we would lose the protection of the deterrent force and be at their mercy.

"This danger is very real and immediate as the following considerations will show. First of all, the Soviets have several advantages in their current effort to establish technological superiority over this country. In comparison with the United States, they can allot a far greater portion of their national income for military spending. In a purely financial sense, our military budget could well be larger than that of Russia but the real difference is that ours probably goes much more for pay, maintenance, etc, than does theirs. However, they can allot vast resources to technological developments without prior approval of the public. They can control labor and dictate to industry in a manner which the free world finds impossible and undesirable.

"Through application of these methods, the Soviets have attained some rather remarkable results since World War II. They have not only managed to maintain their air force and their military production for military purposes, but they have even increased the rate of their military spending. While the Soviets recently announced an ostensible 8 to 10% decrease in their 1956 military budget, our experts believe this does not include 'hidden figures.'

"In the period of 1945 to 1947, they have made significant technical progress, particularly in the development of jet fighters and fighter-bombers. Hundreds of single-jet Heinkel 162s, twin-jet Messerschmitt 262s and rocket powered Messerschmitt 163s—all highly advanced aircraft—became available to the Soviets when Germany surrendered. These models were exploited by able Soviet designers, including such men as Mikoyan, Gurevich and Ilyushin.

"In addition, the Soviets captured thousands of skilled technicians from Luftwaffe ground units and put to effective use their knowledge, together with information furnished by many of the leading aeronautical engineers of Germany who were enticed or compelled to work in Soviet aircraft factories. Nor should it be overlooked that they received a great deal of valuable equipment from us during the Lend-Lease program.

Gains Recorded

"Early in 1947, the Soviets put into their squadrons the first jet plane, the Yak-15. This was a conventional Yak-9 with a German JUMO jet engine of 2,000 lb. thrust.

"By the summer of 1947, the Soviets were furnishing their squadrons with the first jet fighter designed and produced by native talent—the MiG-9—which was equipped with two German BMW jet engines and intended for use in ground attack missions.

"In the period of 1948 to 1950, the Soviets made great strides in the development and production of jet engines, and began to close the technological gap that had existed between the East and the West. There were, in particular, these three developments: One, exploitation of the British Nene jet engine, a number of which had been sold to the Soviets; two, advances in the field of metallurgy, possibly aided by analysis of the turbine blades used in the Nene; three, development and production of the MiG-15.

"In 1953, the Soviets brought out a new interceptor, Fresco (MiG-17), and continued work they had already started in the improvement of their bomber capabilities. Today, their air force represents a formidable threat against this country as the following review of their record will show:

Largest Fighter Force

"They have built up their fighter force, from a few thousand conventional aircraft in World War II, to the largest fighter defense force in the world, completely jet-equipped.

"They have built an imposing fleet of modern conventional bombers; are rapidly equipping their light bomber and reconnaissance wings with modern jet aircraft, and have medium and heavy jet bombers which can be compared with the most advanced aircraft we possess.

"They have made progress in the field of electronics and appear to be closing the gap between Soviet and Western technology in this field.

"They have exploded both atomic energy devices and a device employing a thermo-nuclear reaction, the former in 1949—much earlier than we expected, the latter only four years later—an interval less than that between the first atomic and thermonuclear explosions in the U. S.

"They appear to be making progress in the development of long-range missiles to supplement their long-range bomber force.

"They have cut the lead-time required for aeronautical development by exploiting four basic concepts of opera-

tion unique to Soviet philosophy and policy:

"First, their development program is dictated solely by military expediency, with complete disregard for the principles of democracy and the requirements of a free economy. Therefore, they can—and do—make unilateral decisions at the highest level, without fear of political consequences.

"Second, they can devote any desired amount of their budget to their military program.

"Third, their policy is to design one weapon for one specific purpose, without the attention we give in this country to safety and durability features.

Soviet Initiative

"Fourth, the Soviets definitely hold the initiative in starting another war and, therefore, are free to concentrate their efforts on specific programs required by their war planners. On the other hand, U.S. policy is to avoid war and to protect ourselves against aggression. Therefore, we must maintain a wide variety of development and procurement programs to provide protection against many different eventualities.

"Additional factors in the Soviets' technological advancement are the education and training of their scientists and technicians; the awards conferred for success in scientific research and development, and the penalties imposed for failure.

"The emphasis on technical training starts in the kindergarten. Textbooks are slanted to condition the boy into the Soviet state fabric. Strong emphasis is placed on the study of mathematics, physics and chemistry. In his formative years, the boy is influenced by the prestige built around successful scientists. When he has reached 17, he has little choice in his future, for it has already been decided upon by the state.

"Since his principal subjects in the lower schools have been those most helpful to science, his entry into the technical field is a foregone conclusion if he shows any promise at all. Although higher education costs money even in Russia, state grants, scholarships and bonuses for outstanding students are generous where the state can be best served.

"The student's incentive to study hard and well is based on the prospects for prestige, awards and many other advantages if he succeeds, and his dismal future if he does not.

Excellent Training

"The quality of Soviet professional training in scientific, technical and applied fields is quite comparable to ours, as pointed out by Nicholas DeWitt of Harvard University, in his recent book "Soviet Professional Manpower." While the American engineer generally obtains his B.S. in four years, his Soviet counterpart spends from 5 to 5½ years in intensive training to reach a similar professional level. He is also required to be proficient in reading foreign languages.

"According to Dr. John R. Dunning, dean of Columbia University School of Engineering, the Soviet Union produced as many Ph.D.'s in 1953 as the United States. But while U.S. degrees were 2.3 to 1 in favor of the humanities, Soviet degrees ran 3 to 1 in favor of science and engineering!

"How does this emphasis on technical training compare with our own program? From 1940 to 1948, the curve of training in the engineering field in both countries was on a fairly even keel. We forged ahead in 1950 when an all-time high of 50,000 engineers was graduated. This spurt was due, in a large measure, to the GI bill for government-subsidized education.

"This figure has dropped each year since then, going to a low of 20,000 last year. At the same time, the training of engineers in the Soviet Union has gone in the opposite direction. In 1950, they graduated 28,000 engineers, and the increase in the last four years has been phenomenal. They graduated 40,000 in 1953, and 54,000 in 1954! At present, they are graduating two and one-half times as many engineers as we do. Records reveal that the Soviets now have 685,000 graduates employed in the physical sciences and engineering fields. Of these, 85,000 are engaged in research and training, leaving a total of 600,000 persons trained in the physical sciences and engineering fields in the Russian economy. In addition there are 90,000 biological scientists engaged in research and training, who, when added to the 85,000 cited above, give a total of 175,000 scientists engaged in the field of research and training. We now have a total of about 650,000 engineers and some 200,000 other scientists.

"In this race for brain power and technological leadership, the Soviets are undoubtedly challenging our technical and scientific domination. The big question is: can they reach and surpass us both quantitatively and qualitatively in the field of trained manpower? If present trends persist, there appears to be little doubt that they can pass us in the quantity of engineers produced—possibly in the near future.

Incentive Is Money

"As to quality, recent events prove convincingly that the Soviets lack neither the intelligence nor the scientific know-how to build intricate modern weapon systems. For instance, the Soviet jet bombers displayed in formation strength over Moscow last July included four-jet heavy bombers comparable to the eight-jet B-52, our most advanced heavy bomber, and medium twin-jet bombers comparable to our six-jet B-47. The smaller number of engines in the Soviet bombers permits the conclusion that they have developed unusually powerful engines.

"In line with other aspects of their overall strategy, the primary purpose of the Soviets in the brainpower race must be to first reach and then surpass us in the production of scientists and engineers essential for achieving technological supremacy. Is it unreasonable to assume, then, that they will insist on quality as well as quantity? The Soviets do not underestimate the quality of our science and technology.

"Ironically, the so-called classless state runs its incentive system on money. Monetary incentives are the strongest single motivating force in Soviet industry and research and development. Top Soviet scientists and managers today derive as much as 50% of their total income from a bonus system that is without parallel. The fact that we have outstanding scientists today must not lull us into a state of complacency for we must continually press for better educational programs in developing new scientists.

"It becomes increasingly obvious that, in a conflict involving nations thousands of miles distant from each other, technology will supplant manpower as the measure of force. It can work for us as well as for the Soviets. It can restore and maintain military balance. In the Soviet strategy, the objective of gaining a technological level with the United States must run concurrent with the objective of reaching and surpassing our strategic air power if they are to gain freedom of action for their nuclear air forces.

Rapid Pace

"In a war with the United States, they must prepare for a war that must be launched across the oceans. No precedent exists for such an operation. Their problems are numerous. Gaining freedom of action in such a war would be a gigantic undertaking but, if needed to carry out their global plan, the Soviets would undoubtedly attempt it. This requires, first, that they equal and then exceed our stockpile of nuclear weapons and our capability to deliver them, and second, that they develop an intercontinental missile that is capable of neutralizing our strategic and industrial forces.

"This, then, is the situation as it now stands. The problem is no longer obscure to us, for the Soviets have brought it to the attention of the world during their air shows and by the recent explosion of a very potent nuclear weapon. They have chosen to enter the race for technological supremacy of the world—a race into which we have been forced by necessity.

"The Soviets are progressing at an extremely rapid pace in this race because they realize that only through superior technical achievement can they create a striking force capable, not only of effective attack on the U.S., but of an effective defense against the retaliatory power of the U.S. as well. For the Soviet Union, the finish line of this race is world domination; for the United States and the rest of the free world, the finish line is survival in freedom.

"In the light of these sobering facts, we must make an all-out effort to maintain our still existing technical predominance. To achieve this vital end, we must continue our study of facts and estimates concerning Soviet capabilities; keep our knowledge up-to-date; estimate future developments within the Soviet Union and its satellites.

"Next, we must plan our research and development program in the light of this information and these estimates. And we must devote this program as far as possible, to the development of specific weapons to meet any of the enemy's specific weapons of the future.

"Further, we must improve our research and development capabilities by improving our educational and training programs, and by attracting the best available talent to our scientific and research efforts. Like the Soviets, we must stimulate the desire for scientific careers in our youth, and we must erase from their minds the pathetic picture of the impractical dreamer whose only rewards for accomplishment are the plaudits of other dreamers. Instead, we must create the picture of a 'Davy Crockett' of science, the modern pioneer fighting on the frontiers of human knowledge.

"Thanks to our industry, and to our scientific and educational institutions, we still possess qualitative superiority both in military technology and scientific brain power. However, every time we make an important technological break-through, it takes the Soviets less and less time to catch up with us. To the best of our knowledge, they still have fewer scientists and engineers than we have, and ours are probably, in general, more experienced and seasoned than theirs. But, in a few years, they may have larger quantities and, if there is no increase in the level of our research and development effort, they may eventually challenge our position of qualitative superiority.

Intangible Asset

"It is the job of all of us to see to it that this will never happen. For our very existence would be threatened if the Soviets would possess technological supremacy, coupled with an unprecedented combination of dictatorial powers, of practically inexhaustible resources in manpower and materiel, of fanatical determination for world domination, and of vast numbers of ultimately seasoned and experienced scientists.

"In spite of these disturbing facts, however, there is still no reason to fear that, some day in the future, we are bound to lose either our qualitative superiority or our 'security by deterrent force.' We still have one intangible asset which, so far, no other nation has been able to steal from us or copy; the asset which has made ours the most prosperous and advanced country in history—our 'creative superiority.'

"Many countries possess some typical national talent, engendered by geographical, ethnological or historical factors.

"The Swiss, for generations, have retained their superiority in watchmaking; the Germans have excelled in photographic equipment, the Swedes in the manufacture of steel, the Italians in music. We have remained unsurpassed in what is known the world over as 'Yankee ingenuity.'

"Some mysterious forces within the American always makes him create something radically new, fantastically big or tremendously far-reaching. Taking the scattered ideas of abstract scientists, he did not hesitate to pour billions of dollars and vast resources into the most ambitious project ever attempted by man: The harnessing of atomic energy. Starting with a primitive carriage, he created the billion-dollar automotive industry, permitting almost everyone to own a car. Creating the principle of mass production, a sound system of time payments, and the art of convincing advertising, he has made it possible for the average person to own things which, in any other country, are expensive luxuries attainable only by the rich.

Industry Challenge

"It is this same 'Yankee ingenuity,' this willingness to try anything and this flair for doing things in a bigger way than ever done before, which I am counting on to maintain our 'creative superiority.' This means that the new weapons which we develop should not merely be better in quality but so radically advanced in concept and design that they give us technological superiority for a limited period of time, that is, until the enemy can make copies of them.

"I am convinced that we can remain ahead of the Soviets in the development and production of new weapons. By continually advancing the state of the art and by an aggressive development program utilizing the latest findings of basic research, we can maintain creative superiority indefinitely and, thereby, maintain 'security by deterrent force' for as long as is needed. And we can do so within the limits of our economic capability and without resorting to Soviet methods of operation.

"To achieve these ends, we must assure a satisfactory level of qualified scientists and engineers, and employ their talents as effectively as possible, backed by enlightened management. We must rely on industry to continue and even expand their excellent programs of financing higher education for promising and deserving employes. Last but not least, we must expect industry to assume a larger share of the research and development burden. In a free economy such as ours, it is of far greater mutual benefit, in the long run, to spend private capital for the development of commercial products which have military possibilities, than to let the Government pay indefinitely for the development of military products which have commercial possibilities.

"We must have greater cooperation between our Government and industry. Our American youth must be given

No Defense Change

Gen. Thomas S. Power, in his speech before the National Security Industrial Assn., makes it clear that the true nature of the Russian threat in the field of technology was made obvious in 1955 through Soviet air shows and nuclear explosions.

His statement was made one week after Defense Secretary Charles E. Wilson told the Senate Armed Services Committee:

"The defense program we are proposing for Fiscal 1957 is not fundamentally different from that outlined to your committee last year.

"Essentially, it is a further development of the same policies and concepts which have guided our defense program for the past several years.

"Nothing has occurred in the international situation during the past year which would indicate the necessity for any major change in these policies and concepts.

"The present defense program was designed to meet our security needs over a long period of time.

"Development of a sound, long-term security requires that we design our forces so as to assure a steadily increasing efficiency, in step with scientific advances but characterized by a stability which is not materially disturbed by every propaganda effort of unfriendly nations or wishful thinking on the part of ourselves or our allies."

greater inducements to enter the scientific field, thereby providing us with larger numbers of young scientists. To maintain our lead in this field will cost money. But if we do not face up to the reality that Russia is fast closing the gap, we may soon be outdistanced by them in the race for technological supremacy.

"The final question, then, is: if the Soviets may conceivably surpass us in quantity, why should they not, some day, challenge our "creative superiority" in spite of everything we may do to prevent it? I am confident that they never will, because the art of creation presupposes a state of mind, an atmosphere of work, an attitude toward fellow men, which are as foreign to Soviet philosophy as theirs is to ours.

"True creation is a reflection of the country, of the people, of the very way of life as it can exist only in a free society. It is for this reason that the free industrial nations of the world have by far higher standards of living than the Soviets and their satellites.

"Thus, the outlook is grave but not hopeless. As long as we recognize and face the facts, and act accordingly; as long as we work together as a team in maintaining technological superiority; and as long as we can and are willing to pay the price for "security by deterrent force," we have nothing to fear. For the day is bound to come when even the most ruthless aggressor must recognize the senselessness and hopelessness of the race for military supremacy and, yielding to the demands of his exhausted and disillusioned people, will concede defeat.

"It is then, and only then, that we no longer need 'security by deterrent force.' Because there will be a far less costly and far stronger security in its stead: the security created by the mutual trust and friendship among all the nations of this world."

Temco Develops Primary Trainer for Export Market

Dallas—Temco Aircraft Corp. has developed a single-engine flight and armament trainer designed for the foreign military market. The company designation is Model 58.

The new plane is a two-place, low-wing, all-metal monoplane powered by a 340-hp, Lycoming GSO-480-A1A engine. It has a tricycle landing gear and power-driven bubble canopy.

Without armament the 58's gross weight is 2,993 lb.; service ceiling is more than 25,000 ft.; cruising speed 174 knots; range 485 nautical miles.

The trainer can carry a variety of armament. There is provision for the installation of two 50 or 30 caliber machine guns, two napalm bombs, two 100-lb. bombs and 16 rockets.

Defense Rejects Hoover Proposal To Merge Assistant Secretaries

Washington—Department of Defense has rejected the recommendation of a Hoover Commission task force that it combine the offices of the Assistant Secretaries for Research and Development and Applications Engineering.

In comments on the Hoover Commission report on research and development (AW June 6, 1955, p. 15) the Defense Department also declares there is no reason to increase the present $20 million level of annual spending for basic research.

The Commission's task force said it considered the $20 million rate inadequate because "the tempo of progress in weaponry technology is limited by availability of new basic and applied scientific knowledge."

The Defense Department replied that it actually spends more than $20 million a year on basic research because a substantial amount of this work is supported through applied research and weapons system contracts.

'Too Early'

It added that the Department "plans a moderate increase in the level of support of such basic work in its Fiscal 1956 program. Moreover, this field will be continually reviewed in order to obtain the maximum contribution to our long-range applied research and development projects."

On the task force's recommendation that the offices of two assistant secretaries be combined, the Department argued in effect that it is too early to declare—as the task force did—that the present setup is unsound.

It pointed out in its comment that Joint Coordinating Committees have been created to combine operations of the Research and Development and Applications Engineering offices.

Since the task force's study, the Department continued, "the Secretary of Defense has strengthened the Applications Engineering operations by delegating to the Assistant Secretary (Applications Engineering) responsibility for recommending action on apportionment and reprogramming requests to obligate production and procurement funds . . . including requests for product improvement projects."

The Department says no further changes should be made until these modifications have been tried and that, "in any event, the two separate offices should be preserved."

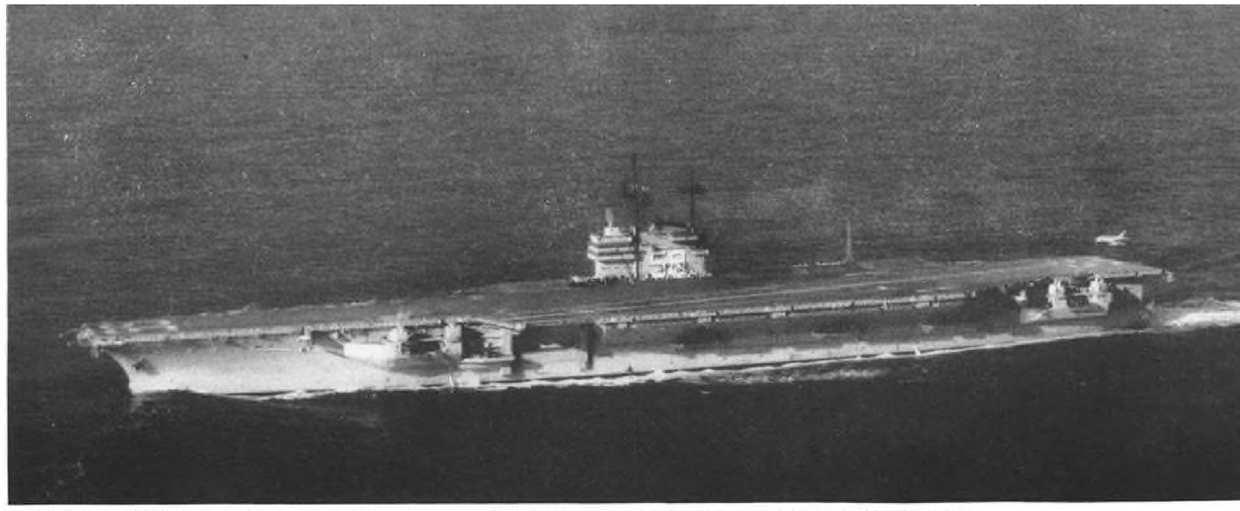
Present Assistant Secretary for Applications Engineering is Frank D. Newbury. His counterpart for Research and Development is Dr. Clifford C. Furnas, who replaced Donald Quarles when the latter became the Secretary of the Air Force.

Research Comments

In all, the Hoover Commission task force made 15 recommendations, most of which the Defense Department did not find objectionable. However, in its comments, these observations were made on the research and development study:

- **The Secretary of Defense** is using his authority over funds to make sure that research programs are properly integrated and to prevent duplication of effort.
- **The Assistant Secretary for** Research and Development will appoint a standing committee to "canvass the needs and opportunities presented by new scientific knowledge for radically new weapons systems."
- **Action is being taken** to shift the weapons system evaluation program to a contract operation in order to get a more adequate staff. However, the department will maintain a small weapons system evaluation group to take care of responsibilities that cannot be contracted.
- **The Army is seeking** a new Assistant Secretary for Research and Development. (William H. Martin now is serving as Army's Director of Research and Development). The duties of the Assistant Secretary of the Navy for Air (James H. Smith, Jr.) have been lightened to give him time for greater emphasis on research and development.
- **The Department does not believe** "all" research and development and design can be best performed by civilians, except when that work will lead to production. The program will be examined and projects shifted to industry if they can be performed there more effectively.
- **Policies will be reviewed** where they have a bearing on the careers of military officers in research and development. Improved stabilization of some personnel is desirable, but officers still must not be so isolated that they get out of touch with operating problems.
- **Higher salaries** for civilian scientists and engineers have been endorsed by the department.
- **Armed Forces Special Weapons** Project soon will get responsibility for guiding the Atomic Energy Commission in its work on new weapons.

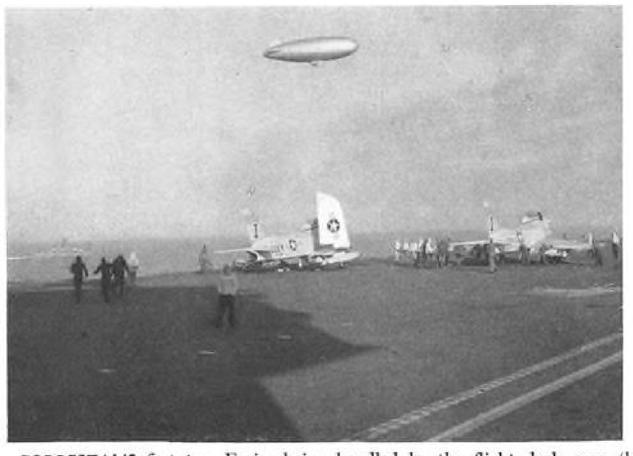
Picture Credits
Wide World—31

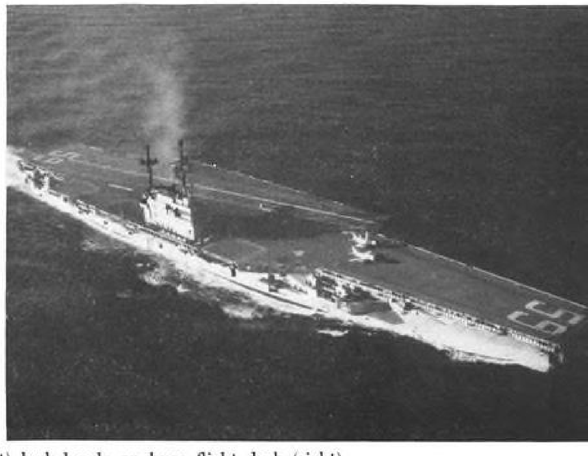


NORTH AMERICAN'S FJ-3 about to touch down is the first airplane to land on Navy's newest and largest carrier.

Furies First Fighters Aboard Forrestal

DECK HANDLER dashes forward as second Fury aboard U.S.S. Forrestal comes to a halt, hooked to arresting gear.





FORRESTAL'S first two Furies being handled by the flight deck crew (left) look lonely on huge flight deck (right).

AMERICAN AIRLINES chooses

America's Leading Airline

Aeroproducts Propellers

for its new fleet of Allison-powered Lockheed Electras

The Lockheed Electra airliners, setting the pace for the era of jet-powered transports and now in production for American Airlines, will be equipped with the proved team of Aeroproducts Propellers and Allison turbine engines. Both are products of General Motors.

Just as the Allison Turbo-Prop engines were selected because they are the most advanced in the world today, American chose Aeroproducts Propellers after the most careful evaluation. The decision in favor of Aeroproducts was based on rugged blade construction combined with unique features of pitch control and dependability. Result of more than ten years' intensive development, the Aeroproducts turbine propeller made its first flight in December 1945, in the first Turbo-Prop airplane to fly in the United States.

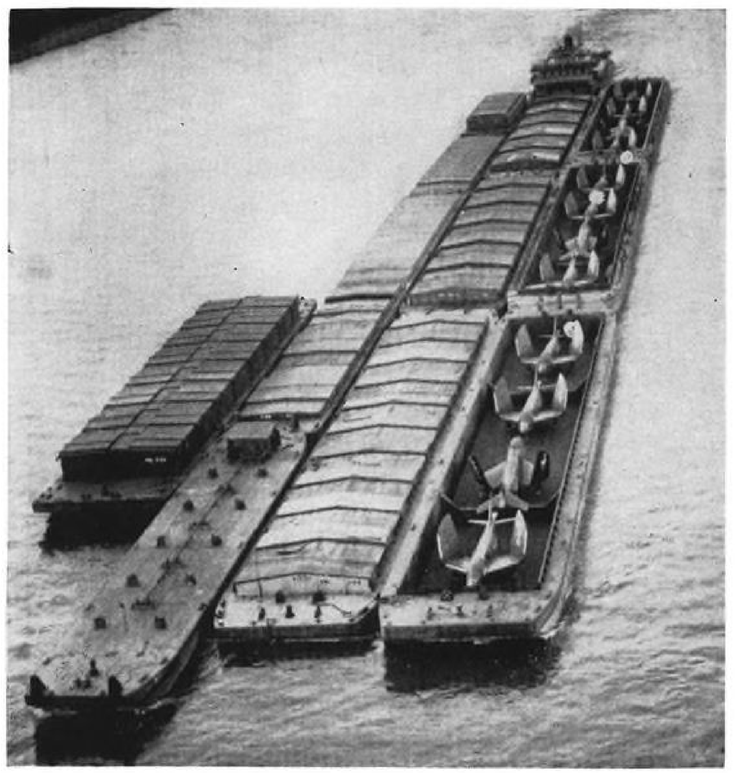
Since then, this General Motors power package of Allison engines and Aeroproducts Propellers has accumulated thousands of hours of successful flight experience in the Allison Turbo-Liner, the Air Force C-131C Transport and the Navy R3Y "Tradewind."

Now the advantages of Turbo-Prop power, demonstrated in this military experience, will be applied to commercial travel by air. The new four-engine Electras will cruise comfortably at more than 400 miles an hour —bringing speed and smoothness to short and medium-range flights. With the ability to take off and land on existing runways, these new Turbo-Prop transports will operate into any airport now regularly served.

Building for today... Designing for tomorrow

Aeroproducts

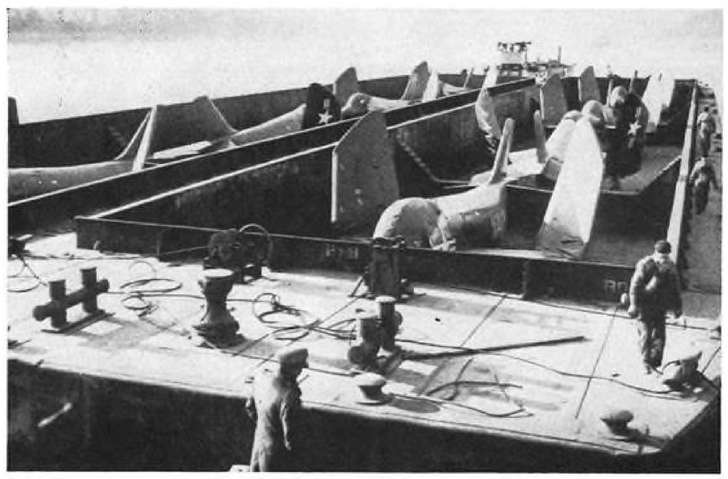
ALLISON DIVISION OF GENERAL MOTORS • DAYTON, OHIO

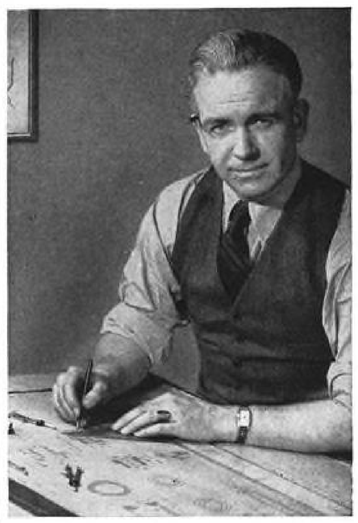


Last Ride for the F3H-1

Twelve "dead" McDonnell F3H-1 Navy fighters (above) barge down Mississippi on long, and final, ride from St. Louis to Memphis, Tenn., Naval Air Station and ground training duties. The Navy called a halt to the fighter's production after ordering 56 and seeing six of them crash during tests (AW Oct. 3, p. 12).

Principal reason behind the aircraft's failure was the Westinghouse J40 engine, whose 7,200-lb. thrust was not enough to power the Demon. End result of the $67-million program can be seen above and below (where the planes are being loaded in St. Louis): a barge, but never an aircraft carrier, for the F3H-1.





"How soon can you deliver ?"

When an aircraft manufacturer asks us that question, we know he wants more than a date on the calendar. Whatever kind of electromechanical equipment is called for, it must be designed to fit requirements of space, weight, work load, maintenance and cost. It must be engineered for foolproof safety of operation, tested for conformity. Then—and only then—can a delivery date have any meaning.

Making delivery dates, with equipment that measures up to standards in every respect, is a fetish with us at Airborne. Our secret lies in our completely integrated facilities — from design engineering to production to testing to delivery to field servicing — and the competent people on our staff.

We'd like to serve you. Just name the date. We'll deliver.

AIRBORNE

ACCESSORIES CORPORATION

HILLSIDE 5, NEW JERSEY

Mackey Orders Two Fokker F-27s

The first order from an American airline for the Fokker F-27 Friendship has been made by Mackey Airlines.

Mackey has ordered two of the turboprop transports from Fairchild Engine and Airplane Corp. and has taken an option on two more. Delivery is scheduled for late 1957.

While the Mackey action is the first firm U. S. order for the F-27, West Coast Airlines took an option on six aircraft in December. KLM Royal Dutch Airlines has ordered two F-27s from Fokker in the Netherlands.

Fairchild has rights from Fokker to build and sell the F-27 in the United States and in all South American countries but Brazil. Fokker is currently testing the Friendship prototype in Holland and is starting production.

The 40-passenger F-27 is designed for the DC-3 replacement market to operate as a short haul transport over routes too short for the larger, long-range transport types now being manufactured or planned.

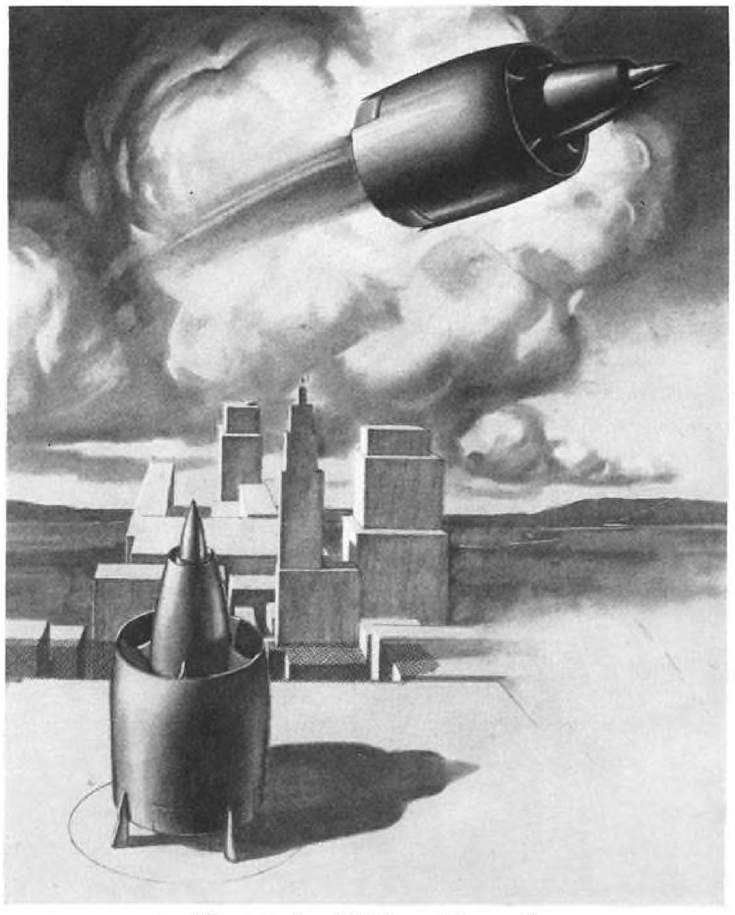
Fairchild is currently conducting a sales campaign in the United States in an effort to develop enough business to make production of the airplane feasible. The F-27 is a high-wing transport powered by two Rolls-Royce Dart turboprop engines and has recently been expanded to accommodate up to 40 passengers.

Mackey Airlines operates between Florida points and Nassau, British West Indies. The carrier has flown over 70,000 passengers between Ft. Lauderdale and West Palm Beach and Nassau in the past three years. The Civil Aeronautics Board authorized the service in 1952.

The airline uses DC-3 and DC-4 equipment in its Florida-Nassau service. Mackey is asking the CAB to extend its routes from Nassau to New York and Havana.

Russian Bomber Range

The range of Russia's four-engine jet bombers is "less" than the 10,000 miles quoted for U. S. long-range bombers, Gen. Nikita A. Sakharov, director of civil aviation for the U. S. S. R., said recently in what may have been a slip of the tongue or of translation.



Kaman's 'Flying Barrel'

Kaman Aircraft Corp., Bloomfield, Conn., has received an aeroelastic study contract from the Office of Naval Research regarding an angular-wing "flying-barrel" aircraft similar to the two shown in the above sketch. Kaman says the aircraft could be powered by either piston or jet engines, land and takeoff vertically and attain speeds comparable to conventional jet planes. A similar coleopter is under development in France.

New F-102A Order Placed by Air Force

San Diego—Convair Division of General Dynamics Corp. has announced receipt of a large contract for production of F-102A all-weather interceptors and TF-102A combat proficiency trainers.

Neither the number of aircraft nor the dollar value of the contract were disclosed but Convair reported that the order is the fourth in the F-102A series and calls for greater numbers of interceptors and trainers than did all the previous contracts combined.

Convair produces the F-102A at its San Diego plant.

Nose sections for the TF-102As are fabricated at Convair's Fort Worth, Tex., plant and shipped to San Diego for mating with the fuselage.

Delivery of the first F-102A was made to the Air Force late in June. Increasing numbers of the delta-wing jets coming off of the assembly line are assigned to a variety of Air Force testing facilities.

First TF-102A produced is undergoing engineering flight tests at Edwards AFB.

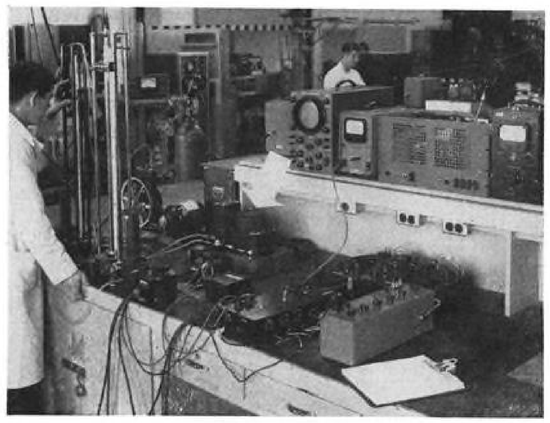
The two-place, side-by-side, TF-102A is the first trainer developed specifically for any of the "century series" aircraft.

Northrop Recruiting Canadian Engineers

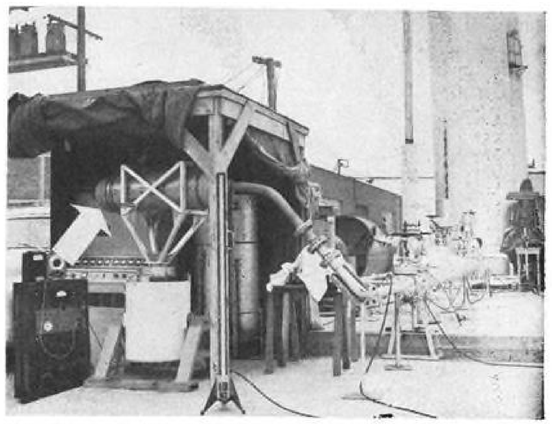
The shortage of engineers on the West Coast has prompted Northrop Aircraft, Inc., recruitment teams to tap Canadian sources.

Results have been good and many applications have been received from men with outstanding qualifications, Northrop says. As aliens, however, the Canadians must obtain visas and declare intention to become U. S. citizens.

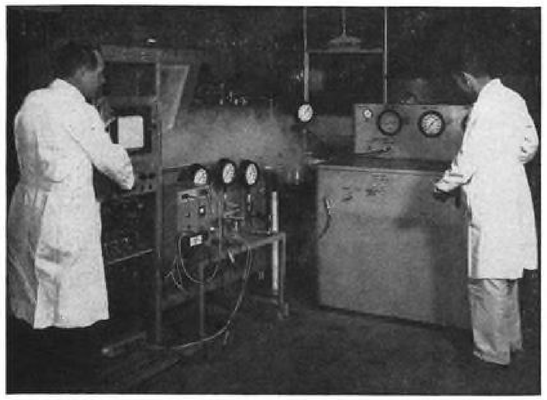
An additional burden to companies hiring such men is the months-long period required before security clearances are granted.



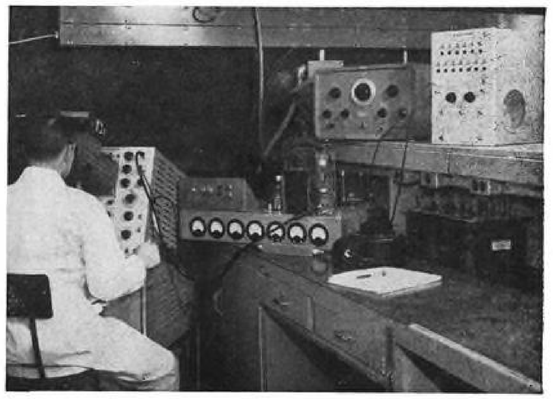
SYSTEM at Wyle Research Corp. tests Mach computer (arrow).



TRUSS supports filter for cabin pressurization bleed air during test.



FOUR-WAY, motor-operated hydraulic valve is tested in cold box.



MODULATION SYSTEM has components made by various vendors.

Role of Test Facility Gains New Stature

By Irving Stone

El Segundo, Calif.—The increasing severity of military service requirements has pushed to the forefront the role of the test laboratory for the proving of aircraft and missile components.

Already this pre-testing of weapon components and systems is taking a considerable portion of the defense dollar. Design performance of aircraft and missiles still on the drawing boards indicates that this portion will grow even larger.

Here are some of the factors behind the rise of laboratory testing:

- **In missiles,** telemetering supplies only a small part of the functional information required, and does not pinpoint operation of the numerous individual components.
- **In modern aircraft,** complexity of the systems prevents the pilot from gathering information on individual components and feeding this data back to the engineer.

The specialized nature of the test operation—it requires a high level of technical administration, special and costly equipment, and highly trained experts in testing procedures—puts its cost far beyond the economic capacity of the average vendor or component manufacturer.

Thus, to test a $100 valve may require a $300,000 installation of test facilities and instrumentation.

Independent Laboratory

To meet this situation, the independent testing laboratory, typified by Wyle Laboratories and Wyle Research Corp., has evolved. To a component manufacturer, use of an independent laboratory facility offers these advantages:

- **It frees capital** that would be tied up in costly test systems and complex instrumentation for which the vendor has limited use.
- **It frees the vendor's laboratory** for development work vital to the engineering of new items for production.
- **For a reasonable fixed charge** the vendor has at his command a testing facility manned by experts who understand his problem and the testing demands of the prime contractor and the armed services.

The prime contractor benefits because the test report he receives is an independent evaluation of the product.

Frequently, the independent laboratory establishes a portion of the prime contractor's system to accommodate different components from different vendors. This affords consistent conditions of test in accordance with actual conditions of operation.

Wyle Laboratories, founded in 1949, specializes in qualification and environmental testing of hydraulic, pneumatic and fuel system components. Wyle Research Corp., founded in 1952, specializes in testing avionic components.

Since their inception, the rate of growth of dollar volume of tests completed has approximately doubled each year, resulting in a current annual rate for both companies of about $1½ million.

The two currently are carrying the qualification testing load for about 200 vendors.

Frank S. Wyle, president of Wyle Laboratories, points out that much of the successful operation and growth of the company stems from the close teamwork between the laboratory and vendor in seeing a program through the failure-fix-retest cycle associated with qualification testing.

Environmental Facilities

To qualify aircraft and missile system components, an extremely wide range of environments, functional systems and instrumentation is required.

Environments fall into two categories —natural and induced. A natural environment is one such as a temperature extreme, humidity or a corrosive atmosphere. An induced environment is one such as vibration, shock or acceleration.

To accommodate a large number of component testing programs simultaneously, Wyle has developed extensive test systems. For example, the low-temperature system embodies a storage tank which holds 12,000 lb. of liquid CO_2. This tank is maintained at zero F by mechanical refrigeration, to keep the system pressure at 300 psi.

The cold liquid is piped throughout the laboratory to provide a source of low temperature at approximately 30 locations.

Direct expansion into a chamber can drop temperature from room value to −100F in 30 sec.

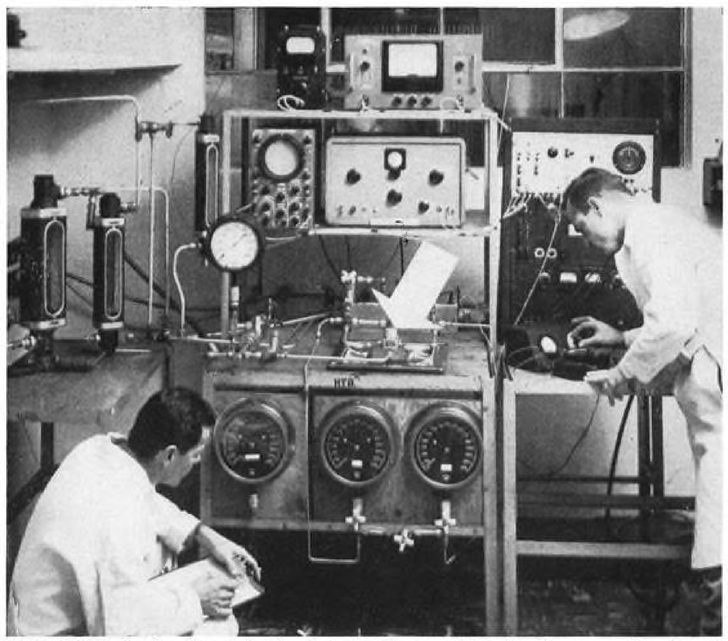
With the flexibility this system allows, simulated ambient temperatures of −65F can be maintained, for example, for testing a jet aircraft bleed installation's hot air pressure regulator carrying high mass flows at 700F.

Functional Test Systems

Functional test systems at Wyle include eight fuel rigs capable of flows as high as 1,200 gpm. There are test stands for qualifying all types of hydraulic components, including electrically operated hydraulic servo valves and equipment required to handle fluids at extremely high temperatures.

In the field of pneumatics, high-pressure missile components are tested with the aid of a 5,000-psi. compressor.

High-temperature high-volume flows required for components operated by jet engine bleed air are furnished by an 820-hp. air system. The high temperatures are obtained for the air flows by a gas-fired 6-million-Btu. heat exchanger.



TEST SETUP for functional check of electrically-operated hydraulic servo valve (arrow).

RATE-OF-TURN table used for precision calibration of accelerometers and gyros.

Complete systems have been set up for testing avionic components. Thus, a complete Hughes radar system has been simulated so that avionic components of many manufacturers may be tested for compatibility with the system under various environmental conditions. This, of course, is in addition to basic qualification testing for individual component requirements.

Vibration Tests

In addition to providing for vibration testing in accordance with existing military specifications, Wyle has extended its vibration facilities so that vibration tests with complex wave forms may be accomplished.

Vibration information from actual airframe installations under actual operating conditions may be tape-recorded and this data played back through the vibration equipment in the laboratory to provide the test conditions which simulate actual operation.

This approach has shown changes occurring in operating characteristics of items such as pressure switches, pressure regulators, check valves and relays, which did not show up under normal specification testing.

Fire Control

Problems of fire control in high-speed aircraft and guidance problems with missiles have necessitated the development of instruments which sense rate, position, Mach number, temperature and acceleration to a higher degree of accuracy than is normally found in laboratory type instrumentation.

To calibrate this new category of instrumentation, Wyle has organized a standards laboratory which is equipped to measure electrical quantities to 1 part in 10,000; rate to 1/100 degree per second; angular displacement to 1½ seconds of arc; temperature to 1/100 degree C; pressure to 0.16 millimeter Hg.

Stock Transactions

Washington—Acquisition of 10,000 common shares of United Air Lines stock through exercise of option by W. A. Patterson, officer and director, is reported by Securities and Exchange Commission for the period of Nov. 11 to Dec. 10, 1955. He now has a direct holding of 15,000 and an indirect holding of 234 common shares. Two officers of the company also acquired shares through an exercise of option. A. M. deVoursney acquired 250 common common shares and Hal E. Nourse acquired 1,840 common shares making a holding of 3,620.

Other recent transactions reported include:

ACF Industries Inc. Disposal of 225 common shares by Ernest L. Nye, director, leaving a holding of 600.

Aero Supply Mfg. Co. Inc. Disposal of 15,485 common shares, his total holding, by William H. Coleman, director; acquisition of 1,900 common shares by Henry M. Margolis, director, making a direct holding of 15,100, and an indirect holding of 24,585.

Air Associates Inc. Acquisition of 1,400 common shares by C. Kenneth Baxter, director, making a holding of 4,000; acquisition of 1,000 common shares by Harold R. Baxter, director, making a holding of 1,100; acquisition of 500 preferred shares by C. Kenneth Baxter, director, making a holding of 500.

Alaska Airlines Inc. Acquisition of 100 common shares by Keith M. Lesh, director, making a direct holding of 10 and an indirect holding of 100.

Allegheny Airlines. Acquisition of 300 capital shares by Philip V. Mattes, director, making a holding of 3,300.

American Airlines. Disposal of 2,000 common shares by R. E. S. Deichler, officer, leaving a holding of 3,000.

Bell Aircraft Corp. Acquisition of 100 common shares by Leston P. Faneuf, officer and director, making a holding of 200; acquisition of 100 common shares by Walter A. Yates, director, making a holding of 4,100.

Bellanca Aircraft Corp. Disposal of 62,916 common shares by L. Albert & Son, officer and director, leaving a holding of 1,008,334; acquisition of 1,000 common shares by James C. Hodge, director, making a holding of 1,000.

Bendix Aviation Corp. Disposal of 440 common shares by Marvin A. Heidt, officer, leaving a holding of 1,700.

Braniff Airways. Disposal of 200 and acquisition of 100 common shares by Walter M. Henshel, officer, leaving a holding of 100; disposal of 39,000 common shares, his total holding, by Thomas F. Ryan III, director.

California Eastern Aviation. Disposal of 1,400 common shares by Edward A. Kerbs, director, leaving a direct holding of 9,400 and an indirect holding of 1,125; acquisition of 500 common shares through exercise of option by Samuel J. Solomon, officer and director, making a holding of 34,055.

Capital Airlines. Acquisition of 2,751 common shares through exercise of option by Hayes Dever, officer and director, his total holding; acquisition of 500 common shares by Crawford Johnson Jr., director, making a holding of 1,705.

Continental Air Lines. Disposal of 2,050 common shares by Marco F. Hellman, director, leaving a direct holding of 4,500 and an indirect holding of 1,200; acquisition of 600 common shares by C. C. West, Jr., officer and director, making a holding of 2,240.

Curtiss-Wright Corp. Disposal of 300 common shares by George R. Hill, officer

and director, leaving a holding of 2,700.

Douglas Aircraft Co. Disposal of 300 capital shares by M. A. Kavanaugh, officer, leaving a holding of 600.

Eastern Air Lines. Acquisition of 300 common shares by Charles Froesch, officer, making a holding of 1,505; acquisition of 100 common shares by Morris M. Frost, officer, making a holding of 1,600.

Electronics Corp. of America. Acquisition of 400 common shares by John F. Rich, director, making a holding of 900.

Emerson Electric Mfg. Co. Acquisition of 5,000 common shares by Mills Inc., beneficiary, making a holding of 112,000.

Emery Air Freight Corp. Acquisition of 100 common shares by Walter G. Corcoran, officer, making a holding of 415; acquisition of 1,000 common shares by Leonard G. Hunt, officer and director, making a direct holding of 2,275 and an indirect holding of 2,225; acquisition of 2,400 common shares by James M. Mathes, director, making an indirect holding of 27,314; acquisition of 1,200 common shares by Horatio J. Snyder, officer and director, making a holding of 4,800.

Fairchild Engine and Airplane Corp. Disposal of 190 common shares by F. Eugene Newbold Jr., officer, leaving a holding of 10.

Flying Tiger Line. Acquisition of 100 common shares by William E. Bartling, his total holding; acquisition of 8,000 and disposal of 6,000 common shares by B. H. Rehrig, director, leaving a holding of 2,000; acquisition of $25,000 and disposal of $10,000 of 5¼ pc convertible debentures by William E. Bartling, officer, leaving a holding of $75,000.

General Dynamics Corp. Acquisition of 500 common shares through exercise of option by Allen D. Marshall, officer, making a holding of 500; acquisition of 3,000 common shares by Frank Pace Jr., officer and director, making a holding of 9,000.

General Motors Corp. Disposal of 1,800 common shares by Edward F. Fisher, director, leaving an indirect holding of 16,264; disposal of 300 common shares by George Russell, officer, leaving a holding of 5,908.

Hoffman Electronics. Acquisition of 1,500 common shares through exercise of option by C. E. Underwood, officer and director, making a holding of 2,500.

Lear Inc. Disposal of 1,000 common shares by William P. Lear, director and beneficiary, leaving a holding of 419,857; acquisition of 1,000 common shares through exercise of option by Richard M. Mock, officer, making a holding of 16,155; disposal of 6,800 common shares by Paul Moore, leaving a holding of 313.

McDonnell Aircraft Corp. Disposal of 100 common shares by Robert H. Charles, officer, leaving a holding of 4,792.

Minneapolis-Honeywell Regulator Co. Acquisition of 700 common shares by T. McDonald, officer and director, leaving a holding of 3,500; disposal of 18,900 common shares by H. W. Sweatt, officer and director, leaving a direct holding of 96,340 and an indirect holding of 7,030; disposal of 1,000 common shares by John J. Wilson, officer and director, leaving a holding of 93,000.

National Aviation Corp. Disposal of 500 common shares by Elmer Wellin, director, leaving a holding of 5,500.

Northrop Aircraft Inc. Disposal of 900 common shares by William B. Collins, director, leaving a holding of 100.

Northwest Airlines. Disposal of 3,550 common shares by Croil Hunter, director, leaving a holding of 10,500.

Pacific Northern Airlines. Disposal of 200 common shares by Robert A. Rowan, director, leaving a holding of 19,557.

Rohr Aircraft Corp. Disposal of 2,000 common shares by Fred H. Rohr, officer, leaving a holding of 41,940.

United Aircraft Corp. Acquisition of 210 4 pc preference stock through exercise of rights by William R. Robbins, officer and director, making a holding of 210.

Western Air Lines. Disposal of 500 capital shares by G. C. Brooder, officer, leaving a holding of 2,000; disposal of 365 capital shares by Marvin W. Landes, officer and director, leaving a holding of 2,500; disposal of 800 capital shares by J. J. Taylor, officer, leaving a holding of 2,050.

Westinghouse Electric Corp. Acquisition of 500 common shares by Frank R. Denton, director, making a holding of 1,000; acquisition of 500 common shares by John M. Schiff, director, making a holding of 11,000; disposal of 593 common shares by C. S. Weber, officer, leaving a holding of 200.

Ft. Bragg Field Board To Help Evaluate R3Y

Army Field Forces Board No. 5 at Ft. Bragg, N. C., says they will take part with other services in joint tests to determine worth of Convair R3Y.

It is anticipated that tests will involve assault landings and paradrops. The aircraft has not yet arrived at Bragg.

Rheem Awarded USAF, North American Contracts

Rheem Manufacturing Co. last week received contracts from North American Aviation, Inc. and the Air Force totaling about $7.5 million.

Under the NAA contract, Rheem will manufacture fins, stabilizers, wing tips, ailerons, leading edges and flaps for F-100 Super Sabres.

The second is a classified Air Force research and development contract "in excess of $2,000,000." Rheem also is producing assemblies and other aircraft components for Lockheed, Northrop, Douglas, Boeing and North American.

Aircraft Demands Exceed Pilot Capability

The Air Force is urging a fresh look at the problem of human error, a factor that was held responsible for approximately 1,200 of the 1,800 or so major USAF accidents over the last year. To reduce the number of accidents ascribed to this cause, "it is necessary to consider the human in terms of his inherent design limitations," according to Brig. Gen. Joseph D. Caldara, USAF Director of Flight Safety Research.

Speaking before the Los Angeles section of the Institute of the Aeronautical Sciences, Gen. Caldara pointed out that "human error" does not necessarily represent either negligence or willful violation on the part of the pilot or other personnel concerned. What it does show is that the human was often placed in a situation whose demands were greater than his ability to respond adequately.

The scope of the accident problem is indicated by the fact that while USAF's major accident rate is down to between 18 and 19 per 100,000 hr. of flying time—the lowest in Air Force history—this still represented 1,774 major accidents in the 12-month period from July 1954 through June 1955. In these accidents, 382 of which were fatal, 810 persons, including 411 pilots, were killed.

Jets Most Dangerous

The inherently greater risk involved in flying jet fighters is reflected by the fact that they were involved in more than half the major accidents during this period, the flight safety research chief said—400 in the last six months of 1954 and 430 in the first six months of 1955.

The figures for other types of aircraft for these two six-month periods:

- **Jet trainers:** 165; 174.
- **Jet bombers:** 16; 28.
- **Non-jet bombers:** 66; 34.
- **Non-jet trainers:** 143; 105.
- **Transport and cargo:** 47; 60.
- **Helicopter and miscellaneous types:** 27, 26.

Gen. Caldara emphasized that the major problem of the Air Force at present lies in the jet fighter and jet trainer fields, which suffer the highest numbers and rates of major accidents. In 1950, jet fighters and trainers accomplished 10% of the flying time and accounted for 31% of the major accidents, 15% of the minor accidents, 35% of all aircraft destroyed, 13% of the pilot fatalities and 30% of the total dollar loss.

Today, jet fighters and trainers fly 29% of the hours but have 68% of the major accidents, 66% of the minor accidents and account for 73% of the aircraft destroyed.

Combat capability of the Air Force depends upon satisfactory handling of this problem, Caldara said, adding that "the impact on the morale of the people who must man these aircraft cannot be overemphasized."

Accident Causes

Study of the major accidents shows that the reasons break down into these categories, Gen. Caldara said:

- **Pilot error:** jets, 46%; non-jets, 52%.
- **Aircraft maintenance:** jets, 3%; non-jets, 6%.
- **Materiel failure:** jets, 23%; non-jets, 23%.
- **Supervisory error:** jets, 4%; non-jets, 5%.
- **All other:** jets, 24%; non-jets, 14%.

The "all other" category includes accidents whose causes are undetermined, but a sizable percentage of these, in the case of jet aircraft, can be attributed to pilot error, maintenance or materiel failure, Caldara believes. All in all, human error is responsible for two-thirds of the major Air Force accidents, he said.

Analysis of aircraft accidents must include the phase of flight during which the accidents occurred, Caldara pointed out.

Accident Break Down

This is how the accidents break down, according to flight phase:

- **Landing:** jets, 45%; non-jets, 55%.
- **In-flight:** jets, 32%; non-jets, 22%.
- **Takeoff:** jets, 16%; non-jets, 11%.
- **Turn-around, taxiing, miscellaneous:** jets, 7%; non-jets, 12%.

Other pertinent points in Caldara's address:

In order to consider the pertinent human design limitations, the role of the human in the man-machine relationship must be defined, in its simplest form, this man-machine relationship may be conceived as a closed circuit. The functioning of an operating machine is symbolically presented in the form of an instrument.

If it is to perform its function, adequately, this machine must accurately reflect the basic operation of which it is a presentation, and it must be so designed that changes in the basic operation are rapidly and effectively indicated in the instrument.

In the second step, the instrument is perceived by the human through a receptor system. In order for this perception to take place, the instrument must be designed so that the presentation is well within the sensory limitations of the human receptor system. Further, it must be presented so that a minimum of time is required for an accurate interpretation of the presentation perceived.

In the third step, the perceived and interpreted instrument presentation is used as a basis for initiating a response. For the sake of efficiency, this response should be simple and very easily learned.

The human response is then the means by which some mechanical control system is activated.

Complicated Situation

This control should be directly associated with the basic operation of the machine in question so that manipulations of the control are directly reflected in the activity of the machine which again is directly and accurately presented in a modification of the instrument reading. This, then serves to inform the human operator as to whether or not additional control changes are necessary.

In practice this simple system is complicated by the fact that in a complex piece of equipment, such as a high-speed, high-performance aircraft, many functions of the basic mechanism are acting as an integrated unit and are necessarily presented by means of a complex instrument system. The human operator in addition to interpreting the information presented by the instruments themselves, must also integrate information perceived outside the cockpit and, at times—for instance during a letdown—must integrate both of these with instructions obtained by reading a relatively complicated chart.

If the demands of the situation exceed the limitations of the pilot in the brief time allowed, the result will quite possibly be an inadequate integration of the information received. This results in a faulty decision which, in turn, leads to the wrong response.

In this complicated setting, the re-

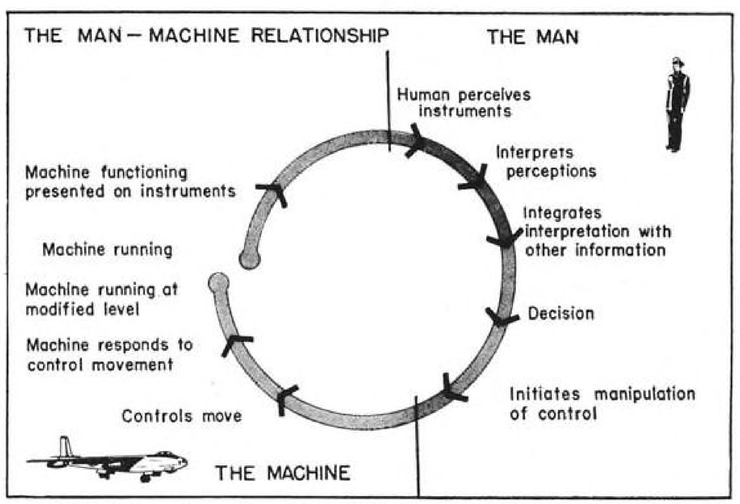
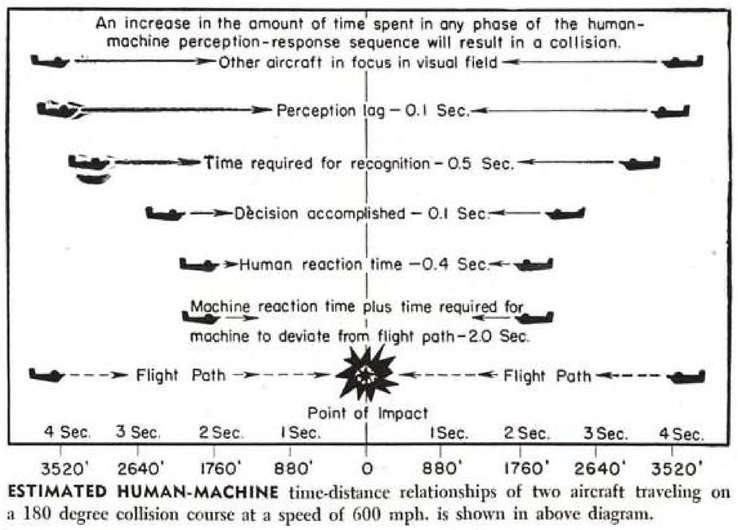


DIAGRAM shows action and response relationship between the pilot and his controls.



ESTIMATED HUMAN-MACHINE time-distance relationships of two aircraft traveling on a 180 degree collision course at a speed of 600 mph. is shown in above diagram.

Brig. Gen. Caldara

Brig. Gen. Joseph D. Croft Caldara, 46, was named director of USAF flight safety research last April after assignments as an air division commander with the Strategic Air Command and as a staff officer with the Joint Chiefs of Staff.

During World War II, he served at U. S. Armed Forces Headquarters in the South Pacific as assistant chief of staff for air operations. He later became chief of staff of the Alaskan Air Command. A 1931 graduate of the University of Maryland, his decorations include the Legion of Merit and the Air Medal with oak leaf cluster.

Accident Rate at Record Low

The Air Force's major accident rate now hovers between 18 and 19 per 100,000 hours of flying time. This is the low point on a curve whose direction has been consistently down since 1921, except for exceptional periods when the trend was reversed.

The exceptional periods: 1946, when hasty demobilization strippped the Air Force of many of its experienced pilots, supervisors and maintenance personnel; beginning of World War II, when the Air Force started to expand explosively; and 1934, when the Air Corps took over the job of flying the air mail with inadequate equipment and facilities.

The fatality rate—number of fatalities per 100,000 hr.—today is 9, compared to 94 in 1921. The fatality rate—number of accidents in which someone is killed per 100,000 hr.—today is 4, compared to 58 in 1921.

However, reflecting the higher performance and speed of today's aircraft, one out of every five major accidents today is a fatal accident; in 1930s, only one out of every 13 major accidents resulted in fatality.

sponse is all too often not a simple manipulation of a single control which directly results in the desired modification of the basic functioning, but is rather a complicated multiplicity of actions which must be integrated in order to affect the total operation of the mechanism in the desired manner. This requires the manipulation of numerous types of controls, dials, knobs, levers, etc., each of which affects its own small portion of the total operation.

The total result of this is a modification of the integrated functioning of the entire mechanism which is again reflected in the basic instrumentation. This presentation must then be re-interpreted. This continuous perception and integration of continuing information from a variety of sources must be carried out by the pilot in addition to other required activities.

Man's Limitations

Although not as readily apparent as in the machine, there are in the human, limitations which cannot be safely exceeded. Any attempt to design a mechanism the human must operate and/or maintain which exceeds these human limitations can result in nothing but ineffective operation of the equipment and, all too often, destruction of both the equipment and the human operation.

Whether the physical-sensory, physiological or psychological aspects of the human are considered, these limitations are important.

As a physical-sensory structure, the human operates according to the laws of mechanics. He is a system of weights, counter weights, balances and levers.

Some of the limitations of the human considered as such a system are obvious. For example, he can only reach so far and lift so much. There are other limitations, however, which are much less obvious but which are very important, especially in terms of the ability to operate high-speed, high-performance aircraft.

For example, the mechanical transmission of a light stimulus from the eye to the brain and the integrated response which results from the interpretation of such a transmission is a time-consuming process which can vitally affect the successful operation of an aircraft. When a light stimulus strikes the eye and from there is transmitted to the

First Accident

Records of USAF's Directorate of Flight Safety show that the first Air Corps accident took place in 1908.

The victims: Orville Wright, broken leg; Lt. Tom Selfridge, fatally injured.

brain in the form of a nerve impulse, a measurable lapse of time occurs. This lapse of time is only on the order of from 30 milliseconds to three-tenths of a second, but when considered in terms of time and distance, it becomes important. An object traveling through space at 60 mph. is traveling at 88 feet per second or 8.8 feet per one-tenth of a second.

If a perceptual lag, i.e. the time required for the transmission of a nerve impulse from the eye to the brain, of one-tenth of a second is considered, this means that an object passing across the visual field at 60 mph. is perceived 8.8 feet behind where it is actually physically located in space.

Critical Time Lag

When speeds of 600 mph., rather than 60 mph. are considered, such a time lag becomes of critical importance, for during one-tenth of a second an object has traveled 88 feet in space. This means that the perception of that object, assuming a one-tenth second perceptual lag, is in error by that measurable amount.

The perceptual lag is, however, only the first of many time lags involved in a perception-response sequence.

When the nerve impulse is first transmitted to the brain the individual only knows that something is in the visual field. Recognition requires still further time, possibly as much as a half-second or more.

Once recognition has been accomplished, the information must be evaluated and interpreted and a decision reached as to the action to be taken. This decision time may be on the order of a second or in many cases may involve seconds.

Following the decision the response is then initiated. This also requires a minimum time on the order of several tenths of a second. Moreover, in the operation of an aircraft the human perception response time is only the beginning of the total man-machine-response sequence, Caldafa said. Two other factors have to be taken into consideration: the time lag in the response of the machine to the controls, and the time required for the aircraft to deviate from a given flight path once the controls have been actuated.

For example, if an aircraft could accelerate at the rate of 1G per one-tenth of a second for five-tenths of a second, at which time acceleration of 5G would have been reached, the aircraft would have deviated less than 10 ft. from its given flight path at the end of this time.

Summarizing this information: If two aircraft were on a collision course at 600 mph., four seconds before the point of collision they would be a mile and a third apart. If all of the steps in the

human - machine - perception - response sequence were executed precisely, a collision could be avoided. If excessive time were taken in any one of these steps a collision would be inevitable.

In view of the fact that it can be readily assumed that the speeds of new aircraft will increase while the response times in the human will remain unchanged, the necessity for recognizing the importance of these human limitations becomes apparent.

Demand vs. Capability

The accomplishment of any task may be looked upon as an integration of two variables: One of these is the level of the operator's ability; the other is the level of the demands of the situation. As long as there is a wide margin between these two, the probaility of successful accomplishment is high, but an increase in the demands of the situation or a decrease in the individual's ability will decrease this margin and often result in a situation with which the individual is not capable of coping. There are many indications that the high-speed, high-performance characteristics of modern aircraft have raised the demands made on the pilot to the point that the probability of successful achievement is considerably lessened. This is demonstrated by the fact that while accomplishing one-third of the flying time, jet aircraft experience approximately two-thirds of the major USAF aircraft accidents.

In order to fly successfully it is essential that all pilots and crew members see what goes on, understand what it means, and manage their aircraft correctly. Due to the speed of aerial flight such seeing, understanding and managing must be accomplished both quickly and accurately. Thus, it is essential that aircraft be so designed that the pilot is given the maximum of assistance in order that he may accomplish his tasks without delay, error or difficulty.

Review of aircraft accidents, however, reveals that design sometimes not only fails to facilitate the pilot's task but may, on occasion, intensify and complicate the occupation of flying to the point where human error is induced. Examples of aircraft design which may induce pilot error are as follows:

Design and Perception

Examples of design factors which adversely affect the pilot's ability to perceive quickly and easily conditions during critical stages of flight. Among them:

• **Visibility from the rear cockpit of jet trainer.** During the calendar years 1952 and 1953 the USAF experienced 55 accidents in which poor vision from the rear cockpit was either a definite or probable factor. Thirty-five of these were

major accidents and 11 fatalities resulted. Inasmuch as this aircraft is utilized extensively for training purposes, the instructor pilot who occupies the rear seat needs to observe the student he is instructing and needs to see outside conditions in case he has to assume control of the aircraft.

The design of the aircraft is such that these visual requirements are compromized or lacking and aircraft accidents result.

• **Position of radio in high-performance aircraft.** During the past few years a specific pattern has been seen to recur in numerous instances in unexplained jet fighter or jet interceptor accidents. The pattern is roughly as follows:

(1) The aircraft is just taking off or is in the early stages of the landing pattern.
(2) The aircraft altitude is approximately 2,000 feet.
(3) Flying conditions are IFR.
(4) The pilot is often in a procedural turn.
(5) The pilot is requested to change radio channels or modes.
(6) The pilot replies to the request stating that the change is being made.
(7) The pilot immediately thereafter strikes the ground in near vertical attitude.

In seeking an explanation of these accidents the position of the channel and mode selectors warrant consideration.

Almost without exception the radio and its channel and mode selectors are on the right console and in some cases they are in a position which is difficult to reach.

Therefore, changing radio channels or modes means that the throttle must be abandoned and the aircraft must be flown with the left hand, and frequently that the pilot has to turn his head to the right and look down and away from his flight instruments to find the channel or mode selector and observe changes which must be made.

The pilot who momentarily lapses in monitoring his instruments may also momentarily lapse in the control of his aircraft. While flying at +50 knots at 2,000 feet above the terrain, an unguided or incorrectly guided aircraft can strike the ground in less than five seconds.

Design and Understanding

There are numerous examples wherein instruments which are difficult to read, diagrams which are difficult to understand, and indicators which are difficult to interpret have led to aircraft accidents.

Misinterpretation of the altimeter is a well-known example. More

recently, misinterpretation or misunderstanding of the control of fuel systems is becoming a significant cause of accidents.

An example: Recently a jet bomber was on a routine training flight with the instructor pilot in the rear seat and the student pilot in the front. Approximately an hour after takeoff the aircraft was observed by witnesses to be flying at a very low altitude and then to stall, spin and crash. Shortly prior to the crash both the instructor pilot and the student pilot attempted to escape by use of the ejection seats but both were fatally injured due to the low altitude when they abandoned the aircraft. Investigation of this accident revealed the following:

a. Both engines were windmilling at the time of the crash.

b. There was no evidence of material failure.

c. The accident occurred at approximately the time when, through normal fuel tank sequencing, the wing tip tanks would be turned on.

d. The student pilot had not turned on the wing tip tanks, but instead had closed the engine fuel shut-off valves.

e. Subsequent to this loss of power the pilots allowed the aircraft to stall and enter a spin at an altitude at which a recovery could not be effected.

The ultimate explanation of this accident lies in the following factors:

a. It was the student pilot's first ride in this aircraft.

b. Fuel management was possible only in the front cockpit which was occupied by the student pilot.

c. In this model the instructor pilot could not see the student pilot or observe any of his actions.

d. In this model the fuel control panel is so arranged that it is exceptionally easy to confuse the wing tip tank control knobs with the engine fuel shut-off control knobs.

In essence, the student's mismanagement of fuel control, which was caused by the design of the fuel control panel, went unobserved and uncorrected because of the design of the tandem cockpit.

Design and Management

The flight safety research chief cited three additional design musts if an individual is to be offered reasonable opportunity for correct management of flight or should the occasion arise, allowed the reasonable chance of survival:

All items used in control of the aircraft must be accessible, must respond to normal human strength or dexterity, and must be reliable.

Failure to meet these provisions have led to repeated aircraft accidents and a number of fatalities. Examples:

• **Accessibility.** In some jet fighter aircraft the emergency fuel switch is so situated a pilot must bend forward and look under the left console to find and actuate it. Several accidents have been induced when the pilot, in seeking access to this switch, relaxed back pressure on the stick and allowed the aircraft to fly back onto the runway or into the ground.

• **Strength and dexterity.** There have been several occasions when pilots in jet trainers have attempted to abandon the aircraft under emergency conditions and have been unable to jettison the canopy and who have subsequently regained control of the aircraft or survived crash landings. The reason they were unable to jettison the canopy was that due to G forces encountered, they had insufficient strength to reach up to the canopy jettison lever.

It is pertinent to note that during the period 1 Jan. 1949 through 31 Dec. 1953 there were 42 fatal accidents in jet trainers where the altitude of the aircraft at time of the emergency should have allowed successful escape but the occupant did not abandon the aircraft. The number who were unable to leave because of inability to reach the canopy jettison handle is conjectural but probably significant.

• **Reliability.** The necessity for reliable instruments and, particularly, reliable attitude instruments is obvious. Upon attitude instruments rest the responsibility of informing the pilot of his position and direction while traversing space at incredible speeds. Yet, design-wise, this grave responsibility has at times been compromised or neglected. An example is in a fighter where the turn and bank indicator is set in a position 15 deg. off the vertical plane of the aircraft. As a result the turn needle indicates a turn opposite to the direction of roll as long as the roll is continued.

Latitude in Design

The conditions or examples cited should not be construed as indicating indifference on the part of designers. Some of the design deficiencies have been direct results of Air Force specifications or situations which allowed no alternatives, and that design often suffers from premature obsolescence. However, in design and manufacture there is a reasonable degree of latitude, and there are provisions for incorporating improvements.

Considering the intrinsic limitations of man and his propensity for error, it is urged that extraordinary thought be given to the design of those things the pilot must see, understand and handle, in order that he may continue to live in the exacting environment of high performance flying.

WHO'S WHERE

(Continued from page 23)

Fred Stricker, manager, Canseal Department, Cannon Electric Co., Los Angeles, California.

Dr. Gunther Mohling, chief metallurgist, Research and Production Departments, Allegheny Ludlum Steel Corp., Pittsburgh, Pa., replacing **Dr. Rush Lincoln,** now technical director, **W. W. Dyrkacz,** quality control manager, Watervliet plant, replacing **Dr. Mohling; Dr. E. E. Reynolds,** associate director of research, in place of **Mr. Dyrkacz.**

Ralph W. Rawson, chief engineer in charge of new centralized engineering department, Fansteel Metallurgical Corp., N. Chicago, Ill.

P. Nelson Gracie, senior liaison officer, Folland Aircraft, Ltd., England, succeeding **Group Capt. S. O. Tudor,** resigned.

Edward S. Maury, general sales manager, Marion Electrical Instrument Co., Manchester, N. H.

Ted Duay, West Coast assistant sales manager, Aircraft Products Sales, Chatham Electronics Division of Gera Corp., Livingston, N. J.

Squadron Leader John S. Booth, chief test pilot, Saunders-Roe, Ltd., England.

J. Labarre Comer, market research supervisor, General Electric Co.'s Light Military Equipment Department, Utica, N. Y. **Gerald A. Hoyt,** marketing manager, Special Defense Projects Department, Schenectady, N. Y.

Chester A. Deguez, director, aircraft battery sales, Reading Batteries, Inc., Reading, Pa.

I. I. Ser, sales manager, Astron Corp., E. Newark, N. J.

Robert O. King, aircraft sales representative specializing in Grumman, Aero Commander and Beech Aircraft, William C. Wold Associates, New York, N. Y.

Richard H. Ewert, gearing sales manager, Foote Bros. Gear & Machine Corp., Chicago, Ill.

Erich M. Helibig, manager, Dayton, Ohio, offices, Standard Coil Products Co., Los Angeles, Calif.

Henry W. Patton, project leader-Engineering Department, Airpax Products Co., Middle River, Md.

James W. Sauber, chief instrument engineer, Waters Manufacturing, Inc., Wayland, Mass.; **William J. McGrail, Jr.,** chief potentiometer engineer.

Lawrence Flemming, rejoined National Bureau of Standards, Mechanical Instruments Section, Mechanics Division, to evaluate telemetering transducers for planes and missiles.

Charles V. Kovac, resident technical representative, Avien, Inc., at Wright-Patterson AFB, Dayton, Ohio.

Frank A. Flower, manager of government sales, Thompson Products, Inc., Accessories Division, Cleveland, Ohio.

Keith G. Orr, charge of all purchasing activities at Goodyear Aircraft Corp.'s Litchfield Park, Ariz., plants.

Frank G. Willey, sales manager, Servo Corporation of America, New Hyde Park, N. Y.; **Warren Schoonmaker,** sales representative.

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TODAY'S MILITARY SERVICES, WITH THEIR TREMENDOUS TECHNOLOGICAL ADVANCES MADE POSSIBLE THROUGH SCIENCE, OFFER A VITAL REWARDING CAREER

Aircraft Radio Booms Commercial Sales

By Erwin J. Bulban

Boonton, N. J.—A new Beech C50 Twin-Bonanza combination flying showcase and testbed is being modified by Aircraft Radio Corp. to spearhead a concerted drive to greatly expand the company's commercial sales of radio and navigation equipment in 1956.

For many years after its founding in 1928, Aircraft Radio was known as a military supplier. It went into the commercial aviation market shortly after World War II. This program was interrupted, however, by the Korean war and increased military purchases in the years immediately afterwards.

In 1954, its commercial sales were about 16% of total business; last year, increased emphasis in this field boosted sales to about 30% on a gross of about $7.5 million. In 1956, ARC expects that its commercial aircraft program will account for 40% to 50%, with attendant increases in civil research and development.

H. S. Christensen, ARC's commercial sales manager, says that, "Frankly, we are set on shooting for the corporate aircraft market."

Two factors weigh heavily in this emphasis on the business aircraft market:

• **The company's growing concern** over a lack of policy by the military services in guarding manufacturer's proprietary rights—a sore point shared by all branches of the aviation industry (AW Nov. 7, p. 21). ARC officials point out that there have been several cases where the military apparently has turned over drawings furnished by the company with contracted material to competitors when re-ordering; items that it says were wholly developed with its own funds. Low profit margins and problems in selling the military are also mentioned by company officials in explaining their interest in commercial markets. "Generally we don't feel the effect of our military sales efforts for three to five years," was one comment.

• **The business aircraft market** has more vitality than that of the airlines, Aviation Week was told. ARC spokesmen said corporate aircraft operators buy new equipment far more quickly than do the airlines, whose turnover they estimate is on the average of about every seven years. "We could produce all the equipment we make for the airlines for their requirement in about four months, leaving us unoccupied for long periods," he noted. As a result the company has not been too active in airline equipment, it states.

When Aircraft Radio's new six-place Twin-Bonanza leaves the company's Boonton, N. J., airport on the start of a series of demonstrations within the next few weeks, it will be carrying some $20,000 worth of ARC electronic radio and navigation gear in addition to new equipment undergoing flight test.

New Instrument Panel

Approximately 1,000 man-hrs. will have gone into readying the airplane for its new mission. Most obvious modification is the new instrument panel. ARC took the factory version ou npletely and, whereas it formerly slanted forward, it is now vertical. Not only did this provide about 3.5 inches more depth at the top of the panel, but it will also give better instrument visibility. The standard panel stands forward just enough, he said, to pick up the distracting reflections of outside light.

Duplicate communications, navigation and flight instrument systems are being installed; one at the left for the pilot; the other to the right for demonstration. At far right is a panel which will contain experimental equipment under test.

To permit easy and quick revision of the layout, the company has installed vertical Dzus bars 5.75-in. high with 5 inches clear width between them. The bars have fastener holes every ⅜ inches. Any equipment can be replaced by merely opening four fasteners, disconnecting the instrument and pulling it out.

For its initial tours the Twin-Bonanza will be carrying this equipment: Dual Type 15D VHF navigational receiving gear, R19 VHF communications receiver and three T-21 VHF transmitters providing 30 channels, R20 marker beacon, dual F-11A isolation amplifier, dual CD-1 course directors and the new ADF Type 21, which will be flight demonstrated for the first time.

The airplane's nose baggage compartment will carry experimental flight test equipment. Since this section will not be heated and normally is subject to the most vibration, it will be ideal for proving new products.

To handle the wiring load, ARC has run 176 leads from the front baggage compartment to the rear baggage compartment, which stores the junctions. It figures that it has about 25% reserve leads for future needs, with an esti-

New Zealand Gets Fletcher Farm Planes

First mass delivery of U. S.-built Fletcher FU-24 Utility aircraft was made to agricultural operators in New Zealand, where the planes were assembled, during ceremonies attended by top-ranking government officials. Seven of the 10 FU-24s flown away after receipt of Certificates of Airworthiness are shown at Rukuhia Airport. The airplanes will be used in New Zealand's huge aerial fertilizing program that has been described by a cabinet member as being three years ahead of any other nation.

Cable-Price Corp., Ltd., has contracted to receive 100 FU-24s in kit form for assembly in New Zealand.

mated correct proportion of large, small and shielded wire for all contingencies.

All equipment is serviced by either one of the C50's dual 50-amp. generators. Christensen estimated that with all possible electronic equipment operating, drain will be approximately 39.6 amp.

Complete weight of demonstration equipment will be under 150 lb.—ARC says that a comparable installation of competitive gear would weigh between 350-400 lb.

A single installation of the ARC equipment would weigh approximately 114 lb., installed; its dual installation weighs less because certain basic hardware does not have to be duplicated.

Company-owned airplanes have been a vital factor in selling Aircraft Radio products. ARC also has a Beech Bonanza and a Ryan Navion. The latter puts in approximately 225 hr. annually, flight testing new equipment and modifications.

The Bonanza demonstrator has been averaging approximately 450-650 hr. a year; in its first three years of service it carried 3,400 people aloft. Once the company had the Bonanza at Wright AFB demonstrating omni equipment and took 52 people up in a two-day period; on another tour (of two-weeks duration) the company's equipment was demonstrated to 190 people in the air.

The airplane also is credited with closing a deal with a sales outlet that Aircraft Radio was anxious to get into its dealer fold. The company's Bonanza demonstration so impressed the prospect that he fitted his Bonanza with the same equipment and in eight months was in the top 10 in sales on ARC's force. "We figure that our dealers did two and a half times better in 1955 than in the previous year because of the additional demonstration time we put in last year," the ARC commercial sales manager said.

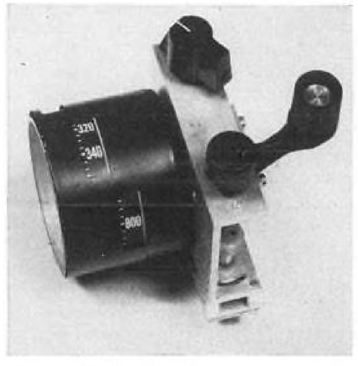
The larger Twin-Bonanza is expected to turn in an even more impressive record. Christensen calculates that the airplane should put in about 500 hours a year, and with the ability to carry five prospects aloft at a time will more than double the Bonanza's capacity. (Loaded with equipment and literature, the Bonanza usually could only take up two prospects at a time.)

Christensen expects to pile up important sales gains using the Twin-Bonanza.

This year's sales demonstrations with the new C50 should build an impressive score for the company, based on past experience with the smaller airplane. For one thing, this tour should spur CD-1 course director sales; Christensen pointed out that about one-third of the U. S. and the whole West Coast have not had demonstrations of the equipment. Some 200 of these $2,200 units are in use on corporate aircraft and current backlog is about $100,000.

Prospects will also get their first flights with the new 20-lb. ADF Type 21, which has only been displayed statically at a few meetings up to now. Even so, company sources say that its backlog for this equipment, which will be available later this year, is now about $250,000. Price is in the $2,000-$2,500 range.

Christensen considers the Twin-Bonanza the ideal light twin for his purposes. He picked the type following a survey of the other available airplanes and said that only the C50 offered the spaciousness and c.g. travel he required. Close grouping of prospects is another essential, he said, so that they can watch what is going on without strain. Aircraft Radio once had a DC-3 demonstrator, with duplicate instrumentation in the cabin, thinking that a large airplane would increase demonstration potentials. But it didn't work out because the lack of proximity to the cockpit dampened passenger interest and the company sold the airplane.



Small ADF Control Head

New type 170 ADF control head incorporating coaxial drum-type dial and dial mask weighs 12 oz. and requires only 3¼x3¼-in. panel area. The manufacturer, Electronics Equipment Engineering, Inc., Dallas, Tex., also has designed an 1170 ADF control panel including the new control head in a standard 5¾x4½-in. RTCA configuration. With a tachometer shaft output straight out the rear of the 170 unit, the control head requires a depth of 3½ in. behind the panel.

Aviation Distributors Get New Role In Federal Telephone Sales Plan

A nationwide sales organization utilizing aviation distributors to market industrial equipment as well as aircraft products has been established by Federal Telephone & Radio Co., a division of International Telephone & Telegraph Corp., Clifton, N. J.

Federal said it made the move because it feels that quality consciousness and precision-equipment maintenance experience of aviation distributors makes them a natural to sell and service its industrial lines in addition to the civil aircraft products it will be putting on the market.

Backing of this sales concept by such a large organization may have important repercussions on the current pattern of aviation distributorships and influence further participation in similar programs by other concerns.

Federal's move should have these immediate influences on its aviation distributors:

- Diversifying their activities into non-aviation lines will level seasonal peaks and valleys in their current business.
- It should enable them in some cases to ease the burden of high fixed overheads; enabling them to bring down charges on aircraft operations.
- Contact with industrial concerns paves the way to exploit aircraft sales; or in the case where the firm already is a plane customer, this provides an entry to interest the prospect in purchasing the new products.

Federal's new distributorship program divides the U.S. into six major sales territories. Distributors are currently handling 25-50 m.c. mobile radio units, private dial automatic telephone systems adaptable to provide centralized dictation and recording. In the aviation field, Federal plans a major program in airline and business aircraft navigation and communications equipment. Initial steps in this program will include its Tacan navigation system and a new low-cost autopilot.

The distributor organization consists of: Atlantic Aviation Corp., Teterboro Airport, N. J., metropolitan N. Y. and New England region; Atlantic Aviation Service, Inc., Wilmington, Del., middle Atlantic region; Bohling Aircraft Corp., Chicago, Ill., Midwest; Pacific Airmotive Corp., Burbank, Calif., Pacific Coast; L. B. Smith Aircraft, Inc., Miami, Fla., Southern area; and Southwest Automotive Co., Dallas, Tex., Southwest region.

In the three months ended December 31, Atlantic Aviation, Teterboro, sold 11 telephone systems to industrial corporations and 73 mobile radio units to manufacturers, taxi and truck fleets, police and fire departments.

W. E. Richards, Atlantic Aviation vice president, states that demonstrating the system in operation is the major factor in closing sales. He has installed the telephone system at his Teterboro Airport facility and a mobile radio unit in one of the company's station wagons. Atlantic has also put a qualified electronics engineer on the project to sell and service the equipment.

Low-cost Autopilot Nears Production

Production engineering is underway on a new business plane autopilot designed to perform three-axis functions and scheduled to sell for approximately $2,000 when it goes on the market late this summer.

The unit will be offered by Aircraft Products Co., Bridgeport, Pa., aircraft hydraulics manufacturer which recently acquired Tactair, Inc., as a wholly owned subsidiary. The autopilot has been under development and flight test by Tactair for the past three years under the direction of William Harcum, formerly of Sperry Corp.

Prototypes of the autopilot have compiled approximately 1,000 flying hrs. on various aircraft including some 200 hrs. on Aircraft Products' own Beech Bonanza. A company official says Aircraft Products has obtained Civil Aero-

nautics Administration approval for Bonanza installations and is now working for Piper Tri-Pacer approval.

He reports that the item weighs about 8½ lb. installed in a Bonanza and requires no electrical power to operate. The autopilot is designed on a building-block concept which would enable additional services, such as altitude control, approach coupler and omni heading tie-in, to be included later.

At present, Aircraft Products says that it plans to hold off demonstrating the unit until after it has reached its dealers' shelves. The company plans to distribute the equipment through authorized business plane dealers.

Also in the works at the new division is a lightplane anti-spiral device not requiring electric power.

PRIVATE LINES

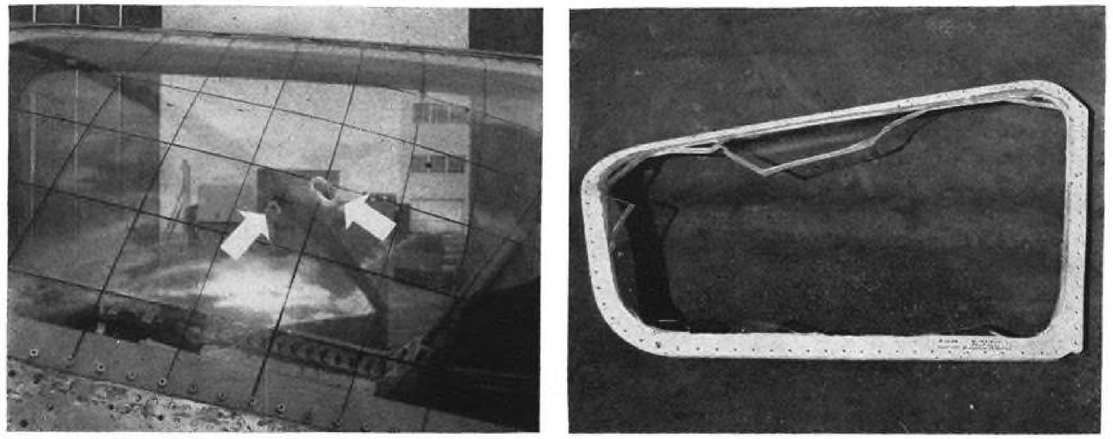
Field Aviation, Ltd., Oshawa, Ont., is adding a hangar at its Calgary, Alberta, base to expand business flying services. Firm also has facilities at Oshawa, Ottawa, Toronto, Winnipeg and Vancouver.

You and Instruments is a pocketsize booklet containing articles by Col. Joseph B. Duckworth (USAF, ret.), providing elementary facts on getting maximum use out of instruments for bad weather flying. Copies are available gratis from local Esso dealers.

Civil Aeronautics Board's proposal to require large aircraft registry numbers and letters has been dropped due to opposition from industry and aircraft owners. USAF Air Defense Command's desired to have the idea placed into effect to ease its aerial intercept and identification job. A number of aircraft owners have gone to larger registry on their planes; American Oil Co. uses 18-in. letters and numbers on the vertical fins of its corporate aircraft.

Use of parachute flares for night emergency landings is covered in detail in Aeronautics Bulletin 17 issued by University of Illinois Institute of Aviation, Urbana, Ill. Actual tests by the University using a Beech C35 Bonanza, Piper Tri-Pacer, Stinson 150 and Cessna 140 and 170 indicated that the 1½-min. electrical flare showed distinct advantages over the one-minute pistol-fired flare.

Don L. Myers Co., Palo Alto, Calif., has been appointed distributor for McCauley Industrial Corp. propellers in the San Francisco Bay area, northern California, southern Oregon and Nevada.



GUNFIRE TESTS produced small bullet holes in stretched plastic F-102 panel (arrows, left) but shattered "as cast" canopy (right).

Stretched Canopies Go Into Production

Development of stretched plastics—which reduce the hazard of explosive decompression at high altitudes—has reached the point where full-scale production of stretched plastic canopy panels has been ordered, according to Convair Division of General Dynamics Corp. Stretching makes the panels shatter-resistant (AW Mar. 21, 1955, p.10). The development program, according to Convair, has had the active cooperation of all airframe manufacturers, plastic material suppliers and fabricators and the military services.

In gunfire tests on F-102 canopies, .30-caliber slugs completely shattered "as cast" acrylic plastic panels (such as Plexiglas, Gafite), whereas the only damage in stretched panels consisted of holes where the slugs passed through the material (see photos above). In the former case, the result would have been explosive decompression at high altitude, in the latter a comparatively slow leak.

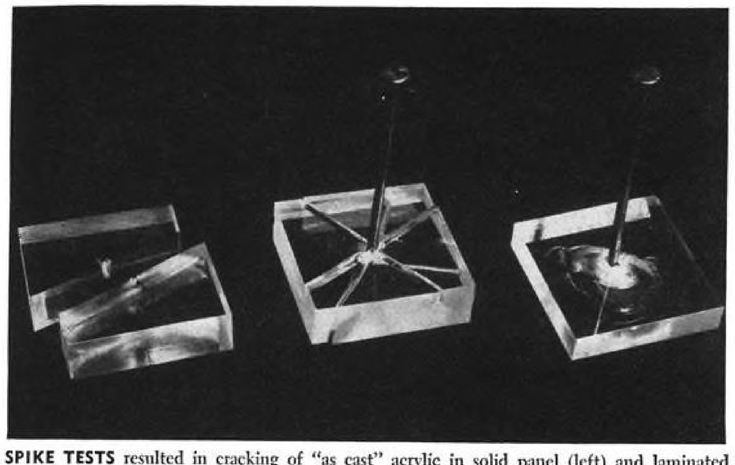
Time for Survival

The Air Force estimates that for a pilot to be able to tolerate decompression from a 7.2-psi. cabin pressure to 1.7-psi. atmospheric pressure, decompression time must be at least 0.35 sec. Based on formulas in Air Force Handbook ARDCM 80-1, the allowable hole size for such a tolerable decompression in a 35-cu. ft. cabin is 40.1 sq. in.

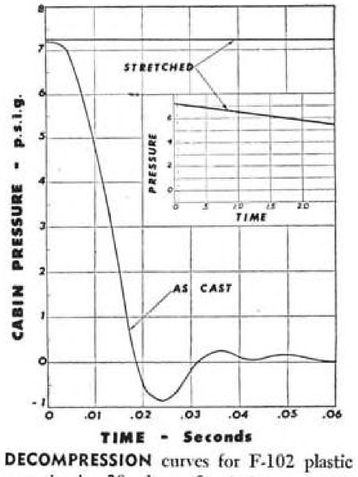
The "as cast" panel, completely shattered by .30-cal. fire, would permit this decompression to take place in only .02 sec. Today's pressure suits, unless worn partially inflated, take considerably more than .02 sec. to inflate and would offer poor protection in such a case.

In other comparison tests, where spikes were driven through specimens of 0.5-in.-thick "as cast" acrylic, a sandwich consisting of two layers of 0.2-in. "as cast" plastic separated by a 0.2-in. vinyl core, and a plate of 0.35-in. stretched acrylic, the latter again showed up best (photo, below left).

The solid block cracked in two before the spike had penetrated halfway; the laminate was held together by the vinyl, but both faces cracked and would have been unable to carry any structural load;



SPIKE TESTS resulted in cracking of "as cast" acrylic in solid panel (left) and laminated sandwich (center). Stretched panel (right) did not crack.



DECOMPRESSION curves for F-102 plastic canopies in .30-cal. gunfire tests.

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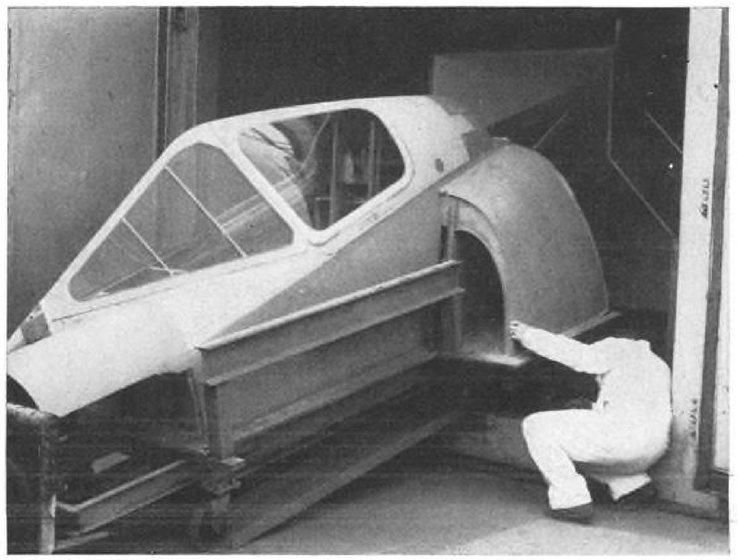


PLASTIC CANOPY on fatigue test structure at entrance to environmental chamber.

the stretched specimen allowed full penetration without cracking.

Why stretching improves the plastics' cracking characteristics is not known. One theory is that the basic structure is altered by stretching, producing a laminate-like molecular arrangement in the stretching plane. This would resist the spreading of cracks between adjacent molecular layers.

Crack Propagation Tests

One of the most important phases of the stretched plastic program has been evolution of a good test for crack resistance, to be used both during development and for quality control.

The procedure now in general use is a crack propagation test developed by the Naval Research Laboratory in Washington. A small hole is drilled in the center of a rectangular specimen and a crack started with a knife blade. The specimen is loaded in tension at a constant rate to produce failure in 3 to 5 min. A crack resistance factor is then derived, based on the length of the propagated crack, dimensions of the specimen and the tensile load at the time of failure.

Other physical properties, such as tensile strength, do not correlate directly with crack resistance, but can be determined from standard tests.

Much has yet to be learned, Convair points out, about the effects of size of projectile, projectile velocity and canopy panel temperature. For instance, it is known that the crack resistance factor for stretched Plexiglas 55 at minus 65F is half that at plus 75F. Despite the drop, however, the stretched material is far superior to the "as cast" at all temperatures, Convair says.

The idea of stretching was born during World War II, when it was noticed that the crown of blown bubble canopies seemed most resistant to cracking. Since this was the most highly stretched area, experiments in stretching were conducted, leading to today's knowledge of the field.

Two general stretching methods are employed: a mechanical system, which uses hydraulic rams and grips around the periphery of a square sheet; and a blowing method, in which a hemisphere or cylinder is blown and later flattened. In both, temperature must be carefully controlled. If too low, the plastic will tear during stretching; if too high, crack resistance will not be improved.

Present indications are that a 70% stretch in length and width produces the best results. A 1-in.-thick cast sheet thus produces a final stretched thickness of 0.35 in.

EXHAUST AIR GOES TO WORK on this air-powered portable router feeding a mist of lubricating oil to the cutters while simultaneously blowing away metal chips. An oil cup and air tube attached to the router's exhaust does these jobs which formerly required two separate hand operations.

GE Opens Production Of B-52 Turbopump

A $45-million production program is being initiated by General Electric Co.'s River Works at Lynn, Mass., to expand the manufacture of turbopumps—air-driven, 3,000-psi., variable-displacement hydraulic pumps—for the Boeing B-52 Stratofortress.

The turbine-driven hydraulic pumps convert the energy of air bled from the plane's jet engines to hydraulic power which is used to actuate landing gear, bomb-bay doors and wing flaps.

General Electric had held the initial development contracts for pneumatic drives, including air-turbine-driven hydraulic pumps and turbo-drives for alternators on the B-52. GE supplied the alternator drives for the experimental XB-52 and YB-52 aircraft and for a limited number of initial production planes.

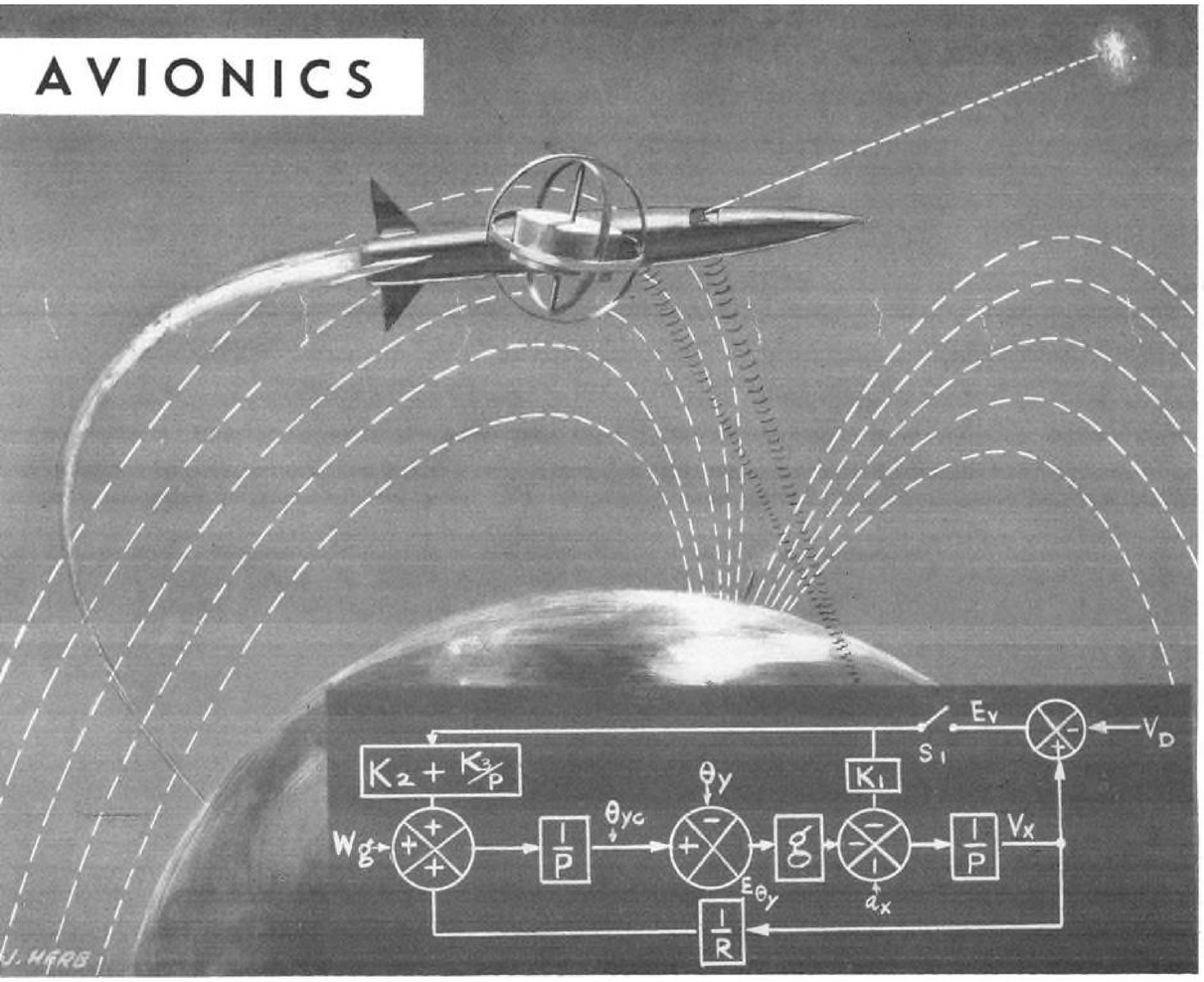
The B-52 is the first aircraft in which the complete accessory system is operated by pneumatic-driven power equipment (AW Nov. 23, p. 53).

The new drives may be used to supply either electric or hydraulic power. Each unit consists of a turbine, reduction gears and controls. The range of ratings for such drives is virtually unlimited, GE says. The drives can be installed in remote locations, close to the power need.

There are fewer moving parts in turbine drives than in any other method of generating power, GE says. Together with the fact that the components in these drives are similar to those which have been proven in jet engine operation, this should give the turbine units very high reliability, according to GE.

Maintenance on the drives is simplified, GE says, because the units are readily accessible. Furthermore, an entire unit can be removed and a new one quickly installed in its place.

With the air turbine drives operating from air bled from the high-pressure compressors of the Stratofortress' J57 engines, a powerplant failure need not mean loss of accessory power, since the compressor air is manifolded, and the check valve arrangement in the air ducts would prevent damage in one line or to one engine from incapacitating the entire accessory power system.



Inertial Guidance: Part IV

Hybrid Systems Ease Design Problems

By Philip J. Klass

A pure inertial guidance system demands an extremely high order of accuracy in its gyros, accelerometers, servo systems and other components, as discussed in previous articles in this series. But because further improvements in inertial component accuracy "come hard," some companies are turning to hybrid systems, which employ a supplemental radar, celestial or ground reference technique to correct for the cumulative errors which build up in a pure inertial system.

A hybrid inertial system sacrifices some of the advantages of a pure inertial system, such as complete freedom from external radiation or reference. However, for certain applications, the resulting reduction in size, complexity and cost makes this a fair swap.

One hybrid system under consideration for use in civil aircraft in the event of an all-out emergency may employ brief, intermittent ground fixes from VOR/DME (or Tacan) ground stations.

One of the most obvious types of hybrid systems results from using a Doppler radar, whose antenna is mounted on the belly of the aircraft or missile. The Doppler radar antenna is pointed forward or aft (not straight down) so that it can measure the vehicle's velocity relative to the ground.

This is accomplished by transmitting a continuous-wave signal (contrasted to the pulses transmitted by a conventional radar). When a portion of this signal, reflected from the ground, arrives back at the antenna its frequency will have shifted slightly from its original value. The amount of this frequency (Doppler) shift is proportional to the vehicle's velocity over the ground.

By measuring this Doppler shift both along an axis parallel to the aircraft's longitudinal axis, as well as along its transverse axis, and combining the two vectorially, the vehicle's total ground velocity can be obtained.

Feedback to Platform

A pure inertial system computes vehicle ground velocity by integrating the output of two accelerometers, suitably compensated for earth's rotation and other factors (AW Jan. 9, p. 42). A signal proportional to this integrator-calculated velocity is fed back to rotate the gyro-stabilized accelerometer platform at the same angular velocity as that of the vehicle around the earth, so as to maintain the accelerometers horizontal. The velocity signal also is fed to a second integrator, which computes the distance traveled.

In the hybrid system described, the accurate ground velocity measurement obtained from the Doppler radar is compared with the integrator-computed velocity. If there is any steady-state difference, then a compensating bias can be introduced into the integrator until the two velocities are identical.

If the vehicle is flying over friendly territory, where the external radiation from its Doppler radar presents no detection threat, the radar can be left on continuously. Under such a condition, the radar might even serve as a primary velocity sensor, with the accelerometer-integrator functioning to average out momentary errors or noise caused by rough or mountainous ground terrain.

For vehicles operating over enemy territory, the Doppler radar could be operated for only a few seconds at a time at irregular intervals of 10 to 15 minutes.

One company which is developing a combination inertial-Doppler navigation system is shooting for a navigation error of no more than 1¼% of the total distance traveled for a 10-hour mission. Thus a 600-mph. bomber flying to a target 3,000 miles distance should end up within 45 miles or less of its target.

Inertial-Pulse Radar Hybrid

An inertial system designed for use in a long-range bomber or transport can make good use of the airborne radar which it carries for surveillance or bombing.

When used to view known landmarks, or ground-radar beacons whose exact locations are known, it is possible for the navigator to determine the vehicle's exact position. This can be compared with the position coordinates computed by the inertial system. If there is any difference, the inertial system indicators can be reset to the correct value.

In a more sophisticated system, the introduction of new (corrected) position coordinates could serve to introduce suitable compensations to correct for inertial system bias errors which are responsible for the error in computed position.

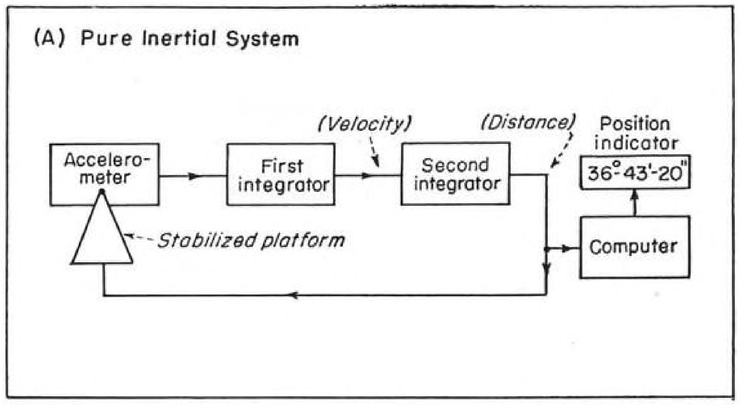
This type of self-compensation is employed in the new AN/ASN-7 dead reckoning computer, developed by Ford Instrument Co. as an outgrowth of its earlier AN/ASN-6. The pilot or navigator sets in the best known wind direction and velocity. However, when he sets in the aircraft's known position coordinates, the computer automatically modifies the original pre-set wind direction and velocity to reflect the actual conditions experienced as determined from the new position fix set in by the pilot.

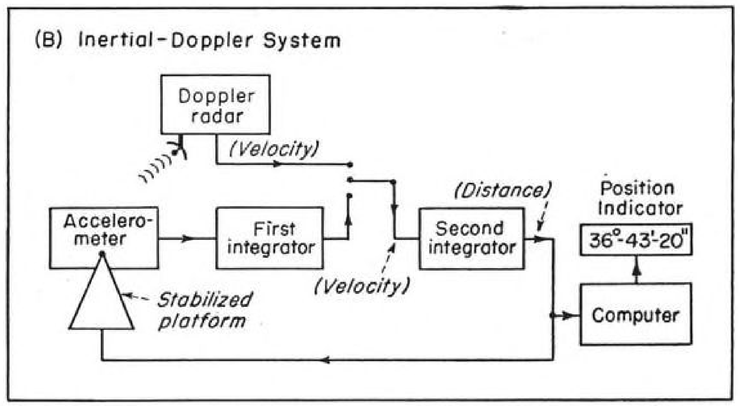
Another way of obtaining position fixes for recalibrating an inertial system is to make use of an automatic celestial navigation system. By obtaining a celestial fix on two stars (their altitude angle relative to the horizontal plus their azimuth positions), it is possible to establish a vehicle's position anywhere on the earth.

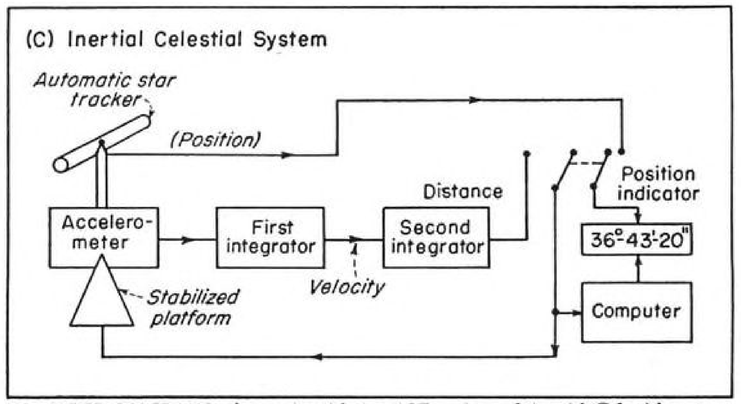
One of the major problems in celestial navigation—that of obtaining an accurate horizontal reference—is solved when used with an inertial system which has a gyro stabilized platform that maintains accurate horizontal alignment.

The recently declassified Kollsman Instrument Co. photoelectric sextant, or automatic star tracker, provides the other key element of an automatic celestial navigation system. This is a device which is able automatically to track pre-selected stars or planets by night, or the sun by day (AW June 13, 1955, p. 92).

A completely automatic celestial navigation system could be formed by using two of these automatic star trackers (or a single unit with dual tracking heads) mounted atop the in-







SIMPLIFIED DIAGRAMS of pure inertial, inertial-Doppler and inertial Celestial systems.

ertial system's stabilized platform or atop a duplicate platform which is "slaved" to the master inertial platform. A spherical trigonometric computer, perhaps the same one used for inertial computations, would complete the unit.

The celestial portion of a combined celestial-inertial system could then be used to make periodic vehicle position fixes, which would be introduced to correct position coordinates determined by the inertial system. Momentary loss of visual star-tracker contact with a star would not affect the accuracy of the inertial system.

If the celestial system is to be able to determine vehicle position anywhere on the earth, and serve as a complete alternative navigation system as well as inertial system "recalibrator," then two star-trackers or equivalent are required. If, however, the celestial system need only serve as a periodic recalibrating reference for the inertial system, and if the approximate flight path of the vehicle is known, then a simplified single star tracker could be used.

Northrop Aircraft reportedly is one of the foremost firms in the field of inertial-celestial guidance (for use in its Snark missile). The hybrid system is an outgrowth of Northrop's original work in automatic celestial navigation.

Inertial-VOR/DME System

One of many problems worrying the Air Navigation Development Board is the planning for civil aviation operations in the event of a major war. Barring an all-out nuclear holocaust, civil aviation and airline operations must be maintained. Yet if present VOR/DME navigation aids are left on continuously, they would provide an ideal navigation aid for enemy bombers.

One possible solution is a "cheap and dirty" inertial navigation system, with accuracy sufficient to provide useful

Expanding Field

The burgeoning field of inertial systems and their major components now includes a large cross-section of the nation's avionics organizations.

Among those active in the field are groups at A. C. Spark Plug, American Bosch Arma, Bell Aircraft, California Institute of Technology's Jet Propulsion Laboratory, Dynatrol, Eclipse-Pioneer, Federal Telecommunication Laboratories, General Electric, General Precision Laboratories, Kearfott, Kollsman, Litton, Massachusetts Institute of Technology, Minneapolis-Honeywell, North American Aviation, Northrop Aircraft, Radio Corporation of America, Ryan Aeronautical and Sperry Rand.

navigation information for short periods without fix recalibration. At irregular intervals of perhaps five to 15 minutes, the VOR/DME signals would be turned on briefly, a special adaptor in the airborne VOR/DME receivers would "freeze" the bearing-distance indications. This would enable a pilot to determine his position relative to these ground stations and then reset his inertial navigator to the aircraft's known position. The plane would then navigate from its inertial system until the VOR/DME station signals flashed on again.

A similar arrangement could be employed with the proposed new long-distance navigation aid, Navarho, which also provides aircraft bearing-distance information.

How Big?

If a combination inertial-VOR/DME navigation system is to prove feasible, the weight of the inertial portion must be brought down under 100 lb. Several firms are known to be working on lightweight inertial systems.

Litton Industries is developing a lightweight, low-cost inertial navigator suitable for use in civil and military helicopters. Litton's inertial activities are headed up by Dr. Henry Singleton, formerly a key man in North American Aviation's inertial systems activities.

Singleton told AVIATION WEEK he believes Litton can build an inertial navigator which will weigh no more than 60 lb., a figure which might be reduced to 30-40 lb. in production. Such a system would have a maximum error of about one-half mile from its last position fix after 15 minutes operation.

A spokesman for Arma estimates that his company could build a device with comparable accuracy at a weight of about 125 lb.

Another firm presently is working on a lightweight inertial navigator for the Navy, which reportedly will have an error of about one mile after one hour's operation, and will weigh about 200 lb. Bell Aircraft Co. has had a study contract with Army Aviation for a lightweight inertial navigator for use in light-planes and helicopters.

It is important to note that the gyro-stabilized platform used in all known inertial systems can also be used to provide signals for the control of an automatic pilot, stabilization of a fire control radar antenna, or a reconnaissance camera, as well as to operate cockpit heading and attitude flight instruments. Thus the inertial system might save from 10 to 25 lb. of gyroscopes and controls now required in civil and military aircraft.

Inertial guidance, based on the laws of Newton, made feasible by an idea advanced by a German professor of applied mechanics in 1923 (Dr. Max Schuler), is fast moving into the stage of operational hardware. Fifteen years ago such inertial systems would have been considered completely beyond the realm of practical achievement for airborne use.

Despite much progress to date, the problems of obtaining smaller, more accurate and more reliable inertial components will continue to challenge the ingenuity of inertial system designers for many years to come. However, the inherent advantages of inertial systems —pure or hybrid—which enable aircraft and missiles to navigate around the globe without ground-based radio aids, make the prize worth the battle.

(This is the final article of the series on inertial guidance. The inertial guidance series will be reprinted by Aviation Week. Single copies will be available in about four weeks to Aviation Week subscribers upon request without charge. Other copies will be billed at the following rates: One to 10 copies, 40¢ each; 11 to 100 copies, 30¢; over 100, 20¢. Orders for reprints should be addressd to Aviation Week, 330 West 42 Street, New York 36, N. Y.)

Avionics Companies Report Expansions

Reeves Instrument Corp. will move into a 260,000-sq. ft. plant at Roosevelt Field, Mineola, N. Y., recently vacated by the Fairchild Engine Division of Fairchild Engine & Airplane Corp.

Other recently announced expansions in the avionics industry include:

• **Sanborn Co.**, Cambridge, Mass., maker of instrumentation devices, will build a new $1.5-million plant in the Waltham (Mass.) Industrial Center. New facility will provide 122,000 sq. ft. of office and manufacturing space.

• **International Business Machines Corp.** will soon begin construction on a 400,000-sq. ft. engineering and manufacturing facility for its newly formed Military Products Div., at Oswego, N. Y. New facility is expected to be in operation late in 1956.

• **Retron Corp.**, Pasadena, Calif., maker of coils, has increased its production capacity by 40% with the addition of 15,000 sq. ft. of factory at 717 North Lake Ave.

• **Waters Manufacturing, Inc.**, Waltham, Mass., maker of precision pots and instruments, is building a 10,000-sq. ft. facility on Boston Post Road, Wayland, Mass. Occupancy is scheduled for February.

• **Cannon Electric Co.**, Los Angeles, maker of connectors, has purchased

facilities, assets, inventory and orders-on-hand of Diamond Manufacturing Co., Wakefield, Mass., maker of coaxial connectors. The new operation will function as a division of Cannon.

• **Hunter Manufacturing Corp.,** Bristol, Pa., has acquired all the outstanding stock of Bristol Engineering Corp., maker of test equipment.

• **Norden-Ketay Corp.,** New York, maker of aircraft instrumentation has opened an office at 11 West Monument St., Dayton, Ohio. A. (Rick) Harris will head the new office.

NEW AVIONIC PRODUCTS

Components & Devices

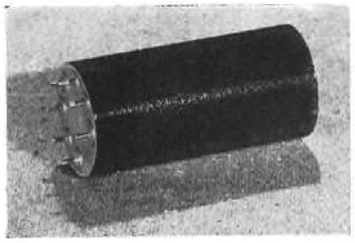
• **Precision 10-turn pot,** Model 800, has standard linearity tolerance of 0.03%, standard resistance tolerance of 3%, or 0.5% on special order. Resistance range is 500 to 400,000

ohms. Up to 50 taps per section can be provided. Spectrol Electronics, 1704 S. Del Mar St., San Gabriel, Calif.

• **High-temperature selenium rectifiers** capable of operation at plate temperatures of 150C without derating are available in a complete range of sizes. Bulletin HT-1 gives ratings and characteristics. Sarkes Tarzian, Inc., Rectifier Div., 415 No. College Ave., Bloomington, Ind.

• **Variable electronic filters,** Model EPN-10A, with Q-values of about 1,000, have resonant frequency which is continuously variable between 30 and 3,000 cps. Q-value also can be adjusted between 0 and 1,000. L. M. Electronics, Inc., 5120 W. Jefferson Blvd., Los Angeles, Calif.

• **Subminiature rate gyro,** measuring 1 in. in dia. x 2⅛ in. long and weighing only 4 oz., is available with an undamped natural frequency of 8 to 75 cps., and rate range of from 10 to 500 deg./second. Gyro is available with choice of potentiometer or inductance type pick-off, and with motor designed



to operate from 6, 12, or 26 v., 400 cps., one, two, or three phase. Robey Rotor Div., J. B. Rea Co., 1723 Cloverfield Blvd., Santa Monica, Calif.

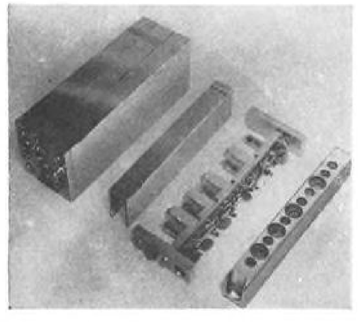
Instrumentation

• **Keyer-subcarrier oscillator,** Type DKO, permits pulse-width multi-channel coding in an FM/FM telemetering system on a standard 40 or 70 kc. sub-

carrier channel. Unit accepts input signals of 0 to 5 volts sampled a total of 900 times per second. Device measures 4¼x1⅞x1⅝ in., weighs 8 oz., requires external plate and filament supply. Applied Science Corp. of Princeton, Box 44, Princeton, N. J.

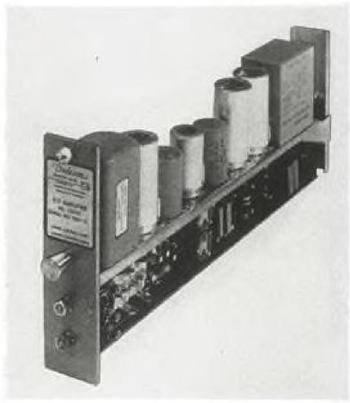
• **Telemetry decommutation station** for both FM/FM and PWM data provides 30 data demodulation channels with independent zero level and gain controls. Overall system accuracy in linearity and stability is quoted at 0.5%. Entire station comes in a single vertical rack. Bulletin 117 gives further information. Ralph M. Parsons Co., 135 West Dayton St., Pasadena, Calif.

• **Subminiature VHF receivers** and power supplies, AM and FM, are constructed in three modules: RF assembly, IF assembly and power supply, each weighing 2 lb. and measuring 1x3x9 in. Three units can be mounted together



or separately. They are available for several frequency ranges from 40 to 235 mc., feature crystal control, wide band response, and high sensitivity, quieting and noise rejection. Land-Air, Inc., Instrument and Electronic Div., Oakland International Airport, Oakland, Calif.

• **Wide-band d.c. amplifier,** Model C23125, is for use as low-level pre-amp where millivolt signals must be amplified with high linearity and speed of response. Amplifier uses a second-harmonic magnetic converter instead of conventional chopper to convert input to a.c., permitting complete isolation of



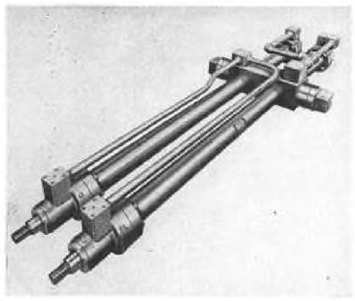
input from amplifier chassis. Amplifier gain is 5,000, linearity is with 0.1% of full scale, and wide band frequency response is less than 0.05 seconds rise time to step function input, according to manufacturer. Bulletin WBA gives application data. Doelcam, 1400 Soldiers Field Road, Boston 35, Mass.

Test Equipment

• **Range-switching vacuum tube voltmeter** automatically selects required scale and polarity (for d.c. measurement). Probe tip is touched to unknown voltage or resistance, button on probe is depressed, and instrument automatically switches to required range, preventing possible damage to instrument. Device can measure a.c. or d.c. voltages up to 1,500 v., and operates from 115 v., 50-60 cps. Bergen Laboratories, 11 Godwin Ave., Fair Lawn, N. J.

• **Radio field strength meter,** Model 728, for lab or portable use, measures field intensity of both AM and FM stations in the frequency range of 19 to 125 mc. It has a measuring range of 2 microvolts to 2.5 million microvolts/meter. Device can provide linear or logarithmic output indications. Telectro Industries Corp., 35-16 37th St., Long Island City 1, N. Y.

NEW AVIATION PRODUCTS

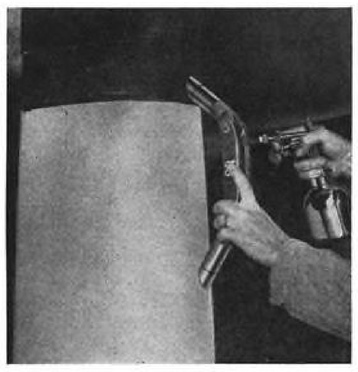


Wind Tunnel Model Aid

Special twin cylinders, yoke-trunnion mounted for operating the model plane support carriage in a wind tunnel, have adjustable hydraulic cushions and decelerate 7,600 lb. of mass at 5 ft./sec. in 2.4 in. The cylinders have a 4½-in. bore x 108-in. stroke. Pistons are an integral part of the 3⅞-in. dia. rams.

All O-rings and packings are designed for use with fire-resistant fluids. Cylinder unit's net weight is 3,200 lb.

Oilgear Co., 1582D W. Pierce St., Milwaukee 4, Wisc.



Magnafluxer for Flight Line

Magnetic particle inspection device that requires no electrical power permits flight line inspection of aircraft propellers and other critical external items, eliminating need for their disassembly. Electric arcing is said to be impossible with this equipment.

Magnaflux YM-5 yoke has angle-cut tips that rotate for optimum magnetic contact on vari-shaped parts. Magnetic pull on a flat surface is reported as more than 40 lb.

The yoke weighs 5 lb., and entire kit, including spray gun, two powder bulbs and wet and dry powder magnetic particle materials, weighs 22 lb. Price is $145.

Magnaflux Corp., 7300 W. Lawrence Ave., Chicago 31, Ill.

Linear Accelerometer for Missiles

New accelerometers sense positive or negative accelerations or both, in either the vertical or horizontal planes.

The new Model GG22 series, designed for both aircraft and missile applications, has units whose full scale

limits range from 0.5 to over 50G. Linearity is given as low as 0.5%, threshold as low as 0.009G. The accelerometers are hermetically sealed and ruggedly made. Internal stops limit the G range to specified values.

The Model GG22 units meet environmental specifications MIL-E-5272A. Power required is 28 v., d.c. at 0.5 watts; weight is 0.9 lb.; size is 3.2x2.3x 2.2 in.

Doelcam div., Minneapolis-Honeywell Regulator Co., 1400 Soldier's Field Road, Boston 35, Mass.

Direct Reading Dehydrator

New Anhydryer dehydrator removes water from air and other gases to any desired dew point by combination of double refrigeration and moisture absorption.

It also removes nearly 100% of oil vapor, provides constant dew point reading directly on a gage.

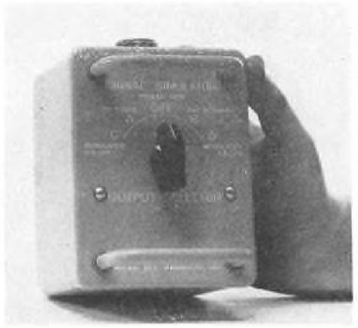
Anhydryer operates automatically for continuous and/or intermittent drying and can be used on either portable or stationary installations. Construction is austenitic type 304 stainless steel.

Robbins & Associates, 1735 W. Florence Ave., Los Angeles 47, Calif.

Go-No-Go Autopilot Checker

Micro Gee signal simulator is a 400-cycle suppressed carrier-modulated signal generator specifically designed to check aircraft or missile autopilots on the flight line.

The unit will check gain, threshold,



saturation and signal symmetry in go-no-go fashion.

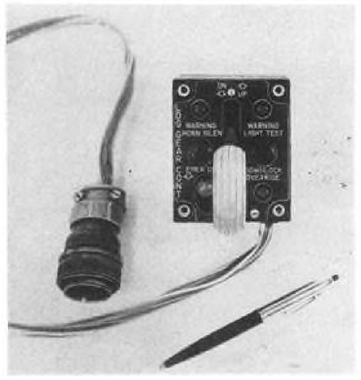
It is qualified to MIL-T-945A and has been designed for use by personnel with little technical training.

Micro Gee Products, Inc., Box 1005, 6100 W. Slauson Ave., Culver City, Calif.

Landing Gear Control Package

Model A1401 landing gear control is a composite package containing all required elements. Unit fits a space 2⅞ in. wide x 3¼ in. high x 2 in. deep.

Wheel-shaped knob on the control lever glows red whenever there is an unsafe condition, and a solenoid lock



over-ride button permits the pilot to negate this warning to make a belly landing if he desires. All switches for directional control of landing gear actuators or hydraulic valves and for sequencing warning signals are contained in the control. Front panel is lighted to MIL-P-7788.

Avionic Products Engineering Corp., Cockpit Control Division, Dover, N. J.

Intervalometer for Timing Uses

Model N-20 intervalometer supplies timing pulses for flight test instrumentation, ballistics, missiles, fire control and in timing of automatic machine processes.

The unit supplies 1, 2, 4, 5, 8 or 10

pulses per second, as well as additional continuous intervals of ½, 1, 2, 5, and 10 seconds, independent of the selectable pulses and also of each other.

Accuracy of pulse and interval is better than 0.5%. Intervalometer operates at temperatures of —50F to 150F.

Photographic Products, Inc., 1000 N. Olive St., Anaheim, Calif.

WHAT'S NEW

Publications Received

• Principles of Helicopter Engineering—by Jacob Shapiro—Pub. by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York, N. Y. $12.50; 433 pp. For the technician concerned with helicopter design, production, inspection, maintenance or operation.

• Control of Insect Vectors in International Air Traffic: A Survey of Existing Legislation—Pub. by World Health Organization, Palais des Nations, Geneva, Switzerland. 70 cents; 59 pp. (Available in French; Sw. fr. 2). Survey of the regulations for the disinfection of aircraft.

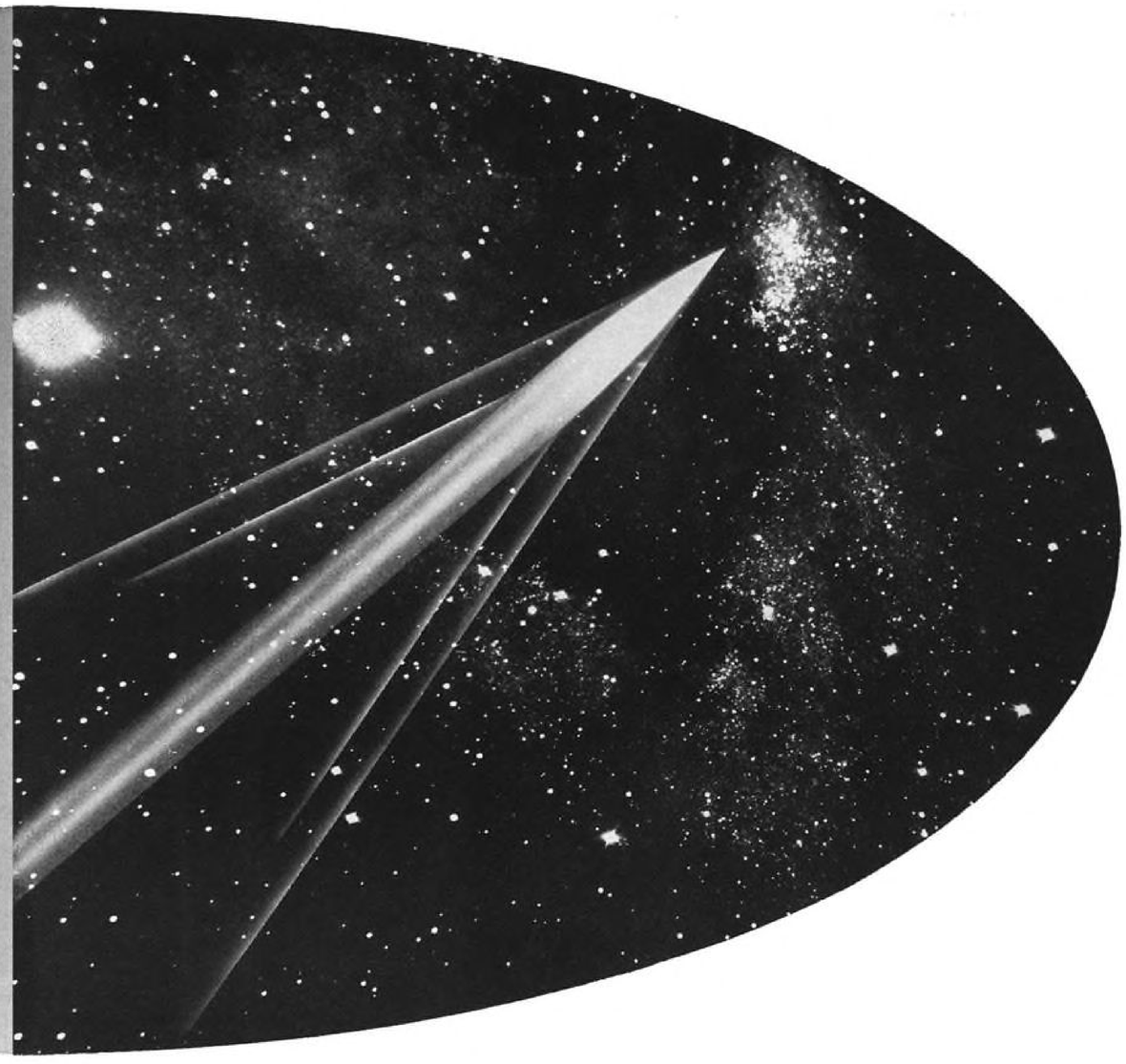
• ASTM Standards on Plastics (D-20) October 1955—Pub. by American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. Heavy paper cover, $5.75; 760 pp. ASTM standards and tentative specifications, methods of analysis, methods of physical testing, recommended practices, and definitions of terms pertaining to plastics.

• Compact Heat Exchangers—by W. M. Kays and A. L. London—Pub. by National Press, 435 Alma St., Palo Alto, Calif. $5.00; 156 pp. Data useful to heat-exchanger designers in the areas of aircraft cooling, air conditioning, large industrial oxygen plants, high-powered air-cooled electronic devices and nuclear plants.

• Men, Rockets and Space Rats—by Lloyd Mallan—Pub. by Julian Messner, Inc., 8 W. 40th St., New York, N. Y. Illustrated; $5.95.

• The Soaring Pilot—by Ann and Lorne Welch and F. G. Irving—Pub. by Pitman Publishing Corp., 2 W. 45th St., New York, N. Y. $3.75; 227 pp. The modern glider and the technique of using it.

NORTH AMERICAN HAS BUILT MORE AIRPLANES THAN ANY OTHER COMPANY IN THE WORLD



SUPERSONIC TODAY

The F-100 SUPER SABRE is the first supersonic operational fighter, and holds the world's first official supersonic speed record of 822.135 MPH. Now in the hands of the Air Force in quantity, the F-100 is produced at North American's plants in Los Angeles, California and Columbus, Ohio. Still faster, more effective fighter planes are—and will be—in continuous development at North American. A prime supplier of fighter aircraft to our Armed Services, North American also builds the F-100 SUPER SABRE as a fighter-bomber, the F-86 SABRE JET, FJ-series FURY Navy Fighters, and the T-28 high-speed Trainer.

ULTRASONIC TOMORROW

We cannot picture or explain North American's progress on the SM-64 NAVAHO Intercontinental Guided Missile because of security restrictions. We can say that it will fly at speeds far beyond what we now call supersonic, be guided by an automatic navigator, flown by an automatic pilot, and driven by a high-thrust rocket engine. North American is one of the prime sources of research and development on our nation's guided missile program—a major addition to the long-range striking power and the aerial defenses of the nation.

North American Aviation, Inc., Los Angeles, Downey, Fresno, Calif.; and Columbus, Ohio

NORTH AMERICAN AVIATION, INC.

Airlines Warned on Transponder Problems

Indications are that lines will go ahead with plans to improve ground radar performance, identification.

By Philip J. Klass

Washington—The airlines were officially cautioned last week that recently disclosed problems in the air traffic control transponder beacon program might result in poorer performance than originally expected.

The warning, confirming an earlier AVIATION WEEK report (Jan. 9, p. 23), came from J. F. Taylor, technical director of the Air Navigation Development Board, who spoke before Aeronautical Radio Inc.'s Airlines Electronic Engineering Committee (AEEC) and more than 150 airline and avionics industry representatives.

Despite Taylor's report, airline engineering representatives present generally indicated that the airlines would take a calculated risk and go ahead with the program because of the pressing operational need for transponders to improve ground radar performance during heavy precipitation and to provide aircraft identification.

A spokesman for Eastern Air Lines, which already has ordered 18 Wilcox Electric transponders for its new Super Constellations and DC-7Bs, told AVIATION WEEK he expected his management would proceed as originally planned.

Reluctance

H. A. Ferris, Trans-Canada Airlines, said he doubted whether the airlines could afford to hold off and said he believed the carriers were willing to take a chance on "being able to invent their way out of any troubles" that might show up in the system, or else accept something less than "gold plated" performance from the transponders.

Taylor made it clear that ANDB has great hopes for the radar beacon program and does not want to squelch industry enthusiasm. For this reason, Taylor said, the decision to disclose recent program problems was made with some reluctance.

"However, we don't want to enthusiastically urge people to immediately go ahead with buying and building transponders," Taylor said.

"We are afraid that the system may not yield the return originally expected and that we might get a reduced class of service."

ANDB wants to make exhaustive system tests "in a typical operational environment" (i.e. several ground stations and many transponder-equipped aircraft) before it approves the system and issues its specifications.

From the course of Taylor's remarks and his answers to questions from the floor, it was obvious that military security forced him to avoid detailed discussion of some of the causes of the present problems.

'Common System'

It is no secret that the civil aviation transponder is to be a "Common System" device which is compatible with identification transponders carried by military aircraft. This will enable both civil and military aircraft transponders to be interrogated by both civil and military ground radars.

Because of these Common System implications, ANDB and Arinc must tailor the civil transponder characteristics to the basic military system. Present problems are one indication that the military system itself has not yet been fully debugged.

The fact that both civil and military transponders can be interrogated, and must reply to both civil and military radars, is one of the causes of the present difficulties. In a congested terminal area such as New York there will be numerous ground radars interrogating each aircraft's transponder.

When a transponder reply to one radar is received by another, these spurious replies (called "fruit"), produce a clutter on the ground radar scope which can be as distracting and as obscuring as that produced by heavy precipitation.

Another serious problem is that too many interrogations from a number of ground radars can overload the airborne transponder so that it is unable to reply to some ground interrogations.

'De-Fruiter'

That such problems would exist has been known for some time. These and other beacon system problems, and possible solutions, were described by Arinc's S. B. Poritzky at last fall's meeting of the Radio Technical Commission for Aeronautics.

For example, a "de-fruiter" which filters out unsynchronized transponder replies (intended for other radars) has been developed and tested by the Civil Aeronautics Administration's Technical Development Evaluation Center. The unit reportedly performed very effectively at TDEC under simulated high-density conditions.

The problem of preventing over-interrogation of airborne transponders is not solved so easily. Because every airborne transponder reply, consisting of a series of pulses, requires a finite time for transmittal, there is a maximum number of interrogations which each transponder can accept and still have time to answer.

If the number of ground radar interrogations exceeds this, it is physically impossible for the plane's transponder to reply to each one. Such a situation might easily exist in an area such as New York or Boston.

Possible Solution

Walter Pike, ANDB's expert on radar beaconry, summed up the problem and its possible solution this way: "It results from technical limitations in the system which we have to solve by operational control."

Taylor also indicated that the solution might prove to be one of operational control, rather than a technical change in the system.

Although neither Taylor nor Pike revealed the form that such operational control might take, qualified observers point out that it might involve reducing the interrogation rates of ground radars and/or working out an arrangement whereby each station would interrogate intermittently on a nonconflicting basis.

Arinc's Poritzky estimated that it would probably require 10 years to develop and implement another Common System radar beacon if the present one proved basically unsound and he said airline operational needs couldn't stand such a delay.

Pointing out that the present Arinc characteristic (spec) for the airborne transponder had been intentionally designed to provide considerable flexibility so that interrogration and reply codes, as well as certain other characteristics, could be easily changed Poritzky asked: "Why not go ahead?"

Taylor agreed that Arinc's AEEC should go ahead and firm up its transponder characteristic, emphasizing that he did not want to slow up implementation of the program. But Taylor qualified his recommendation this way: "If we can work out the problems—we'll have a big gain. If we can't, we may have to accept a big degradation of service."

Emphasizing the importance of a beacon system, Taylor noted that the new jet liners will not show up too well on ground radars, even in good weather, particularly when viewed by the radar from a head-on position.

Propellers, which are excellent reflectors of radar energy, make piston-engine aircraft much better radar targets than jets.

CAA implementation of a five-ground-station beacon evaluation set-up in the New York area will be delayed until at least January 1957, or until June of 1957 if CAA decides to install "de-fruiters," Pike estimated.

Although Taylor did not say, observers report that ANDB expects to know by this spring whether the present beacon system problems can be easily solved, and need not await operation of CAA's New York set-up.

Observers speculate that the solution hinges on certain high-level military policy decisions, which Taylor was not free to reveal because of security.

Although ANDB's warning has made transponder manufacturers somewhat more cautious, it probably will not slow down the availability of airborne equipment, providing that the problem is resolved within the next few months.

Wilcox Electric, which will manufacture and market a transponder developed by Melpar, plans to start tooling up for production in April and expects to be turning out transponders by June, a company official told AVIATION WEEK.

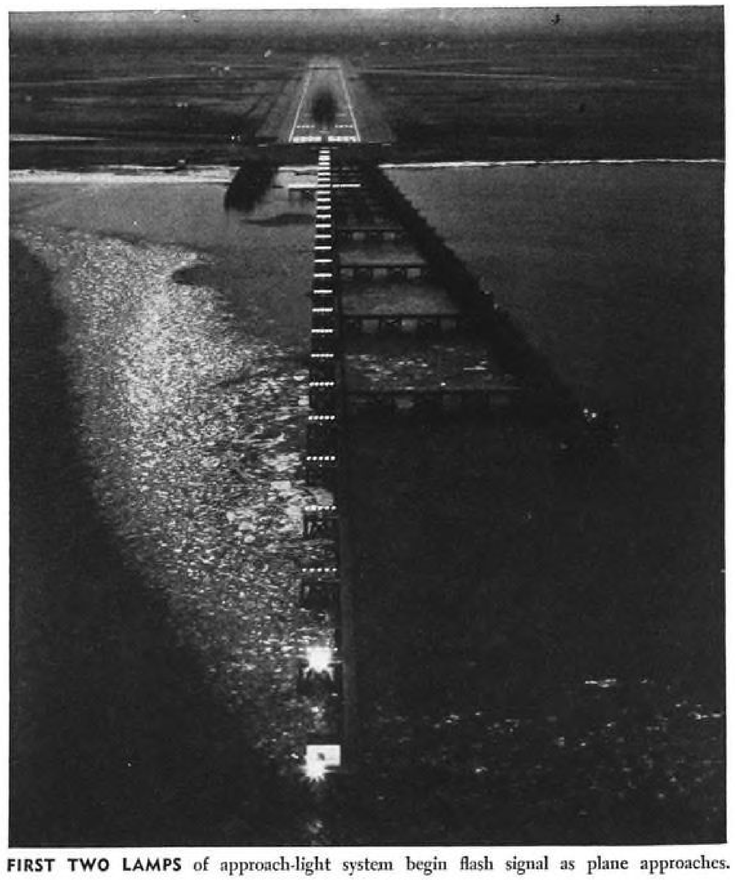
Bendix Radio and Collins Radio both plan to continue their transponder equipment developments without any slow-down, company representatives indicated. However, Collins says that its manufacturing plans "will have to be reconsidered in view of the possible effect on airline plans to install transponders."

BOAC Bid for New Routes Approved by Examiner

New routes to the West Coast, the Midwest and the British West Indies for British Overseas Airway Corp., have been recommended by Civil Aeronautics Board Examiner Curtis C. Henderson.

Henderson would allow BOAC to add Detroit as a coterminal point in the United States and to operate between London and San Francisco. He also favors granting BOAC a route between New York and Nassau, B. W. I.

The British carrier has applied for the new routes under terms of the air service agreement signed between the U. S. and the United Kingdom at Bermuda in 1946.



FIRST TWO LAMPS of approach-light system begin flash signal as plane approaches.

New Idlewild Approach System Designed to Ease Landing Hazard

By George L. Christian

New York—The installation of a fog-penetrating, high-intensity approach-light system designed to reduce the hazards inherent in bad-weather landings has been completed at New York International Airport.

Basically, the system—U. S. National Standard Configuration "A"—operates on the principle of brilliant, sequenced flashing lamps visible in almost any weather but with a flash duration short enough not to blind the approaching pilot.

The 3,000-ft. long approach light system, 2,500 ft. of which is mounted on pylons extending from the south end of Instrument Runway Number Four (see picture above), was installed at Idlewild under a Civil Aeronautics Administration contract and consists of 30 centerline bars spaced 100 ft. apart.

The bars are 14 ft. wide (except for the 42-ft.-long imminence-of-threshold bar and the 100-ft.-long distance bar). Each 14-ft. bar mounts five sealed-beam incandescent lamps. The lamps are unfiltered except for the imminence-of-threshold and two wing bars (these are red-filtered) and the runway threshold bar lights (green). The bar lights give a pilot roll information.

Giant Tracer Shell

The principal feature of the new lighting system is the incorporation of one Strobeacon (high-intensity flashing xenon light) in the center of each of the first 20 outer bars. Called EFAS (electronic flash approach system), each of the 30-million candlepower tubes is fired twice a second in sequence towards the runway. Pilots on approach receive the impression of giant tracer shells being fired towards the end of the instrument runway at a speed approaching 2,700 mph.

Pilots are not blinded by the flashes since the very short flash duration—

about 1/5,000 sec.—does not permit retention by the human eye.

The extreme intensity of the 30-million candle power lamps manufactured by Sylvania Electric Products pushes the flashes through bad weather conditions that would obscure other light sources.

Capt. John Gill, chief pilot of Eastern Air Lines and a long-time advocate of Strobeacon, listed these three elements essential to a successful instrument approach and provided by the xenon lights:

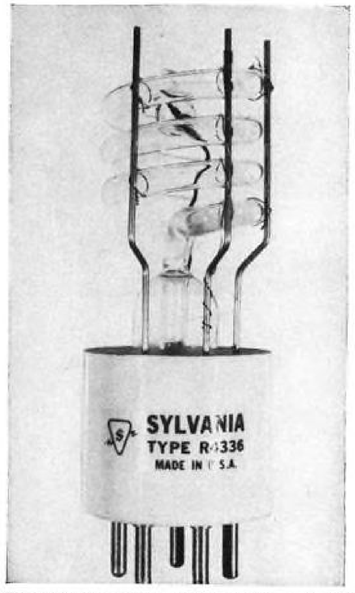
• **Identification.** The brilliant lights, flashing towards the runway through rain, fog or snow, instantly identify the lights as an approach lane; they could not be mistaken for any other type of illumination.

This is how the Strobeacon's light looked to Captain Gill while making an approach through heavy fog: "The first flash resembled a white-hot football racing away in front of the plane. In a very short space of time, the other flashes became visible."

• **Direction.** Because of the sequenced flashing, a pilot can immediately orient himself and determine the instrument runway's direction.

Captain Gill said Strobeacon's directional feature also eliminates the momentary problem of orientation that usually besets a pilot when he first breaks out beneath an overcast.

• **Transition.** Transition from instrument to contact flying is greatly simplified because the Strobeacons are visible five to nine seconds before the horizontal bar lights come into view (intensity of the bar lights can be regulated from the control tower). The bar lights establish roll guidance and allow the pilot to complete his transition from instruments to visual approach.



SYLVANIA CONDENSER LAMP emits 30 million candle power and is heart of system.

Electrical & Mechanical Details

The heart of the Strobeacon is a xenon-filled lamp placed across a 30-microfarad condenser. Application of an instantaneous, high-voltage trigger pulse causes the condenser to discharge, producing a bright white light. The lamp costs approximately $36 and has an average operating life of about 500 hr.

Sylvania made a conscious effort to keep all electrical circuits and components as simple as possible, and the coils are a standard automative type.

The lamp is housed in a waterproof, corrosion-resistant aluminum housing. The front lens is of tempered glass to resist breakage. The rear cover is easily removed with a screwdriver.

The lamp chassis has wheels on the front end so that it can be easily rolled out of the cabinet for maintenance and repair.

A special device allows the lamp to be levelled in the event that the support is not level. Provision is also made for the adjusting of the lamp's elevation.

All components are made to joint Army and Navy specifications.

Total Cost

Total cost of the Idlewild installation (equipment only) was about $20,000.

The Idlewild installation is an improvement on a similar Sylvania system which has been operating at Newark Airport for the last ten years and has been rated highly by airline pilots.

Experts See More Airline Gains, Hear Attack on Defense Transport

By Craig Lewis

Washington—Predictions of continued gains in airline business have been made to an annual transportation meeting of the U. S. Chamber of Commerce, which also featured a Hoover Commission official's attack on Defense Department transportation policies.

Defense has issued a report answering the Hoover Commission recommendations. It agrees that certain military transportation services should be streamlined, but objects to efforts to curtail the Military Air Transport Service and the use of administrative aircraft.

The views on the future of transportation were heard at the 1956 National Transportation Outlook Conference held here under the chairmanship of J. H. Charmichael, president of Capital Airlines.

Economist Paul W. McCracken told the group that the outlook for the nation's economy is good and the current boom will continue through this year if government expenditures, capital outlay and consumer spending continue to make expected gains.

Passenger Increase

A financial expert told the meeting the outlook for air travel is exceptionally good. The country is becoming more air minded, and passenger traffic can be expected to increase more than 12% this year, according to F. J. Iseman, transportation specialist of Merrill Lynch, Pierce, Fenner and Beane.

Iseman pointed out that recognition of the economic soundness of air transportation has been confirmed by large money lending organizations which have made substantial loans and credit provisions to airlines recently to finance new equipment programs (AW Jan. 9, p. 96).

Investor confidence is returning slowly to airline stocks as future growth and earnings prospects are better appreciated, Iseman said. He said strong financial positions and the prospect of higher earnings from heavy capital investment now planned "suggest modestly better dividends at future dates."

A review of Hoover Commission proposals to improve Defense Department transportation policies and procedures was made by P. M. Shoemaker, chairman of the Hoover committee which made the study.

MATS Criticism

Shoemaker said that MATS and other military air services are duplicating route services of the commercial airlines and that operations of the military airlines are overlapping and inefficient.

The Hoover committee found that the Navy is operating an airline, Fleet Logistics Air Wing, in competition with MATS, using one fourth as many four engine aircraft as MATS, Shoemaker said. These services are further duplicated by the Navy's Quicktrans charter operation, the Air Force Logair operation and the extensive use of administrative aircraft by the various air commands, he said.

All these competing services should be combined under MATS, according to the Hoover study. The Hoover Commission also feels that MATS should

confine its operations to essential traffic and stop carrying passengers and cargo which could be reasonably handled by commercial airlines.

The Defense Department agrees in its report that existing military air services should be merged into one operation. It plans to do this and to put the whole operation on an industrial fund basis in order to allocate costs among the military departments using the service.

Airlift Capacity

But Defense disagrees that MATS activities should be restricted to absolutely essential traffic. The department argues that in order to develop and maintain an adequate and efficient wartime airlift, it must keep a large peacetime establishment in readiness. And as long as this large airlift capacity exists, it should be used, Defense argues.

The Defense report acknowledges the need for strengthening and expanding the civil air transportation industry, but it feels that diversion of traffic from military services is an artificial basis for expansion and would increase the over-all Federal cost of providing for a mobilization air fleet.

The only way to develop the air transport capability needed for war, Defense believes, is to increase peacetime use of air transport as a normal means of transportation. Right now, airlift capacity is used for emergency or other high priority use, and is not generally used to take advantage of potential over-all logistics savings.

Defense studies now being conducted will point to the advantages of a logistics system geared to the use of air transport as a normal means of transportation. Defense plans to use civil airlines to a larger degree in its logistics system as a means of expanding air transport on a sound financial basis without damaging the mobilization readiness of the military air transport services.

The department says it will insure the maximum feasible use of civil airlines and will keep peacetime operations of military air transport services to the minimum level required for mobilization readiness and to meet requirements the civil airlines can't handle.

Administrative Flights

A strong objection is reported against Hoover Commission recommendations that the number of military administrative aircraft be cut drastically. Such aircraft are used to maintain flight proficiency by rated personnel assigned to administrative jobs, Defense said. Traffic carried in them is incidental and uses space that would otherwise fly empty, according to Defense.

Defense concurs generally with the Hoover Commission finding that a Director of Transportation should be established to handle all its traffic and transportation activities. The report said action is under consideration which would strengthen traffic management operations and enhance the authority of the Director of Transportation and Communications at the policy level.

In a directive issued after the department commented on the Hoover Commission recommendations, Defense defined its policies for utilization of military facilities and procurement of transportation from commercial carriers.

The directive says that the department's economic resources won't be used "in such a manner as will adversely affect the economic well-being of the commercial transportation industry.

Under the policy stated in the directive, the department promises not to favor any mode of transportation in procurement of transportation. It says commercial transport will be used when it is available and capable of meeting military requirements.

Frequent review of administrative procedures is called for to insure routine use of each form of transportation in a way that will recognize its inherent advantages. Considerations in such reviews will include the utilization of the productive time of the personnel being moved and conservation of stocks through reduction of pipeline and storage requirements.

Monroney's Bill to Establish CAA As Separate Agency Gains Support

Washington—Sen. Mike Monroney (D.—Okla.) has drawn more support on his proposal to divorce the Civil Aeronautics Administration from the Department of Commerce.

Two civil aviation associations and the AFL-CIO aviation unions have endorsed the Monroney-sponsored legislation.

All three groups—Aircraft Owners and Pilots Assn., National Assn. of State Aviation Officials and the combined labor union, are critical of the Commerce Department's "domination" of civil aviation policies.

Spokesmen for AOPA and seven unions representing airline and airport employes also attacked the Eisenhower Administration's ouster of Fred B. Lee as CAA administrator.

They were the first outside witnesses to testify before Sen. Monroney's Commerce Aviation Subcommittee, which is investigating Lee's firing last Dec. 10, and considering the bill to return CAA to the status of an independent agency.

The subcommittee's hearings may resume this week after a week's recess necessitated by Sen. Monroney's preoccupation with a bill on natural gas. The tentative witness list is headed by Louis S. Rothschild, Commerce Under Secretary for Transportation, whose appearance promises the most fireworks since the hearings opened Jan. 4. Also, the Air Transport Assn. is prepared to face the subcommittee with a staff of experts on air traffic control operations.

J. B. Hartranft, president of AOPA, told Monroney that CAA administrators are being "bounced in and out of office like tennis balls." He described the rapid replacement of CAA chiefs in recent years as a "fantastic spectacle of musical chairs" which he said has retarded the growth of private flying. AOPA has a membership of about 50,000 active pilots, Hartranft said.

As president of AOPA, Hartranft said he favored a divorce of CAA from Commerce "as essential to afford the administrator a clear and unobstructed channel for creating and implementing fundamental aviation policies."

He pointed to the last three administrators as having served an average of only 21 months and declared: "No businessman would tolerate a turnover of his key personnel like this." But the Commerce Department, he said, has made a ridiculous bean-bag out of the administrator's office.

Hartranft called Lee one of the few competent, well-qualified administrators the CAA has ever had. He warned that "another Lee incident might well collapse the CAA organization by shattering job security for the hundreds of technicians who perform services vital to the public safety."

A. B. McMullen, executive secretary of NASAO, said he didn't know of any instance where aviation has benefitted from Commerce Department administration, particularly in comparison with what could have been accomplished if CAA had been operating as an independent agency.

He added that NASAO has reluctantly come to the conclusion that "civil aviation has not been given active and vigorous representation at the White House nor has it enjoyed a real cabinet status since CAA was put in the Commerce Department."

McMullen said that of 36 state commissioners of aviation queried by his association all but three favored legislation separating CAA.

Another witness, George D. Riley, legislative representative of the AFL-CIO, said the aviation industry unions were unanimous on their approval of the Monroney bill.

PRATT & WHITNEY FLEETS OF ENGINES TO POWER JET AIRLINERS

The jet air age is arriving for passenger travel with the new Boeing 707 and Douglas DC-8 jet transports. Leading U. S. and foreign airlines have recently announced orders for large quantities of the new transports, and still more orders are in prospect.

Both the Douglas DC-8 and the Boeing 707 airliners are powered by turbojet engines designed, developed and produced by Pratt & Whitney Aircraft. These are the J-57, most powerful jet engine in quantity production and already in service in leading military aircraft, or a new advanced engine also of twin spool, axial-flow design.

The new jet transports will fly from Los Angeles to New York in about 4½ hours, or across the Atlantic in under 7 hours, cruising at speeds of more than 550 m.p.h.

Pratt & Whitney Aircraft engines have been used continuously from the early days of commercial airline operations. They pioneered transoceanic flight two decades ago and today they are flying for all the major airlines of the free world.

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Sncase Starts International Drive To Sell Caravelle Jet Transports

New York—A world-wide sales and service organization is being established by Sncase to promote its SE 210 Caravelle turbojet airliner Georges Hereil, president and director general of the French company, is inviting U.S. airlines to inspect and fly the prototype of the medium-range transport.

The Mark 1, of which 12 have been ordered by Air France, will be powered by two Rolls-Royce Avon RA29 engines, now delivering 10,500 lb. static thrust each. (Rolls-Royce has promised that the RA29 will soon produce 11,000 lb. thrust.)

This model will have a range of 1,500 mi. with full payload of 16,000 lb. and fuel reserve of 7,000 lb. Maximum gross takeoff weight is 90,000 lb. Normal seating arrangements are for 70 passengers, five abreast. But a high-density version is possible with seats for 90 people. Cruising speed will be 450 mph.

The Mark 2, which Sncase expects to power with Rolls-Royce Conway engines, will gross 105,000 lb. at takeoff. With a 16,000 lb. payload, its range will be increased to 2,500 mi. with normal fuel reserves.

Seat-Mile Costs

Using standard Air Transport Association formulas, Sncase claims these first economies for the Caravelle:

- **One aircraft** will provide 70 million seat/nautical miles per year, based on a stage length of 500 mi.
- **Fourteen Caravelles,** representing an investment of $22 million, will provide one billion seat/nautical miles per year.
- **Seat-mile costs** range from 2.4 cents on a 200 mile stage to a low of 1.3 cents for an 800 mi. stage to 1.5 cents for a 1,200 mi. stage and 1.7 cents for a 1,500 mi. stage.

Since its first flight last May 27, the prototype has made 103 flights, totaling 222 hr.

The company claims that 90% of the technical tests, including the controls, are completed. Testing of the radio and deicing equipment is about to begin.

A second prototype is scheduled to begin flying in April.

At maximum gross weight of 90,400 lb., the prototype takes off and clears a 50 ft. obstacle in 4,000 ft. With one engine cut out at the critical point of the takeoff run, it clears an obstacle at 6,250 ft.

Sncase further claims that from a standing start on a single engine, the Caravelle grossing 66,000 lb. clears a 50 ft. obstacle at 6,500 ft.

Landing distance over a 50 ft. obstacle is 3,400 ft.

The first prototype will be delivered to Air France this summer for endurance tests. Operations on Air France's European and North African routes will begin early in 1958.

Production Plans

Noting the unhappy experience of Vickers in underestimating the production requirements for the Viscount, Sncase has arranged to expand Caravelle production if orders pour in. It will build only 50% of the airframe and components, subcontracting the remainder to Sncaso and Sncan. Their initial goal is four aircraft per month.

Further arrangements have been made for production by other European aircraft manufacturers, including Fokker in Holland, Fiat in Italy and German companies.

Hereil does not believe that Republic Aircraft Corp., as reported, will manufacture the Caravelle in this country, unless major USAF orders are received. He expects Republic's assistance in verifying Sncase's technical standards and competence (Sncase makes spares for Republic's F-84F jet fighter), and in providing major maintenance for those Caravelles sold to American operators.

Minor Changes Made In Southwest Case

Washington—The Civil Aeronautics Board made only minor changes in its Southwest-Northeast service case decision when it dealt with petitions for reconsideration.

The main change was a modification in a long-haul restriction on Trans World Airlines' new service at Tulsa and Oklahoma City. In place of long-haul restrictions on service from the two points to Albuquerque, Wichita, Topeka and Kansas City, Mo., the CAB decided simply to prohibit TWA from serving Tulsa or Oklahoma City on flights which serve Wichita, Topeka or Kansas City.

Other minor modifications were made in the awards to American Airlines, Capital Airlines and Delta Air Lines.

Major objections to the CAB decision had been raised by Eastern Air Lines in its petition for reconsideration. Eastern asked the Board to grant added services between Dallas/Ft. Worth and various points on the airline's system.

The CAB said Eastern presented very little new material in its proposals, and the new material was so foreign to Eastern's previous case that further hearings would be required before an award could be made. The Board found that reopening of the record is unwarranted.

The petition of Ft. Worth to reopen the record was also rejected. The CAB pointed out that both Dallas and Ft. Worth were named as separate points without restriction, and the only purpose of reopening the case would be to restrict or deny service to Dallas to the advantage of Ft. Worth.

CAB Orders

(Jan. 5-11)

GRANTED:

Central Airlines an exemption to serve Ft. Smith, Ark., as an intermediate point between Tulsa and Ft. Worth/Dallas, for one year.

Central Airlines an exemption from terms of its certificate which requires Ft. Worth/Dallas to be served through Amon Carter Field. Central can now serve the points through their separate airports.

American Airlines permission to serve Houston through the Houston International Airport and Pittsburgh through the Greater Pittsburgh Airport.

APPROVED:

Agreements between Pan American World Airways, Seaboard and Western Airlines and various other carriers relating to intercarrier arrangements.

ORDERED:

Suspension and investigation of a Trans Caribbean Airways proposal to provide free ground transportation and special baggage allowances.

Capital Airlines' exemption to provide free air transportation to employes of the Bell Telephone Laboratories extended six months.

United Air Lines' mail rate for its Hawaiian route set at the rate proposed by the Board in its show cause order for the period May 1, 1947 to Aug. 6, 1952.

DISMISSED:

North Central Airlines' complaint against the serving by Robert B. Stewart as director and officer of Lake Central Airlines, since the Board finds that the charges, if true, don't warrant action against Stewart.

DENIED:

Petitions of the Town of Silver City, the Silver City-Grant County Chamber of Commerce and the Town of Clifton-Morenci for reconsideration in the Tucson service case. The petition of the City of Safford and the Safford-Graham County Chamber of Commerce for permission to intervene in the case is denied.

Airline Traffic — November 1955

	Total Revenue Passengers	Revenue Passenger Miles (000)	Load Factor	U. S. Mail Ton-Miles	Express Ton-Miles	Freight Ton-Miles	Total Revenue Ton-Miles	Per Cent Revenue to Available Ton-Miles
DOMESTIC								
American	583,436	335,803	**67.04**	1,469,683	994,812	6,017,465	41,388,017	**62.04**
Braniff	133,540	49,167	**58.39**	149,488	125,978	272,012	5,250,528	**52.47**
Capital	199,788	62,588	**58.94**	232,291	250,515	346,668	6,807,663	**44.46**
Colonial	28,357	6,840	**45.56**	13,147	8,361	35,583	709,245	**46.72**
Continental	49,911	18,228	**50.79**	64,287	25,618	110,160	1,945,589	**44.08**
Delta	168,804	72,520	**60.35**	267,846	250,078	582,630	8,056,960	**56.92**
Eastern	529,864	255,938	**57.80**	842,140	515,555	1,330,877	29,260,161	**47.11**
National	87,835	57,797	**60.45**	265,812	64,165	380,015	6,593,441	**60.40**
Northeast	39,252	7,769	**56.35**	9,943	15,473	22,140	768,502	**55.74**
Northwest	89,015	58,319	**55.79**	351,444	242,207	633,609	7,060,201	**49.92**
Trans World	310,571	228,835	**60.24**	1,020,192	841,343	2,184,661	25,937,762	**56.53**
United	405,189	264,083	**58.45**	2,094,902	1,166,141	2,544,868	31,186,507	**52.16**
Western	87,710	39,496	**53.89**	227,787	83,468	214,755	4,298,204	**51.20**
INTERNATIONAL								
American	9,883	6,653	**62.74**	11,611	386	218,805	936,491	**64.68**
Braniff	2,298	4,959	**32.15**	30,491	.....	71,315	671,589	**34.62**
Caribbean Atlantic	10,551	777	**48.85**	963	.....	4,080	75,818	**46.67**
Colonial	1,488	1,166	**43.95**	524	.....	7,174	135,602	**49.13**
Delta	3,618	4,014	**41.66**	7,985	.....	68,787	490,562	**36.49**
Eastern	13,323	18,793	**52.40**	66,762	.....	70,176	2,176,011	**47.82**
National	7,391	4,201	**50.66**	8,263	3,435	43,216	488,606	**47.96**
Northwest	6,183	12,239	**42.82**	1,014,164	15,941	667,099	3,035,505	**62.55**
Pan American								
Alaska	5,259	10,127	**62.17**	33,759	.....	230,067	1,346,045	**53.55**
Atlantic	58,397	72,846	**58.21**	836,005	.....	1,992,918	10,500,700	**59.23**
Pacific	18,032	52,269	**63.50**	1,090,716	.....	1,201,775	7,895,262	**64.47**
Latin America	76,450	68,554	**57.39**	304,272	.....	3,208,763	10,459,541	**57.98**
Panagra	10,551	12,186	**52.36**	44,253	.....	227,062	1,610,361	**51.56**
Trans World	14,265	37,665	**55.25**	747,605	.....	789,958	5,589,886	**65.38**
United	5,102	12,672	**59.76**	97,685	.....	39,272	1,430,415	**50.88**
LOCAL SERVICE								
Allegheny	25,922	4,207	**43.78**	6,394	17,623	.....	425,210	**44.66**
Bonanza	9,080	1,994	**37.50**	3,352	2,145	5,105	200,822	**36.33**
Central	7,389	1,310	**28.90**	3,480	1,675	5,229	135,334	**25.49**
Frontier	12,089	3,199	**39.27**	13,925	6,564	51,096	377,238	**48.63**
Lake Central	9,325	1,489	**34.79**	1,810	14,620	.....	154,626	**34.25**
Mohawk	26,387	4,855	**49.17**	4,712	5,946	7,229	480,544	**48.66**
North Central	33,542	4,930	**43.55**	15,221	29,219	.....	512,641	**39.65**
Ozark	22,239	3,328	**34.83**	7,069	17,942	.....	336,039	**35.66**
Piedmont	29,754	5,597	**49.47**	13,347	10,955	16,867	576,039	**49.96**
Southern	13,932	2,379	**40.62**	7,263	12,244	.....	246,751	**38.88**
Southwest	19,973	4,029	**51.53**	5,381	4,262	9,523	409,604	**51.38**
Trans Texas	13,116	2,964	**39.08**	12,480	6,054	12,960	313,502	**30.16**
West Coast	14,036	2,455	**37.57**	3,492	2,238	5,024	238,569	**44.90**
HAWAIIAN								
Hawaiian	27,634	3,711	**54.32**	3,719	.....	118,350	456 053	**49.63**
Trans Pacific	12,426	1,537	**44.36**	942	.....	7,908	127,446	**44.94**
CARGO LINES								
Aerovias Sud Americana	.....	.....	.....	.....	.....	668,618	668,618	**61.57**
Flying Tiger	5,402	14,306	**95.99**	.....	.....	5,828,868	7,259,381	**77.77**
Slick	2,017	3,253	**74.00**	29,919	.....	5,304,530	5,659,725	**73.13**
Riddle	.....	.....	.....	1,000	.....	1,533,317	1,534,317	**91.52**
HELICOPTER								
New York Airways	2,344	47	**59.49**	943	1,307	555	7,169	**54.29**
Los Angeles Airways	575	21	**21.00**	4,060	1,592	.....	7,560	**37.46**
Helicopter Air Service	.....	.....	.....	2,030	.....	.....	2,030	**39.18**

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

Rizley Urges CAB Regulation Of International Carrier Rates

Washington — Civil Aeronautics Board sought authority to regulate rates of international air carriers in opening testimony at hearings before a House Commerce Subcommittee on civil aviation policy.

Congress has repeatedly turned down CAB requests for the same rate regulatory authority over international carriers that it has over domestic carriers.

Emphasizing that the necessity for the additional authority is increasing, CAB Chairman Ross Rizley told the subcommittee that this was pointed up last year by "the cut-throat bidding" which developed for foreign military charter services. Because of the stringent competition, he said, "The situation is such as to give rise to reasonable fear that unless the minimum rates of these carriers are regulated and fixed by the board, the safety of their operations will be jeopardized."

CAB Seeks Speed

Other developments at the hearings of the subcommittee, headed by Rep. Oren Harris (D.-Ark.), were:

• **Air Transport Assn.'s** new president, Stuart Tipton, called for legislation requiring all irregular and contract carriers to obtain certificates similar to scheduled carriers. He denounced CAB's recent decision authorizing irregulars to operate 10 round-trips monthly between any two points as "heightening confusion" and leaving the nonskeds "free to roam over the U. S. operating between any points they choose."

• **Recommendations to provide** for a speed-up of proceedings are now being drafted by CAB for submission to Congress.

• **CAB is considering** a "clamp down" on "leaks." Rizley suggested calling in the Federal Bureau of Investigation on future incidents and the possibility of amendments to Civil Service law providing for the dismissal of employes. Premature information, Rizley objected, opens the way for interested parties to bring heavy pressure on the Board before final action is taken.

In international commercial operations, Rizley told the subcommittee, "Up to now there has always existed a temptation to cut rates below economic levels in order to try to capture a larger share of the market, with the hope that the losses, if any, could be transferred to the subsidy.

"But now that a number of major routes are for the first time being operated without subsidy, there is a real danger that the trend will shift in the opposite direction. Since revenue increases to a subsidy-free carrier redound to his financial benefit, there will be an increasing temptation to increase rates to a point which will maximize the carrier's revenue, though this may well be above levels that would be considered reasonable."

Tipton's Views

Rizley protested elimination of CAB's authority to provide new services by exemption from the certificate requirement, as proposed by Tipton. Rizley said that certificate procedures "should be used in instances where the new services proposed are of the same type and nature as those already in operation and, in effect, merely propose to duplicate those services."

Tipton vigorously denounced this as meaning "that anyone who can think up anything at all new to do" would be authorized to operate an air transport service without having to obtain a certificate.

With its decision in the Large Irregular Case, Tipton said, "The Board seems to have abandoned all efforts to bring the nonsked carriers into the certificate system. On the contrary, it has given them a pat on the back."

The large-scale operations of nonskeds, he objected, demonstrates the "erosion of the 1938 Civil Aeronautics Act." Tipton insisted that the act was intended to authorize only small-scale operations, such as fixed-base operations without the certificate requirement.

Shortlines

▶ **Air Austria** has ordered four Vickers Viscount 803 aircraft for delivery late in 1957.

▶ **Brazil** has eased entry regulations for Americans and Canadians so visitors can stay for 60 days without a visa. Visitors will need only a passport, vaccination certificate and through plane ticket when the regulation becomes effective in March.

▶ **B. K. S. Air Transport Ltd.** will start a new service between Belfast and Edinburgh Apr. 30. The route will be operated with Viking aircraft.

▶ **Southern Airways** carried 13,500 passengers in December, a 16% increase over the previous December. The carrier flew 2,300,000 passenger-miles last month.

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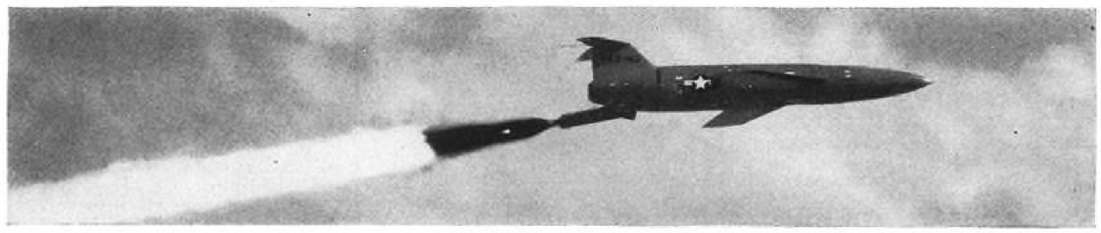

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ELECTRO-MECHANICAL

OPPORTUNITIES
in
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AUTONETICS
A Division of North
American Aviation, Inc.

During 10 years of research and development in Missile Controls, North American's electro-mechanical projects have become so diverse and important that a separate division named AUTONETICS has been formed. AUTONETICS still has openings for engineers.

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AUTONETICS

A DIVISION OF
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ENGINEERS

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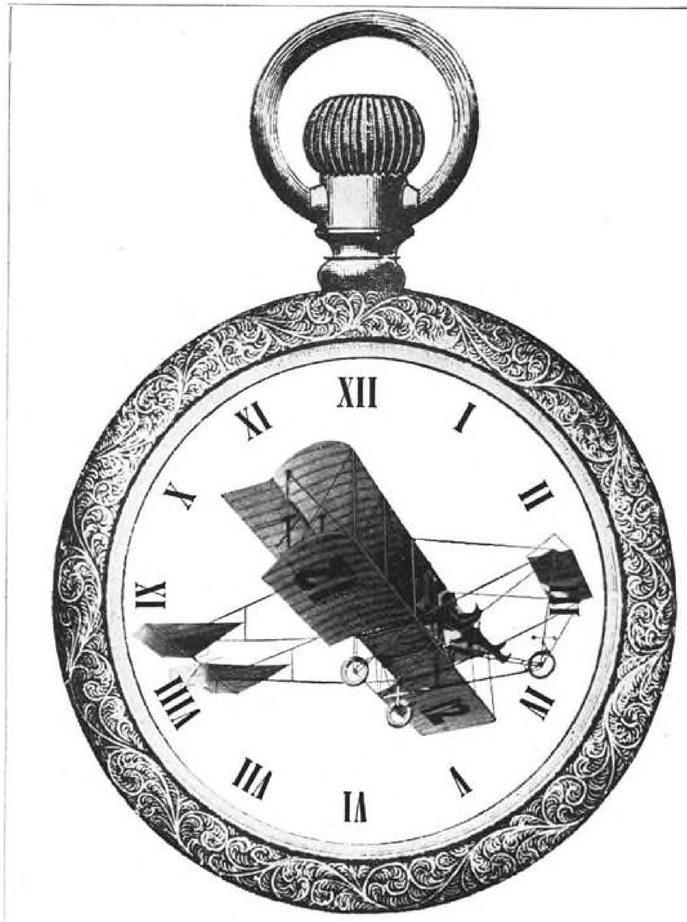

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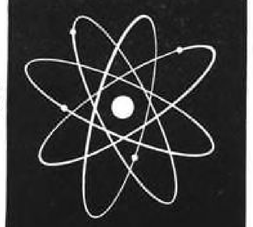

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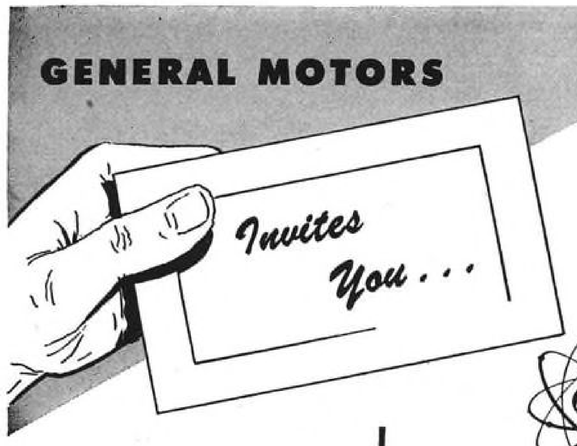

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ENGINEERS

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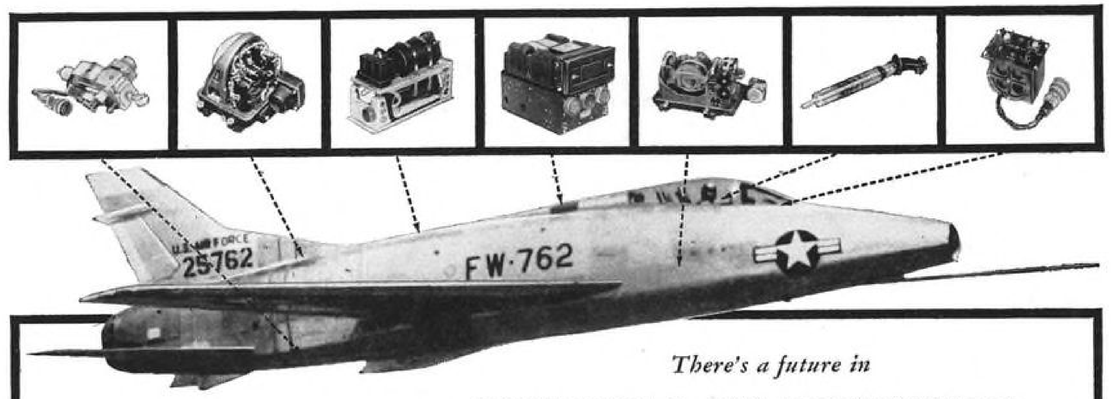

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36	A80348	828-12Z-2	Weston	Air Temp. Indicator
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19	A80522	36001-1C-3-A1	Eclipse Pioneer	Direction Indicator
34	A80551	146102	Bendix	Power Brake
233	A80559	1265-900	Airex	Valve
22	A80561	AA31400	Vickers	Valve
21	A80565	HC2109	Air Associates	Cylinder
40	A80566	AN6203-3	Bendix	Accumulator
6	A80585	HC2110	Air Associates	Cylinder
227	2021D80604	6141-H69	C-H	Clr. Breaker
66	D80620	M862A	Pollack	Switch
804	D80628	58G926	G.E.	Ballast
395	D80642	58G946	G.E.	Ballast
29	A80654	4150-1-1/4-3S	Parker	Fuel Selector Valve
32	A80661	1408	Hydro-Aire	Valve
54	A80681	25432	Airesearch	Control Cable
1	A80686	AN4116-R6A	Jack & Heintz	Starter
19	D80688	117-10	Edison	Control Box
72	A80709	1416-12	Eclipse-Pioneer	Starter
53	D80731	MS-52A	Bendix	Fitting
37	D80744-	21846	Isolantite	Antenna Mast
55	A80877	727-72-Z2	Weston	Air Temp. Gauge
87	A80878	727-73-Z2	Weston	Air Temp. Gauge
83	A80879	727-74-Z2	Weston	Air Temp. Gauge
49	A80898	715E	Fulton Sylphon	Temp. Control
46	A80958	M870036B	Kidde	Fire Ext.
9	A80960	982499	Kidde	Valve
35	A81002	923748	Kidde	Oxygen Cylinder
13	A81035	8DJ-29AAy	G.E.	Cowl Flap Indicator
44	A81058	979270	Kidde	Control
438	A81125	33786-2	Edison	Thermocouple
129	D81336	AN3200-450	Westinghouse	Shunt
42	D81337	AX31	Westinghouse	Ammeter
76	D81356	C768696-1	Pioneer	Transformer
686	D81406	L6861		Luminator
282	D81407	L6863		Night Light
67	D81560	58G927	G.E.	Ballast
262	2021D81567	L6993		Lights
239	D81568	L6998		Lights
29	D81587	AX31	Westinghouse	Ammeter
69	A81714	25435A	Kidde	Bracket
12	A81750	15701-1A	Pioneer	Controller
37	A81804	EYLC2434	Aircraft Control	Motor
17	A81813	4582AA-6C	Dynamic Air	Blower
10	A81815	FYLD2516	Barber Coleman	Thermostat
116	D81912	EA-1	Airpax	Vibrator
50	D81923	AYLZ22845	Barber Coleman	Micropositioner
21	A81976-01	72400	Hamilton Standard	Control
30	A82109	18784	Adel	Valve
18	A82708			Antenna Mast
9	A82827	366-2LH	Warren McArthur	Seats
12	A82828	366-2RH	Warren McArthur	Seats

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10	R170-M1	Actuator
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2	R174-M6-10	Actuator
1	R174-M6-11	Actuator
1	M8684	Actuator
1	M8691	Actuator
3	D15485-15	Actuator
6	D15485-16	Actuator
7	100-322C	Air Compressor
2	AVR524D702	Blower
12	3A410012-1	Bushing
14	3A410012-2	Bushing
5	3A720123	Barrels
6	3A111310-2	Bushing
36	3A111310-3	Bushing
5	729-23	Brace
2	729-25	Brace
150	4508-6	Bearing
179	AT-8	Bearing
429	B-539	Bearing
8	8-201R	Coupling
3	8-301	Coupling
7	8-301R	Coupling
19	8-310	Coupling
13	8-834	Coupling
23	424 AG2	Coupling
6	223602-2	Control
23	2209-5	Cap & Chain
193	9760-22	Cap & Chain
194	9760-32	Cap & Chain
3	62240	Cylinder
17	982-C	Control
4	982-E-1	Control
3	0441	Control
14	0443	Control
377	G464	Cog
20	A6602	Connector
5	AFB129-100	Heater
2	C97A49	Heater
7	C97A28	Heater
2	DJ11	Indicator
2	530FM9835	Indicator
2	8DJ3ECB	Indicator
1	8DJ4PGC	Indicator
3	8DJ11GAD	Indicator
2	8DJ12GAA	Indicator
2	8DJ26AAA	Indicator
2	4774-55-10	Indicator
1	12121-1A	Inverter
8	C-17021	Insulator
16	C-17022	Insulator
3	C-17023	Insulator
190	RD206-5B-8	Inserts
4	83-1AC	Switch
4	8712-R4	Switch
3	555-2058	Switch
11	A800B2-7	Switch
2	A800J2-7	Switch
3	5T-2N	Switch
10	C200JB-4R-19	Switch
5	W7927-16-D2	Switch
7	5-201	Switch
9	801 RC	Switch
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19	A35-BU	Switch
4	W-7927-20-D	Switch
22	92990	Valve
17	6-585	Valve
2	3834-2	Valve
13	3934	Valve
6	4116-24D	Valve
11	5222-2	Valve
6	5718	Valve
40	7201-2	Valve
19	10003	Valve
4	10058-3	Valve
8	12782	Valve
5	530880-2	Valve
10	17589-2	Valve
5	14517-2	Valve
12	20168	Valve
1	20373	Valve
1	24402	Valve
1	29851	Valve
11	90420	Valve
8	90420-2-50	Valve
7	314894	Valve
3	401473-3	Valve
3	401856-3	Valve
6	840104	Valve
1	14517-4	Valve
10	9530493	Valve
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28	D1100-D-1	Valve
10	D1100-D-1A	Valve
16	D1100-D-2	Valve
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9	A34220	Valve
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27	A4456	Rheostat
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24	FCD19265-1-1	Wood Rib
5	FCD19265-1-2	Wood Rib
18	FCD19265-2-1	Wood Rib
18	A4427	Lamps
25	A5075	Light Ends
97	B3581	Lamp Cover
138	B4755	Light Fixture
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246	B4788	Light Fixture
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64	A-11	Lamp Assy.
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11	J2.5-27	Adel	Metering	Pump
4	J2.5-24D-4	Adel	Metering	Pump
4	J2.5-27.5D-4	Adel	Metering	Pump
17	J5.0-245-7	Adel	Metering	Pump
32	J5.0-27.5S-7	Adel	Metering	Pump
5	B52415-6	Eclipse	Rheostat	
78	AN3155-25-100	Ohmite	Rheostat	
129	AN3155-50-100	Ohmite	Rheostat	
20	B12306	Marquette	Selector Valve	
144	702-FG-6D	Kohler	Selector Valve	
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5	715-FT-6D	Parker	Selector Valve	
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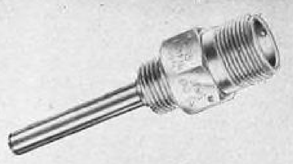

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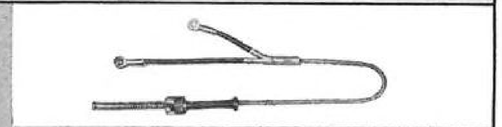

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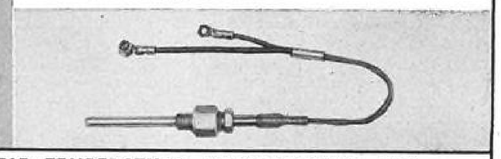

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LETTERS

Traffic Control Muddle

I'm not too often moved to write "The Editor", however, the subject of Air Traffic Control is usually a sufficient enough reason to push me toward the typewriter. The recent upsets in the CAA, both with respect to policy, and now top level personnel, have been highlighted in the press and Congress—all too late. It's been quite obvious for some time now, since the ANDB (Air Navigation Development Board) was founded I'd say, that soon we were to face the realization that air traffic was about to outgrow its control system.

Your "Questions for the Probers" (AW Dec. 26, p. 94) are all good ones and they must be answered. I ask, though, why has it taken so long for these direct questions to be asked? Must a Mr. Lee be fired (or resign) first everytime?

I won't take the time to go into each of your questions to the "Probers" now since I don't feel sufficiently versed in all respects to give an informed opinion, but there are a few with respect to which I feel myself on firm ground. Your first query will be hard for anyone in CAA to answer.

The present system and its attempts to delve into the future are not the thinking results of too many people who should have foreseen what we all see now. If we go back 10 years or so, there must have been many qualified "thinkers" on this subject in the U. S. Not all of them would have been right, but some may have pointed toward the horizon even then. This first question of yours ties directly in with the next three you pose.

Trials of SC 31

There seems little doubt that an electronic ATC environment is the obvious answer—as obvious now as it was, or should have been then, ie., 10 years or so ago. The trials and tribulations of SC 31 back in the early days of the ANDB show that someone did have the right horizon in mind, but where did it go? Politics? Airline pressure? ALPA reluctance (or stubborness) to be "controlled"? Military "secret" reasons?

A combination of military and civil equipment, especially radar systems, is and was then the only logical answer both from a dollars standpoint and from the vital utilization of sufficiently trained personnel. No one can say there weren't enough trained operators in 1945! How many good ones were released from the Navy that year?

You ask why the CAA radars are turned off when it rains? If the CAA won't tell you why, I think I may be able to as can many others. Signal attenuation in the snow or rain of radars of 3 and lower centimeter wavelengths has always been an operating problem (even if the manufacturers say it isn't so). When you start with 5.5, or preferably 10 cm. equipment, the problem starts to solve itself.

Advertisements will stress the need for larger antenna size with the latter radars, but definition just as good as with 3 cm. and 1.25 cm. gear can be had with 5.5 and 10 cm. output. On the ground, what difference does antenna size really make?

This problem is an old one at sea—especially where *trained* operators are really few and far between. This I know because I established the country's first commercial operational radar training service. As it turned out, it was (and basically still is) a service for the Maritime Industry. There weren't any airline installations then.

With proper control manipulation all but the most severe main storms can be read through, but it's easier, so much easier, with 5.5 and 10 cm. equipment. Even the highly experienced eye can hardly tell the difference between signal sizes with antennae of the same size. This Training Service, by the way, was not affiliated with any manufacturing organization whatsoever and my personal approach to the problem is a relatively unbiased one since I've shown many times that the basic answer is understanding control manipulation until the severity of the atmospheric disturbance is beyond the capability of the equipment.

To answer your question directly, either someone was unknowingly sold "a bill of goods" on equipment, or proper personnel training is not up to snuff—or both. Let's face it—any good radar is better than none if it's used properly, but the locale for one wavelength may not be the spot for a different one.

Electronic Development Plans

Now, about the CAA's electronic development plans. If the CAA didn't have any, there's no one else to blame. I feel that SC 31, previously mentioned, which tried to evolve something didn't because too many different people, companies and agencies were blowing too many individual horns rather than trying to solve the *problem* which the committee knew had to be faced and solved.

Certainly 31's efforts did some good and *much more good recently*, but not the complete good it could have done. Had the equipment (radars, etc.) we (the U. S.) had on hand at the end of WW II been immediately implemented into the ATC system, there would have been many inequities, unreliabilities and problems, but the electronic groundwork would already have been laid. Now we find ourselves, systems-wise, nearly where we were then, except that the technological advances have made obsolete the WW II gear.

Basic communications plans, area surveillance systems, inter-area control changeovers, etc., have been outlined in the quasi-technical press as far back as 1950 with respect to a none too technical, but mbryonic control system written in 1945.

Use of the civil system with the military's for the latter's fighter direction if need be after the same system had served and as an Early Warning measure was pointed out.

Others, in a far better position to see the problem, could have done the same—only better, if politics and group pressures might not have kept them from so doing.

Your other questions, especially those on intra-CAA problems are those on which I know only that I, too, would like to know the answers as you would like to know. I'm certain that when anyone does find out, another issue of Aviation Week will print the facts.

HILLIARD L. LUBIN
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Aviation Week welcomes the opinion of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor. Aviation Week. 330 W. 42 St., New York 36. N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

Worcester Airport

Through the medium of your fine magazine I would like to thank Mr. Herb Singer for his very complimentary remarks about the Worcester Airport facilities in his letter which appeared in the January 2 issue of AVIATION WEEK. This building is proof that that airport terminals can be beautiful, traditional and functional without involving unnecessary expenditures.

Back in 1951, while in the process of designing this building, the commission attempted to forecast what Worcester's future terminal aviation needs would be. . . .

Rather than to allow this space to go unused and be a financial burden until needed by aviation interests, the commission feels that it is entirely proper, and certainly good business procedure, to approve short term leases with non-aviation tenants. Moreover it is felt that such a policy is definitely in the public interest since maintenance of all airport facilities is financed with tax money (City of Worcester) and revenue derived through such rentals helps to underwrite maintenance expenses. All of our "future expansion areas" have been rented to non-aviation tenants who in 1955 collectively paid $11,075.00 in rent. . . .

The Chrysler product automobile which Mr. Singer saw displayed in our lobby is located where it is planned to locate Western Union, an auto rental counter, and a newsstand when the facilities are required by the traveling public. In the meantime the local Chrysler dealer is paying a very satisfactory rent for this space.

If non-aviation revenue was not available the necessary airport operating finances would have to be raised in some other manner such as taxes or user charges such as landing fees for private aircraft or considerably higher charges to the airlines which of course would be passed on to the airline patrons. . . .

It is important to re-state that all of our "non-aviation leases" are of the short term type and that the areas occupied by these tenants can be quickly made available for aviation uses as required.

GEORGE J. BEAN, Manager
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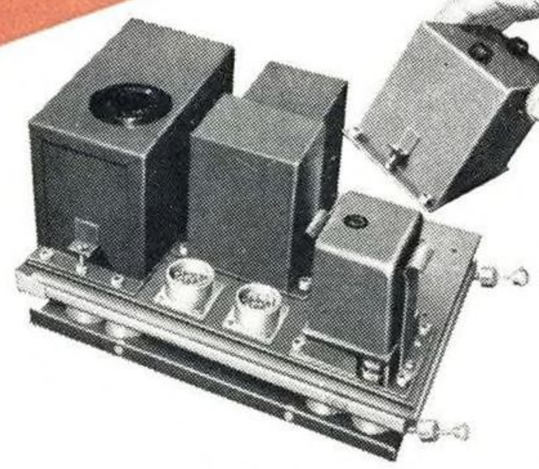

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