The AIRCRAFT YEAR BOOK *For 1953*

The AIRCRAFT YEAR BOOK

1953

PRINTED BY
THE MONUMENTAL PRINTING COMPANY, BALTIMORE, MD

THE

AIRCRAFT YEAR BOOK

1953

Official Publication

of

THE AIRCRAFT INDUSTRIES ASSOCIATION OF AMERICA, INC.

Thirty-fifth Annual Edition

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Edited and Published by

Lincoln Press, Inc. • PUBLISHERS
511 11th ST., N.W. • WASHINGTON 4, D. C. • STERLING 3-1944

ACKNOWLEDGMENTS

The 1953 Aircraft Year Book represents the combined editorial talent of the industry. Only through the generous collaboration of company public relations officials, writers in other branches of aviation and aircraft executives, has this edition been possible. To these people we should like to express our thanks. We should like, also, to express our special gratitude to the Aircraft Year Book Editorial Board of the Public Relations Advisory Committee of the Aircraft Industries Association, who gave much valuable time in suggesting the handling of the material. The Committee included Mr. Carlyle Jones, Director of Public Relations, Sperry Gyroscope Co.; Mr. Harold Mansfield, Director of Public Relations, Boeing Airplane Co.; and Mr. J. J. Synar, News Bureau, General Electric Co. Coordinating the work of the Committee were Mr. Avery McBee, Director of Public Relations of the Aircraft Industries Association, and Mr. Burton E. English, Public Relations, AIA, to whom we are also deeply grateful.

THE EDITORS

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Foreword

The United States and the free world have just completed a year long celebration of 50 years of powered flight. During 1953, this anniversary celebration was marked by the publication of many worthwhile volumes which recounted the history of the Wright Brothers and their first successful flight on December 17, 1903. Other equally important publications tell the story of aviation's development and progress during this first half century period.

In the 1953 edition, the Aircraft Year Book pays tribute to the achievements of the Wright Brothers, and consistent with the policy of earlier editions, relates the progress of American aviation during the past year—its problems and achievements.

It is pertinent to note that with this edition of the Aircraft Year Book, thirty five years of the history of powered flight in America have been chronicled in these annual publications, thus making up in all a comprehensive and unique coverage of the subject.

Since that momentous flight in 1903, the U. S. aircraft industry has produced more than 496,000 aircraft of all types of which 373,000 were for military use and 123,000 have contributed to the development of the world's commercial air traffic. During the past year, the industry delivered to our armed services and those of our allies, some 12,000 military planes, the majority of which were jet-propelled. In addition to this significant contribution to the defense and security of the free world more than 4,000 new planes were added to the civil aircraft fleets of the world, approximately 300 of which were multi-engined transport types.

To accomplish this relatively high level production the industry directly employed more than 750,000 workers, and by adding the employees of major subcontractors and suppliers the total number of people engaged in aircraft manufacture in the United States exceeded the million mark.

Highlighted also in this volume is the outstanding progress in the research and development field which made possible flights at speeds in excess of 1600 miles per hour and flights at altitudes above 80,000 feet.

This edition of the Aircraft Year Book reports not only on the aircraft industry but on many other aspects of major aviation achievement. The activities of the Air Force, Naval Aviation, the Marine air arm, and Army aviation are included. The Year Book likewise deals with the work of other Government departments and agencies. It reviews the great progress of the commercial airlines, which set new records in the last year, not only in passenger and cargo services but in safety of operation. It gives coverage to utility aircraft and their progress as servants of business, industry and agriculture, and on the development of the helicopter, both in its military role and its bright commercial future.

The Aircraft Industries Association believes that the 1953 edition of the Aircraft Year Book will contribute, as have the thirty-four which preceded it, to a more complete public understanding and appreciation of the contributions of aviation to the general welfare, prosperity and security of our country.

ADMIRAL DEWITT C. RAMSEY (USN, Ret.)
President
Aircraft Industries Association

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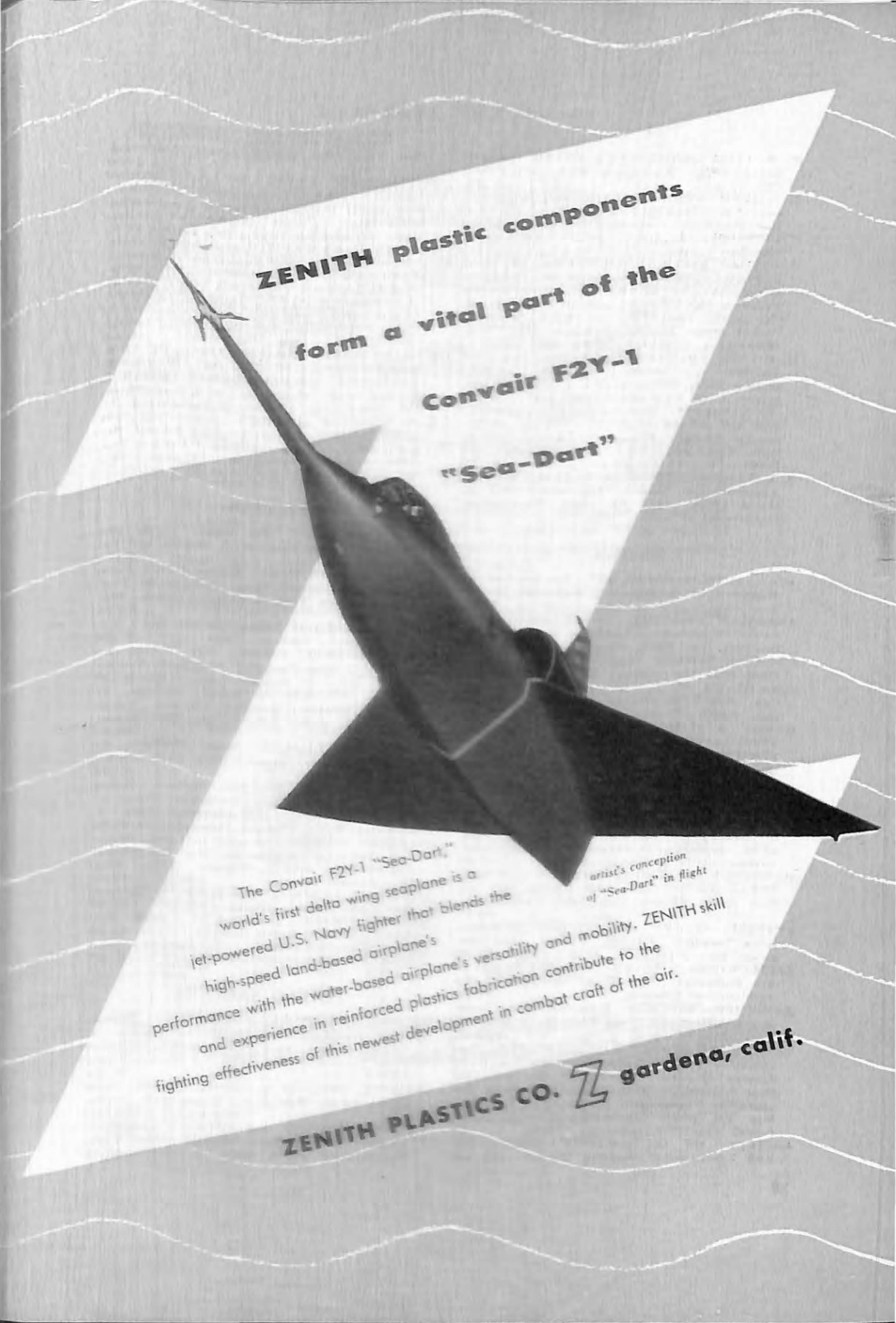
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McFARLAND, ROSS ARMSTRONG. Human Factors in Air Transportation; Occupational Health and Safety. New York, McGraw-Hill Book Company. 830p. $13.00

MILITARY AERONAUTICS

THE AIR OFFICER'S GUIDE. A Ready-Reference Encyclopedia of Military Information Pertinent to Commissioned Officers of the

Putting POWER in the Air!

In 1953, the Pratt & Whitney Aircraft J-57 was officially recognized as the most powerful turbojet engine in production. It brought the Collier Trophy to Leonard S. Hobbs, United Aircraft Corporation's vice-president for engineering, who headed the team responsible for bringing the engine from idea stage to production. Beside production of this 10,000-pound thrust class engine, Pratt & Whitney Aircraft increased output of other jet and piston engines.

Hamilton Standard developed its big turbine-engine propeller, while increasing production of Hydromatic propellers and a wide range of other essential equipment.

Chance Vought Aircraft announced production of Regulus, the new Navy guided missile, in addition to F7U-3 and A2U Cutlass fighters. A new Navy day-fighter is being designed.

Sikorsky Aircraft's twin-engine S-56 helicopter, built for the Marine Corps, entered its flight test program, while S-55 helicopters—the famed "Guardian Angels" during the war in Korea—were produced for the military services and an increasing number of civilian users.

United States Air Force. 7th ed. Harrisburg, Pa., Military Service Publishing Company. 520p. $4.00

THE AIRMAN'S GUIDE. A Ready Reference of Helpful Information and Counsel for all Airmen of the United States Air Force. 5th ed., April 1953. Harrisburg, Pa., Military Service Publishing Company. 530p. $2.75

BRODIE, BERNARD. The Heritage of Douhet. 31 December 1952. Santa Monica, Calif., Rand Corporation. 40p. (Project Rand Research Memorandum, RM-1013)

COLBY, C. B. Our Jets. New York, Birk & Company, 1952. 32p.

FELLERS, BONNER. Wings for Peace; a Primer for a New Defense. New York, Henry Regnery Co. 248p. $3.50

LAMENSDORF, ROLLAND G. History of the 31st Fighter Group. Washington, The Author. 1952. 79p.

MITCHELL, RUTH. My Brother Bill, the Life of General "Billy" Mitchell; with an Introduction by Gerald W. Johnson. New York, Harcourt, Brace. 344p. $4.00

SQUADRON ADMINISTRATION. 2nd ed. January 1953. Harrisburg, Pa., Military Service Publishing Company. 527p. $3.00

SCOTT, ROBERT L., Jr. God is My Co-Pilot. Garden City, N. Y., Doubleday & Company, Inc. 277p. $1.93

U. S. AIR FORCE. AIR HISTORICAL GROUP. The Army Air Force in World War II. Vol. V. The Pacific: Matterhorn to Nagasaki, June 1944-August 1945. Edited by W. F. Craven and J. L. Cate. Chicago, University of Chicago Press. 878p. $8.50

U. S. DEPARTMENT OF THE AIR FORCE. Careers for Civilians; a Guide to Air Force Opportunities for Scientists, Engineers, Administrators, and Technicians. Washington, U. S. Govt. Print. Off., 1952. 55p.

U. S. DEPARTMENT OF THE AIR FORCE. OFFICE OF THE AIR ADJUTANT GENERAL. Air Force Register. 1 January 1953. Washington, U. S. Govt. Print. Off. $3.25

MODEL FLYING

AIR TRAILS MODEL ANNUAL FOR 1953. New York, Street & Smith Publications, Inc. $ .50

MODEL AERONAUTIC YEAR BOOK 1953. New York, Model Aeronautic Publications. $1.00

MUSCIANO, WALTER A. Building and Flying Scale-Model Aircraft. Illustrated by the Author. New York, McBride Co. $2.95

MUSCIANO, WALTER A. The Model Plane Manual. New York, McBride Company, 1952. 160p. $2.95

WINTER, WILLIAM J. The Model Aircraft Handbook. Illustrated by H. A. Thomas, Paul Plecan, and Bruce Wennerstrom. 3rd ed. New York, Thomas Y. Crowell. 200p. $3.50

PILOTING

CIVIL AIR REGULATIONS AND REFERENCE GUIDE FOR PILOTS. Rev. ed. Los Angeles, Aero Publishers. 143p. $1.75

HALPINE, CHARLES G. A Pilot's Meteorology. 2d ed. New York, D. Van Nostrand Company, Inc. 351p. $5.00

MERRELL, CREIGHTON. Your Instrument Rating. Seattle, Merrell Aviation Ground School, 1952. 64p.

PILOT & AIR-CREW HANDBOOK. Hollywood, Calif., Pilot's Handbook Co. 72p. $2.50

U. S. AIR FORCE. Air Navigation for Pilots. (Downgraded September 2, 1952). Washington, U. S. Govt. Print. Off. 221p. (AF Manual 51-43) $1.50

U. S. AIR FORCE. Aircraft Engineering for Pilots. Student Manual. (Downgraded September 2, 1952). Washington, U. S. Govt. Print. Off. 264p. (AF Manual 51-42) $1.75

U. S. AIR FORCE. Instrument Flying Techniques and Procedures. (Downgraded May 1, 1952). Washington, U. S. Govt. Print. Off. 142p. (AF Manual 51-37) $1.25

U. S. AIR FORCE. Instructor Manual, Instrument Flying Techniques and Procedures. (Downgraded May 1, 1952). Washington, U. S. Govt. Print. Off. 132p. (AF Manual 51-36) $ .35

U. S. AIR FORCE. Theory of Instrument Flying. (Downgraded May 1, 1952). Washington, U. S. Govt. Print. Off. 260p. (Air Force Manual No. 51-38) $1.50

U. S. CIVIL AERONAUTICS ADMINISTRATION. Pilot's Radio Handbook. Washington, U. S. Govt. Print. Off. 122p. $ .45

ZWENG, CHARLES A. and ALLAN C. ZWENG. Aeronautical Training; a Quiz System Covering Navigation, Meteorology, Aircraft, Aircraft Engines, and Civil Air Regulations, including Air Traffic Rules. 10th rev. ed. North Hollywood, Calif., Pan American Navigation Service. 318p. $4.00

ZWENG, CHARLES A. and ALLAN C. ZWENG. Radio and Instrument Flying; a Guide to the Instrument Rating. New 1953 ed. North Hollywood, Calif., Pan American Navigation Service. $4.00

POWER PLANTS

BURGESS, ERIC. Rocket Propulsion. New York, The Macmillan Company. 235p. $4.50

CHAPEL, CHARLES E. Jet Aircraft Simplified. 2d ed. Los Angeles, Aero Publishers, Inc. $2.75

KUECHEMANN, DIETRICH and JOHANNA WEBER. Aerodynamics of Propulsion. New York, McGraw-Hill Book Company. 340p. (McGraw-Hill Publications in Aeronautical Science) $9.00

LENT, CONSTANTIN P. Rockets, Jets and Atoms. Drawings by the Author. New York, Pen-Ink Publishing Co. 1v. $5.00

LISTON, JOSEPH. Power Plants for Aircraft. New York, McGraw-Hill Book Company. 577p. $8.50

MORLEY, ARNOLD W. Aircraft Propulsion, Theory and Performance; an Introductory Text Book for Students of Aeronautics. New York, Longmans, Green and Co. 221p. $5.50

NEWELL, HOMER E., Jr. High Altitude Rocket Research. New York, Academic Research. 312p. $7.50

U. S. NAVAL AIR TECHNICAL TRAINING COMMAND. Aircraft Engines. Reprinted with Minor Changes. Washington, U. S. Govt. Print. Off. 327p. (Navy Training Courses. NAVPERS 10334-A) $2.25

WILKINSON, PAUL H. Aircraft Engines of the World, 1953. 11th ed. New York, The Author, 225 Varick St. 320p. $12.00

REFERENCE WORKS

AERONAUTICAL ENGINEERING CATALOG. Ninth 1953 edition. Editor Welman A. Schrader. New York, Institute of the Aeronautical Sciences. 413p. $7.50

AERONAUTICAL ENGINEERING INDEX, 1952. New York, Institute of the Aeronautical Sciences. 172p. $5.00

THE AIRCRAFT YEAR BOOK 1952. Official Publication of the Aircraft Industries Association of America, Inc. Thirty-fourth Annual Edition. Washington, Lincoln Press, Inc. 464p. $6.00

AMERICAN AIR MAIL SOCIETY. The American Air Mail Catalogue of Air Letter Sheets, including Military and Prisoner of War Air Letter Cards. Edited by American Air Mail Society, Catalogue Committee. 1953 ed. Albion, Pa., The Society. 147p. $2.50

AMERICAN AVIATION DIRECTORY. Vol. 14, Nos. 1 and 2. Spring-Summer and Fall-Winter 1953. Washington, American Aviation Publications, Inc. 2v. Per issue $7.50

AVIATION FACTS AND FIGURES. 1953 edition. Edited by Rudolph Modley and Thomas J. Cawley. Washington, Lincoln Press, Inc. 256p. $5.00

BRADLEY, LITTLETON P., Jr. Filing Manual for Aircraft Correspondence. Normandie, Mo., The Author. 256p. $5.00

GRIGGS, THURSTON and PHILLIP J. RULON. International Language for Aviation: Instrument Flight. Cambridge, Mass., Educational Research Corporation. 1v.

INSTITUTE OF THE AERONAUTICAL SCIENCES. Books on Selected Technical Subjects in the IAS Library (up to 1950). New York, Institute of the Aeronautical Sciences. $2.00

INSTITUTE OF THE AERONAUTICAL SCIENCES. Roster of Members, 1953-1954. New York, Institute of the Aeronautical Sciences. 226p.

JANE'S ALL THE WORLD'S AIRCRAFT, 1952-1953. Compiled and Edited by Leonard Bridgman. New York, McGraw-Hill Book Company. 1952. 324p. $22.50

SOARING DIRECTORY, 1953. Elmira, N. Y., Soaring Society of America. $3.00

U. S. AIR FORCE. Index of Specifications and Related Publications Used by the Air Force. Wright-Patterson Air Force Base, Wright Air Development Center, Air Research and Development Command. 423p. (Military Index, Vol. 4) $2.75

U. S. BUREAU OF AERONAUTICS. List of Military Specifications and Standards Used by the Bureau of Aeronautics. Rev. Washington, Bureau of Aeronautics, Navy Department. 275p.

U. S. CIVIL AERONAUTICS ADMINISTRATION. Catalogue of Films Distributed by the Civil Aeronautics Administration. Rev. 1953. Washington, Civil Aeronautics Administration, Office of Aviation Development. 44p.

U. S. CIVIL AERONAUTICS ADMINISTRATION. Statistical Handbook of Civil Aviation 1953. Washington, U. S. Govt. Print. Off. 109p. $ .40

ROTOR AIRCRAFT

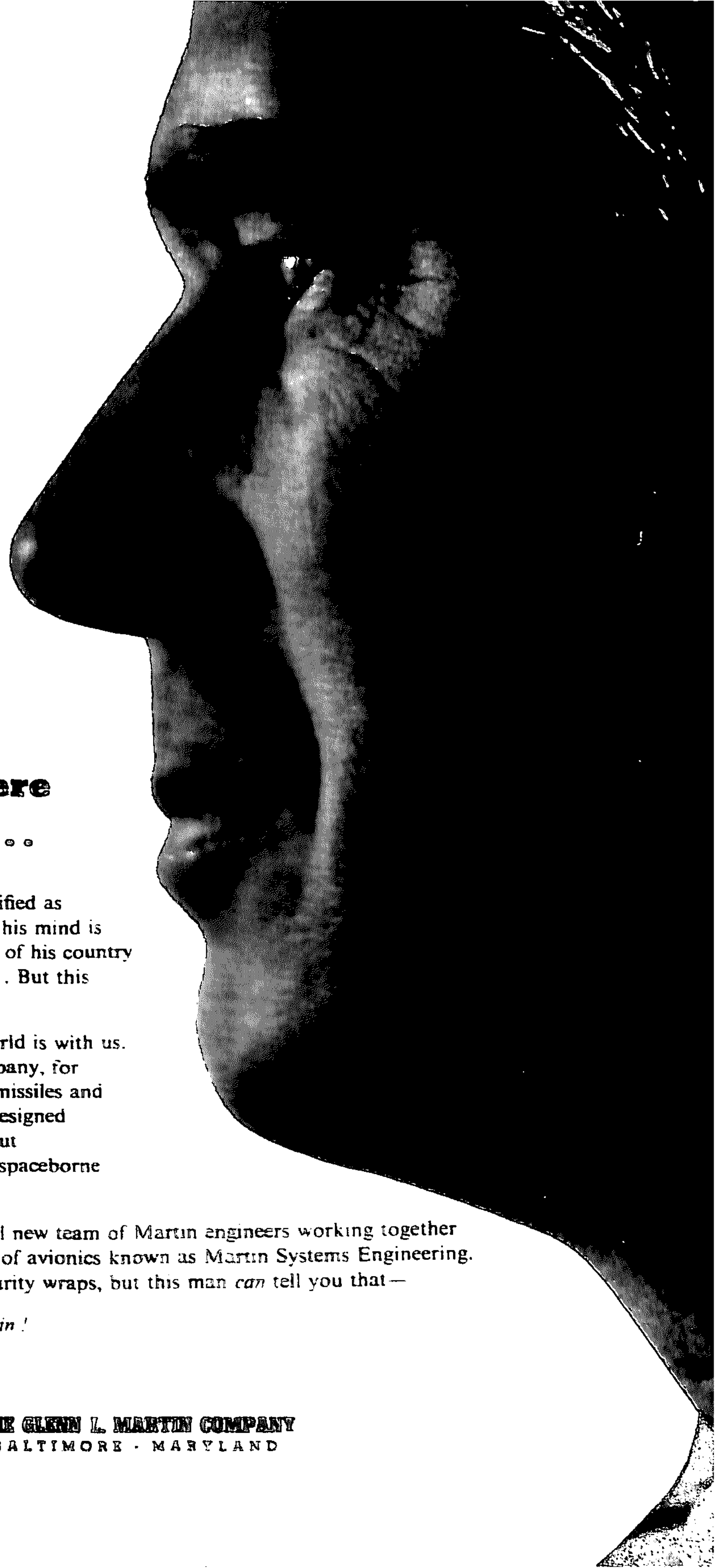
AMERICAN HELICOPTER SOCIETY. Proceedings of the 9th Annual Forum of the American Helicopter Society, Inc., Washington, May 14-17, 1953. New York, American Helicopter Society, Inc. 276p. $7.50

BOEHLER, GABRIEL. An Extension of Helicopter Rotor Theory to Include Operation at High Tip-Speed Ratios and High Inflow Conditions Together with the Effect of the Variable Induced Velocity. Washington, Catholic University of America Press. 47p. $ .50

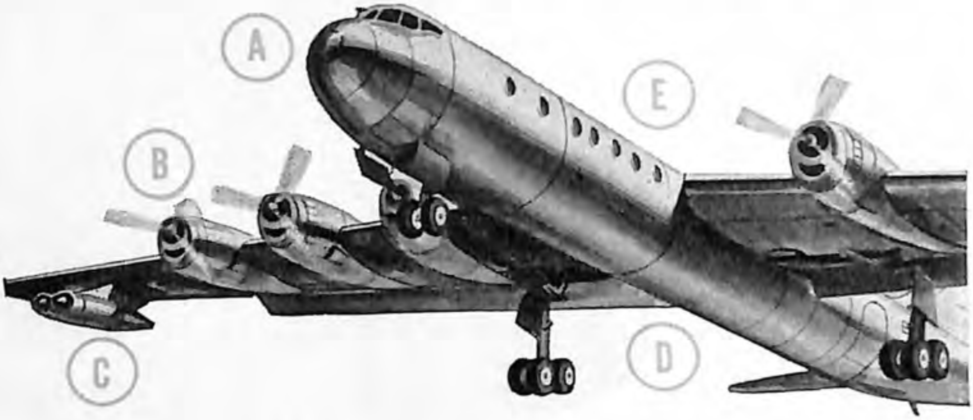
DOMMASCH, DANIEL O. Elements of Propeller and Helicopter Aerodynamics. New York, Pitman Publishing Corporation. 178p. (Pitman Aeronautical Publications. Aeronautical Engineering Series) $4.50

2ND CONVERTIBLE AIRCRAFT CONGRESS, PHILADELPHIA, DECEMBER 12, 1952. Proceedings. New York, Institute of the Aeronautical Sciences. 140p. $5.00

[1]Note. Also includes 1952 books published too late for inclusion in last year's edition.



This is Bendix



The airplane illustrated is a composite since, obviously, no single plane carries all of the Bendix equipment on these pages. However, many Bendix products fly with every U. S. fighting plane and are used extensively on commercial, executive and private planes as well.

A

Radio Noise Filters
Switches
Flow Equalizers
Vacuum Operated Instruments
Filters for Aircraft Heaters (Auxiliary, Engine, Cabin)
Pneumatic System Filters
Dynamotors
Blower Motors
Band-Change Motors
Booster Dynamotors
Actuator Motors
Special Inverters
Aircraft Interphone Systems
Radar
Radio Transmitters
Radio Receivers

Radio Communication Systems
Electronic Navigational Equipment
Automatic Radio Compass
VHF Omni-Directional Range Equipment
Automatic Pilot and Flight Path Control Equipment
Autosyn* and Magnesyn* Remote Indicating Systems For
Fuel Flow • Fuel Pressure • Hydraulic Pressure • Liquid Level • Manifold Pressure • Oil Pressure • Position • Temperature • Torque Pressure • Water Pressure
Fuel Flow Totalizing Systems

Manifold Pressure Gauges
Electric Tachometer Systems
Warning Units
Accelerometers
Airspeed Indicators
Attitude Horizon Indicators
Driftmeters
Dual Radio and Magnetic Compass Indicators
Gyro Flux Gate* Compasses
Gyro Horizon Indicators
Magnetic Compasses
Rate of Climb Indicators
Turn and Bank Indicators
ODR Components
Sextants
Control Panels

in Aviation

THE NAME Bendix AVIATION CORPORATION MILLIONS TRUST

B

Bendix* Starter Drives
Magnetos
Ignition Harnesses
Booster Coils
Igniter Plugs
Ignition Analyzer
Low and High Tension Ignition Systems for Reciprocating Engines
Radio Shielding Harnesses
Hydraulic—Line Type Filters
Reservoir—Line Type Filters
Vent—Line Type Filters
Fuel System Filters
De-Icing System Filters

Alternators
Fault Protection Systems
Generators
Inverters
Line Relays
Overvoltage Protectors
Reverse Current Cutouts
Voltage Booster Dynamotors
Voltage Regulators
Power Failure Indicators
Engine Starting Equipment, including
Booster Coils • Induction Vibrators • Relay Switches • Starters

Automatic Engine Power Controls
Automatic Engine Boost Controls
Propeller Governor Controls
Supercharger Regulator Controls
Injection and float type carburetors
Direct injection fuel systems, including
Distributing Pumps • Regulator Units • Injector Nozzles • Fuel Supply Pumps
Speed-Density Fuel Metering Systems for Jet and Reciprocating Engines
Water Injection Systems

C

Ignition Systems for Jet and Turbine Engines
Igniter Plugs for Jet and Turbine Engines
Jet Engine Starters and Generators
Speed-Density Fuel Metering Systems
Duplex Nozzles
Fuel Metering Systems for Starting Conditions
Fuel Flow Dividers
Fuel Supply Pumps

D

Brake Lining
Hydraulic Actuating Cylinders
Power Brake Valves
Shock Absorbing Struts
Shoe and Segmented Rotor Type Brakes
Wheels
Master Cylinders
Hydraulic Brake Control Valves

E

Electrical Connectors
Small Electric Actuators
4-Way Hydraulic Valves
Hydraulic Accumulators
Hydraulic Hand Pumps

Position Light Flashers
Pressure Control Valves
Electric Timing Devices
Hydraulic Equipment, including
Pumps • Valves

Air Pressurization and Ice Elimination Equipment, including
Electronic and Mechanical De-Icer System Timers • Oil Separators • Pumps • Valves • Pressurization and Control Units

ADDITIONAL AVIATION PRODUCTS

Beacons
Telemetering Equipment
Missile Guidance Systems
Micro-Wave Equipment
V. H. F. Ground Direction Finders
G. C. A. Ground Controlled Approach Radar
Long Range Search and Surveillance Radar
G. C. A. Ground Controlled Approach System
Actuators—linear and rotary

Differential Pressure Switches
Oxygen Regulators
Gear Boxes
Flexible Drive Shafts
Special Purpose Electron Tubes, including
Amplifier Tubes • Counter Tubes • Gas Filled Control Tubes • Klystron Tubes • Rectifier Tubes • Spark Caps • Temperature Tubes • Voltage Regulator Tubes

Precision Components for Servo-mechanism and Computing Equipment, including
Autosyn Synchros—(transmitters receivers, differentials, control transformers and resolvers) • Amplifiers • Low Inertia Motors • Servos • Transformers • Gyros • Rate Generators
For Guided Missiles—Specialized fuel metering and control systems
Aircraft Gun Chargers
Switches • Controls

BENDIX IN THE WEATHER FIELD

In addition to the products listed above, Bendix makes many meteorological instruments which are the source of much of the weather data governing flight schedules for all types of planes.

*REGISTERED TRADEMARK OF THE BENDIX AVIATION CORPORATION

SUMMARY STATISTICS

The following statistics are as nearly up-to-date as was practicable at the time the Year Book went to press. Wherever possible, last-minute, 1953 figures were included in the main text of the book, and may be found under appropriate chapter headings.

The Editors

AVERAGE WEEKLY HOURS IN THE AIRCRAFT, ENGINE, PROPELLER. AND PARTS INDUSTRY

(Source: Aviation Facts and Figures)

Year and Month	Aircraft and Parts	Aircraft	Aircraft Engines and Parts	Aircraft Propellers and Parts	Other Aircraft Parts and Equipment
1949	40.6	40.5	40.7	41.0	40.4
1950	41.6	41.4	42.1	42.4	41.7
1951	43.8	43.3	45.4	46.2	43.7
1952	43.0	42.6	43.9	45.0	43.2
1953					
January	43.3	42.6	45.1	44.7	43.4
February	43.0	42.3	44.3	44.0	43.7
March	42.3	41.5	43.7	41.7	43.8
April	42.0	41.4	42.7	41.3	43.3
May	41.7	41.1	42.9	41.3	42.5
June	41.2	40.7	41.6	41.0	42.4
July	41.5	40.8	42.9	41.5	42.0
AVERAGE WEEKLY EARNINGS					
1949	63.62	62.69	65.24	66.83	65.08
1950	68.39	67.15	71.40	73.90	70.81
1951	78.05	75.82	85.90	89.17	78.53
1952	81.70	79.66	86.92	92.25	81.22
1953					
January	85.73	83.50	92.00	92.08	84.63
February	85.14	82.91	89.49	91.08	85.65
March	84.18	82.17	87.84	83.82	86.29
April	83.16	82.17	85.40	83.84	85.10
May	82.57	80.97	85.80	83.43	83.30
June	81.58	79.77	84.03	84.46	83.53
July	82.17	79.97	87.09	84.66	83.16
AVERAGE HOURLY EARNINGS					
1949	1.567	1.548	1.603	1.630	1.611
1950	1.644	1.622	1.696	1.743	1.698
1951	1.782	1.751	1.892	1.930	1.797
1952	1.90	1.87	1.98	2.05	1.88
1953					
January	1.98	1.96	2.04	2.06	1.95
February	1.98	1.96	2.02	2.07	1.96
March	1.99	1.98	2.01	2.01	1.97
April	1.98	1.98	2.00	2.03	1.97
May	1.98	1.97	2.00	2.02	1.96
June	1.98	1.96	2.02	2.06	1.97
July	1.98	1.96	2.03	2.04	1.98

[a] Revised

THESE CONNECTORS ARE ACTUAL SIZE

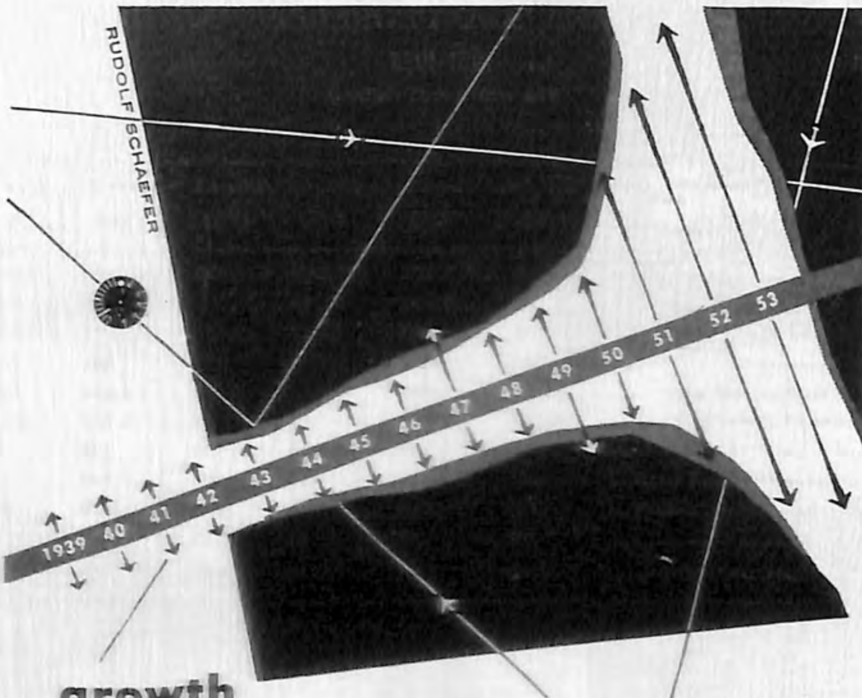
TOTAL EMPLOYMENT IN AIRCRAFT AND PARTS INDUSTRY[1]

(In thousands)

Source: Aviation Facts and Figures

Years and Months	Total	Aircraft	Aircraft Engines & Parts	Aircraft Propellers & Parts	Other Aircraft Parts & Equipment
1951					
January	354.2	236.7	70.4	9.3	37.8
February	382.7	258.2	74.6	9.4	40.5
March	400.0	271.4	77.2	9.5	41.9
April	415.9	281.7	81.1	10.2	42.9
May	428.5	289.1	84.5	10.5	44.4
June	451.7	304.9	89.6	10.5	46.7
July	471.3	319.7	92.9	10.4	48.3
August	486.3	330.6	95.4	10.5	49.8
September	493.4	330.8	99.8	11.5	51.3
October	496.2	339.8	90.3	11.8	54.3
November	539.0	364.0	106.5	12.1	56.4
December	556.0	373.2	112.6	12.4	57.8
1952					
January	566.4	377.5	116.1	12.7	60.1
February	581.0	386.6	120.4	12.9	61.1
March	586.1	390.2	120.7	13.2	62.0
April	591.9	395.1	120.9	13.4	62.5
May	598.2	399.9	121.6	13.5	63.2
June	611.0	406.1	124.9	13.9	66.1
July	625.0	416.1	127.0	13.8	68.1
August	638.1	425.7	128.4	14.2	69.8
September	620.0	401.3	131.8	14.4	72.5
October	684.3	430.2	147.5	14.8	91.8
November	694.5	434.0	150.2	15.2	95.1
December	711.4	444.5	153.9	15.7	97.3
1953					
January	721.4	447.8	158.1	16.3	99.2
February	729.2	448.1	163.7	16.6	100.8
March	735.0	449.2	165.6	16.5	103.7
April	727.3	446.9	159.2	16.5	104.7
May	728.4	445.6	161.3	16.4	105.1
June	729.9	444.6	162.3	16.4	106.6
July	743.2	449.6	169.9	16.3	107.4
August	748.8	454.9	168.8	16.2	108.9

[1]As of pay period ending nearest the 15th of the month.


RUDOLF SCHAEFER
1939 40 41 42 43 44 45 46 47 48 49 50 51 52 53

PASSENGER MILES, MAIL, EXPRESS AND FREIGHT TON-MILES

U. S. Domestic and American Flag Carriers

(Source: Air Transport Association)

Year	Total Passenger Miles (000)	Passenger Load Factor	Air Mail Ton Miles	Express Ton Miles	Freight Ton Miles
			DOMESTIC[1]:		
1940	1,052,156	57.90	10,117,858	3,476.224	....
1941	1,384,733	59.13	13,118,014	15,636,811	....
1942	1,417,526	72.21	21,166,024	5,258,551	....
1943	1,634,135	88.00	36,068,309	11,901,793	....
1944	2,264,495	89.38	51,145,402	17,702,932	....
1945	3,362,456	88.12	65,100,133	22,196,852	1,350,048
1946	5,947,956	78.71	32,962,122	23,788,392	14,822,325
1947	6,103,879	65.12	33,089,696	28,766,659	35,911,554
1948	5,981,603	57.59	37,925,396	30,092,833	71,283,727
1949	6,744,425	57.78	41,418,156	27,773,669	95,057,219
1950	8,002,792	61.25	47,008,947	37,279,035	114,072,045
1951	10,566,139	67.87	63,848,335	41,268,219	102,356,646
1952	12,528,437	65.60	69,258,172	41,317,560	119,502,241
			INTERNATIONAL:		
1948	1,888,947	57.37	17,202,868	41,581,133	4,011,668
1949	2,053,980	56.67	19,365,769	49,443,623	6,714,414
1950	2,206,423	59.66	21,188,090	44,501,521	16,049,809
1951	2,599,915	59.98	21,970,111	44,512,759	68,566,689
1952	3,019,810	62.28	27,713,051	....	72,627,275

[1] Includes Trunks, Local Service and Territorial Carriers.

U. S. AIR CARRIER OPERATING REVENUES

Domestic and International

(Source: Air Transport Association)

Year	Passenger Revenues	% of Total	Mail Revenues	% of Total	Express & Freight	% of Total	Other Revenues	% of Total	Total Revenues
				DOMESTIC:					
1942	74,757,776	69.13	23,446,588	21.68	6,968,357	6.44	2,975,188	2.75	108,147,909
1943	87,481,456	71.06	24,212,580	19.67	8,381,539	6.81	3,029,390	2.46	123,104,965
1944	116,440,690	72.36	33,317,399	20.70	8,306,288	5.16	2,863,848	1.78	160,928,225
1945	166,519,923	77.59	33,557,040	15.63	10,835,140	5.05	3,694,562	1.73	214,606,665
1946	275,593,712	86.88	21,953,759	6.92	13,620,295	4.29	6,037,245	1.91	317,205,011
1947	308,575,954	84.58	29,444,746	8.07	19,377,949	5.31	7,440,928	2.04	364,839,577
1948	343,289,730	79.05	59,309,343	13.66	24,372,395	5.61	7,323,916	1.68	434,295,384
1949	385,509,049	78.69	68,569,538	13.99	26,928,631	5.50	8,923,223	1.82	489,930,441
1950	443,852,000	79.66	63,772,233	11.45	35,109,399	6.30	14,428,708	2.59	557,162,340
1951	591,186,365	84.17	57,421,687	8.18	36,914,107	5.26	16,842,347	2.39	702,364,506
1952	696,315,486	85.13	58,169,621	7.71	42,864,065	5.24	20,556,304	2.52	817,905,476
	Domestic Lines include Trunks, Territorial and Local Service.								
				INTERNATIONAL:					
1948	151,337,705	60.72	57,331,556	23.00	20,808,679	8.35	19,756,259	7.93	249,234,199
1949	158,479,705	57.81	75,197,073	27.43	22,126,830	8.07	18,350,930	6.69	274,154,538
1950	156,427,209	58.85	68,348,283	25.71	20,620,858	7.75	20,448,009	7.69	265,844,359
1951	184,691,825	64.14	63,343,846	22.00	25,244,764	8.77	14,655,226	5.09	287,935,661
1952	211,600,436	67.87	51,376,305	16.48	26,784,903	8.39	22,014,276	7.06	311,775,920

AIRPORTS AND LANDING FIELDS

1926-1952

(Source: Civil Aeronautics Administration)

Calendar Year	Total	Commercial	Municipal	CAA intermediate	All others
1927	1,036	263	240	134	399[a]
1928	1,364	365	368	210	421[a]
1929	1,550	495	453	285	317[a]
1930	1,782	564	550	354	314[a]
1931	2,093	829	780	404	80
1932	2,117	869	777	352	119
1933	2,188	938	827	265	158
1934	2,297	872	980	259	186
1935	2,368	822	1,041	291	214
1936	2,342	774	1,037	296	235
1937	2,299	727	1,053	283	236
1938	2,374	760	1,092	267	255
1939	2,280	801	963	266	250
1940	2,331	860	1,031	289	151
1941	2,484	930	1,086	283	185
1942	2,809	1,069	1,129	273	338
1943	2,769	801	914	240	814
1944	3,427	1,027	1,067	229	1,104
1945	4,026	1,509	1,220	216	1,081
1946	4,490	1,930	1,424	201	935
1947	5,759	2,849	1,818	178	914
1948	6,414	2,989	2,050	161	1,214
1949	6,484	2,585	2,200	139	1,560
1950	6,403	2,329	2,272	76	1,726
1951	6,237	2,042	2,316	57	1,822
1952	6,042	N.A.	N.A.	N.A.	N.A.

N.A. Not Available.
[a]Include auxiliary marked fields, later classified as to ownership, commercial or municipal.

ALLOCATIONS AND APPROPRIATIONS FOR AERONAUTICS, U. S. ARMY

1899	Langley experiments.	$25,000
1900	Langley experiments.	25,000
1908	Baldwin dirigible, revoked and later applied toward payment for Wright plane.	25,000
1909	Herring & Scott airplanes. Later for Wright plane.	21,000
1910	Wright plane.	9,000
1912	Signal Service of Army.	125,000
1913	Signal Service of Army.	100,000
1914	Signal Service of Army.	125,000
1915	Signal Service of Army.	50,000
		$505,000

AVERAGE SPEED (Miles Per Hour)

Domestic Scheduled Air Carriers
(Source: CAA Statistical Handbook)

Year	Average speed (miles per hour)
1945	155.4
1946	160.2
1947	168.2
1948	171.9
1949	179
1950	181.2
1951	184.6
1952	190.8

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- Airframe and Powerplant Manufacturers

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U.S. AIRCRAFT PRODUCTION

(units)

1913-1953

(Source: Aircraft Industries Association)

Year	Total	Military Aircraft	Civil Aircraft
1914	49	15	34
1915	178	26	152
1916	411	142	269
1917	2,148	2,013	135
1918	14,020	13,991	29
1919	780	682	98
1920	328	256	72
1921	437	389	48
1922	263	226	37
1923	745	689	56
1924	377	317	60
1925	789	447	342
1926	1,186	532	654
1927	1,995	621	1,374
1928	4,346	1,219	3,127
1929	6,193	677	5,516
1930	3,437	747	2,690
1931	2,800	812	1,988
1932	1,396	593	803
1933	1,324	466	858
1934	1,615	437	1,178
1935	1,710	459	1,251
1936	3,010	1,141	1,869
1937	3,773	949	2,824
1938	3,623	1,800	1,823
1939	5,856	2,195	3,661
1940	12,804	6,019[a]	6,785[b]
1941	26,277[c]	19,433[a]	6,844[b]
1942	47,836[c]	47,836[a]	[d]
1943	85,898[c]	85,898[a]	[d]
1944	96,318[c]	96,318[a]	[d]
1945	49,761[c]	47,714[a]	2,047
1946	36,670	1,669	35,001
1947	17,717	2,100	15,617
1948	9,586[e]	2,284[e]	7,302
1949	6,089[e]	2,544[e]	3,545
1950	6,520[e]	3,000[e]	3,520
1951	7,277[e]	4,800[e]	2,477
1952	12,600[e]	9,000[e]	3,600[e]
1953	16,700[e]	12,000[e]	4,700[e]

[a]Includes military aricraft for Lend-Lease shipments.

[b]Represents domestic civil production only.

[c]Includes United States-financed aircraft manufactured in Canada.

[d]No production except military.

[e]Estimate.

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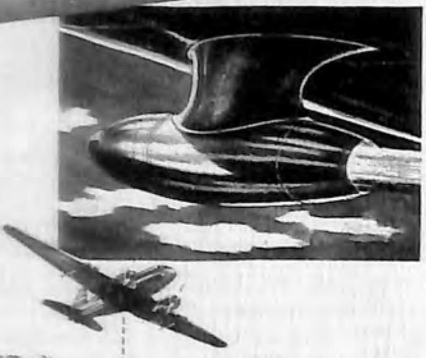


UNITED STATES AIRCRAFT EXPORTS

Number and Value

(Source: Aircraft Industries Association)

Year[1]	Aircraft exported[2] Number	Aircraft exported[2] Value	Value of all aeronautical exports[3]
1913	29	$81,750	$107,552
1914	34	188,924	226,149
1915	152	958,019	1,541,446
1916	269	2,158,395	7,002,005
1917	135	1,001,542	4,135,445
1918	20	206,120	9,084,097
1919	85	777,900	13,166,907
1920	65	598,274	1,152,649
1921	48	314,940	472,548
1922	37	156,630	494,930
1923	48	309,051	433,558
1924	59	412,738	798,273
1925	80	511,282	783,659
1926	50	303,149	1,027,210
1927	63	848,568	1,903,560
1928	162	1,759,653	3,664,723
1929	348	5,484,600	9,125,345
1930	321	4,819,669	8,818,110
1931	140	1,812,809	4,867,687
1932	280	4,358,967	7,946,533
1933	406	5,391,493	9,180,328
1934	490	8,195,484	17,662,938
1935	333	6,598,515	14,290,843
1936	527	11,601,893	23,143,203
1937	628	21,076,170	39,404,469
1938	875	37,977,324	68,227,689
1939	1,220	67,112,736	117,807,212
1940	3,522	196,260,556	311,871,473
1941	6,011	422,763,907	626,929,352
1942	10,448	879,994,628	1,357,345,366
1943	13,865	1,215,848,135	2,142,611,494
1944	16,544	1,589,800,893	2,825,927,362
1945	7,599	663,128,543	1,148,851,587
1946	2,302	65,257,749	115,320,235
1947	3,125	74,476,912	172,189,502
1948	2,259	66,354,000	153,629,000
1949	1,264[4]	37,388,553[4]	282,984,025
1950	759[5]	44,292,222[5]	242,362,699
1951	894[5]	18,606,528[5]	301,424,786
1952	1,180[5]	27,500,121[5]	603,181,876

[1]1913-18, fiscal years; 1919-49, calendar years. Data for the second half of 1918 is included with calendar year 1919.

[2]Exclusive of gliders and barrage balloons.

[3]Total value of aircraft, engines, parts, etc. 1913-21 include values of aircraft and aircraft parts. Prior to 1922, engine values were not reported separately, but were probably included with either "other" internal combustion engines or with "parts" of aircraft. Values for parachutes and their parts have been included only since 1932.

[4]For security reasons the 1949 figures do not include exports after April on military and cargo aircraft and engines of 400 hp and over. Right hand column includes military.

[5]For security reasons the 1950 figures do not include military, cargo and used transport aircraft, engines of 400 hp and over, propellers, instruments nor any other parts or accessories. Right hand column includes military.

COMPARATIVE TRANSPORT SAFETY RECORD

Passenger Fatalities per 100,000,000 Passenger Miles

(Source: Air Transport Association)

	1944	1945	1946	1947	1948	1949	1950	1951	1952
Domestic Scheduled Air Lines									
Fatalities	48	76	75	199	83	93	96	142	46
Rate	2.12	2.23	1.24	3.21	1.30	1.30	1.10	1.30	.4
Buses									
Fatalities	....	120	140	1.40	120	120	100	NA	130
Rate	.22	.17	.19	.21	.18	.20	.17	NA	.22
Intercity Railroads									
Fatalities	2.49	142	116	74	52	32	184	126	0
Rate	.26	.16	.18	.16	.13	.09	.58	.41	0
Pass. Autos & Taxicabs									
Fatalities	....	12,900	15,400	15,300	15,200	15,300	17,600	NA	NA
Rate	2.9	2.9	2.5	2.3	2.1	2.1	2.2	NA	NA

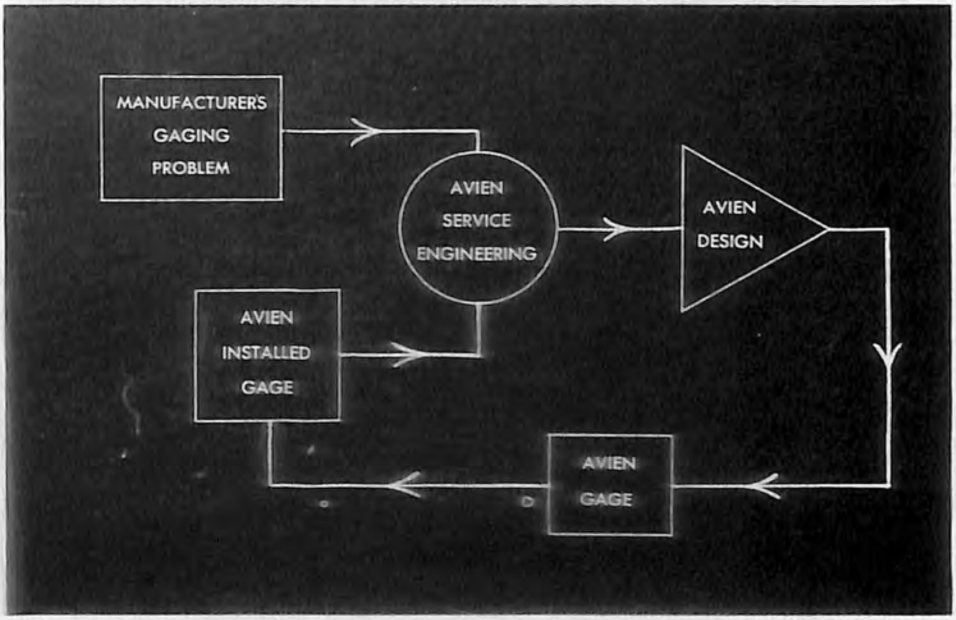
N. A. Not available.

ASSETS AND LIABILITIES

Domestic Trunk Airlines 1946-1951

(Source: Air Transport Association)

	1947	1948	1949	1950	1951	1952
Current Assets	$132,484,512	$171,859,726	$175,472,186	$204,018,828	$286,240,499	344,115,976
Flight Equipment—Net	173,886,500	188,351,172	188,619,849	201,630,303	226,223,625	309,355,329
Other Op. Property	52,855,302	59,963,595	61,476,977	58,149,892	61,152,504	75,793,917
Non-Operating Property	2,789,790	5,779,353	2,704,375	1,117,230	758,591	714,939
Other Assets	72,561,452	58,286,768	58,668,273	77,624,812	794,160	398,678
Total Assets	434,577,556	484,240,614	486,941,660	542,541,065	648,550,195	775,764,980
Current Liabilities	81,829,236	99,836,921	98,428,787	130,111,887	218,363,023	231,757,632
Long Term Debt	154,513,026	167,403,669	148,017,443	135,842,945	134,006,470	168,246,905
Capital Stock	126,621,702	121,312,622	123,710,057	123,467,063	120,286,647	145,132,929
Capital Surplus	41,929,868	53,428,648	56,289,876	57,499,411	63,698,098	81,882,841
Earned Surplus	7,675,418	12,952,554	35,285,887	64,365,672	96,249,920	130,653,833
Operating Reserves	1,591,145	2,387,158	3,635,427	3,970,701	3,682,245	4,169,446
Other Liabilities	20,417,161	26,919,042	21,574,183	27,283,386	12,263,792	13,921,394
Net Worth & Liabilities	$434,517,556	$484,240,614	$486,941,660	$542,541,065	648,550,195	775,764,980



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U. S. CIVIL AIRCRAFT

By States

(Source: Civil Aeronautics Administration)

State	Number of civil aircraft[1] Jan. 1, 1952	Jan. 1, 1953	State	Number of civil aircraft[1] Jan. 1, 1952	Jan. 1, 1953
TOTAL	88,545	89,313	Montana	1,111	1,165
			Nebraska	1,790	1,790
Alabama	787	752	Nevada	390	439
Arizona	1,094	1,164	New Hampshire	235	221
Arkansas	1,119	1,080	New Jersey	1,767	1,826
California	9,845	10,067	New Mexico	708	754
Colorado	1,291	1,263	New York	4,308	4,397
Connecticut	601	603	North Carolina	1,627	1,547
Delaware	283	275	North Dakota	1,256	1,183
District of Columbia	553	554	Ohio	4,187	4,157
Florida	2,546	2,612	Oklahoma	1,994	2,026
Georgia	1,159	1,169	Oregon	1,747	1,747
Idaho	905	906	Pennsylvania	4,006	3,925
Illinois	4,779	4,923	Rhode Island	203	187
Indiana	2,675	2,679	South Carolina	621	598
Iowa	2,276	2,126	South Dakota	1,017	1,112
Kansas	2,462	2,477	Tennessee	924	919
Kentucky	678	655	Texas	6,404	6,581
Louisiana	1,105	1,159	Utah	479	456
Maine	583	550	Vermont	153	163
Maryland	859	837	Virginia	1,272	1,267
Massachusetts	1,402	1,425	Washington	2,173	2,219
Michigan	3,914	3,876	West Virginia	615	609
Minnesota	2,048	2,092	Wisconsin	2,006	1,995
Mississippi	762	802	Wyoming	517	509
Missouri	1,892	1,924	Outside U. S. A.	1,417	1,551

[1]Includes gliders.

CIVIL AIRCRAFT PRODUCTION

Number of Units

(Source: Aircraft Industries Association)

Month	1949	1950	1951	1952	1953
January	160	167	255	224	365
February	257	225	239	227	382
March	400	326	272	248	358
April	456	329	247	291	402
May	474	377	248	330	417
June	439	369	216	335	339
July	301	321	207	353	402
August	272	354	171	349	350
September	284	301	184	337	359
October	228	204	124	293	....
November	158	242	162	268	....
December	116	305	152	254	....
TOTAL	3,545	3,520	2,477	3,509	....

PLANES IN USE

Domestic Airlines

(Source: Air Transport Association)

		1943		1944		1945		1946		1947	
Aircraft	No. of Engines	No. Planes	Miles Per Day	No. Planes	Miles Per Day	No. Planes	Miles Per Day	No. Planes	Miles Per Day	No. Planes	Miles Per Day
Beechcraft	2	2.0	437	1.2	323	0.8	66	0.4	502	5.3	721
Boeing											
247-D	2	....	....	....	....	....	....	1.0	607	4.0	654
SA-307B	4	1.0	248	....	....	3.6	2,094	5.0	1,695	5.0	1,344
377	4	....	....	....	....	....	....	....	....	....	....
Convair 240	2	....	....	....	....	....	....	....	....	....	....
Douglas											
DC-2	2	....	....	....	....	....	....	....	....	....	....
DC-3	2	161.8	1,671	205.6	1,814	314.3	1,756	426.6	1,638	446.7	1,303
DST	2	....	....	....	....	....	....	....	....	....	....
DC-4	4	....	....	....	....	....	....	85.8	1,758	149.6	1,546
DC-6	4	....	....	....	....	....	....	....	....	21.1	1,462
Lockheed											
Electra	2	....	....	....	....	1.3	727	3.0	587	....	....
Lodestar	2	11.5	1,392	14.3	1,719	17.7	1,545	16.7	1,285	11.5	1.086
Constellation	4	....	....	....	....	....	....	6.6	1,190	21.3	1,742
Sikorsky S-38	2	3.0	210	2.8	240	2.0	184	0.1	100	....	....
Stinson											
Single Motor	1	9.3	379	10.6	377	10.9	404	11.0	445	7.8	420
Tri-Motor	3	4.4	151	4.0	148	4.0	61	....	....	....	....
Waco	1	0.3	337	....	....	....	....	....	....	....	....
Martin 202	2	....	....	....	....	....	....	....	....	2.0	782
404	2	....	....	....	....	....	....	....	....	....	....
Curtiss C-46	2	....	....	....	....	....	....	....	....	....	....
		1948		1949		1950		1951		1952	
Beechcraft	2	6.4	648	....	....	....	....	....	...	....	....
Boeing											
247-D	2	0.6	818	....	....	....	....	....	....	....	....
SA-307B	4	5.0	1.362	5.0	1.365	5.0	656	....	....	....	....
377	4	....	....	10.0	410	10.0	1.283	16.0	1.630	10.0	....
Convair 240	2	16.2	899	93.0	853	103.0	940	102.0	1.102	99.0	1.366
340										25.0	624
Douglas											
DC-2	2	....	....	....	....	....	....	....	....	....	....
DC-3	2	442.4	1.190	398.0	1.077	388.0	972	425.0	1.014	384.0	844
DST	2	....	....	....	....	....	....	....	....	....	....
DC-4	4	150.8	1.318	160.0	958	150.0	1,324	137.0	1,614	124.0	1.166
DC-6	4	54.4	1.864	104.0	1.655	111.0	1.751	139.0	2.207	161.0	1.922
Lockheed											
Electra	2	3.9	591	....	....	....	....	....	....	....	....
Lodestar	2	12.0	335	11.0	975	11.0	969	11.0	1.152	11.0	1.184
Constellation	4	32.0	2.067	55.0	1.596	83.0	1,264	101.0	1.976	125.0	2.051
Sikorsky S-38	2	....	....	....	....	....	....	....	....	....	....
Stinson											
Single Motor	1	7.0	447	....	....	....	....	....	....	....	....
Tri-Motor	3	....	....	....	....	....	....	....	....	....	....
Waco	1	....	....	....	....	....	....	....	....	....	....
Martin											
202	2	17.6	859	24.0	1.255	33.0	954	12.0	786	21.0	968
404	2	....	....	....	....	....	....	18.0	1.089	96.0	1.122
Curtiss C-46	2	0.2	802	2.0	224	....	....	....	....	....	....

Airline Statistics

AIRLINE REVENUE PASSENGER MILES

U. S. Domestic Air Carriers By Months

(Source: Air Transport Association)

	Millions of Passenger Miles							
Month	**1945**	**1946**	**1947**	**1948**	**1949**	**1950**	**1951**	**1952**
January	200,819	331,714	380,757	401,214	429,935	481,428	742,598	878,497
February	182,869	331.965	372,276	356,859	432,226	479,650	683,196	824,981
March	240,474	406,403	493,864	440,106	533,548	568,162	861,466	954,858
April	246,418	461,703	526,188	483,233	577,852	636,440	860,750	1,027,603
May	277,213	512,625	563,771	539,431	608,302	684,940	888,380	1,007,643
June	295,402	562,722	546,685	588,677	676,842	784,870	958,610	1,154,793
July	320,154	569,875	543,541	561,075	640,718	746,463	949,311	1,122,136
August	332,014	624,481	611,838	569,583	627,127	775,238	995,394	1,187,262
September	315,895	611,961	609,756	549,539	634,088	741,777	967,436	1,160,558
October	339,687	557,223	578,889	534,758	608,837	757,721	952,359	1,159,536
November	314,704	468,734	435,083	452,441	504,939	639,826	840,837	1,004,905
December	296,305	507,643	441,231	486,355	478,164	705,953	862,682	1,050,820
Total	3,362,454	5,947,049	6,103,879	5,963,271	6,752,578	8,002,468	10.563,019	12,533,592

AIR CARRIER OPERATING EXPENSES

Domestic

(Source: Air Transport Association)

Year	Aircraft Operating Expenses	% of Total	Ground and Indirect Expenses	% of Total	Total Operating Expense
1942	36,392,090	43.14	47,974,400	56.86	84,366,489
1943	34,613,411	36.22	60,949.609	63.78	95,563,020
1944	45,150,125	36.26	79,371,967	63.74	124,522,092
1945	69,222,625	38,32	111,403,704	61.68	180,626,329
1946	129,645,346	40.24	192,573,836	59.76	322,219,182
1947	169,164,673	43.80	217,034,447	56.20	386,199,120
1948	199,990,706	46.33	231,643,571	53.67	431,634,277
1949	223,193,168	48.34	238,539,727	51.66	461,732,895
1950	228,503,346	48.18	245,797,635	51.82	474,300,981
1951	287,157,305	48.37	306,559,357	51.63	593,716,662
1952	360,868,900	49.96	361,500,280	50.04	722,369,180

BREAKDOWN OF DIRECT AIRCRAFT OPERATING EXPENSES

	Flying Operations	% of Total	Direct Maintenance Flight Equip.	% of Total	Depreciation Flight Equip.	% of Total
1942	21,865,924	25.92	8,664,436	10.27	5,861,730	6.95
1943	20,739,121	21.70	9,132,260	9.56	4,742,030	4.96
1944	28,238,316	22.68	11,892,963	9.55	5,018,846	4.03
1945	43,421,033	24.04	16,392,654	9.07	9,408,938	5.21
1946	70,805,391	21.98	33,272,916	10.33	25,567,039	7.93
1947	88,839,885	23.00	42,902,710	11.11	37,422,078	9.69
1948	109,636,528	25.40	49,034.659	11.36	41,319,519	9.57
1949	127,397,922	27.59	54,028,364	11.70	41,766.882	9.05
1950	131,086,952	27.64	55,768,177	11.76	41.648,217	8.78
1951	172,677,416	29.08	71,364,212	12.03	43,115,677	7.26
1952	208,405,790	28.85	92,485,678	12.81	59,977,432	8.30

Includes Trunks, Local Service and Territorial

MILLIONS OF HOURS AHEAD
in lightweight turbo-machinery!

Today, AiResearch has a backlog of *25 million hours of actual operating field experience* in lightweight turbines. These units provide auxiliary power, starting power, pressurization, heating and refrigeration for U. S. aircraft. With rpm's ranging from 10,000 to 100,000, average efficiency is 83%.

The many thousand AiResearch turbine machines now in operation are the result of a development and manufacturing program begun 9 years ago. In its course more than 2¼ *million* hours were spent in engineering development, plus over 100,000 hours of laboratory tests.

This *experience* where others are still exploring is typical of AiResearch leadership in the small but highly efficient power and control units required by modern industry.

AiResearch Manufacturing Company

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AIRESEARCH—specialists in the design and manufacture of aircraft accessories in the following major categories: air turbine refrigeration • cabin superchargers gas turbines • pneumatic power units • electronic controls • heat transfer equipment • electric actuators • cabin pressure controls and air valves

NUMBER OF ENGINES PRODUCED

1917-1952

	Total	Military	Civil
1917-1919	N.A.	44,453	N.A.
1931	3,776	1,800	1,976
1932	1,896	1,085	813
1933	1,980	860	1,120
1934	2,736	688	2,048
1935	2,965	991	1,974
1936	4,237	1,804	2,433
1937	6,084	1,989	4,095
1938	N.A.	N.A.	N.A.
1939	11,172	N.A.	N.A.
1940[a]	N.A.	22,667	N.A.
1941[a]	N.A.	58,181	N.A.
1942[a]	N.A.	138,089	N.A.
1943[a]	N.A.	227,116	N.A.
1944[a]	N.A.	256,911	N.A.
1945[a]	N.A.	109,650	N.A.
1946	43,407	2,585[b]	40,822
1947	21,178	4,808	16,370
1948	N.A.	N.A.	9,039
1949	N.A.	N.A.	3,982
1950	N.A.	N.A.	4,314
1951	N.A.	N.A.	4,580
1952	34,382	29,000	5,382

[a]Excludes aircraft engines produced for other than aircraft use.

[b]Excludes experimental engines, engines classified by the armed forces as secret or confidential, engines for non-man-carrying, pilotless aircraft, jet assist mechanisms.

Source: 1917-1947—AIA Aircraft Year Book, 1948, P. xxl.
1948-1952—Bureau of Census Facts for Industry Series M42A.

SHIPMENTS OF CIVIL AIRCRAFT ENGINES

1952

Month	Number of Engines	Horsepower (in thousands)	Total Value (Thousands of Dollars)
January	395	248	$3,244
February	283	265	3,590
March	405	254	3,531
April	495	322	4,559
May	524	260	3,587
June	502	270	3,766
July	547	229	2,917
August	438	182	2,510
September	443	271	4,009
October	458	263	3,888
November	373	198	2,849
December	519	175	2,272

CIVIL AIRPLANE OUTPUT

By Power and Types

(Source: Aircraft Industries Association)

1937-1952

		1937	1938	1939	1940	1941	1945
Total		**2,289**	**1,823**	**3,715**	**6,785**	**6,844**	**2,047**
				By number of engines			
Single-engine		**2,171**	**1,770**	**3,613**	**6,562**	**6,629**	**1,946**
Multi-engine		**118**	**53**	**102**	**167**	**165**	**101**
Unclassified		**0**	**0**	**0**	**56**	**50**	**0**
				By horsepower			
50 hp. and under		**1,393**	**1,350**	**1,686**	**490**	**7**	**0**
51-70 hp.		**44**	**23**	**1,349**	**4,529**	**4,303**	**1,828**
71-100 hp.		**183**	**61**	**311**	**935**	**1,805**	**105**
101-165 hp.		**193**	**149**	**120**	**211**	**206**	**13**
166-225 hp.		**47**	**16**	**9**	**318**	**309**	**0**
226-300 hp.		**199**	**122**	**86**	**37**	**15**	**0**
301-600 hp.		**142**	**54**	**76**	**72**	**31**	**28**
601-800 hp.		**88**	**48**	**78**	**137**	**118**	**63**
		0	**0**	**0**	**0**	**0**	**10**
Unclassified		**0**	**0**	**0**	**56**	**50**	**0**
				By types			
Landplanes:							
1-2-place	**....**	**1,668**	**1,487**	**3,118**	**5,527**	**6,060**	**1,929**
3-5-place	**....**	**460**	**258**	**465**	**1,031**	**573**	**17**
6-20-place	**....**	**48**	**26**	**21**	**8**	**3**	**63**
21-place and over	**....**	**57**	**17**	**55**	**132**	**112**	**10**
Seaplanes	**....**	**41**	**26**	**51**	**18**	**16**	**0**
Amphibians	**....**	**15**	**10**	**5**	**3**	**30**	**28**
Unclassified	**0**	**0**	**0**	**0**	**66**	**50**	**0**

1946-1949[1]

	1946	1947	1948	1949	1950	1951	1952
Total Civil	**35,001**	**15,617**	**7,302**	**3,545**	**3,520**	**2,477**	**3,507**
Personal	**34,568**	**15,339**	**7,039**	**3,379**	**3,391**	**2,279**	**3,057**
Transport	**433**	**278**	**263**	**166**	**129**	**198**	**452**
By Place:							
2-place	**30,766**	**7,273**	**3,302**	**996**	**1,029** }	**2,275**	**3,056**
3- to 5-place	**3,802**	**8,066**	**3,737**	**2,383**	**2,362** }		
Over 5-place	**433**	**278**	**263**	**166**	**129**	**202**	**453**
By Horsepower:[2]							
1-74	**20,659**	**2,372** }	**2,990**	**930**	**597** }	**2,273**	**3,056**
75-79	**9,122**	**4,690** }					
100-399	**4,736**	**8,246**	**4,026**	**2,440**	**2,789** }		
400-3,999	**345**	**129** }	**286**	**174**	**134**	**204**	**453**
4,000 and over	**139**	**180** }					

[1]Exports excluded 1936-1941; no civil production during 1942-44; exports included 1945-50.
[2]Total rated horsepower of all engines.


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Now in production for the U. S. Navy, the Demon adds a potent weapon to our carrier striking forces . . . keeping American air power out in front throughout the world.
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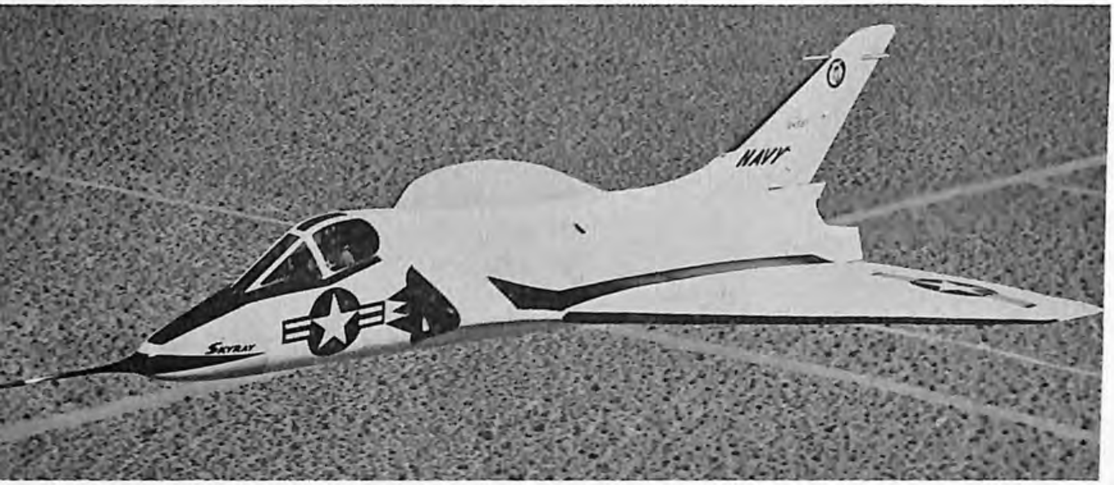
AVIATION EVENTS 1953

A pictorial report on some of the outstanding activities during the 50th year of powered flight.

EVENTS

During its Fiftieth Anniversary Year, powered flight piled up new records in virtually every phase of aviation. Speed records, in particular, set a sonic pace:



DOUGLAS F4D SKYRAY

The Douglas-Navy F4D Skyray jet interceptor returned two world speed records to the United States during October. Lcdr. James B. Verdin, Navy test pilot, blasted the modified delta-winged craft over a measured three-kilometer course near California's Salton Sea, averaging 753.4 mph for an official world record. Less than two weeks later, Douglas test pilot Robert O. Rahn cut in the afterburner of the Skyray's Westinghouse J-40 engine and streaked around a 100-kilometer course at 728.114 mph for another world mark.

NORTH AMERICAN F-100

About this same time, North American's F-100, the company's 50,001st airplane, powered by a Pratt & Whitney J57-P-7, became the world's fastest land-based production fighter when it hit 754.98 mph in level flight. This record performance had been forecast earlier in the year when the F-100 was flown at supersonic speeds during its first test flight.

BOEING B-47

The Boeing B-47, powered by six General Electric J-47's, continued to set new records during the year. Among these was an unofficial trans-Atlantic crossing of 4 hr. 45 min., flying the 2933 miles from Limestone AFB, Maine, to Fairford RAFB, England, at an average 617.4 mph. Two other B-47 models made their appearance during the year. One, the RB-47E, became the world's fastest day or night long-range photo reconnaissance production airplane. Another modification—as yet without designation—was the changeover of the standard model into the world's first jet-powered aerial tanker.

DOUGLAS D-558-II

Late in the year, the Douglas 558-II Skyrocket flew 1,327 mph at 35,000 ft.—twice the speed of sound at that altitude. Piloted by Scott Crossfield, NACA test pilot, the rocket-powered craft was released from its mother plane, a B-29.

PIASECKI YH-21

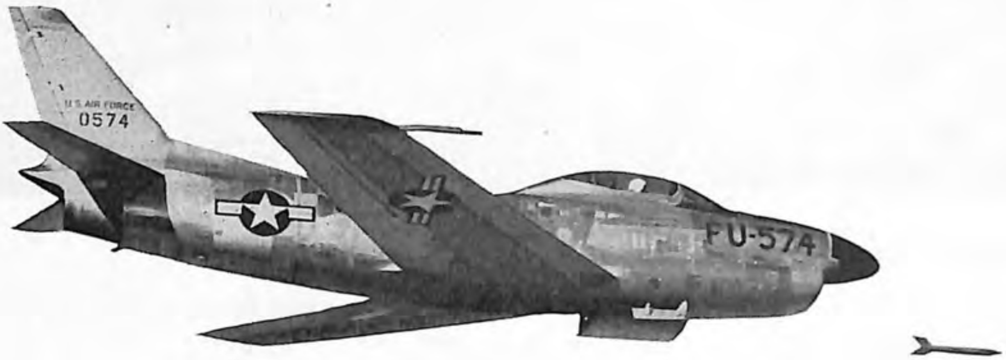
The record limelight was shared by the helicopter industry when new world speed and altitude records were set during 1953 by the Piasecki YH-21 Work Horse, powered by a Wright R-1820-103 engine. Pilot for both runs was Capt. Russell M. Dobyns, who set a record of 146.735 mph on the speed run, and reached 22,289 ft. to smash the existing helicopter altitude record.

REPUBLIC THUNDERJETS

Jets worked hard during the year to close the gap over their greatest obstacle—range. In August, with the aid of mid-air refueling, 17 Republic Thunderjets flew the longest non-stop jet fighter flight in history (4485 mi.) when they landed at Lakenheath, England, after a trans-Atlantic flight from Turner AFB, Albany, Georgia. On the same day, Col. David Schilling led a flight of seven F-84's on a new aerial route across the central Atlantic to North Africa, marking another first for the F-84, the longest non-stop jet fighter over-water flight (4470 mi.).

DOUGLAS DC-7

Airline progress kept pace when American Airlines, with its new Douglas DC-7, powered by four Curtiss-Wright R-3350 compound engines, scheduled the first non-stop roundtrip daily service between New York and Los Angeles.



F-86 SABREJET AND MiG 15

U. S. aircraft superiority was graphically demonstrated with the final totals from the Korean conflict. Most dramatic proof was the resounding 13-1 victory rolled up by the North American F-86 Sabrejet, powered by the General Electric J-47 engine, over its Russian-built counterpart, the MiG-15. Spurred by an Air Force $100,000 reward offer, a MiG-15, intact, was turned over to U. S. officials at mid-year and close inspection revealed striking deficiencies in the plane.

BOEING B-50 AND CHANCE VOUGHT CORSAIR

The end of an era for two history-making planes powered with reciprocal engines came in 1953. On February 28th, the last Boeing B-50 piston-engine bomber rolled off the production line, ending a 20-year and 17,000-plane Boeing era in the reciprocal bomber field. The last of the once-mighty Superfortresses went to work as a trainer for future Stratojet crews. Chance Vought, in this same month, closed out an era of piston engine fighter aircraft, beginning in 1917, when its last Corsair F4U was delivered to the French Navy.

FIRST CLASS AIRMAIL

A giant step forward in the future of airmail was the flight of first class mail at the regular 3-cent rate. Here pictured are presidents of the four participating airlines receiving their first sacks of mail from Postmaster General Arthur E. Summerfield at National Airport, Washington, D. C. A total of 3,629 pounds of mail was placed on the planes of the four carriers for the flight to Chicago. From left to right: J. H. Carmichael, President of Capital Airlines; Ralph Damon, President of Trans World Airlines; Postmaster General Summerfield; C. R. Smith, President of American Airlines, and W. A. Patterson, President of United Airlines.

Behind every outstanding record during 1953 were the men who made them. Some of these will remain forever unidentified but many were honored by the industry with awards. Space prohibits a complete list of those awards but a few of the outstanding are pictured here:

Air Force awards for exceptional service were presented by the Air Force Association to Donald W. Douglas, President, Douglas Aircraft Company; James H. Kindelberger, Chairman of the Board, North American Aviation, Inc.; and Frederick B. Rentschler, Chairman of the Board, United Aircraft Corporation.

At the annual Wright Memorial Dinner in December:
The Collier Trophy was presented to Leonard S. Hobbs "for the greatest achievement in aviation in America, the value of which has been demonstrated by actual use during the preceding year." Mr. Hobbs was the chief engineer in designing and building the Pratt & Whitney J-57 turbo-jet engine.

The Frank G. Brewer Trophy went to Dr. Leslie Bryan "for contributing most to the development of air youth in the field of education and training." Dr. Bryan is director of the Institute of Aviation at the University of Illinois.

Honorable Carl Hinshaw received the Wright Brothers Memorial Trophy "for public service of enduring value to aviation in the United States." Congressman Hinshaw, of California, is Chairman of the House Interstate & Foreign Commerce Committee.

High point of the Air Force Association's Airpower Banquet was the presentation of the H. H. Arnold Award to "Aviation's Man of the Year"—recently retired Air Force Chief of Staff Gen. Hoyt S. Vandenberg.

At the Institute of Aeronautical Sciences' summer meeting in Los Angeles, William Bridgeman, Engineering Test Pilot, Douglas Aircraft, was given the Octave Chanute Award for 1953 "for outstanding contributions to the knowledge of supersonics resulting from flights at recorded speeds and altitudes never before reached in a piloted aircraft."

I. Irving Pinkel, NACA Lewis Propulsion Laboratory, received the Flight Safety Foundation Award for his crash fire work.

The Daniel Guggenheim Award for 1953 was won by Charles A. Lindbergh for "pioneering achievements in flight and air navigation" during the past 25 years.

An astounding number of new developments came into prominence during the year:

CONVAIR SEA DART

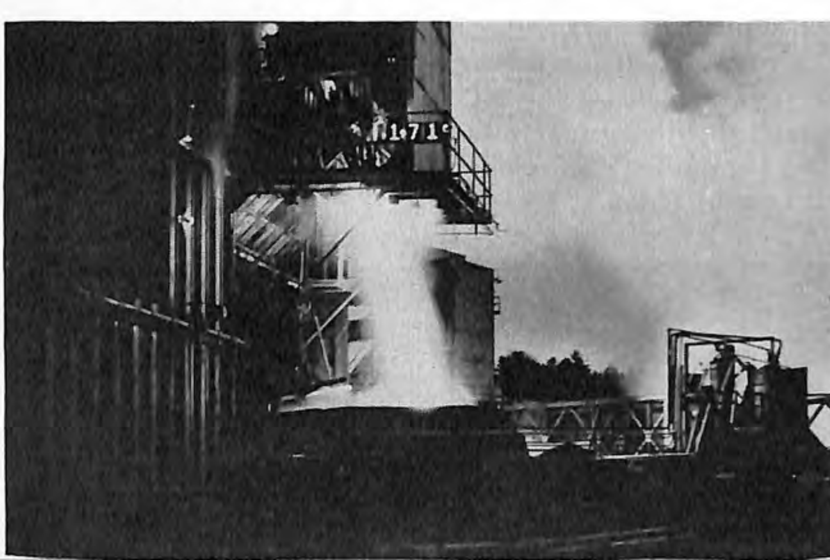
One of the most significant new planes was the revolutionary delta-wing XF2Y-1 Sea Dart which made its first flight on April 9th. Built by Convair, this first delta-wing seaplane is powered by two Westinghouse jet engines. Two air ducts channel air to the power plants. The XF2Y-1 has no horizontal tail but is equipped with a triangle-shaped vertical fin-rudder. Elevons on the wing trailing edge replace conventional ailerons and elevators for control action.

PIASECKI YH-16

Transport helicopter design got a shot in the arm with the unveiling of the Piasecki YH-16, the world's largest transport helicopter. Designed to carry 40 passengers, initial models are slated for long-range rescue, troop and equipment transport missions for the armed services. Minor modifications can put it on tomorrow's commercial airways.

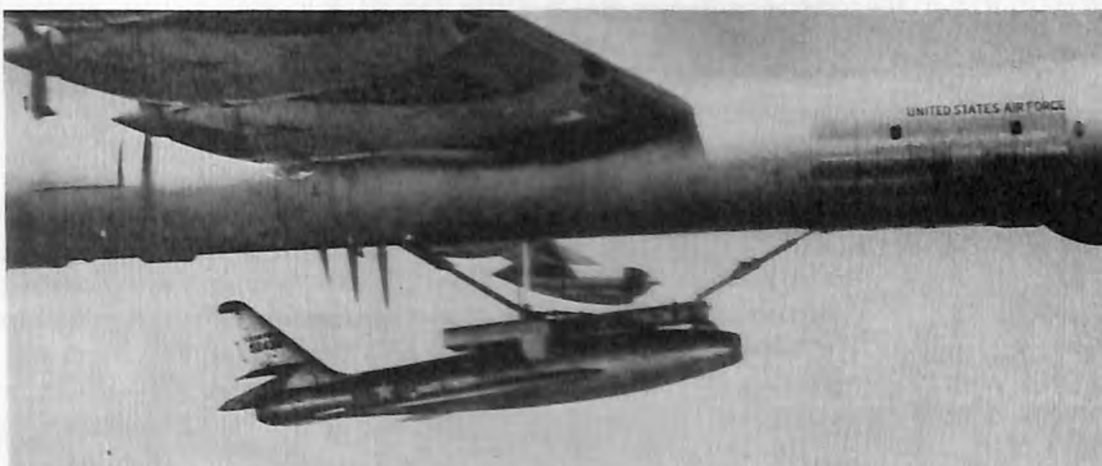
GE 20,000 LB. THRUST ROCKET MOTOR

In the field of rocket propulsion, General Electric made news with their 20,000 lb. rocket propulsion motor. The thrust from this motor is equivalent to two 2,000 hp locomotives.



CHANCE VOUGHT REGULUS

Missile research and production got into high gear during '53 with practically every major industry company involved. Most publicized development was the Chance Vought Regulus. Unveiled for the first time during the year, the Regulus saves millions of research dollars by an intricate recovery system which allows the same missile to be used as many as ten times.



REPUBLIC F-84 AND CONVAIR B-36

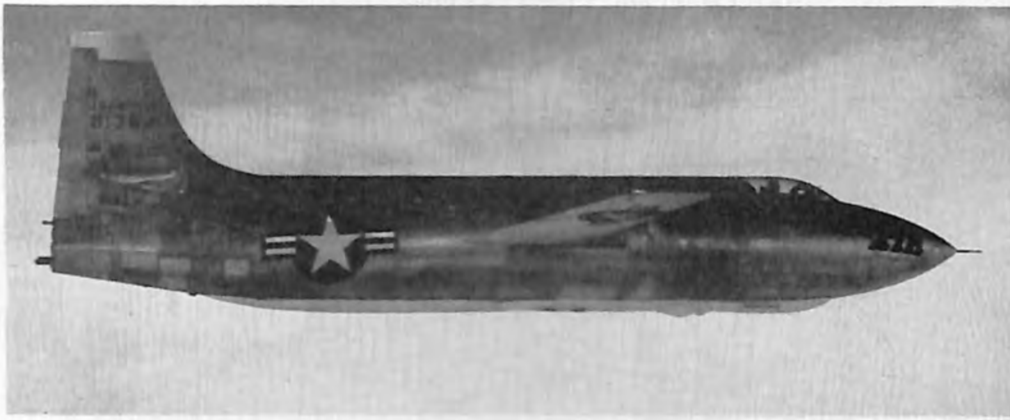
New uses for old equipment were graphically demonstrated in August when, after three years of experimenting, the Air Force announced that the F-84 could take off and land on a Convair B-36 carrier aircraft. It was the first time a full-sized combat aircraft had accomplished this feat, and combines in one plane the 10,000-mile range of the B-36 with the high speed and maneuverability of a jet fighter.

DOUGLAS X-3

The stiletto-like Douglas X-3, a new research aircraft, made its appearance during the year. Directed by the Air Research and Development Command to test design features of an aircraft suitable for sustained flights at extremely high speeds, the X-3 is powered by two axial-flow turbojet engines. The gross weight and length of the airplane slightly exceed those of the familiar DC-3 transport, but it has a wing span less than that of a DC-3 tail. The X-3 follows a line of research aircraft which include the Bell X-1, X-2, and X-5, the Northrop X-4, and Navy's Douglas D-558-I and D-558-II.

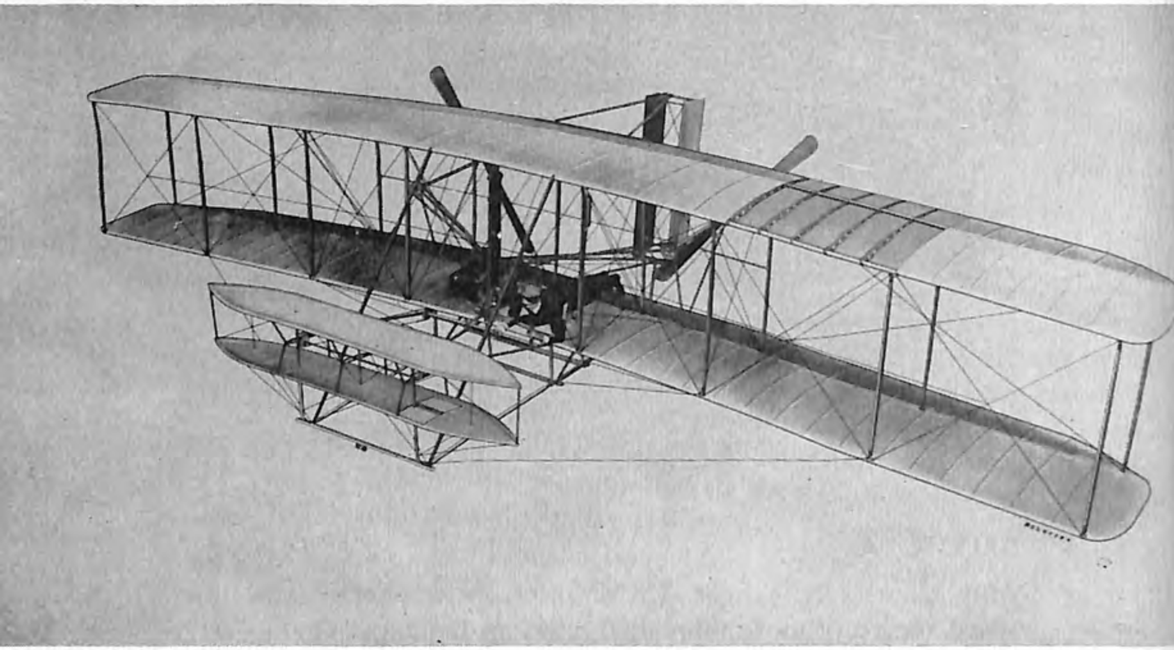
BELL HSL-1

Bell Aircraft Corp. became a new source for tandem rotor helicopters with its XHSL-1. Designed for the Navy, it was successfully flight-tested early in the year and became a production model for the Navy for its anti-submarine activities.



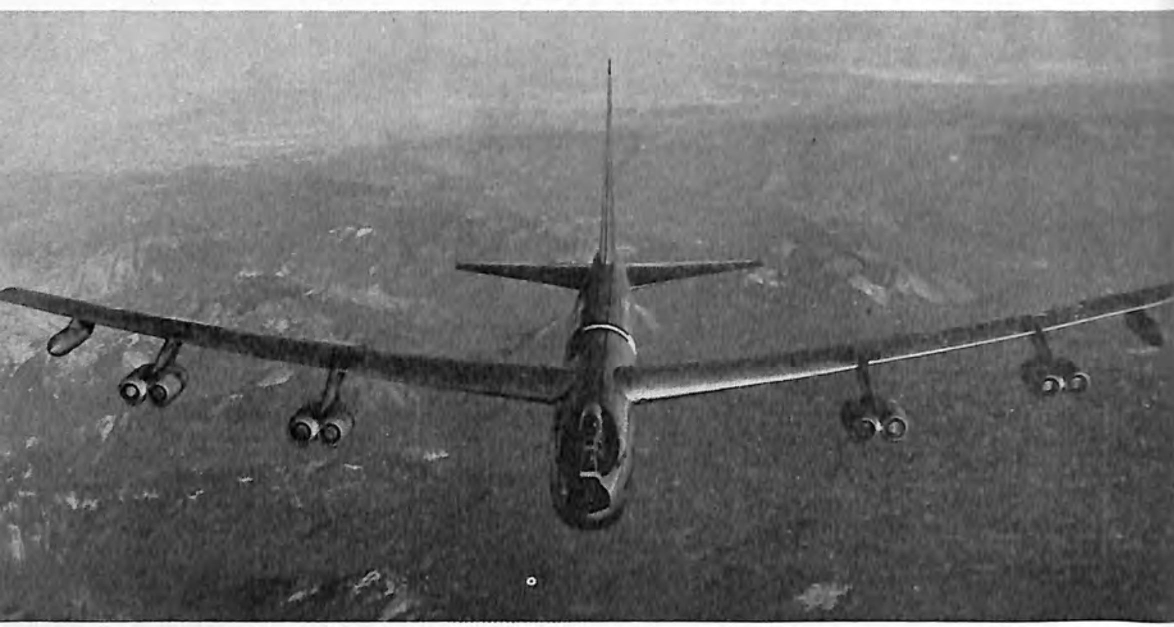
BELL X-1A

Maj. Charles E. Yeager, USAF pilot, established a new world speed record of more than 1600 miles an hour on December 12th in the Bell X-1A. He is pictured below being congratulated by Lawrence D. Bell, president of Bell Aircraft Corp., after completing one of the preliminary flights at Edwards Air Force Base, Calif.



1903—WRIGHT FLYER

1953—BOEING B-52 STRATOFORTRESS



CHAPTER ONE

The Industry

THE U. S. AVIATION INDUSTRY celebrated its golden anniversary in 1953 by turning in the most spectacular record of achievements in the peacetime history of the nation.

Year-end saw manufacturers producing 12,000 planes annually, making 1953 the biggest peace-time production year on record. Employment reached a new peace-time high and a number of companies, including Northrop and Fairchild, reported personnel rolls larger than World War II peaks.

Jet planes powered by the latest model engines shattered scores of speed and distance records. Reciprocal-powered transports contributed their share to the record-breaking. The dream of non-stop scheduled transcontinental air service became a reality. Flying first class mail was another milestone in the transport field, and helicopters became an active factor in local transport as well as with a wide variety of other services where no other unit of transportation could do the job. Lightplanes hit new highs in service to industry generally, notably in the executive field.

Work on guided missiles, covered by security, indicated progress, and giant strides in research were reported covering all aviation problems.

Climaxing the year, the industry made history by honoring it in numerous celebrations honoring the 50th anniversary of powered flight. Aviation even contributed to the literature of the year with a contemporary classic and best-seller, Charles A. Lindbergh's "The Spirit of St. Louis."

Detailed reports, listing companies in alphabetical order, follow.

AIRCRAFT MANUFACTURERS

Aero Design and Engineering Co.

One of the industry's newest members, Aero Design and Engineering Company, took a permanent place as an aircraft producer in 1953. After pioneering in the production and sales of light twin-engine transports with the Aero Commander, the company completed its second full year of production.

All divisions of the Oklahoma City operations were expanded during the year. Additional space, personnel and equipment were added and production increased. By year-end, production had reached eight planes per month and over 140 Aero Commanders were in operation throughout the world.

The Commander attracted the attention of the aviation world when it made its precedent-breaking 1,160-mile single-engine flight from Oklahoma City to Washington, D. C. The entire flight, including take-off and landing, was made under full load conditions with the left propeller completely removed.

Since this demonstration of single-engine safety, the Commander has been accepted as one of the leading executives' transports.

Commanders now operate in Brazil, Ecuador, Mexico, Chile, Japan, Philippine Islands and the Dominican Republic. All deliveries to foreign countries have been direct fly-away from the factory. On one 15,000-mile flight via the Atlantic, performance figures show an average ground speed of over 190 mph. Fuel consumption averaged 22.7 gallons per hour.

Three Commanders have been purchased by the United States Army for evaluation purposes and are being used as staff transports and liaison planes.

Actual production on the first Commander was started in February, 1951, and production was completed August 26. Within this six months, a vacant hangar was transformed into a complete aircraft manufacturing unit, capable of manufacturing an entire airplane with the exception of engines, landing gears, propellers, and other standard items.

Delivery of the first Aero Commander was made in January, 1952, following the CAA acceptance of this new design.

Since the delivery of the first Aero Commander, the number of employees has steadily increased from the original 14 to the present day 600.

Anderson, Greenwood & Co.

Anderson, Greenwood & Co. continued its military work in 1953, the program including airplanes as well as more specialized aircraft. The company's design contracts with Consolidated Vultee-San Diego on the R3Y were completed, representing nearly a two-year effort. Engineering work on the Boeing B-47 was accelerated to a major portion of the business.

Work with Boeing-Seattle was expanded and broadened in scope to include not only preliminary design and engineering but also fabrication and testing of complete systems. This responsible work is giving the company an invaluable background in little-known fields of aircraft engineering.

Negotiations were under way at press time for a military research program on a specialized application of aeronautical design to a military usage developed by Anderson, Greenwood & Co. as a private venture. High speed facilities were developed by the company to carry out this work, and were expanded as the subject was explored.

During the year work went forward on missiles and their ground-handling and launching equipment.

Shop facilities were doubled in 1953 to handle fabrication and test projects; high grade machine tools were installed to carry out these programs.

Employment level was rising towards the end of the year.

Avco Manufacturing Corp.

Avco enlarged considerably its role as an aviation manufacturer of precision products during 1953, through increased activity by both its Lycoming and Appliance and Electronics Divisions. Aircraft production encompassed both civilian and miltary products and final assemblies as well as components.

Lycoming continued as the major producer of aircraft engines for light executive planes, particularly twin-engined models. Increased utilization by busy executives of these flying offices has resulted in a sizable gain in Lycoming's engine production for such planes as the Aero Commander, the Grumman Widgeon, the Piper Apache and the Riley Twin-Navion Conversion.

Lycoming manufactures at its Stratford, Connecticut, plant the R-1800 reciprocating engine for military use along with jet engine components. Other precision aircraft components were built at the Williamsport, Pennsylvania, plant, which was the sole source for assemblies for the Piasecki helicoper and the North American's F-86 Sabrejet.

Avco's Appliance and Electronic Division, which produces Crosley and Bendix home appliances, conducts a defense manufacturing program in the majority of its plants throughout the middle-west. Chief among the materiel for the Air Force are electronic-mechanical fire control devices and wing components for fighters, bombers and transport planes.

Beech Aircraft Corp.

Four new models, two for the military services and two for business executives the world over, went in production at Beech Aircraft Corporation in 1953.

In the military field, production was started in January on the Beechcraft USAF L-23A, a six-place, twin-engine, high-performance airplane designed for utility use by the U. S. Army Ground Forces. This airplane, a version of the Beechcraft Model 50, was in use by the end of the year by military forces throughout the United States and in critical areas around the globe.

Production started on the USAF T-34 Mentor primary trainer, designed as a replacement for the veteran T-6 in pilot training for the Air Force. First production model was accepted by the Air Force in September, and the two-place plane began to emerge in sizable quantity from Beechcraft production lines.

Early in January, Beechcraft introduced the D-35 Beechcraft Bonanza, an improved version of the famous Beechcraft four-place low-wing monoplane with a V-tail which has been a favorite of executive pilots and passengers since its introduction.

The fourth airplane introduced by Beechcraft was the Beechcraft Model B-50 for executive and business use, a new version of the Beechcraft Twin-Bonanza. The twin-engine six-place executive transport is designed to fill the need of business today for an economical light twin-engined utility airplane for rapid and safe transportation.

The L-23 and the B-50, with the same basic configuration, are designed for a top speed of 202.5 miles per hour and a cruising speed of 190. Both planes are powered with two 260-hp Lycoming engines and are equipped with Beech constant speed propellers. The empty weight is 3,800 lbs. and the gross weight 5,500 lbs., giving the plane a useful load of 1,700 lbs.

The rate of climb is 1,500 fpm, the service ceiling 19,000 ft., and the range 1,155 miles.

The L-23 design allows for easy modification to a twin-engine trainer, or a photographic ambulance, or cargo airplane.

The USAF T-34A, the Beechcraft 45 Mentor, is an all-metal low-wing cantilever monoplane with a fully-retractable tricycle landing gear incorporating a steerable nose wheel. Powered by a Continental 225-hp engine with a Beech constant-speed propeller, the plane has a top speed of 189 mph, a service ceiling of 20,000 ft., and a maximum range of 975 miles.

The T-34, in spite of its high performance, operates at very low fuel consumption and maintenance costs. The plane has no acrobatic restrictions, and has a safety factor of ten. Its empty weight is 2,170 lbs., the gross weight is 2,900 lbs., and the useful load 730 lbs.

During the year, in addition to the order from the United States Air Force, the Chilean Air Force signed a contract for more than a million dollars for the delivery of the new plane, and other nations are expected to follow.

The Model D-35 Beechcraft Bonanza incorporates a long list of recent improvements, in addition to the features of the other Beechcraft Bonanzas.

The D-35 Bonanza has a top speed of 190 mph and a cruising speed of 180, with a range of 750 miles on the remarkable fuel economy of 19.9 miles per gallon.

Beechcraft facilities were increased in 1953 by more than 160,000 sq. ft., bringing the total area owned and leased by Beechcraft to more than 2,000,000 sq. ft. of floor space.

Work was completed on a 100-million-gallon reservoir, supplying an emergency water supply for industrial use, and providing, eventually, a recreation area for Beechcraft employees. The reservoir, stocked with better than 13,000 fish this spring, is fed by streams and wells in the vicinity.

President O. A. Beech announced in May the appointment of C. C. Pearson, a veteran of more than 23 years in the aircraft industry, as vice president—manufacturing.

In August, he was made a director of Beech Aircraft and two veteran Beechcrafters were elected to vice-president positions. Lynn D. Richardson, Washington, D. C., was made vice president—military sales, and James N. Lew was made vice president—contract administration.

Beech Aircraft participated widely in national celebrations observing the 50th Anniversary of Powered Flight, with displays and exhibits at the National Aircraft Show in Dayton, the International Petroleum Exhibition in Tulsa, the Detroit Air Show, and the 50th Anniversary celebration of Powered Flight of Wichita, Kansas.

Final fiscal year figures covering Beechcraft's 1953 operations were not available at press time for the AIRCRAFT YEAR BOOK, but sales were expected to total approximately $97-million, including both military and commercial products. Of the total sales, exports amounted to more than $7-million. Sales of more than $80-million are anticipated for 1954.

In addition to the four new planes rolling off the Beechcraft production lines, Beechcraft is building the famous Model 18 twin-engine executive transport for business use. Nearly 1,000 of these planes have been produced since the end of World War II. Beechcraft is also rebuilding sizable quantities of Beechcraft Model 18's for the United States Navy and Air Force.

In 1953, Beech continued to produce sizable quantities of wings for the Lockheed USAF T-33 jet trainer and the Lockheed USAF F-94C Starfire jet interceptor. Other major subcontract items are now entering production at the plant.

Bell Aircraft Corp.

Emphasis on the development and production of guided missiles and their components, supersonic research aircraft, and military and commercial helicopters was continued by Bell Aircraft Corporation throughout 1953.

In addition to development and production of a missile for which it is the prime contractor, the company also engaged in producing rocket propulsion, servomechanisms and electronic components for other manufacturers

Another of the now famous Bell supersonic series, the X-1B, was displayed in public for the first time at Dayton, Ohio, by the U. S. Air Force, which disclosed it was in the 1,600-mile-an-hour class.

The X-1A also made the news by establishing a new world speed record of more than 1600 miles an hour on Dec. 12th.

Both airplanes have the same configuration but are slightly larger than the Bell X-1, which became the world's first supersonic airplane in October 1947.

The X-1, it was revealed by the Air Force late in 1953, attained a speed of 967 miles an hour in 1948 and reached an altitude of 70,140 feet in 1949.

The X-2, another in the Bell supersonic series, was undergoing some modification and refinement and was expected to be tested with its rocket powerplant during the early part of 1954.

In keeping with its guided missile research and development programs, Bell Aircraft expanded the engineering departments in its Niagara Frontier Division, in the Buffalo, N. Y., area, and at the end of the year engineering personnel constituted slightly more than 20 percent of the total employment of 13,000.

Rocket engine development continued to be one of the major fields in Bell research and the company was one of three in the country supplying all three major missile components: airframe, rocket engine and guidance.

Commercial application of servomechanisms and electronics devices also were undergoing study by company scientists.

In addition to work in its own laboratories, Bell Aircraft also was ordering advanced electronic components, designed by company engineers, from specialized industries in the field.

Proportional control, automatic helicopter pilot systems and automatic landing systems for fixed-wing aircraft were among other engineering projects receiving attention.

With the diminishing of military demands resulting from the cessation of hostilities in Korea, Bell Aircraft's Texas Division at Fort Worth, Texas, was able to increase production of commercial versions of its three-place helicopter.

A new model, the 47-G, was announced in May. It incorporated major basic control and rotor blade improvements, as well as a one-third increase in fuel capacity, with a proportionate increase in range.

Another feature of the 47-G was a controllable stabilizer mounted near the tail rotor, operating in conjunction with the cyclic control for forward and backward flight. The stabilizer, combined with other control improvements, has increased center-of-gravity travel 40 percent.

Bell also announced a major revision in inspection procedure for all its 47-series helicopters, based on experience gained through more than one million flight hours.

Interval between major inspections was increased from 300 to 600 hours, doubling operation time between overhauls and decreasing maintenance costs.

The company also announced that more than 1,300 of the Model 47's had been delivered to the military and commercial operators in 32 countries throughout the world.

Utility of this model continued to expand. Operating at altitudes of about 5,000 feet, Bell helicopters helped speed the construction of a half-billion dollar power and smelter development of Aluminum Company of Canada, Ltd., 400 miles northwest of Vancouver, B. C.

Hauling men, supplies and equipment, the pilots operated from 14 by 14 foot platforms erected at camps huddled on the sides of the mountains. In one instance, surveying time was reduced from two years to three months and manpower cut from 20 men to the pilot and a surveyor.

Bell Aircraft has entered the twin-rotor field with a helicopter designed specifically for Navy anti-submarine patrol.

Designated the XHSL-1, this helicopter was flown for the first time in March at Fort Worth, Texas. Deliveries are scheduled to begin in 1954. Details of its construction and performance have not been released by the Navy.

Development of a convertiplane, one of two designs selected by the U. S. Air Force, was progressing rapidly at year-end.

Boeing Airplane Co.

The two experimental prototypes of the Air Force's newest heavy bomber, the XB-52 and YB-52, continued to hold the spotlight at Boeing Airplane Company during 1953 as flight and ground tests of these eight-jet swept-wing bombers were stepped up.

But even as the successful testing of the more than 300,000-pound aircraft continued, production B-52A's already were under construction at Boeing's Seattle, Washington, plant. Tooling, jig erection and other preparation for quantity production of this plane received added impetus late in the year when the Defense Department announced that the original order for B-52's would be increased by 25 to 40 percent. Although no exact figures were given, the action involved enough planes to equip more than seven heavy bombardment groups in the proposed 143-wing air force, the Defense Department announced. Also named was the company's Wichita, Kansas, division as the second source of B-52 production.

Meanwhile production of the swift B-47 Stratojet medium bomber continued at the Wichita plant at the rate of better than one per working day for the year. More than 600 had been delivered by the fall of 1953. Versatile KC-97s, Boeing's third production airplane project, continued to roll off the line at Boeing's Renton, Washington, factory.

Further applications of Boeing's model 502 gas turbine engine were investigated while production models were being delivered to the Navy. The year also saw a stepping-up in the company's pilotless interceptor program

The last day of February marked a milestone in Boeing's history. On that day the last piston-engined bomber built by the company took off from Boeing Field and the company entered fully into jet bomber production. The plane, a TB-50H Superfortress, ended a long line of Boeing-built piston-engined bombers dating back to the B-9 of the early 'thirties and totaling more than 17,000 planes. It was delivered to the USAF's Air Training Command where it joined other TB-50's used to train the "triple-threat" bombadier-navigator-observer crew members of the B-47 Stratojet.

At Wichita, where the company has met or exceeded B-47 production schedules for 19 consecutive months, the latest model of this 600-mph bomber, designated the B-47E, began coming off the line. Also being built at Wichita is the new photo reconnaissance Stratojet, the RB-47E.

The new RB-47E ranks as the world's fastest day-or-night long-range photo ship and differs from the standard B-47E in its longer nose and air conditioned camera compartment. Equipment includes intervalometers which make it possible to take continuous pictures of large areas at regularly spaced intervals, an optical viewfinder, and photocell-operated shutters that are actuated by the light of flash illuminants for night aerial photography.

The air conditioning system in the camera compartment maintains uniform temperature and humidity and also keeps the camera windows free of moisture or frost to assure maximum photographic quality at high or low altitudes. The reconnaissance airplane has more windows than the B-47E and, like the standard bomber, is in the 600-mph class, with an operational altitude above 40,000 ft. Like other Stratojets, it is equipped as a receiver for Boeing-developed Flying Boom aerial refueling.

Announced during 1953 was the RB-47B—a basic B-47B model modified to Boeing photo-recon design by Grand Central Aircraft Corp. at Tucson, Arizona, and by Douglas Aircraft Co., at Tulsa, Oklahoma.

The "B" reconnaissance model is fitted with a convertible camera pod or ready-to-go package of camera equipment which, as a unit, readily can be installed or removed in the airplane's bomb bay. Modifications include principally bomb bay structural changes, installation of special wiring to the bomb bay and modification of the airplane's hot air ducting system to provide heat for the pod. The pods, each mounting eight fixed cameras, are built to Boeing specifications by the Aeronca Manufacturing Corp.

Among the outstanding accomplishments of the Stratojet during the year was the successful completion of a 1000-hr. accelerated service test program in which one B-47 duplicated as nearly as possible the conditions with which it might be confronted on a continuous combat status.

In all, the Stratojet flew 121 missions averaging more than 3,000 miles each and totaling 432,066 miles. Half of the time logged was at night and the test also included both live and simulated bombing runs and 69 aerial refueling transfers from Boeing KC-97's. The missions averaged eight and one-half hours each with one lasting more than 14 hours. On one mission at 40,000 feet the Stratojet picked up a jet stream and held the astounding speed of 794 mph for 30 minutes.

Another event concerning the Stratojet which made headlines during the year was the announcement that Boeing and the Air Force had been conducting experimental tests using a modified B-47 as a tanker plane for aerial refueling operations. Begun more than two years ago, the project has provided test data upon which to base requirements for future high-speed, high-altitude aerial refueling tankers.

In the Wichita operation alone, Boeing not only provides technical assistance to other contractors, but conducts a broad procurement program in which parts and assemblies for the B-47's are brought from more than

1,400 suppliers. Procurement last year for the B-47 also involved dealing with more than 1,500 suppliers who provided miscellaneous materials and services necessary for the operation of the plants and machinery.

According to the Defense Department announcement naming the Wichita Division as the second source of B-52 production, tooling and related preparations will cost in the neighborhood of $250-million.

At the Renton plant, where employment during the year exceeded even the wartime peak, newer, more versatile KC-97G Stratofreighter tanker-transports began emerging from the factory doors at about the middle of the year. Eleventh model in the Stratofreighter series, the "G" model, through relocation of its fuel tanks, can double as a cargo carrier without removal of its refueling equipment. A second new feature incorporated in this plane is the provision for two streamlined droppable fuel tanks slung under the wings.

The 350-miles-per-hour KC-97's quickly can be converted entirely to cargo, troop or hospital transports by removing the Flying Boom pod and installing cargo doors in its place. As a cargo carrier, the Stratofreighter can transport payloads up to 34 tons on normal missions and as a transport, 96 fully-equipped troops, or 69 litter patients together with medical attendants and supplies. The entire airplane is pressurized, maintaining sea level pressure up to 15,000 ft. airplane altitude. At 30,000 ft. cabin pressure is maintained at 8,000 ft.

The big double-deck Stratofreighters are in service the world over with the Strategic Air Command as tankers and cargo planes in support of SAC fighter and bomber movements, and with Military Air Transport Service for transporting troops, supplies and hospital patients.

During the year SAC KC-97 tankers refueled the F-84 Thunderjet fighters in "Operation Longstride"—the non-stop Turner AFB, Georgia, to Lakenheath, England, flight and SAC and MATS KC-97's and C-97's played a vital role in moving the 305th and 306th Medium Bomb Wings to England in the first mass flight of Stratojets across the Atlantic.

Having served throughout the Korean war as hospital planes, the Stratofreighters were used in this configuration to return the first American prisoners of war to be released from North Korean prison camps to the United States in "Operation Little Switch."

Continuing to experiment with this versatile aircraft, Boeing also was able to disclose during the year that it would equip two C-97's with Pratt & Whitney T-34 turboprop engines for service testing under an Air Force contract.

The contract calls for installation of 5,700-hp T-34's in two production line C-97's in place of the four Pratt & Whitney R-4360-59 Wasp Major reciprocating engines, which power the current production model. In addition to providing the modified planes with almost 63 percent more power, installation of the turboprop will decrease the Stratofreighter's empty weight by almost 5,000 pounds.

The company's major production of gas turbine engines, exclusive of test models, continued to go to the Navy for use as electrical power generators on minesweepers.

Having already undergone testing as a powerplant for small boats, trucks, a Kaman helicopter and various stationary uses as well as currently powering a 34-ton Kenworth truck and trailer on regularly-scheduled freight runs out of Seattle, the Model 502 has been put to use as a starting aid for larger jet engines. Initial quantities were delivered to the Air Force.

Probably outstanding in news of the turbine during the year was its installation in the Cessna XL-19B Bird Dog light observation plane. In this turboprop installation the Model 502 sent the XL-19 to an altitude of 37,063 feet to set a new world's altitude record for light planes.

As the year drew to a close, the prototype of this country's first jet transport neared completion at the Boeing Renton plant. Scheduled to fly sometime this summer, most details of this aircraft have been withheld, but it will be a large, swept-wing, jet-powered airplane. The new plane will be powered by four Pratt & Whitney J-57 jet engines and will have a speed in excess of 500 mph.

In the field of missiles it was revealed during the year that Boeing has for some time been engaged in developing and preparing for production its Bomarc F-99 pilotless interceptor. This project, about which almost all information is still secret, involves not only the basic research and design of the weapon itself, but an entire concept of air defense. Communications, logistics, maintenance, co-ordination and bases are but a few of the problems involved against which Boeing is matching its extensive research and developmental facilities and the experience gained in its earlier GAPA program.

The Air Force contract for an engineering study of the application of nuclear energy to aircraft, which Boeing and Pratt & Whitney were given in 1951, continued to move along during 1953, but no additional details are releasable.

Manufacture of Boeing's electronic analog computer continued throughout the year.

Boeing added some 851,000 sq. ft. of floor space during 1953. Improvements at Seattle included the new $4-million engineering building addition and a gunnery revetment at the south end of Boeing Field.

The year also saw the completion of a new theodolite station overlooking Boeing Field to aid in testing the B-52's and improvements were made to the Shuffleton steam laboratory near Renton where the company is doing research on ram jet engines. At Wichita, contract was let for a new two-story cafeteria-engineering building.

Total Boeing employment was above the 60,000 mark at year-end, with 36,000 persons at Seattle and 24,000 at Wichita.

Boeing reported net earnings of $13,576,164 for the first nine months of the year, a net return of 2.07 percent on sales and other income totaling $657,435,301. Earnings per share for the nine-month period were equiva-

Cessna XL-19C, turboprop version of L-19

lent to $8.36 per share and the company declared two dividends totaling $3.50 per share during the first nine months.

Cessna Aircraft Co.

The largest commercial aircraft sales volume in its twenty-six year history, backlogs indicating an even better year in 1954, outstanding progress in hydraulics and helicopter fields, and the development of a magnesium corrugator, were among the top accomplishments at Cessna Aircraft Company in 1953.

During the year, Cessna built over 1,800 commercial and military aircraft. The military model is the L-19 Bird Dog. An increase of 55 percent in aircraft sales over 1952 places the 1953 total sales figure at almost $14-million.

Contributing to this gain in 1953 was the introduction of the "Golden Year" Model 180, which the Cessna Aircraft Company built and dedicated during the year in commemoration of the Golden Anniversary of Powered Flight. The Model 180 is a four-place, all-metal, high-speed aircraft for businessmen.

Every military commitment with Cessna since the outbreak of the Korean conflict has been made on schedule or bettered. This is true of the more than $100-million in military contract work. Present military backlog exceeds $54-million and a great portion of this work extends well into 1955.

In April, 1952, Cessna secured all the stock of the Seibel Helicopter Company, Inc., started in 1948, which had done considerable work on small helicopters and was the fifth such company to receive a helicopter certificate from CAA.

Work at Cessna is well underway on a somewhat larger helicopter designated the CH-1, which incorporates the best of the proven principles in the helicopter field, plus new design and simplification of certain moving parts. The helicopter division is also engaged in a helicopter research program on contract with the Navy.

Cessna's hydraulics division completed its move to Hutchinson, Kansas, during 1952, and total sales in the division reached a new high of $1,553,000 in that fiscal year. In 1953, total sales hit an all-time high of almost $2-million. An additional 20 percent increase in the division is anticipated during fiscal 1954.

Cessna's outstanding 1953 production development was a magnesium corrugator that will form magnesium at room temperature. This eliminates costly sandwich-type heaters and stamp presses. The corrugator weighs approximately 2,000 lbs., is 5 ft. long, 34 in. high and 48 in. wide. Laboratory tests indicated no material change in sheer, tensil, elongation or grain growth of the metal. The tests and use of the corrugator with magnesium offer a new concept in the corrugation, not only of magnesium, but aluminum and similar light metals.

Since 1950, Cessna has had a 54 percent increase in total covered floor area, an increase of 466 percent in personnel, and a 507 percent increase in sales. Sales increase is based on the total sales for 1953 over the total sales for 1950. A $54-million backlog of military business extends well into 1955. Principal subcontracts are with Boeing, Lockheed and the Buick, Olds, Pontiac Division of General Motors. All Cessna land, buildings, machinery and equipment is owned and operated without Defense Plant Corporation or other United States Government funds.

For the twelfth consecutive year a fifty-cent cash dividend was declared. Also in 1952 stock was placed on a regular cash dividend payment basis of fifty cents per year, to be paid semi-annually at the rate of twenty-five cents per share.

Chance Vought Aircraft, Inc.

The existence of Chance Vought Aircraft's Regulus guided missile program was disclosed by the U. S. Navy during 1953 and it was also reported that the company had received authorization to build an A2U attack version of its twin-jet F7U-3 Cutlass fighter airplane already in quantity production for the Navy.

In addition, Chance Vought won a design competition for a new Navy day fighter the F8U-1 which is planned to follow the F7U-3 and the A2U on the production line. Announcement that Chance Vought had won the design competition was made by the Navy in May, 1953.

To further a number of projects of a classified nature, the company concentrated in 1953 on expansion of engineering and development activity, both in Dallas and at a newly-opened engineering facility in Boston, Massachusetts.

The company increased its personnel from 10,500 to over 14,000 employees during the year. Currently using more than 2,250,000 sq. ft. of manufacturing and office space, the company has undertaken a large-scale construction program. Completed, under construction or planned are a low-speed wind tunnel, a structural test laboratory building, a missile hangar, a missile test building, two jet engine test cells and a warehouse and manufacturing building.

Chance Vought closed out an era of piston-engine fighter aircraft that began in 1917, when its last Corsair, an F4U-7, was delivered to the French Navy in February, 1953. Delivery of the last airplane, the 12,571st to be built, marked another chapter in a long history that began in 1938 when the XF4U-1 Corsair went on designing boards. The XF4U-1 first flew in 1940.

In addition to production of its airplanes and missiles, Chance Vought produces, under sub-contracts, nose sections for the Boeing B-47 Stratojet, tail sections for the Lockheed P2V Neptune and oil tanks for Pratt & Whitney Aircraft.

When existence of the Regulus project, started in 1947, was disclosed in March, 1953, the Navy revealed that the guided missile was designed for launching from submarines, surface ships and shore bases.

First flown in 1950, Regulus is now in production. Test and training versions have tricycle landing gear so that missiles can be recovered upon completion of flights. The tactical version has no landing gear.

Launching equipment can be installed quickly on several types of vessels at relatively low cost and with only slight modifications to the ship itself.

The U. S. submarine Tunny, recommissioned on the West Coast in 1953, had been specifically modified to launch the Regulus. The Tunny is a converted World War II submarine modernized by a snorkel and streamlined hull and conning tower. While in the shipyard a tank for stowing a guided missile and a launching rack were installed.

Officers and enlisted men on the Tunny were specially trained at the U. S. Naval Air Missile Test Center at Pt. Mugu, California, in the operation and maintenance of the Regulus.

Although the assault missile, and certain other configurations, will employ a drone version of Regulus, tactical employment will also include those techniques and guidance systems associated with the operation of all-weather, distantly controlled guided missiles. Such plans will make it possible to use the missile in various ways without the expense and effort of designing and procuring a separate missile for each function.

The test and training versions of Regulus are equipped with tricycle landing gear so that the missile may be recovered upon completion of its flight. This recovery feature is important because the missile is not lost after each flight. A flight test vehicle, during the early stages of development, approximates the cost of a jet fighter. To evaluate a jet fighter, approximately 100 hours of flight time are required. To obtain the same flight test information on a non-recoverable missile comparable to the Regulus, around 200 missiles would have to be used if each were expended. The recovery feature permits the number to come down to about 30.

In addition, much important test data, which might be lost if the missile were destroyed, are recovered and used to good advantage in subsequent flights. Test missiles now in use have been flown many times at subsonic and supersonic speeds and have been recovered without damage. As many as 15 flights have been made with a single vehicle, cutting to one-fifteenth the cost of a comparable operation involving loss of a vehicle or missile for each test. Regulus is recovered through the use of a parachute-type brake on an average sized runway.

In appearance, Regulus resembles a conventional, swept-wing jet fighter. It is about 30 feet long.

Service plans envisage a wide use of Regulus, both as a tactical weapon and as a recoverable test vehicle. Tactically, Regulus will be used against appropriate land targets and in amphibious warfare by the U. S. Marine Corps and the Navy. The recoverable version is being used to train operating units in launching and guidance techniques and can be used as a high speed drone for anti-aircraft guided missiles and anti-aircraft gunnery.

Regulus performance has exceeded early design specifications. The missile was initially developed in 1948, and first flown at Edwards Air Force Base in 1950.

Overwater testing has been conducted at the Navy's Air Missile Test Center, Point Mugu, California.

At the end of 1953, United Aircraft Corporation announced a plan to establish its Chance Vought Aircraft Division as a separate corporation. The new corporation, Chance Vought Aircraft, Incorporated, came into being January 1, 1954, to frunction as a wholly-owned subsidiary of United until, subject to submission of the plan to UAC stockholders in April, 1954, status as an independent corporation is established some time during the year.

Consolidated Vultee Aircraft Corp.

The first flights of two delta-wing fighters, one a seaplane, one a landplane; the successful development of the B-36 as a carrier for reconnaissance fighter-type aircraft; a change in corporate control; the observance of the company's 30th anniversary, and the activation of an operating division in a new manufacturing facility were among the highlights of development, production, and management activities at Consolidated Vultee Aircraft Corporation during 1953.

The first flight of the high-speed, revolutionary, Navy XF2Y-1, Sea-Dart delta-wing jet seaplane fighter occurred off San Diego Bay April 9, 1953. World's first delta-wing seaplane, the XF2Y-1 is also the world's first combat-type plane equipped with retractable hydro-skis which enable it to operate from rough waters. Sea-Dart development is continuing.

On October 24, Convair's YF-102, the nation's first supersonic, delta-wing, all-weather interceptor, made its initial flight over the Mojave Desert, taking off from the Air Force Flight Test Center, Edwards, California.

In production at San Diego, the single-place F-102 is the latest Air Force aircraft designed for air defense of the United States.

The Fort Worth-built B-36/F-84 combination marks the first known accomplishment of flying a full-scale combat aircraft from a mother plane. This strategic aircraft team made its first public demonstration at the National Aircraft Show, Dayton, Ohio, in September.

Convair marked the 30th anniversary of its founding with ceremonies at San Diego and Pomona, California, and Fort Worth and Daingerfield, Texas. The company was established May 29, 1923, at East Greenwich, Rhode Island, by Major Reuben H. Fleet.

Corporate control of Convair passed from the Atlas Corporation to General Dynamics Corporation on May 15, 1953. At that time, John Jay Hopkins, board chairman and president of General Dynamics, succeeded Floyd B. Odlum as Convair board chairman. General Dynamics acquired from Atlas 400,000 shares of Convair common stock and became its largest single stockholder. Atlas retained 30,300 shares of Convair stock in the transaction.

During early 1953, the physical move from San Diego's Plant II to the new government-built facility at Pomona, California, was made. This division is engaged in a comprehensive program of research, development, and production of guided missiles for the Navy.

At Daingerfield, Convair is developing and testing supersonic ram-jet-powered guided missiles for the Bumblebee program. Engineers, technicians, and craftsmen at Daingerfield number nearly 300.

Convair-San Diego turned out Convair-Liner 340's at a rate of about eight per month, with approximately 100 delivered to customers. Production of pressurized T-29 Flying Classrooms for the Air Force was accelerated. By the end of 1953, two types were coming off assembly lines —T-29C navigator-bombardier trainers and T-29D special bombardier trainers.

Production also began on an order for C-131A Flying Samaritans, the first of which is scheduled for delivery to the Air Force in 1954. Based on T-29 types, the Samaritan is an air evacuation transport capable of carrying 27 litters, or 40 passengers, or combination loads.

Latest type to enter production at San Diego during 1953 was the Air Force F-102 supersonic delta-wing all-weather interceptor. Additional space at Plant II was acquired during the year for expansion of F-102 production. The first YF-102 was constructed in the experimental factory, Plant I, and was moved October 5-6 to Edwards Air Force Base, California, for its flight test program. First flight of the YF-102 occurred October 24, 1953, at the Air Force Flight Test Center, at Edwards, with Richard L. Johnson at the controls.

Capable of supersonic speeds in straight and level flight, the F-102 is powered by a Pratt & Whitney J-57 turbojet engine. The plane incorporates improvements in electronics and armament to make possible all-weather around-the-clock interception of enemy bombers.

U. S. Navy projects at San Diego include R3Y Tradewind turboprop seaplane transport production and development of the XF2Y-1 Sea-Dart delta-wing seaplane fighter.

First production model of the 80-ton R3Y is slated for transpacific Navy service in 1954. Fastest fiying boats in the 40-year history of water-based aviation, the Tradewind transports are designed to cruise long distances at nearly double the speed of existing transport flying boats while carrying the same or greater payloads.

R3Y design top speed exceeds 350 miles per hour. With full load, takeoff time is about 30 seconds. The R3Y is the first flying boat to be equipped with air conditioning and high-altitude pressurization systems, and the first water-based transport fitted with rearward-facing seats. Another feature is built-in multicell compartmentation below the cabin floor level. This provides water-tight integrity and leaves the cabin free of bulkheads and other obstructions which previously hindered cargo and passenger accommodations in large seaplanes. The R3Y is among the first aircraft in the world to utilize magnesium in cargo decks.

Developed through extensive testing by the Convair Hydrodynamic Research Laboratory at San Diego, the slim Tradewind hull contrasts sharply in appearance and performance with old-time stubby "winged boats." The length-over-beam ratio of 10 is about double that of previous hull designs built by Convair.

The R3Y is equipped with four Allison T-40 gas turbine engines which develop more than 5,500 hp each and are geared to swing contra-rotating Aeroproducts propellers. Reversible pitch controls enable the pilot to maneuver easily on the water. Self-contained AiResearch gas turbine compressors supply air for penumatic engine starters and other auxiliary systems.

Largest seaplane ever built by Convair, the R3Y has a wingspan of nearly 145 ft., is 142 ft. 6 in. long, and towers 51 ft., 5 in. at vertical fin tip when beached on its cradle.

To expedite handling and servicing the new transports, Convair is developing high-speed ramp and beaching facilities. Among these are concrete pontoon (floating) "thru-docks," high-speed winches, self-propelled beaching cradles and associated equipment. The planes have a large cargo door on the left side of the fuselage to supplement personnel doors on both sides for faster loading and unloading operations.

The San Diego Division is building an undisclosed quantity of Tradewind transports, to be operated by the Navy's Fleet Logistics Air Wings, Pacific, out of Alameda, California.

Development work on the Navy XF2Y-1 Sea-Dart continued throughout 1953. Launched on San Diego Bay on December 16, 1952, the Sea-Dart made its first flight April 9, 1953, with E. D. (Sam) Shannon, chief of experimental flight at San Diego, as engineering test pilot. Shannon also was the first man to fly a land-based "delta."

The high-speed, water-based XF2Y-1 is the first known combat-type aircraft to use retractable hydro-skis for improved rough water landing

Convair RB-36, world's largest reconnaissance bomber

and takeoff performance. Designed to expand the air defense perimeter of fleets at sea and installations ashore, the Sea-Dart represents a successful blending of the high-speed, land-based airplane's performance with the waterbased airplane's inherent versatility and mobility. It is equipped with two Westinghouse turbojet engines. It has no horizontal tail, but is equipped with a triangle-shaped vertical fin-rudder. Elevons on the wing trailing edge replace conventional ailerons and elevators for control action. Other details of XF2Y-1 are classified.

The XF2Y-1 is part of a high performance waterbased "flying fleet" being developed by the Convair Hydrodynamic Research Laboratory for the Navy. Like Convair's XP5Y-1 turboprop patrol bomber and R3Y-1 Tradewind turboprop seaplane transport, the Sea-Dart was developed with the aid of small-scale, dynamically-similar, precision model seaplanes which can be remotely controlled to forecast accurately performances of full-size aircraft long before they are built.

In addition to handling aircraft projects for the armed forces and commercial customers, the San Diego Division is also working on several restricted programs, including guided missiles, electronic systems, and advanced-type aircraft.

Employment at San Diego increased about 10 percent during 1953. On Jan. 1, 1953, employment was approximately 21,000; by the end of the year, about 23,000.

Besides acquiring additional factory space at Plant II, Convair-San Diego leased a former tuna-canning plant to provide more storage area. Approximately 150,000 sq. ft. of space were added to the division's warehouse facilities.

A $369,000 static test facility was constructed at the company's seaplane ramp in 1953. Built especially for testing structural characteristics of Navy flying boats, the huge steel fixture is the largest of its kind in the industry.

In order to suppress the sound of large jet engines being tested in San Diego, the company constructed a $90,000 concrete and steel muffler. Largest single-unit muffler in the area, it has proved to be very effective in reducing noise.

Studies leading to a 10-year equipment-modernization program involving the possible expenditure of about $1.8-million annually for 10 years were completed at San Diego. To be ordered are straight replacements, additional faciilties, and new-type equipment.

One of the largest template cameras in the aircraft industry was installed in San Diego's tooling department in 1953. The camera is 29 ft. long and has an all-metal copy board 12 ft. long and 5 ft. high. Three lenses—a 42 in. Goerz and a 36 in. and 24 in. Zeiss—produce enlargements to four times. This equipment is being used primarily to speed up engineering and tooling for the F-102.

The Air Force announced in August the successful development of the Fort Worth-built B-36 intercontinental bomber as a carrier for reconnaissance fighter-type aircraft. Basic objective of the project is to provide the Air Force and the Strategic Air Command with the capability for long-range, high-speed reconnaissance.

Both the Convair B-36 and the Republic F-84 aircraft have modifications enabling them to take off and land as a single unit. The B-36 can also launch and retrieve the jet fighter in flight. This development marks the first known accomplishment of flying a full-size combat aircraft from a mother aircraft.

Meanwhile, production continues at Fort Worth on B-36H and RB-36H models. They are powered by six Pratt & Whitney 3800 hp piston engines and four General Electric J-47 turbojet engines rated at 5,200 lb. thrust. B-36 production is scheduled to be completed in late 1954.

The Air Force ordered America's first twin-engine turboprop military transport planes from Convair in September. The two transports will be Convair-Liner 340's equipped with General Motors' YT-56 Allison gas turbine engines swinging Aeroproducts propellers. Fort Worth is handling the conversion work on the two planes.

Development work is being done at Fort Worth on a supersonic bomber for the Air Force.

The SAM-SAC program, involving inspection and repair of the Air Force's entire fleet of B-36's over a period of years, was assigned to Fort Worth in mid-1953. It was the first contract awarded under the Air Force's new plan of returning a product to the manufacturer for maintenance and repair instead of doing the work itself at Air Force depots. The plan was adopted by the Air Force on the theory that it is more economical for the manufacturer to modernize and overhaul the airplane which he has produced, since he has the necessary equipment on hand, the technical know-how, and the personnel qualified to do the work.

Several hundred persons were employed at Fort Worth making tools and parts for four different airplanes in production at San Diego. These airplanes included the Air Force F-102 interceptor; the Air Force T-29 navigator trainer; the Air Force C-131 Samaritan air evacuation transport; and the Navy R3Y Tradewind turboprop seaplane transport. Fort Worth also is producing tools for a San Diego military plane still classified for security reasons. In connection with these programs, Fort Worth acquired a 7,000-ton hydraulic press, first of its kind to be installed anywhere, and is using it to manufacture parts for the F-102.

In 1953, Fort Worth added buildings, machinery, and an enlarged yard area at a cost of more than $4-million.

A manual joggle fixture was built and placed in operation at Fort Worth. This fixture, which can turn out compound joggles, will eliminate tens of thousands of dollars of expensive tooling.

In June, Convair-Fort Worth was presented the award of honor, highest safety award of the National Safety Council, in recognition of the division's 1952 record of improvement over the aircraft manufacturing industry's safety standard.

On October 25, 1953, employment at Fort Worth totaled nearly 20,000.

For the nine months ended August 31, 1953, Convair reported income, before federal income and excess profits taxes, of approximately $13,144,000, compared with approximately $11,523,000 for the like period in 1952. After federal taxes, net income for the first nine months amounted to $5,333,337, equal to approximately $2.24 a share, compared with $6,480,921, or about $2.73 a share for the similar period in 1952. The 1952 net income for nine months, totaling $6,480,921, included an extraordinary income item of $936,514, covering a tax refund of a prior year. Sales for the nine months ended August 31 amounted to nearly $285-million compared with $274-million for the like period in 1952. Unfilled orders as of August 31, including those in negotiation and expected to mature, exceeded $1-billion.

The company's net income for the fiscal year ended November 30, 1952, after all charges including taxes, amounted to $10,426,476, equal to $4.39 a share, compared with a net profit of $7,750,524, or about $3.27 a share, for 1951. Federal taxes on earnings in 1952 were $8.5-million, as compared with $3.8-million for 1951. The 1952 net income included profit on the sale of the company's general office building in San Diego in November, 1952, amounting to $946,735, profits derived from sale of miscellaneous securities totaling $249,735, and a tax refund for prior years of $935,265. Net sales for 1952 were $390,997,843 as against $322-million in 1951.

As of December 1, 1952, certain Convair assets were transferred to the then newly-formed San Diego Corporation, including $1.3-million in cash, the second mortgage note of $1.7-million received in connection with sale of the firm's general office building, and Convair's interests in oil investments which had a book value of $180,000. The oil properties had been acquired as an investment, but it was later determined desirable to separate the investment from Convair and pass on to stockholders the values that had been created. The company took in exchange all the outstanding stock of the San Diego Corporation amounting to 240,000 shares. This stock of the San Diego Corporation was then declared as a special dividend on December 12, 1952, on the basis of 1/10th of a share of San Diego Corporation per one share of outstanding Convair stock.

In addition to the special dividend just mentioned, the company declared dividends of 45 cents a share in January, April, July, and October.

Doman Helicopters, Inc.

Outstanding development in 1953 for Doman Helicopters, Inc., was the announcement that Hiller Helicopters of Palo Alto, California, will produce the Doman YH-31 evacuation ambulance helicopter for the Army.

Doman's YH-31, an evacuation ambulance which carries four litters plus attendant and the pilot, has an empty weight of 2,860 lbs. with a useful load of 1,559 lbs. is powered by a 400 hp Lycoming engine and has a speed of 104 mph and service ceiling of 18,000 ft. Its retrieving radius for two litter patients is 240 miles. Seven-foot wide folding doors on either side afford rapid loading of patients with greater safety and comfort to victims, and speeds landings and take-offs. Doman's H-31 spacious cabin of 147 cu. ft. allows for in-flight attendant.

The Army helicopter first flew in April of this year and currently is in a military test. The LZ-5 ship is in a preflight stage and will be test-flown for CAA certification early this Fall.

This same ship is also in production as the commercial model being manufactured at the Danbury plant and Doman-Fleet Helicopters, Ltd. of Fort Erie, Ontario, Canada. Schedules are being timed to meet the increasing interest by foreign and domestic operators.

Douglas Aircraft Co.

Diversified production of both commercial and military aircraft on an expanded scale, and notable achievements of airplanes in both categories, highlighted Douglas Aircraft Company's 33rd year of continuous operation under the same management.

Twelve aircraft models and a number of guided missiles were in full production at the company's four divisions located in Santa Monica, El Segundo and Long Beach, California, and Tulsa, Oklahoma.

Four types of transport planes were in continuous and simultaneous production at the company's Santa Monica Division during the year. Experienced engineering, careful planning, ingenious tooling and painstaking production control all contributed to the unparalleled feat of manufacturing consecutively on the same assembly line DC-6A, DC-6B, and DC-7 commercial airliners, and two military configurations of the DC-6A Liftmaster.

Liftmasters, with interiors engineered for quick conversion from cargo carriers to passenger transports or hospital planes, were delivered to the Air Force as C-118A's and to the Navy as R6D-1's.

On a parallel line, in a portion of the Santa Monica plant, service-worn R4D's were extensively modified and reconstructed into R4D-8 twin-engine transports for the Navy.

The company's heavy commitments in the design, development and production of guided missiles also is centered at Santa Monica. Alone, and in collaboration with leading electronics research organizations, Douglas was engaged in work on every category of missile: surface-to-surface, surface-to-air, air-to-surface and air-to-air.

Newest in the post-war series of Douglas commercial transports, the DC-7 entered full production during 1953 and deliveries were started following flight tests and certification.

With a top speed in excess of 400 mph and a normal cruise speed of 365 mph, the DC-7 is the world's fastest piston-powered commercial transport.

More than 85 of the high-speed airliners, which provide non-stop transcontinental service in both directions between New York and Los Angeles, had been ordered through November of 1953 by seven airlines.

Deliveries of the DC-6B also will continue through 1954.

Security wraps were lifted partially on the Douglas X-3 high speed research airplane when the Air Force turned the stiletto-shaped aircraft over to the National Advisory Committee for Aeronautics for further research flying.

The X-3 has a slender fuselage with an extremely long, tapered nose and short wings located well back toward the tail. It is 66 ft. 9 in. long, nearly three times its span of 22 ft. 8 in. The top of its vertical stabilizer extends 12.5 ft. from the ground.

Developed by the Douglas Santa Monica division, the plane is a mid-wing monoplane powered by two axial flow turbojet engines. Problems solved in its design involved not only aerodynamics but uses of new materials and construction methods. To cope with thermodynamic problems, the aircraft is artificially refrigerated and insulation has been provided to protect the pilot, instruments and other internal equipment.

Information obtained in the design, development and flight tests of the X-3 has been made available to the aircraft industry through NACA and military channels. It was flown by Douglas test pilot William E. Bridgeman under supervision of the Douglas testing division.

Production of the C-124 Globemaster series aircraft entered its fourth year at the Long Beach division. Continuous improvements and refinements of the series have resulted in the current production model C-124C which is powered by four 3800 bhp Pratt & Whitney R4360-63 engines driving 17-ft., three-bladed reversible Curtiss Wright propellers. Minor structural changes permitted an increase of 10,000 lb. in take-off weight to bring the design gross weight to 185,000 lb., providing substantial gains in payload and range.

The capability of the C-124 airplane to transport virtually any military vehicle, general cargo, 200-fully-equipped troops or 125 stretcher patients has been fully exploited by the Tactical Air Command in its Korean operations and by the Strategic Air Command and Military Air Transport Service in their global operations.

Manufacture of a prototype model YC-124B also was completed during the current year. This airplane is powered by four 5400 bhp Pratt & Whitney YT34-P-1 turbo prop engines driving 18-ft. Curtiss propellers. Flight test experience to be gained by this airplane will provide additional information to aid in the design of the latest and most modern transport airplane for the US Air Force, the Douglas YC-133.

Engineering and tooling design of this advanced model are in active progress at Long Beach, and portions of the design have been allocated to the Santa Monica division to aid in expediting the program. The YC-133 is a four-engined, long-range, heavy cargo airplane of high wing design using a later model of the YC-124B power plant.

The YC-133 will offer tremendous increases in payload, range, economy, and speed over the C-124 airplanes in current service. Cargo handling will be simplified by the large ramp opening in the aft fuselage, truck-bed-height floor, and forward side cargo door.

Major engineering effort at Long Beach was directed towards completing design for the new Air Force RB-66 reconnaissance bomber which is now being manufactured at this plant. The twin jet Allison J71 powered swept wing airplane is being produced for the Tactical Air Command. Based on the A3D originally designed by the El Segundo division, the RB-66 carries a three-man crew and is rated in the 600-700 mph class. It is designed to meet Air Force requirements for high and low level photo reconnaissance during day or night missions. With completion of the RB-66 engineering, work has been concentrated on the bomber version of the airplane, the B-66B. Engineering of another reconnaissance version of this versatile airplane has been assigned to the Tulsa division.

Tulsa also will produce major sub-assemblies for the C-124 in addition to its major operation as a prime source of the Boeing-designed B-47 Stratojet bomber. Deliveries of B-47's began at Tulsa in February, 1953, 25 days ahead of schedule.

The Tulsa plant is also engaged in modifying B-47's for the Air Force.

Five airplane models—employing jet, turboprop and piston power plants—were in simultaneous production at the Douglas El Segundo division. This thriving facility had production contracts from the Navy for AD-5 and AD-6 Skyraiders, the F3D-2 Skynight, A2D Skyshark, A3D and F4D Skyray.

Production of the Skynight, a twin-jet all-weather fighter, was completed in June culminating a production contract dating back to 1949. Indications were that the two-place fighter would remain in operation with Navy and Marine all-weather squadrons for some years. The F3D was the first American jet to shoot down an enemy jet at night, employing electronic devices to locate and destroy Red planes in Korea.

June, 1953, also saw another veteran of the Korean conflict leave the

El Segundo line when the AD-4 Skyraider was succeeded by an improved AD-6 model. Production was started at the same time on the AD-5, a multiplex version of the same basic airframe. The AD-5 may be converted aboard carriers to serve as 12-place personnel transports, one-ton-cargo planes, four-litter ambulances or six-seat VIP transports. It was the eighth year of production for airplanes of the Skyraider series.

First production model of a new Douglas attack plane, the large twin-jet A3D was rolled out of the El Segundo plant in September. Built to perform as a high-altitude, long-range bomber in the 600-700 mph class, the A3D has two Pratt & Whitney J57 jet engines installed in pods slung under its swept wings.

Still another new Navy plane, the rakish F4D Skyray jet interceptor, also was in production at El Segundo. The modified delta-wing fighter gained international prominence on October 3 when it flashed to a new official three-kilometer straightaway speed record of 753.4 mph. This average of four scorching passes over a measured course bordering California's Salton Sea bettered a previous mark of 737.3 held by a British jet fighter. The record was established by Navy test pilot Lt. Comdr. James B. Verdin.

Thirteen days later, Douglas test pilot Robert O. (Bob) Rahn raced the same plane around a closed 100-kilometer course over Muroc Dry Lake, California, to set a new mark of 728.110 mph. He toppled an earlier British record of 709.2 mph.

A Westinghouse J40 jet engine, with afterburner, powered the Skyray on its record runs. Production models, due in 1954, will be equipped with even more powerful engines.

Another achievement by a Douglas plane was recorded August 21 when Lt. Col. Marion E. Carl, USMC, blasted the D-558-2 Skyrocket to an altitude of 83,235 feet. This erased the Skyrocket's own previous best altitude of 79,494 feet reached in 1951.

Not only did Douglas-built airplanes fly faster and higher during 1953, but one of them won considerable renown for flying farther. A DC-6B delivered to the French airline, TAI, flew non-stop from Los Angeles to Paris—a distance of 5700 miles—in 20 hrs. and 28 min. The flight was the longest recorded for a commercial airliner.

Another Douglas commercial plane, a KLM DC-6A, won the transport category of the London-to-Christchurch race carrying a payload of passengers and cargo on the 13,000-mile flight to New Zealand.

To meet its expanded production effort, Douglas increased its plant area by approximately one million sq. ft. during 1953 and increased its work force to a total of more than 64,000.

New post-war highs in sales and earnings were reported by the company at the end of the first three quarters of fiscal 1953. Sales totaled $632,280,525. Earnings, after estimated taxes, amounted to $13,325,000.

Sales for the first nine months of the year were 88 percent military and 12 percent commercial. The backlog of unfilled orders on August 31 exceeded $2-billion.

Fairchild Aircraft Div.
Fairchild Engine & Airplane Corp.

Production of C-119 Flying Boxcars reached an all-time high at Fairchild Aircraft Division during 1953. With contract orders with the U. S. Air Force and Marines, the Royal Canadian Air Force, and Belgium and Italy, the Division stepped up its monthly output to better than 30 planes by midyear.

Employment at the division also reached an all-time high, with approximately 10,000 employees on the division payrolls by midyear, eclipsing the World War II peak by more than 1,000.

A production milestone was celebrated as the 1,000th Flying Boxcar was delivered in a series which began with the XC-82 in 1944 and has continued through the "G" revision of the C-82's successor, the C-119. Many of the 220 C-82's produced under the original postwar contract are still in service in the United States and Europe.

A $9-million expansion and improvement program begun in the autumn of 1951 was completed in the summer. Four major buildings were added to the existing plant setup: a production bay, a hangar, an office building, and a processing room. Ramp areas and storage facilities also were enlarged.

Flying Boxcars during the summer began moving down the new and improved final asembly line which was transferred from the former production area in less than a month under one of the industry's most unusual relocation programs.

C-119 Flying Boxcars rounded out three full years of service on the Korean Combat Cargo airlift in September. During this period they hauled 164,000 tons of cargo, dropped 18,000 tons of equipment, carried 251,000 passengers, dropped 30,500 paratroops in training and 5,500 in combat operations, in 39,000 individual flights totaling 130,000 hours.

Flying Boxcars were again during the year featured in numerous airborne exercises calling for paratroopers and hauling of bulky and heavy equipment items such as bulldozers and howitzers. During Operation Test Drop at Fort Bragg in January, C-119's set an aerial delivery record by dropping 400 tons of special construction vehicles in the first mass paradrop of heavy engineering equipment.

C-119's were used to teach the concept of airborne warfare to the nation's future generals and admirals at CAMID '53 (Cadet-Midshipman) exercises in June. The exercise, conducted as a full-scale air-supported amphibious invasion, saw a paratroop force of potent striking power dropped from C-119's a short distance behind an "enemy" beachhead while amphibious troops stormed ashore.

Twin-tailed C-119 sky carryalls took part in many rescue missions. The most important of these were in Netherlands flood rescue operations, during which they dropped food, life rafts and other vitally needed items to stranded persons; in two Japanese floods, the worst in history; and in the

Greek earthquakes in which they transported medical supplies and helicopters to expedite rescue work.

In October, Fairchild Aircraft Division was awarded a contract to produce an undisclosed quantity of the C-123 Avitruc assault transports.

A major subcontract program got underway at Fairchild in March to build outer wing panels and vertical fins for Boeing B-52 bombers.

In the field, the Flying Boxcar came off with flying colors. Maximum performance test maneuvers by the USAF including abrupt rudder kicks, high speed side slips and maximum aileron force rolling pullouts showed that the C-119 far surpasses all structural requirements set for it.

New altitude and endurance records for C-119's were set by service pilots during the year. Crews of the 456th Troop Carrier Wing at Miami, Florida, flew a C-119 up to a height of 30,900 feet and kept another one aloft for 20 hours and five minutes without auxiliary fuel tanks.

A multi-million dollar research and development program for a new, completely American design jet transport plane was announced by Fairchild. The project will be financed entirely from Corporation funds.

Development-wise, Fairchild Aircraft Division reported plans for incorporating a composite of design ideas over the next two years in its production model C-119 Flying Boxcar. The modified airplane, given the company designation M-194, would have enlarged control surfaces, external fuel tanks, rough field landing gear, three-piece engine cowling, flight-operable beavertail doors, greater paratroop drop and litter capacities, and improved protection for aircraft and occupants.

Airview shows expanded facilities at Fairchild's Hagerstown, Md. plant to handle increased volume

Grumman Aircraft Engineering Corp.

Grumman Aircraft Engineering Corporation will celebrate in 1954 its Silver Anniversary featuring the oldest management team in point of service—not age—in aviation history. Leroy R. Grumman, now chairman of the board; Leon A. Swirbul, president; William T. Schwendler, executive vice-president; E. Clinton Towl, vice-president; Edmund W. Poor, treasurer, and Joseph H. Stamm, secretary, founded the company twenty-four years ago in a small garage in Baldwin, Long Island. Grumman now occupies an airport and four large factories at Bethpage, and employs over 10,000 persons.

Construction of an all-jet plant and a large test field on a 4,500-acre plot at the Peconic river facility on eastern Long Island was one of the oustanding 1953 Grumman projects.

For twenty of the years Grumman has been in business the Navy has had a Grumman fighter plane in its line-up. And when the Korean War broke, Gumman had the F9F-5 Panther jet ready. It was Grumman's first jet and the first jet to be used by the Navy in combat.

The Panther maintained a round-the-clock schedule for Navy and Marine pilots, serving in such diversified missions as combat air patrol, armed reconnaissance, photo reconnaissance, flak suppression, target cap and rocket, bombing and strafing missions. In its infrequent personal engagements with the MiG-15, the Panther has a perfect score. Navy records show that the Grumman jet accounted for 15 of the Russian-built fighters without loss.

The F9F-6 Cougar has presently replaced the Panther on the Grumman production line. This plane is a swept-wing, transonic successor to the Panther.

Grumman amphibians, whose production exceeds the combined efforts of all other manufacturers, continued to play a leading aviation role during 1953.

Current production model, designed solely for the military, is the SA-16A Albatross, which presently gets into print more frequently than Grumman fighters and sub-killers in rescue work in all parts of the globe for the Air Force Air Rescue Command.

The Albatross, powered by two Wright R-1820 engines of 1425 hp each, is also used for air-sea rescue work by the Navy and Coast Guard, and was the first aircraft adopted by the unified commands. It was credited with saving over 900 lives in Korea alone.

The Albatross has been converted to a triphibian with a retractable ski attached to its hull, making it capable of operating on snow and ice as well as on land and water.

The Air Rescue Command recently formed a Triphibian Rescue Unit at the Narsarssuak Air Base in Greenland. It is the first of its kind, with pilots specially trained for ice and snow landing in the sub-zero Arctic regions.

New Grumman search plane, the S2F-1 Sentinel

Grumman also is active in Navy torpedo-bomber plans. The AF Grumman Guardian was developed from the experience gained in making the Avenger. Carrier-based Guardians operated in pairs as a hunter-killer combination. One is equipped with radar devices for hunting subs, and another loaded with bombs and torpedos used in the kill.

Late in 1952 the Guardian was replaced on the production line by the S2F-1. The Navy's electronic answer to any submarine threat, the twin-engine S2F is the first carrier aircraft to combine the elements of submarine search and attack in one airplane. An all-weather performer, its elaborate equipment includes the latest detection and destruction devices to hunt out and kill enemy subs.

In addition to the Cougar, Albatross and S2F-1 assembly lines, Grumman has a metal boat section which is the largest manufacturer of canoes in the world. Aerobilt Bodies, Inc., a wholly-owned Grumman subsidiary, has found increasing acceptance of its truck bodies among such well-known organizations as United Parcel Service, Railway Express, National Biscuit Company and the Scandinavian Airlines System.

Grumman is planning projects years in advance for newer jet fighters, anti-submarine planes and pilotless aircraft. Among these are a new top secret fighter and a lightweight, simplified jet with a performance far exceeding that of the supersonic Cougar.

Gyrodyne Company of America, Inc.

The year 1953 was a period of substantial and solid growth for Gyrodyne. During the year a major portion of the efforts of the company were devoted to building up an efficient, fully equipped manufacturing division. This division of the company is at the present time engaged in an expanding subcontract business, specializing in precision machine parts and sheet metal sub-assemblies, for major aircraft manufacturers.

With this build-up in facilities, Gyrodyne is now in a position to carry out a complete program of design, fabrication, testing and certification of commercial and military rotary-wing aircraft.

Hiller Helicopters

Hiller Helicopters in 1953 continued quantity production of its H-23B utility helicopter for the U. S. Army, the HTE-2 trainer for the U. S. Navy, and the Hiller 12-B for other military and commercial customers throughout the world. In September the company passed a milestone when it turned out its 500th production helicopter.

For its helicopter familiarization program, the U. S. Army continued to use Hiller H-23's, basing them at a steadily increasing number of army posts and training camps. The U. S. Navy continued to use HTE-2's for its Reserve helicopter training program.

Outside the United States, the Royal Navy of Great Britain acquired HTE-2's early in the year for training purposes. Other military organizations acquired Hiller aircraft for Indo-China, Switzerland, and Siam.

Commercial sales of the Hiller 12-B were stepped up considerably in March when military requirements were completely met by the company and commercial helicopters were put into regular production again after almost two years of inactivity in this field. The first international air carrier to acquire Hillers for initial helicopter service and use was Philippine Air Lines, which acquired two 12-B's in July, and will employ them on Luzon. The newly-formed Korean National Airlines also acquired a Hiller 12-B as one of its original aircraft.

In research and development, the company continued work on jet tip-powered rotors. The H-32, an advanced military version of the Hiller Hornet, first flown in 1950, was manufactured in limited quantity for evaluation by the Army, Navy, and Marines.

Hiller also signed a license agreement with Doman Helicopters, Inc., to produce the YH-31 military helicopter, a four- to five-place utility machine which can carry up to four litter patients internally.

Hiller engineers cooperated with Stanford University to initiate the first fully-accredited college courses on rotary wing principles and design on the West Coast.

In the model aviation field, the company inaugurated the first event for flying model helicopters, which will become international in scope and has as its prize the specially-designed, perpetual Hiller Trophy.

Kaman Aircraft Corp.

Among Kaman Aircraft Corporation's 1953 achievements was opening of a new plant in Bloomfield, Connecticut. This took place in August and gives Kaman a total office and manufacturing area of 191,000 sq. ft. in four units.

During 1953 employment rose to 1,100.

A new type helicopter, the HOK-1, was in its initial production stage at the beginning of the year and deliveries to the Navy were started in April. HTK-1 production continued.

Work on classified research and development contracts toward a diversification of Kaman products continued at an accelerated pace.

Volume of business for the first six months was 67 percent greater than for the first six months of 1952. Total sales will be approximately $11,000,000, compared to $7,277,322 for 1952.

Lockheed Aircraft Corp.

Receipt of U. S. Air Force contracts to build prototypes of the XF-104—an air superiority fighter—and to conduct a preliminary design study on nuclear-powered aircraft were among the top 1953 news highlights from Lockheed Aircraft Corporation, Burbank, California. Details on both projects are classified.

President Robert E. Gross described 1953 as one of the most important years in Lockheed's history. The firm hit a long-planned production peak in both military and commercial aircraft. Commercial production was highest in the company's history, and full-scale military production, coming on the heels of Korea, rolled into high gear. Turbo-prop and turbo-jet aircraft mass production is anticipated in the immediate future.

Besides joining in the industry-wide celebration of the 50th anniversary of powered flight, Lockheed took time out this year to observe a major milestone of its own: production of the 25,000th Lockheed airplane under the present management.

The 25,000th plane was an F-94C Starfire jet fighter-interceptor, the most spectacular performer ever to come from the Burbank assembly lines, with 600-mph-plus speed, all-rocket armament and near-automatic operation.

The Starfire is only one of a number of new aircraft which Lockheed introduced during the year.

First was the turbo-compound Super Constellation transport, more powerful and faster than any previous U. S. airliner. Already in service over the Atlantic, the Super Constellation has a convertible interior which can be quickly changed from a high-luxury arrangement for only 50 or 60 passengers to a tourist plane acommodating up to 99. The Super is basically the veteran Constellation transport with a fuselage longer by 18.4 ft. (total 113 ft. 7 in.) and much more powerful engines.

"Old 1961," first Constellation to fly and now used by Lockheed as an experimental airplane, began as a 72,000-pound airplane. The new Super Constellations have a maximum gross takeoff weight of 130,000 pounds. Tremendous increases in available power, culminating in today's 3250-hp compound engines, have made the advance possible.

Heavy demand for Super Constellations by 18 world airlines gives Lockheed the greatest transport production program in company history, with a backlog of more than 90 commercial planes, valued at about $150-million, not counting undisclosed quantities of military transports.

In his report to stockholders at mid-year President Gross announced that total sales had reached an all-time high for any six-month period in the

Lockheed history. Sales totaled $389,111,000, more than double the sales for the first half of 1952. Correspondingly, net earnings for the six months ($9,074,000) were higher than the entire year of 1952.

During 1953 Lockheed also disclosed development of several military versions of the Super Constellation.

For the U. S. Navy, the 106-passenger R7V-1 is now flying. It can carry up to 19 tons of cargo when its readily removable seats are taken out, or fly from battle zones to home hospitals with more than 70 wounded on litters.

Soon the military Super Constellation will appear with turbo-prop engines, which at 5550 hp each will make it 70 percent more powerful than present models. It will cruise at more than 400 mph.

Still another military version of the Super Constellation, called the WV-2 by the Navy and RC-121C by the Air Force, is equipped with huge radomes above and below its fuselage and contains an array of electronic devices to search for approaching sea or air danger. Besides spotting duties, the radar planes are expected to be able to direct fighter planes in finding and destroying the enemy despite darkness or storm.

The golden anniversary year saw construction of the new Lockheed C-130, a huge U. S. Air Force cargo carrier now being readied for production at Lockheed's Georgia division at Marietta, Ga. This plane is powered with turbo-prop engines.

After the first C-130's are flown at Burbank, a quantity will be produced at Marietta, where, during 1953, Lockheed moved into quantity production of B-47 Stratojet bombers under U. S. Air Force contract.

Another highlight of 1953 at Lockheed was applying auxiliary jet engines to the famous P2V Neptune, the Navy's versatile sub-killer, bomber, and patrol craft. To give the Neptune extra speed for its run over its target, plus extra power for takeoff from small, forward-area fields, Lockheed added two J-34 jet engines to the plane to augment its regular turbo-compounds, giving the plane an estimated 50 percent more power.

The P2V, which established a world's long-distance record of 11,236 miles from Perth, Australia, to Columbus, Ohio, in 1946, is being built for a number of friendly nations including England and Australia.

Lockheed continued to build the T-33 jet trainer. An outgrowth of the F-80 Shooting Star, the one-man trainer was lengthened approximately three feet and dual controls installed by the company when the need for a jet trainer became apparent.

The F-94C Starfire is an outgrowth of this same design, with the installation of radar equipment in the rear seat and provision of other specialized equipment for a radar operator.

First all-rocket jet interceptor, the 20,000-lb. plane carries 48 rockets. Twenty-four 2.75-inch rockets, the main battery, can be fired from a circle of tubes housed almost at tip of the Starfire's needle-like nose, designed to provide maximum accuracy.

The other 24 missiles are carried in sets of 12 in two pods, one on each of the plane's stubby wings.

During the year, F-94C Starfires were produced in increasing quantities for continental U. S. Air Force squadrons. Equipped with some 1,400 pounds of radar and special electronics devices to spot, catch and destroy bombers at night or in black weather, the aircraft is almost automatic, with the crewmen often destroying targets never seen with the naked eye.

Lockheed employment totaled 52,723 at midyear, including 34,983 in the California division and corporate offices, 13,505 in the Georgia division, and 4,235 in subsidiaries.

Work has started on a three-story structure at Marietta to provide an added 242,000 square feet of floor space for electronics and production flight activities.

In California, new facilities include a turbo engine testing laboratory, an icing wind tunnel for tests of various component parts, and a fortune in computing equipment. All of this activity is part of Lockheed's $14-million two-year expansion program now under way.

Lockheed Super Constellation has Wright turbo-compound engines

At Lockheed's Palmdale plant, expansion plans were announced in 1953. The U. S. Air Force's jet production center will include facilities to be used by three aircraft manufacturers. Lockheed's Palmdale facilities will be increased by more than 100,000 sq. ft. in the over-all $3,200,000 construction program. Currently, Lockheed operates a flight test base there for USAF jet aircraft.

In Burbank, early in 1953 Lockheed announced a $3-million expansion project to provide vastly increased production facilities for large aircraft. A 392-foot-long assembly line structure will be added to one of the largest manufacturing buildings, doubling its size and locating 240,000 sq. ft. of factory space under one six-story-high roof.

The new area will accommodate parallel assembly lines for both military versions of the Super Constellation and P2V Neptunes.

Lockheed's engineers and scientists within the past year have made many major strides in research activities. Developments include new light-weight fuel couplings for jets and reciprocating engines; advances in integrally-stiffened construction of fighters, cargo planes and transports; plastic foam material with superior weight and strength characteristics; stronger-but-lighter magnesium flooring for cargo aircraft; and the widened application of plastic tooling in production.

McDonnell Aircraft Corp.

In 1953, McDonnell Aircraft Corporation laid much of the foundation for an all-out production effort of the F3H-1 Demon and F-101 Voodoo. A backlog of $496,902,953 on June 30 was composed largely of Demon and Voodoo orders and is expected to push the employment level to 17,000 by 1955.

Sales for the fiscal year (ending June 30) were $133,531,447, compared with $81,743,306 for the previous year. On these sales, earnings after taxes were $4,234,301, compared with $3,064,243 for the previous year. The ratio of earnings after taxes to sales was 3.17 percent, as compared with 4 percent for the 14 years since the beginning of the company.

Regular dividends of $1.00 per share were continued. A total of $3,549,881 of the fiscal 1953 earnings were retained to continue growth of the company, and the book value per share increased from $19.29 to $24.39. The capital stock and earnings retained for growth increased from $13,155,127 to $16,723,008.

Production of the twin-jet Navy Banshee continued on schedule throughout the fiscal year, the last airplane being delivered on October 30, 1953, culminating a ten-year intensive development and production effort.

The last Banshee to be delivered to the Navy was one of the all-weather series with greatly improved radar, more armament and greater fuel supply.

Phantom and Banshee experimental and production contracts over the ten-year period have totaled $339,204,896. A total of 60 Phantoms and over 800 Banshees of all types have been delivered to Navy and Marine operational units. The F2H-2 Banshees, which have seen intensive combat duty in Korea, are currently in service with 29 squadrons in the Mediterranean, Atlantic and Pacific theatres.

An intensive flight-test program of the experimental XF3H-1 Demon was carried on throughout the year in preparation for the production program. Deliveries of the F3H Demon, a Navy single-engine carrier-based jet fighter with swept wing and tail, are scheduled to continue into fiscal 1956.

All of the Demon fighters will be produced at the McDonnell plant at St. Louis.

Work also continued at an accelerated rate on the initial production order for F-101A Voodoos for the Air Force. The Voodoo is a twin-jet, swept-wing fighter which combines high performance with long range. The

XF-88A continues on flight test status as the aerodynamic prototype for the Voodoo.

The versatility of the Voodoo is evidenced by receipt in March, 1953, of a contract for production engineering and tooling of a photo-reconnaissance version, the RF-101A.

A flight program of the XF-88B Voodoo was undertaken during the year to provide research data on supersonic-type propellers. The flight test bed, the XF-88B, is equipped with an XT-38 Allison turboprop engine which powers a single propeller, in addition to the aircraft's regular powerplant of two J-34 Westinghouse turbojet engines.

The addition of an Allison engine, which powers a Curtiss Wright electric propeller, enables the XF-88B to attain speeds beyond the normal range of propeller operation, and will provide a valuable source for data on the high-speed operation of propellers.

Gear boxes provide three propeller speeds. These speeds will be tested successively with propeller blades of approximately ten, seven and four foot diameters in various combinations of two, three and four blades.

Approximately one month of flight testing took place at Lambert Field before the XF-88B was ferried to Langley Field, where the research program is being conducted by NACA.

In July, 1953, the Navy announced retirement of the FH-1 Phantom. This twin-jet fighter, first Navy carrier-based airplane, made aviation history in July, 1946, when it took off from the deck of the USS Franklin D. Roosevelt. It was last in service with Naval Reserve training units.

McDonnell's growing helicopter engineering division carried on active research and development work on three types of rotary wing aircraft for the military services, the XH-35, Army-Air Force reconnaissance convertiplane; the XHCH-1 Navy cargo unloader helicopter, and the XHRH-1 Navy assault helicopter.

The three helicopter development programs are scheduled so that each obtains maximum benefits for the technical progress made on the others. Security restrictions prevent discussion of design and performance details.

The company's third engineering division—missiles engineering—continued an expansion program during the year in various phases of activity. Details of the program are restricted.

McDonnell XF-88B, latest Voodoo prototype

McDonnell's integrated plant at Lambert-St. Louis Municipal Airport now consists of 31 buildings enclosing 1,849,003 gross sq. ft. of floor area on 311.8 acres of land, of which 292,671 sq. ft. and 44.8 acres are leased. In addition, 196,493 gross sq. ft. of office, manufacturing, and storage space are occupied elsewhere in the St. Louis area.

During the year the company neared completion of an $18-million emergency facilities program. During fiscal 1953 the $3.6-million hangar and the $1-million propulsion laboratory were completed. The $1-million low-speed wind tunnel neared completion in December. McDonnell also has a one-sixth share in the $6.6-million improvement program that will increase the range of the Southern California Cooperative Wind Tunnel to include transonic and supersonic speeds.

Another addition to the company's expanding research facilities program during the year was the new altitude environmental test chamber, largest in the United States, and probably largest in the world. The chamber can simulate altitudes up to 70,000 feet and has a temperature range of —100 degrees F. to +165 degrees F. It is used to test various aircraft components under extreme conditions of heat, cold, altitude or humidity.

An order was also placed during the year for a 7,000-ton hydraulic press, largest of its type ever erected in the St. Louis area.

The company also commenced the installation of an emergency arresting gear, similar to the type used on aircraft carriers, at six locations on the runways of St. Louis' Lambert Municipal Airport. This is part of a safety improvement program proposed by McDonnell and approved by the city.

The Glenn L. Martin Co.

Initial deliveries of the B-57 twin-jet Night Intruder were made to the U. S. Air Force during 1953. This high-performance bomber is one of a succession of strategic weapons systems being produced under an organization of manpower and facilities known as Martin Systems Engineering. This concept makes possible new aircraft, guided missiles and electronics weapons, designed not as traditional flying vehicles but as coordinated and controlled spaceborne systems.

In addition to the versatile B-57 Night Intruder, other aircraft in active production included the USAF B-61 Matador pilotless bomber and the Navy P5M-1 Marlin anti-submarine seaplane.

Production schedules in 1953 were reflected in an employment level of slightly over 20,000 with minimum fluctuations. It is significant that one out of every five employees has more than 14 years' continuous service at Martin, one of the highest experience-level records among employees anywhere in the industry. Cessation of hostilities in Korea had little effect on this employment level, the production schedules, or the backlog.

Of the significant number of P5M-1 Marlins built in 1953, most were assigned to duty with the Atlantic and Pacific fleets. One production P5M was modified with a "T" tail (control surfaces atop the stabilizer) and

Martin B-61 Matador pilotless bomber now on regular assignment

given exhaustive tests by both Martin and Navy test teams. This was the prototype of the P5M-2, which will contain further modifications before going into production.

Deliveries also began in the late fall of a small quantity of P5M's ordered by the U. S. Coast Guard for coordinated air-sea rescue work. These Coast Guard airplanes are similar in configuration to the Navy flying boats, but are equipped with the necessary special gear for their specialized mission.

Engineering, tooling and actual construction proceeded with increasing tempo on the prototype of the P6M-1 Seamaster, a high-performance multi-jet seaplane. Further details on this weapons system are restricted.

The B-57 Night Intruder is powered by two Wright J-65 Sapphire engines. Combining extreme maneuverability with high speed capabilities, the B-57 is destined to replace World War II piston engine aircraft which were converted to the night intruder role during the Korean conflict.

Launchings of the B-61 Matador are now being conducted on regular operational basis by Air Force teams. Operational training of these first Air Force units is taking place on a pilotless bomber range stretching out over the Atlantic Ocean into the Bahama Islands. The Matador is launched from a zero-length, roadable platform. It is powered by a turbojet engine with rocket assist for the launch. When thrust is exhausted, the rocket drops off.

The Matador's prompt qualification as an operational weapon can be primarily attributed to the embodiment in it of the Air Force's philosophy of systems development and to its early operation under a completely automatic guidance system.

During 1953, Martin continued to produce specialized aerial gun turrets.

Engineering and manufacturing facilities for electronics systems expanded under more than 750 electronics engineers.

Plant facilities were expanded during the year. A foundry for manufacturing aluminum alloys of aircraft quality was opened in midsummer; and a much needed four-story addition to the main engineering building was completed.

The Glenn L. Martin Company's sales for the nine months ended September 30 were $116,904,036. Net income for the period was $7,365,843 (no provision required for Federal income taxes), equal to $3.45 per share in 2,135,645 shares then outstanding.

North American Aviation, Inc.

North American Aviation, Inc., celebrated its twenty-fifth anniversary year with a series of outstanding accomplishments in the performance of its combat planes, the success of its new designs, and the delivery of its 50,001 airplane.

In Korea, the final score in air-to-air combat was the destruction of 801 Russian MiG-15s against the loss of only 58 F-86 Sabre Jets. In addi tion, the F-86 was highly regarded for the effectiveness of its close support bomber missions.

The demonstration of Sabre Jet superiority over the MiG-15 in the Far East resulted in the dispatch of F-86 squadrons to Europe in the middle of the year when the cold war in Germany gave evidence of warming up.

During the same period squadrons of F-86D Sabre Jet interceptors were being activated at Air Force bases near all the major industrial centers in the northern half of the United States. Rocket armed, and equipped with elaborate electronic search and firing equipment for all weather operation, the Sabre Jet interceptors are an indispensable cog in America's domestic defense machinery.

While North American Sabre Jets were demonstrating their battle worth in military operations, a new Super Sabre was confirming its design predictions in a series of significant test flights. First fighter designed to fly and fight at supersonic speeds in level flight, the F-100 prototype exceeded the speed of sound on its initial test runs in May.

The production version, the first of which rolled off the assembly line in October to become North American's 50,001 airplane, is expected to exceed the performance of the prototype materially. Installation of the more powerful Pratt and Whitney J-57-7 turbojet engine with afterburner, coupled with minor refinements of the basic design, will give the operational model more speed and improved handling characteristics.

Incorporating a razor thin, 45 degree swept wing and tail, the F-100 represents a greater technical step over the Korea-famed Sabre Jet than the F-86 represented over the F-51 Mustang of World War II, J. L. Atwood, North American president, has declared.

Larger than most existing fighters, the Super Sabre F-100 is 45 feet long, 13 feet high, and has a wing span of 36 feet. The supersonic fighter has a service ceiling above 50,000 feet and a combat radius of more than 500 nautical miles. Like the F-86 Sabre Jet, the Super Sabre is capable of close support bombing missions as well as air to air combat.

In addition to its thin, highly swept wing and tail, the F-100 incorporates other features which reflect an answer to the problems of supersonic flight. The new, heat-resisting material, titanium, is used extensively throughout the plane. A low-drag, ultra-streamlined fuselage and canopy with but one air intake duct help make supersonic speed possible. Other features include automatic leading edge slats and a low-positioned, one-piece horizontal stabilizer.

Latest in the F-86 fighter bomber series is an improved version of the current "F," bearing the model designation of "H." This is also a dual role fighter-bomber and day fighter. The "H" will be powered with General Electric's J-73 engine, developing greater thrust than the J-47 in the "F." Other refinements based on the fighting experience with the "F" in Korea have been incorporated in the "H."

An improved and faster version of the Navy Fury jet fighter, the FJ-3, was also successfully test flown in 1953. Slightly heavier and somewhat larger, this latest in the Fury series will be powered by a Wright J-65 Sapphire turbo jet engine and is rated in the high subsonic speed class.

Application of a rocket engine generating 50,000 pounds thrust to a test sled that was driven from a dead stop to more than 1,500 miles an hour in 4.5 seconds was further evidence of the rapid progress made by North American with its rocket engine program. The engine was fueled with a combination of oxygen and alcohol.

During the year the production potential of the Los Angeles plants was expanded materially with the leasing of a specially constructed 126,000 square foot building on an 8½-acre site at the corner of 111th St. and Anza Blvd. from the Airport Building Development Corp. The additional space will be devoted to the manufacture of F-100 Super Sabre detail parts and sub-assemblies.

Construction was also begun on a $1,134,681 engineering flight test hangar on the north side of the Palmdale Airport. The new hangar will be 360 x 220 feet with a total floor area of 111,480 square feet. Approximately 350 people are expected to be assigned to the experimental projects that will be moved from Edwards A.F.B. to Palmdale. The hangar will be government owned and occupied by North American under leasing arrangements.

Northrop Aircraft, Inc.

Northrop Aircraft, Inc., at the end of 1953, was at the highest production peak in its 14-year history.

Full-scale production of the U. S. Air Force's Scorpion F-89D, manufacture of Snark B-62 guided missiles, continued activity of U. S. Ordnance Corps range-finder production at Northrop's Anaheim Division, and production of target planes at its fully-owned subsidiary, the Radioplane Company of Van Nuys, constituted the major activities for the Hawthorne, California, company.

Northrop's major production facilities are devoted to the Scorpion F-89D, the rocket-armed version of the long-range twin-jet all-weather interceptor. The fighter carries an armament load of 104 2.75-in. folding fin air-to-air rockets in permanent wing-tip pods. The speedy, 600-mph-class F-89D flies at altitudes exceeding 45,000 feet, and with its extreme long range is a formidable foe for any enemy craft seeking to invade the United States by air. A crew of two mans the F-89D, aided by electronic devices that enable them to locate and intercept enemy craft by night and in foul weather. During 1953, an F-89 made a 1900-mile non-stop flight from Edwards Air Force Base, California, to Dayton, Ohio, in a demonstration of long range capabilities.

The Snark guided missile culminates Northrop research and development which began in 1946. Designated the XB-62 by the Air Force, it is being built under a secret program. Northrop is operating a facility at the Air Force's Missile Test Center at Cocoa, Florida.

Now in its second full year of operation, Northrop's Anaheim, California, division has already completed one $30-million range-finder contract for Army Ordnance, and is now producing a new type of sighting and aiming device for use on the Army's new Patton 48 tanks, periscopes and telescopes for 105-mm howitzers, telescope mounts and other precision instruments.

Near completion are large new production flight-test facilities for Northrop's use at the Palmdale, California, Airport. The Palmdale Airport project, which is being sponsored by the Air Force for the use of several major aircraft companies, will provide test facilities for Northrop Scorpion F-89 all-weather interceptors. The facility is slated to reach peak operation in mid-1954.

During the year the personnel roster at Northrop passed the 20,000 mark, twice the number employed during the company's World War II production peak.

Northrop's research and development program is continuing at its greatest pace in the history of the company. Extensive laboratory test facilities, experiments with new types of metals and methods of fabrication, plus advanced aircraft design developments, are responsible for this acceleration.

A special titanium committee has been formed at Northrop for study of this new wonder metal; advanced studies in aeronautics including continuing boundary layer control research are progressing; and experiments and developments have been made with electronics, laminated plastics, hydraulics, protective coatings and castings.

Special facilities have been constructed for testing aircraft and missile

Radioplane target plane production line at Van Nuys, Calif.

components. Included in this program are a fuel system test laboratory, a giant aircraft control test stand, a new acceleration device capable of testing components up to 25 G's and other test devices for electronic, electrical and mechanical components.

Among Northrop's activities is the above-mentioned Radioplane Company of Van Nuys, California. The Radioplane Company continues its successful production of radio-controlled target airplanes for the armed services. Its current work on jet target planes is designed to serve the government's need for more complex, higher-performance type target planes, capable of more nearly simulating the actual flight of jet airplanes. In addition to manufacturing pilotless aircraft, Radioplane produced automatic pilots for use in such targets, and furnished various items of ground handling and launching equipment.

Research and development activities undertaken by Radioplane during the past year included work in parachute recovery techniques and in the field of guided missiles.

During the year, Northrop's backlog of military orders reached $508-million, the highest in the company's history.

For the fiscal year ended July 31, 1953, consolidated sales and other income amounted to $184,230,018. Consolidated net profit, before including a tax credit of $1,022,157 relating to prior years, was $2,338,359. After including the tax credit, the profit amounted to $3,360,516, equivalent to $5.23 per share on 642,092 shares outstanding at July 31, 1953. Estimated Federal income and excess profits taxes for the fiscal year ended July 31, 1953, amounted to $4,615,000 or $7.19 per share.

Piasecki Helicopter Corp.

In 1953, Piasecki Helicopter Corp. celebrated its tenth anniversary with sales estimated at $90-million, compared with $38,000 in 1943 and $64,-450,000 in 1952.

Helicopters produced during 1953 included the six-place HUP-2 for the

Navy. After nearly four years of production of this model, existing contracts are scheduled for completion in the Spring of 1954. Deliveries of two other models also continued in 1953. They are the H-25 Army Mule, a transport and medical evacuation version of the HUP type, and the H-21 Work Horse, a 14-to-20-passenger helicopter built for both the Army and Air Force.

On Sept. 11, 1953, Piasecki unveiled the YH-16 Transporter, a 40-passenger, twin-engine transport built for the United States Air Force. The machine made its first flight Oct. 23. The helicopter is powered by two Pratt & Whitney R-2180 reciprocating engines with takeoff power ratings of 1650 hp each. A second version, the YH-16A, will have two Allison T-38-type shaft turbines. This helicopter will be completed in 1954.

During 1953 Piasecki was operating in four plants with a total floor area of approximately 613,000 sq. ft. This compares with about 342,000 sq. ft. a year earlier, an increase of nearly 80 percent.

Employment during the year reached about 4,300.

Piasecki started 1953 with a new president, Don R. Berlin, formerly an executive with McDonnell Aircraft Corp. Under his leadership, two new subsidiaries were formed during the year to meet the company's responsibilities in foreign fields, Piasecki Helicopter Co., of Canada, Ltd., and Piasecki International Corp.

Piasecki's military backlog of unfilled orders remained stable at about $150-million during the year.

Piper Aircraft Corp.

Outstanding airplane in the Piper Aircraft Corporation picture for 1953 continued to be the Piper Tri-Pacer. Preference for the tricycle gear was demonstrated in sales figures showing that the Tri-Pacer outsold the four-place Pacer, with tail wheel-type landing gear, by a ratio of six to one.

Continuing growth in business use of the various Piper planes led to a 48 percent increase in civilian sales during the year. A breakdown of private owner sales of the Tri-Pacer, Pacer and Super Cub revealed that farmers and ranchers ranked first, accounting for 22.5 percent of the sales. Manufacturers came next with 17 percent, and other groups were represented in the tabulation as follows: construction firms, 14.5 percent; physicians, doctors and dentists, 13.4 percent; wholesalers and distributors, 6.7 percent; engineers and architects, 6.2 percent; salesmen, 5.5 percent, and all others, 14.2 percent.

Growing use of Piper aircraft for business purposes was also reflected in figures showing that 67.4 percent of 1953 purchasers used their planes exclusively for business, compared with 40 percent two years ago.

Early in 1953 the United States Air Force adopted the 105 hp Super Cub as the standard trainer to be used by cadets during their first 25 hours at primary schools. Designated the Piper PA-18-T, the trainer gives cadets dual and solo experience in the air before they graduate to the 650 hp T-6 trainer.

One of the most celebrated of Piper aircraft—the Pacer designated N7330K—and its equally celebrated pilot, Max Conrad, won new honors in 1953. Conrad, who has crossed the Atlantic Ocean four times in "330K," flew his plane to the 48 State Capitals in the course of "Operation Flying Paul Revere," a special observance in connection with the fiftieth anniversary of powered flight. When he reached the West Coast, Conrad flew his Pacer non-stop from San Francisco to New York to set a new, though unofficial, record of 22 hrs., 24 mins., for the 2,600-mile distance.

Biggest production news at Piper's Lock Haven, Pa., plant was the completion of the design for the Piper Apache, the new twin-engine plane with which Piper enters the light executive transport field. Flight tests of the prototype Apache revealed that the plane will cruise at 167 mph and climb at over 1,300 fpm.

Tooling for Apache production was nearly completed by the end of 1953 and first deliveries were slated for early 1954. Price for the Standard model was set at $32,500, with $35,075 announced as the Super Custom price. The plane goes into production with several hundred advance orders.

Piper continued its program of manufacturing L-18 and L-21-C liaison aircraft models for the U. S. Army and the NATO nations and also was active in sub-contract work for a number of military aircraft manufacturers.

Republic Aviation Corp.

Republic Aviation Corporation set another production record in mid-1953 when it completed its 4,457th Thunderjet, last of this model, which was followed immediately on the assembly line by the new F-84F Thunderstreak, USAF's first swept-wing fighter-bomber. Already in mass production along with its sister plane, the RF-84F reconnaissance counterpart, the Thunderstreak has been slated for Air Force units and NATO allies. The new craft gained added importance as one half of FICON, the B-36-Thunderstreak composite plane.

In the Korean war, work of the Thunderjets was described by Lt. Gen. Frank F. Everest, then commanding the Fifth Air Force: "The Thunderjet, comprising 40 percent of the fighter-bomber strength in Korea, was responsible for 60 percent of the damage inflicted." Thunderjets accounted for more than 200,000 enemy buildings destroyed or damaged. Other kills included 2,484 vehicles, 10,673 rail cuts, 3,996 rail cars, 4,846 gun positions, 259 locomotives and 588 bridges.

As this most up-to-date model fighter-bomber was going into top production, the Air Force announced Republic's plane of the future, the F-105. Although all performance and production details are classified, the Air Force announced that the plane would be powered by a J-71-A-7 turbojet engine, a new powerplant developed by the Allison Division of General Motors. At the time of announcement in September, 1953, the F-105 was the highest number assigned to a fighter type, making it the latest publicly-known development in the field.

The Thunderjet gained additional importance in March of this year, when the Air Force announced that the mid-air refueling aircraft was capable of carrying the atomic bomb. The T-Jet's global ability was demonstrated in August, 1953, by the longest non-stop jet fighter flight in history —4,485 miles from Turner AFB, Ga., to Lakenheath, England.

The new, radically different swept-wing F-84F got into real volume production during 1953. The "F," which with its 7,200-lb. thrust Wright Sapphire engine boasts more power than the F-84G, carries far greater armament loads than its predecessor. The "F" is also capable of much higher speeds than the 600-mph class F-84G, and, like its predecessor, is equipped for ocean-hopping performances using mid-flight refueling.

The RF-84F, photo reconnaissance version of the Thunderstreak, went into production in 1953. This high-speed, high-or-low altitude, day-or-night photo plane, has the same speed as the fighter-bomber and can be equipped with various camera combinations enabling it to get the intelligence photographs vital to modern warfare. The "RF" is armed with four .50 caliber machine guns.

A unique specialized employment of the "RF" was disclosed as it went into production. Dubbed "FICON," it combines the photo plane with an RB-36 mother ship for extraordinarily long reconnaissance missions. The "RF" can take off and land from the RB-36 in mid-air. The 4,000-mile radius of the 10-engine bomber combined with the 1,000 mile-plus radius of the "RF" and the high speed and maneuverability of the reconnaissance fighter will make possible photo missions almost anywhere in the world and under most hazardous conditions.

The "F" and "RF" have incorporated the most advanced developments in airframe manufacturing. Republic continued pioneering optical tooling methods which enabled the company to put the "F" into production in record time. They also incorporated the latest findings in plastic development in the "F." Of the more than 2,000 plastic parts installed in the "F" and "RF," approximately 200 are laminate plastic parts, replacing costly and heavy metal in many cases and permitting new design features to be incorporated in the super-fast fighters.

Heavy forgings, pioneered at Air Force request by Republic development experts, led to incorporation in the Thunderstreak of more and larger forged parts. Thunderstreak forgings range in size from a 12-ft. two-sectional wing spar to forgings the size of a cigarette package. They have added strength for heavier load-carrying duties and cut down on production time and complexity.

Large-scale production of the "F" and "RF" on a rush basis meant continued expansion for Republic at home and abroad. While maintaining the network of field representatives and foreign offices necessary for maintenance of Thunderjets stationed throughout the world, the company took additional steps to perfect the NATO-RAC set-up in anticipation of the arrival of F-84F Thunderstreaks.

In June, 1953, Republic Aviation (Internationale) S.A., with headquarters in Lugano, Switzerland, was formed to produce spare parts for the F-84F's slated for NATO nations and for USAF wings in Europe. During the same month USAF announced that Republic Internationale had been awarded a two-year government contract to produce $50-million in F-84 spare parts. Thirty million dollars' worth was immediately subcontracted by RAC Internationale to the Societe Nationale De Constructions Aeronautiques Du Sud-Est, a French firm.

At home, Republic continued to expand its facilities and personnel. Early in 1953, warehousing facilities at Greenlawn, L. I., were converted to a third production plant providing 45,000 sq. ft., housing almost the entire electrical and tubing assembly operations for the "F" and "RF."

More than 6,000 sq. ft. was added to the main plant at Farmingdale, bringing total floor-space to 2.3-million sq. ft. as compared to 1,650,000 sq. ft. before the Korean war. New shops, office space and research installations were equipped with the most modern facilities.

Still under construction at the end of 1953 was a new 38,000 sq. ft. engineering area.

A 3,000-foot extension of the northwest-southeast runway brought landing length available to the super-fast Thunderstreaks to 7,500 feet.

Employment during the year rose from its 1952 high of 22,500 to more than 26,000.

To insure ample capital for its all-out effort for the Air Force the company continued its $15-million line of credit with the Chase National Bank of New York and the Bankers Trust Company of New York. Net income for the first nine months of the year was $6,105,199 after provision for

Atom carriers vary in size from giant Convair B-36 through Boeing B-47 to single-engine Republic F-84G

taxes compared with $4,190,111 earned during the same period last year. The earnings were equivalent to $5.52 per share on the 1,105,946 shares of common stock outstanding, a substantial increase over the figure for 1952, even though there were fewer shares of stock outstanding in the previous year. Sales for the period amounted to $308,159,201, compared with $215,-302,294 in the corresponding period of 1952. The backlog of unfilled orders exceeded $1-billion for the second consecutive year.

Ryan Aeronautical Co.

In the midst of soaring production which broke postwar records every month, Ryan Aeronautical Company during 1953 entered a transitional period of adjusting its sights on new major objectives.

When the Air Force announced plans for expanded production of the Boeing B-52 jet bomber and the Pratt & Whitney J-57 jet engine, soon after ordering cutbacks on the General Electric J-47 engine, Ryan was already well into the tooling up for quantity work and took G. E. cancellations in stride.

When the Navy made its first official disclosure of details of the Westinghouse J-46 jet engine, Ryan was already accelerating production of afterburner units for this power plant.

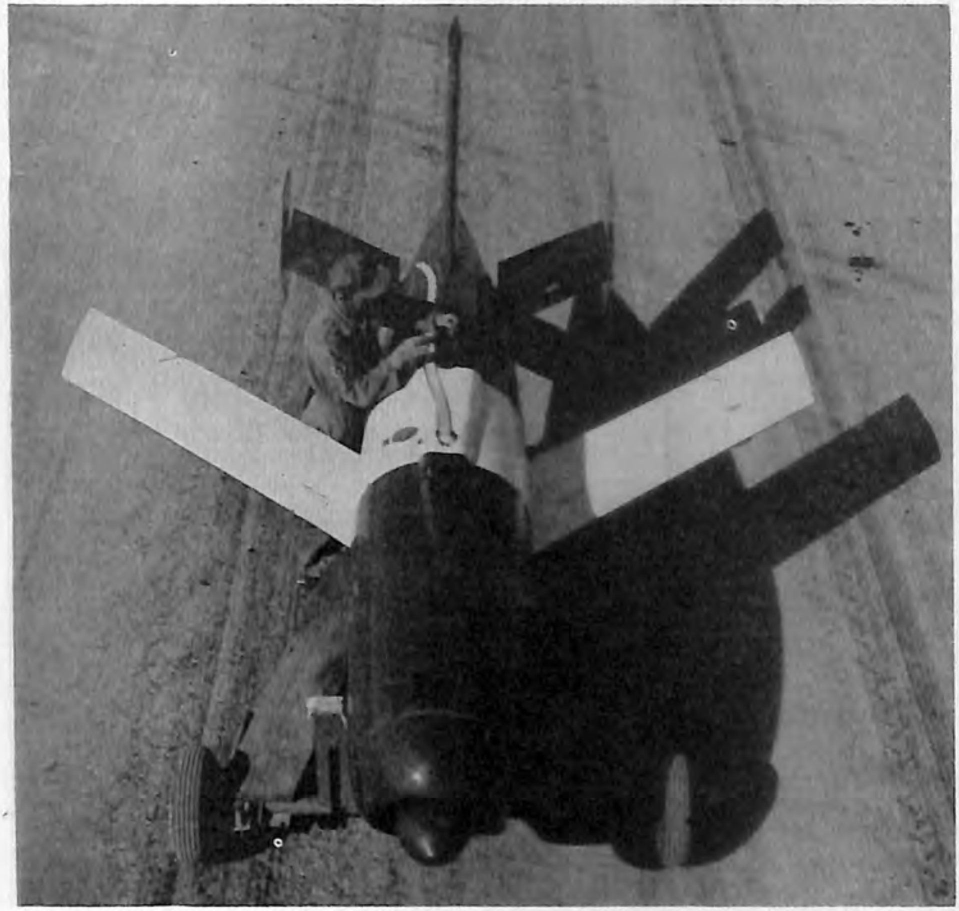
When its contract for the world's largest external fuel tanks built for the Boeing B-47 bombers neared completion, Ryan was moving rapidly toward large scale output of a new and smaller fuel tank for the Boeing KC-97G Stratofreighter.

And during these changes in production emphasis, an ever-increasing flow of exhaust manifolds, Boeing C-97 aft fuselages, cargo doors, mid-air refueling pod assemblies, floor beams, and other metal products continued to pour from the factory. Most amazing was the almost doubling of the rate of deliveries on the huge C-97 aft fuselages with virtually no increase in floor space, made possible through a realignment of tools and improvement of assembly techniques. At a crucial time when additional space was needed to accommodate new projects, Ryan was able to merge the first and second shifts on airframe components manufacture in its big assembly building.

Ryan developed two new unusual designs in 1953, its Model 59 and Model 72.

The Model 59 is a primary phase jet trainer. Confronted with the fact that no jet engine in the required power class had gone into quantity prodction, Ryan engineers designed a jet trainer that could not only be built around any power plant to be available in the near future, but could accommodate any engine of this power class that might be developed in the still more distant future.

Enough space was left in the fuselage to provide for installation of dual engines. Two versions were submitted, one with a single Allison jet engine, the other with two French Marbore jets. The Model 59 with the Allison



Jet-driven Ryan X-2 Firebee

engine had a maximum speed at sea level of 427 mph, maximum speed at 35,000 ft. of 438 mph, and a cruising speed of 329 mph at 35,000 ft.

In the Model 72, Ryan engineers developed a primary military trainer in which the instructor and the student sit side by side, instead of the conventional fore-and-aft tandem arrangement. This unusual trainer is a military version of Ryan's famed commercial Navion, with wing completely rebuilt, strengthened and increased in span by four feet, and cockpit modified.

The Navy is testing the Model 72 in an evaluation program at Pensacola.

Earnings for 1952 at Ryan were eclipsed in 1953. The fiscal 1952 high of $878,359 net income was surpassed during the first nine months of fiscal 1953, when net earnings were $1,342,946 or $3.42 per net outstanding share. Deliveries during 1953 were approaching a rate of $5-million a month.

Hundreds of thousands of dollars' worth of precision machinery continued to flow into the plant during 1953. These included four huge vertical boring and turning mills acquired by the Air Force from Germany, a $63,000 three-headed boring machine, and a 40-spindle drill.

New orders during the year included one from Army Ordnance for an undisclosed quantity of Ryan Firebee jet-propelled pilotless target planes to be used in training Army troops operating anti-aircraft guns and guided missiles. This followed more than two years of development and test flights under Air Force, Navy and Army supervision.

Details of the spectacular Firebee, America's most successful drone of its type, were revealed officially for the first time during the year. Somewhat less than half the size of present-day jet fighters, the Firebee has performance characteristics comparable to jet planes used in Korea. Powered by a Fairchild J-44 turbo-jet engine with approximately 1,000 lb. thrust, the mid-wing, all-metal robot has sharply swept-back wings and tail surfaces. Its length is about 18 ft. and its span 12 ft. Weight is 1800 lbs. The Firebee can be launched in flight from a mother plane, or from the ground using a rail launcher. A unique parachute recovery system goes into operation at a signal from the ground operator at conclusion of each flight, bringing the Firebee to earth. Remarkably little damage has been experienced in such descents.

Other new orders received by Ryan during the year were in the fields of titanium research for both the Navy and the Air Force; and for airborne electronic equipment. One of the latter contracts, from the Navy Bureau of Aeronautics, is for improved models of electronic navigational devices Ryan has been developing for the past four years. Flight testing is being conducted in a Navy P2V Neptune bomber on loan from the Navy. Electronic components for guidance systems also are being developed for the Air Force, which has loaned Ryan an F-86 Sabrejet for in-flight testing.

Ryan's electronic development has remained at a high level of activity since the company's pioneering work several years ago on the famed "Firebird" air-to-air missile.

Ryan's engineering department expanded more than 50 percent, and all other departments grew during the year. As 1953 neared its close, the payroll totalled 4,300 men and women, many of whom were veterans of ten and fifteen years' employment.

Ryan's most famous airplane, the Spirit of St. Louis, made literary history in 1953 with the publication of Col. Charles A. Lindbergh's book of the same title.

Sikorsky Aircraft Div.
United Aircraft Corp.

Production of a twin-engine helicopter by Sikorsky Aircraft was announced in September by Marine Corps commandant General Lemuel C.

New Sikorsky XHR2S-1 features five-blade rotor

Shepherd. Known as the XHR2S, the new assault helicopter, with complete military accessories, will carry 26 fully-equipped troops.

Classified since its inception a year ago, the new helicopter has been known by the Sikorsky designation S-56. Photographs of the new 'copter had not been released by the Marines at press time.

Despite a taut peace in Korea, military demand for production units continues. S-55's in military versions are in wide use by Air Force, Army, Navy, Marine Corps and Coast Guard.

During the year the Army's helicopter program expanded. It was rapidly adapting helicopters as replacement units for trucks, amphibian tractors, and weapons carriers. Two companies of transport helicopters using H-19's were already on duty in Korea as troop and supply carriers and as rescue vehicles. Army H-19's made airlift history by carrying the entire contingent of policing Indian troops to the neutral zone at Panmunjom.

Biggest Sikorsky commercial news of 1953 was inauguration by Sabena Belgian Airlines of international helicopter passenger service. Operating from a modern heliport in Brussels, Sabena flies its fleet of S-55's to Holland, Germany, France and Luxembourg.

Also newsworthy commercially was the purchase of an S-55, with options on two more, by National Airlines, the first major U. S. trunkline carrier to get into helicopter passenger business. National plans to operate the S-55's experimentally pending availability of larger, twin-engine helicopters.

New York Airways Inc., first regularly scheduled helicopter passenger operator, observed its first anniversary in October. Using S-55's, NYA flies passengers between the major metropolitan New York airports. It also flies mail and freight into New Jersey, Long Island and Connecticut.

Sperry Gyroscope Corporation bought an S-55 for use as a flying laboratory. The Hudson Bay Mining and Smelting Co., Ltd., of Canada, bought one for survey, personnel transport and supply work, portending a vast copter potential in the mining industry. S-55's owned by the Aluminum Company of Canada and operated by Okanagan Airways, Ltd., made copter history in the construction industry while on ALCAN's Kitimat project in British Columbia. ALCAN's cargo S-55's penetrated regions inaccessible to other forms of transportation.

Japan took delivery on the first units of an ordered fleet of S-55's to be used as rescue vehicles. Argentina ordered three. Additional units have been delivered or ordered by Ambank Airlift, Ltd. (Canada) and the Royal Canadian Navy.

Other S-55's, sold to Britain, are seeing wide use in Malaya. The copters have in many cases opened heretofore impenetrable jungle.

Mail and freight operations via S-55 continue in the Los Angeles area by Los Angeles Airways, oldest helimail operator in the U. S. LAA added to its fleet during 1953.

The S-52, used extensively in Korea as the HO5S, is presently undergoing further development for USAF around a new power plant.

Announced in mid-1953 were plans for a multi-million-dollar satellite plant in which to build the S-56. At press time, exact location of the new plant was still under negotiation but Sikorsky officials have indicated preference for Connecticut. Production at the Bridgeport plant will continue. The new plant will operate as a branch of the Bridgeport facilities.

Plant area remained at the 1952 level of 600,000 sq. ft. but various testing sites and service units were added outside the plant. Employment has increased to about 4,500 and continues upward.

At the year's end, research, the true yardstick of progress, continues on a large scale.

Stroukoff Aircraft Corp.

In 1953, Chase Aircraft Co., Inc., reorganized, and Michael Stroukoff, its founder, disposed of controlling interest in the company in return for 100 percent of the stock of a new company bearing his name.

The Henry J. Kaiser interests, who had owned 49 percent of Chase, deposited $1,750,000 as assets in the new corporation in return for Stroukoff's Chase stock.

Stroukoff now occupies all buildings at Mercer County Airport, New Jersey, formerly occupied by Chase.

The Air Force transferred to the Stroukoff Aircraft Corporation research and development contracts formerly in the possession of Chase when Mr. Stroukoff was chief engineer of that concern. Under his direction, Stroukoff Aircraft is continuing with the comprehensive studies of boundary layer control systems and other projects related to development of cargo aircraft.

Temco Aircraft Corp.

Temco Aircraft Corporation expanded facilities, continued large-scale airframe sub-contracting, stepped up aircraft modification and overhaul work, and designed and developed an all-new primary trainer in 1953.

Only 75 days were required to develop the Model 33 Plebe, as the trainer was designated, from preliminary design to first flight. This fact, together with the aircraft's all-round suitability for military training, make the Plebe Temco's most striking 1953 undertaking. The trainer entered Navy trainer evaluation tests September 1 at Pensacola.

The Plebe has a one-piece, power-driven bubble canopy; compact, silver-zinc battery; inter-connected fuel system with common sump, nylon bag-type fuel cells and simple, on-off fuel selector. Like an advanced trainer, the Plebe has trim tabs, a complete engine control quadrant and retractable, tricycle landing gear. Its 225-hp Continental engine gives the Plebe a 1,350 fpm rate of climb and a 20,000-ft. service ceiling.

During 1953, Temco's engineering department was greatly expanded. Most significant part of this growth was the construction, during 1953, of a complete, modern engineering laboratory.

While the Plebe underwent Navy performance tests to determine a replacement trainer for the SNJ, Temco's three Texas plants continued production of airframe components and renovation of complete aircraft.

By June 30, Temco had delivered more than 1.4-million lb. of airframe. Another 2-million lb. of airframe was scheduled for delivery before the end of 1953.

At Temco's Dallas plant, manufacture continued on aft fuselage sections for the B-47 Stratojet and outer wings for the P2V Neptune. Temco's prime contract to build the McDonnell F3H Demon as a second source producer was terminated in June.

This contract was partially replaced by a sub-contract for production of F3H components amounting to about 35 percent of the complete airframe. This production was underway in Temco's Dallas plant by late 1953, as was production on another sub-contract calling for assemblies for McDonnell's F-101 Voodoo jet fighter.

At Temco's Garland, Texas, plant, activity included manufacture of flaps and bomb-bay doors for the P5M Marlin, wing assemblies for the F3H-1 Demon and rudder, elevator and door assemblies for the B-36 strategic bomber.

At the company's Greenville, Texas, facility, cycle reconditioning of MATS C-54 Skymasters continued.

The Greenville plant also was the site of a new assembly line for conversion of the Ryan Navions to the Riley Twins. This contract, signed by Temco with Riley Aircraft Manufacturing, of Fort Lauderdale, Florida, called for production of at least 100 of the Twins. Each Twin conversion requires some 500 new parts which are fabricated at Temco's Garland plant. Assembly is a 50-step operation, in which modification work is done on every major component of the original aircraft. Two 150-hp Lycoming engines power the four-place Twin.

Other contracts obtained during 1953 by Temco include a prototype contract to convert a Boeing C-97 Stratofreighter for air evacuation, which was followed by a production contract for like conversion of 50 more C-97's and a prime overhaul contract to provide progressive heavy maintenance for Navy Super Constellations.

In addition, Temco's Greenville plant, equipped during 1953 for overhaul and conversion of executive aircraft, served an increasing number of private and corporate aircraft owners as the year progressed.

In February, 1953, Luscombe Airplane Corporation, formerly a Temco subsidiary, was merged with Temco and became known as the Garland plant of Temco Aircraft Corporation.

Expansion of the Garland plant, completed during 1953, has doubled the size of the facility since it was acquired in 1950 by Temco.

New construction at the Dallas plant will, by the end of 1953, add 58,000 sq. ft. of floor space. An additional 43,025 sq. ft. of enclosed space will be added by construction already committed, but not yet started.

At the Greenville plant, ground was broken late in 1953 for a production hangar capable of sheltering aircraft with empennages up to 50 ft. high. The hangar will enclose a total of 95,700 sq. ft.

During 1953 Temco completed installation on new equipment awarded two years ago under a $12-million Navy facility contract.

Net earnings for Temco Aircraft Corporation for the nine months ending September 30, 1953, amounted to $1,499,280, or $1.34 per share, as compared to $1,359,894, or $1,21 per share, for the corresponding period of 1952.

Sales for the current nine months' period were $41,888,170 as compared to $38,862,412 for the same period last year.

Employees at the three Temco plants total about 6,000. Total payroll for 1953 is estimated to be $30-million.

United Aircraft Corp.

Because United Aircraft Corporation's four divisions operate autonomously, discussion of the company's 1953 activities are found under the names of the divisions—Pratt & Whitney Aircraft (engines), Hamilton Standard (propellers and aircraft equipment), Chance Vought Aircraft (airframes and guided missiles), and Sikorsky Aircraft (helicopters).

High level production was maintained during the major expansion program which was completed last year. This included the new Hamilton Standard plant at Windsor Locks, Connecticut; Pratt & Whitney Aircraft's new facility at North Haven, Connecticut, and that division's addition to the former Hamilton Standard plant in East Hartford which it now occupies; and Sikorsky Aircraft's enlarged Bridgeport plant.

Under construction during the year was the major expansion of Pratt

& Whitney Aircraft's jet-engine development facility, the Andrew V. D. Willgoos Turbine Laboratory.

It was announced that Sikorsky Aircraft would build a multi-million dollar plant to augment present facilities. The site of the new plant, probably in Connecticut, has not yet been determined.

In January, Howard C. Sheperd, chairman of the board of the City Bank Farmers Trust Company, New York, was elected to the board of directors of United Aircraft Corporation.

A scholarship program for the sons of employees of United Aircraft Corporation, including all its operating divisions and its domestic subsidiaries, was announced in September. The plan proposes to award ten scholarships each year for the study of engineering or allied sciences at colleges and universities offering degrees in those subjects.

In 1952, the last complete year for which figures are available, United Aircraft reported a net income of $17,809,391, or 2.7 percent, on sales totaling $667,769,234. Total current assets at December 31, 1952, amounted to $187,603,109 compared to total liabilities of $119,970,848 at that date.

Unfilled orders amounted to $1.55-billion at the 3rd quarter of '53.

ENGINE MANUFACTURERS

Aerojet-General Corp.

As a result of the merger with Crosley Motors early in the year, Aerojet-General now has four plants engaged in rocket work. Research, development, and testing are conducted at the main plant in Azusa, California. Solid-propellant rockets are produced at the Sacramento plant, and facilities for the fabrication of metal parts are located at Cincinnati, Ohio, and at Marion, Indiana. Another new member of the Aerojet-General organization is the Bergen Engineering and Development Corp., of Paramus, N. J., a company that specializes in precision gear boxes and transmissions, particularly for helicopters.

The 14AS-1000 Jato widely used by the Air Force, the Navy, and commercial aircraft for extra takeoff power, has been approved by the CAA as a source of standby power for commercial airplanes.

A new, smokeless Jato (15KS-1000) has been developed for the Armed Services, proved, and placed in production. This unit also provides improved performance at extreme temperatures and weighs considerably less than earlier Jatos.

Extensive research and development work is continuing on liquid-propellant rockets for fighters, bombers and missiles. Successful flight tests have been conducted with several of these units, and plans for production are nearing completion.

Production of the Aerobee, a rocket for upper-air research, is continuing, and the altitudes reached have been increased to 86 miles.

The Aeromite, a 2.75-inch ordnance rocket, using a special Aerojet propellant, is now in mass production.

Other important programs include research work on new propellants, and the development of missile guidance devices, underwater power plants, and auxiliary power units. Architect-engineer services are also being provided for the design of new rocket test stations.

Aircooled Motors, Inc.

Production of engines specially designed to power helicopters continued as a major 1953 activity of Aircooled Motors, Inc., manufacturers of Franklin air-cooled engines.

Four out of the five CAA certificated helicopters under 400 hp use Franklin engines exclusively. These are the Bell H-13D, Hiller 12-B, Sikorsky S-52 and McCulloch MC-4. Military versions of these helicopters are also Franklin-powered.

Both Bell and Hiller helicopters continued production at a substantial rate and their needs accounted for a large share of Aircooled Motors' production. During the year Bell completed its 1,000th production helicopter and Hiller completed its 500th. All of these helicopters have been Franklin-powered. The non-stop distance record for helicopters of 1,217 miles was set in 1952 by a Bell H-13 helicopter with 200-hp Franklin engine.

Development work continued during the year on new versions of Franklin vertical and horizontal engines for helicopter and fixed-wing installations, particularly on supercharged versions of the 425 cu. in. engine. Substantial amounts of sub-contracting work were also undertaken, as were several military development contracts on aircraft engines and components.

Allison Div.
General Motors Corp.

For the aircraft engine industry, 1953 was a year of transition as several long-time engine models began a phase-out in production in favor of new and higher rated models. This experience was shared at the Allison Division of General Motors where new turbo-jets and turbo-props began to take the place of the engine models which have been built in substantial quantities since 1945.

A new turbo-jet, the J71, came into early production and first units were delivered for installations in two new airplanes. The Douglas B-66 will be powered by two J71-A-9 engines and the Republic F-105 will use a J71-A-7.

In the turbo-prop field, work continued on models which represent advances over the T38 and T40 series. One of these new models will power America's first twin-engine turbo-prop military transport ordered by the USAF from Consolidated Vultee. Two 340 Convair Liners are on the prototype order.

This is the second transport type aircraft placed on order by the USAF with Allison turbo-prop engines. Earlier in the year it was announced that

Allison turbo-props would power the Lockheed C-130 cargo carrier—the first transport designed from the beginning for turbo-prop engines.

Proof-testing for these projects was continued in the Allison Turbo-Liner, America's first commercial-type turbine transport. Two production model T38's were installed in the Turbo-Liner in the third quarter, and hours on the airplane mounted as demonstration flights continued for military and aircraft industry personnel.

Production deliveries also were made in T40 turbo-prop engines for the Douglas A2D Skyshark and the Convair R3Y Tradewind. These engines, rated at 5,850 hp, continued to be the most powerful propeller-type engines in production. Accelerated flight test was carried on in the Douglas XA2D.

Of the older model turbo-jet engines, production in the J35 series centered on J35-A-35 afterburner engines for the Northrop F-89 Scorpion. Performance tests carried on at Allison's flight test facility in Indianapolis resulted in a higher altitude rating for the new engines in the "D" airplane.

Despite cutbacks in spare engine requirements as a result of increasing service life for turbo-jet engines, quantities of J33 engines continued in production and on order for the Lockheed T-33 and TV-2 trainer.

Allison-powered aircraft continued to play a major role in the air warfare in Korea right up to the final sortie before the truce. A final recapitulation showed that Allison engines powered 69 percent of the total jet fighter sorties flown by the Air Force. These planes included the Republic F-84 Thunderjet, the Lockheed F-80 Shooting Star and F-94 Starfire—the latter two using J33 engines. The F-84 carries Allison J35's. The Navy used Grumman F9F's with Allison J33's.

As the truce was established, Allison received word that a J33-A-35 engine in an F-80 had completed its full time of 1,200 hours—all combat time. This engine was shipped from Allison in 1950, went through three minor repairs, and in one instance flew 800 hours—or roughly the equivalent of 400,000 miles—without minor repair.

The 3561st Maintenance Squadron at Webb Air Force Base also claimed what is believed to be first jet engine to reach 1,000 hours without minor repair of any kind. The Allison J33-A-35 was installed in a Lockheed T-33. It was also reported that the newest J33, the -16A, has been operated to 1,000 hours at the Naval Air Test Center, Patuxent, Maryland, to give the Navy its first 1,000-hour jet engine.

Another significant first was added to Allison achievement in 1953 when Colonel David C. Schilling led a mass flight of Republic F-84G's across the Atlantic. Colonel Schilling's flight of eight planes from the 31st Strategic Fighter Wing completed the 4,470-mile flight to Nouasseur, French Morocco, in 10 hours and 21 minutes with mid-air refueling and no stops. Colonel Cy Wilson, Commander of the 508th Strategic Fighter Wing, led 17 Thunderjets into Lakenheath, England, after the longest non-stop jet fighter flight on record—4,485 miles in 11 hours 20 minutes.

Allison made further additions to its test facilities. A new test center, which will be used entirely for turbo-jet engine and component testing, will cover 176,000 sq. ft. when completed.

Although first units of the new test center will be in operation early in 1954, the project will not be completed until 1956.

A new Allison flight test facility was established at Edwards Air Force Base to supplement the facility in Indianapolis. First flight tests of the J71 were made at Edwards in a test bed suspended from the bomb-bay of a North American B-45.

With completion of these projects, Allison floor space will total well over 5-million sq. ft.—including the plant space acquired at Dayton when Aeroproducts Division of General Motors became an operation of the Allison Division.

Hours in the air with Allison turbo-jet engines by year-end had reached a new record total of approximately 4-million hours.

Continental Aviation & Engineering Corp.

Continental Aviation & Engineering Corp., subsidiary of Continental Motors, is building a $7-million jet engine plant at Muskegon, and enlarging its Detroit engineering and administrative setup at a cost of $750,000. to take care of expanding production of the Continental-Turbomeca family of gas turbines which Continental Aviation is licensed to manufacture by its parent Continental Motors Corp. Both new facilities are scheduled for completion in 1954.

The new Muskegon plant will have a total area of some 150,000 sq. ft.. and is expected to employ 1,200 persons.

The two Detroit buildings add some 50,000 sq. ft. to existing facilities.

The company is in production on a $4-million Air Force contract calling for portable compressed air generators for use as starters of jet aircraft. Two Continental-Turbomeca Marbore 352 models power the Cessna Model 318 twin jet trainer.

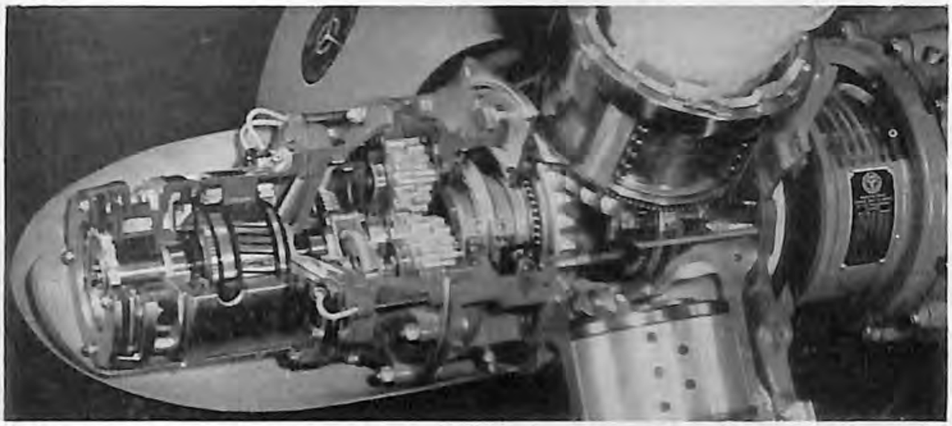
Curtiss-Wright Corp.

The year 1953 saw the start of a new era of long-range, high-speed commercial transportation with the Curtiss-Wright Corporation's Turbo-Compound engine, mass-produced by the Wright Aeronautical Division, and now used by 22 leading world airlines.

Now proved by more than 1-million flying hours and designated as the power plant for the advanced Lockheed Super Constellation and the new Douglas DC-7, this engine went into service during the late summer on KLM and Air France.

By fall, three more operators—American Airlines, National Airlines. and Eastern Air Lines—took delivery of Douglas and Lockheed transports powered by this engine.

Other domestic and international carriers which have ordered transports with Turbo-Compounds for the world's air routes include Air India International, Avianca Colombian National Airways, Delta-C&S Air Lines,



Cutaway shows control features of Curtiss-Wright propeller

Northwest Airlines, Thai Airways Company, Ltd., Iberia-Lineas Espanolas, Pan American-Grace Airways, Linea Aeropostal Venezolana, West German Air Lines, Pakistan Air Ltd., Qantas Empire Airways, Ltd., Seaboard & Western Airlines, United Air Lines, Trans-Canada Air Lines, Trans World Airlines, "Varig" Brazilian Airlines, Compania Cubana De Aviacion, and a Mexican airline.

Outstanding production news was created by the Wright Aeronautical Division in November with announcement of the first progressive assembly line in history to use automation.

This line, which increases capacity by 250 percent, makes wide use of machinery which automatically assembles, torques, conveys, and checks the quality of engine parts. It has been so designed that it can produce advanced models of the Turbo-Compound, which exceed 3,500 hp in output today and which in still more powerful engines in the future will make possible piston-powered airliners that can cruise at speeds of as much as 450 mph.

The 7200-pound J65 turbojet engine continues in quantity production at the Wright Aeronautical Division. This engine is the power plant for the Republic F84-F fighter, the Martin B-57A twin-jet night intruder bomber, and the North American FJ-3 carrier-based Navy fighter.

The newest development during 1953 in the field of turbo-jets is the Curtiss-Wright J67, a twin-spool, axial-flow engine. Designed for extremely high output, this engine has been designated for aircraft still to be announced.

The Wright Aeronautical Division continued to be active during the year in the ramjet field. Large amounts of new test equipment intended to accelerate power plant work for guided missiles were designed or put into service.

Progress, similarly, was recorded in the development of large-horsepower turboprop engines.

Curtiss-Wright Cyclone 7 and Cyclone 9 engines and models of the Cyclone 18 continue to be licensed to other manufacturers. These engines are used in helicopters, blimps, and conventional aircraft.

Under the terms of a continuing research program, several new study techniques were adopted, including the use of radioactive isotopes.

Turbolectric propellers made by the corporation's Propeller Division were delivered with Air Force approval to the manufacturers of the turboprop-powered Douglas C-124 and Lockheed C-130 transports.

The Curtiss-Wright Turbolectric propellers have been selected for use with every turboprop engine that is either in production or planned. Six-bladed dual rotation props of the Turbolectric series are on test or have been accepted by the Air Force.

Curtiss Electric propellers of the extruded steel blade type went into commercial airline service during the year on Super Constellations, in the military Douglas C-124 Globemaster, and on Navy blimps. All Naval lighter-than-air ships use Curtiss Electrics.

Activity at the Curtiss-Wright Electronics Division throughout the year established new records for the delivery of Curtiss-Wright Dehmel Electronic Flight Simulators, Duplicators, and Radio Aids Units.

Up to the end of December, 1953, the Division had completed the first production units on Air Force orders for C-124, C-119, and B-36 simulators. Additional C-97 simulators, the first of which was built in 1952, were also completed.

The Electronics Division contracted with the Air Force to build a simulator for the eight-jet Boeing B-52 bomber.

On the commercial side, the company completed the first of four simulators orders by United Air Lines at a total price of more than $3-million.

The first one to be finished was a simulator for the Convair 340 transport. UAL's order also calls for a second CV340 and two Douglas DC-6B simulators.

Air France received its first duplicator. Both Eastern Air Lines and Trans World Airlines placed orders for seven duplicators. Before the first unit was delivered, Trans World Airlines doubled its amount of units on order. Fulfillment of the contract to both airlines will be made in the early part of 1954.

Long production runs far exceeding 100 electronic flight training units for the Air Force are on hand at the Electronics Division.

The Metals Processing Division in Buffalo, New York, continued its advancement in the application of new forging, casting, and extrusion techniques to the alloys required by turbojet and turboprop aircraft engines.

During the year this division steadily increased its delivery of forged and finished steel compressor and turbine blades for turbojet engines. This division also produces the main center bearing support for the Curtiss-Wright J65 turbojet engine, superior metal castings, forgings, and extrusions for aircraft power and industrial applications. Construction continued on the Division's new plant, which will house a 12,000-ton press to make propeller blades by the hot extrusion process.

A new division of the corporation that was formed during 1953 is Curtiss-Wright Europa N.V., with offices in Amsterdam, Holland. Its main purpose is the servicing and supplying of the corporation's products to NATO nations.

Caldwell-Wright Airport, Inc., another Curtiss-Wright division, is primarily engaged in the sale of spare parts and in servicing Curtiss-Wright engines for the military, the airlines, and private operators. Its factory is located on the Caldwell-Wright Airport in New Jersey. At present ten test aircraft, ranging in size from single-engine craft to multi-engine bombers, are housed there.

The Marquette Metal Products Co., also a Curtiss-Wright subsidiary, manufactures electric windshield wipers for all types of aircraft, including high-speed jet fighters. Marquette, in addition, produces a wide variety of other products including hydraulic governors, precision clutches, and heavy-duty pumps.

Curtiss-Wright Corporation reported for the nine months ended September 30, 1953, consolidated net sales of $317,885,461 and consolidated net profits of $8,058,376 after provision for Federal income taxes. These figures compare with consolidated net sales of $214,211,056 and consolidated profit of $5,214,770 in the first nine months of 1952.

Continued expansion and a planned program of product diversification thus finds Curtiss-Wright today a corporation with ten divisions and subsidiaries, manufacturing a variety of products and providing service facilities that span the industrial field.

General Electric Co.

The fiftieth anniversary year of powered flight found the General Electric Company one of the most diversified producers of aviation products, with widespread plans to extend its role in the aviation industry through research, development and production of equipment for sonic and supersonic aircraft, both military and commercial.

Aside from the numerous research and development labortories working on aviation product problems, General Electric maintained a fleet of jet-propelled and piston-engined aircraft to serve as guinea pigs for accelerated testing programs for aviation equipment, including aerial camera drives, afterburner fuel pumps, aircraft defense systems, aircraft energizers, air-turbine drives, amplidynes, amplistats, autopilots and flight stabilization equipment, ballasts, capacitors, circuit breakers and control.

Also electric starters for jet engines, electronic and communication systems, engine control systems, gas-turbine starters, generator control systems, generators, heaters, hydraulic constant-speed drives, instruments, jet-engine ignition systems and motors.

And propeller control devices, rectifiers, relays, selsyns, servo systems, switches, transformer-rectifiers, transformers, turbo-hydraulic pumps, turbojet engines, turbosuperchargers, all kinds of instruments, and rockets.

Besides a flight test center in Schenectady with specialized facilities for developmental and experimental work, the company this year expanded its flight test facilities at Edwards Air Force Base at Muroc, California.

Expansion of G.E.'s world-wide aviation service network was continued in 1953. In addition to the United States, where 65 locations are brought within reach of the company's service engineering, representatives are available in Korea, England, Germany, Puerto Rico, Alaska, Greenland, Iceland and France. These trouble shooters work with USAF bases, airframe manufacturers, USAF overhaul bases, G-E service shops, and special experimental locations.

The company's Aircraft Gas Turbine Division plants in Evendale, Ohio, and Lynn, Massachusetts, pierced new horizons in the aircraft jet engine field during the year. In midsummer, the Evendale plant shipped its 10,000th jet engine, which does not include production at Lynn, Massachusetts, which has produced approximately the same number. The Lynn plant continued to meet or better its budgeted output for more than 30 consecutive months.

Another milestone was reached by the Aircraft Gas Turbine Division when a total of more than one million hours of flight time was completed during 1953 by J-47 jet engines. The time was logged on such Air Force planes as North American's F-86 Sabre Jets, Convair's B-36 intercontinental bomber (four jets, six piston engines), Boeing's B-47 Stratojet bomber, North American's B-45 Tornado bomber and the Navy's North American FJ-2 Fury.

Another year's highlight was the increase of the allowable flying time between overhauls on General Electric J-47 jet engines, which has been multiplied more than 80 times within the past five years. The Air Force recently upped the allowable flying time on all engines to 1,200 hours between overhauls, excepting the J-47-17 afterburner model.

In 1948, the first model of General Electric's J-47 engine was allowed to operate only 15 hours before overhaul.

A savings of over $100-million will be realized by the USAF as a result of a 100 percent increase in the life expectancy of the J-47-25. Because of this tremendous increase in engine service life, the number of engines required to support the Boeing B-47 program was reduced.

North American Sabre Jets powered by J-47 turbojets captured most speed awards at the 1953 National Aircraft Show, Dayton, Ohio, including the Thompson, Bendix, and General Electric trophies. In addition, a world's air speed record of 715.7 mph was established by a GE powered F-86D Sabre Jet on July 16, 1953, over a desert course at El Centro Naval Air Station.

One of the newest General Electric jet engines now in production, in the J-73 series, is the J-73-3, powering the production model of North American's F-86H. More powerful than the J-47 for the same frame size, the J-73-3 has a lower fuel consumption per pound of thrust, a turbine engine starter, and automatic temperature control. The engine is designed to provide greater accessibility for servicing and overhaul of accessories. Limited use of titanium alloys is employed in selected engine components.

Substantial progress was made towards completing G.E.'s new component development facilities at Evendale. These facilities are functionally designed to establish principles and limitations arising in the research and development of aircraft gas turbine engine components. Another function of the component development facilities is to assist the various engine projects in finding rapid solutions and answers to problems encountered in jet engine design.

The Division's aircraft accessory turbine department with headquarters in Lynn, Massachusetts, points to several accomplishments in the field of small, high-speed aircraft accessory turbines. It has designed, developed and is now producing a self-contained, 60 KVA, air turbine alternator drive to operate over an extremely wide range of flight conditions. A self-contained, air turbine-drive hydraulic pump unit is another accomplishment. A cartridge-type gas turbine starter, afterburner fuel pumps and turbo-superchargers are among the other products in quantity production.

Continuing the trend begun in 1952, AC generating equipment has been applied to most new aircraft in 1953. This includes planes where the requirements for 400 cycle AC power is creating a demand for this type of equipment even where total power is relatively small.

General Electric has contributed in a large measure to this trend by making available in 1953 a small, ball-pump hydraulic transmission. Continued work is being carried on in applying pneumatic turbine drives in both small and large sizes.

A smaller and lighter-weight version of the static voltage regulator has been developed for constant-speed, 400 cycle generators. This development, with that of smaller AC machines, makes available a complete G.E. AC package, with either hydraulic or pneumatic drive in ratings suitable for small aircraft.

General Electric J-73 powers B-29 in test flight

Work has been completed on the development of a control and protective system for parallel AC generators.

Complete G.E. AC generator systems are currently employed on the McDonnell F-3H Demon and the Convair R-3Y Tradewind. American Air Lines is now flying DC-7's equipped during 1953 with a complete G.E. DC generator system.

The G.E. electronics division in Syracuse, N. Y., engaged in the development and manufacture of a wide range of aviation electronic equipment and radar systems for the nation's air terminals, in 1953 built a new and improved surveillance radar system which gives the airport control tower the location and flight path of all aircraft flying within a 30 to 60 mile radius. The system has been installed at 16 major U. S. air terminals. Systems for seven additional airports are in various stages of installation.

Continuous scientific research and technological development towards better instrumentation and metering of aircraft equipment and flight functions is being carried out by the Meter and Instrument Department's Measurements Laboratory in Lynn, Massachusetts. A mass flowmeter for use with jet aircraft engines was developed this year. This instrument accurately measures the fuel consumption in pounds per hour. The flowmeter, in measuring the true mass rate of the fuel consumption, automatically eliminates fuel density errors due to type and temperature of the fuel.

This department also manufactures over 50 kinds of aircraft meters and instruments, including tachometers, magnetic compasses, fuel indicators, temperature and pressure indicators, and flap and landing gear position indicators.

The department opened an aircraft instrument school this year. The School's first class was attended by Royal Canadian Air Force squadron leaders, Douglas Aircraft engineers, and G.E. service engineering representatives.

The G.E. Aeronautic and Ordnance Systems Division, responsible for the development and manufacture of a wide range of defense products, includes an Aircraft Products Department with plants located in Johnson City, New York, and Burlington, Vermont, and a Naval Ordnance Department at Pittsfield, Massachusetts. In addition to headquarters and extensive manufacturing operations in Schenectady, the division operates the flight test laboratory there. The Guided Missiles Department, also in Schenectady, maintains a plant for guided missile research and development and operates an Army Ordnance Corps missile test center at Malta, New York.

The year 1953 saw the development by this division of a new flight control system, called the FC-5, which is 35 percent lighter and 25 percent smaller than presently available flight control systems.

The development of an improved and lighter autopilot also resulted during the year through joint cooperation with McDonnell Aircraft engineers. Functioning as a relief pilot, the device will assume control at the push of a button by the human pilot and hold the plane at the desired barometric altitude and heading. A 20 percent weight reduction has been made in the device.

The division designed a capacitor discharge ignition system to simplify turbojet engine ignition. The new lightweight system eliminates external, gas-filled transformer coils and their heavier clamps and leads, and reduces the number of ignition plugs by 50 percent.

A rocket proplusion motor was developed, capable of producing power equal to that of two 2,000-hp locomotives pulling a train at sea level. Suggested applications for the motor, made of non-critical materials, include aircraft and torpedo propulsion, glider takeoff and landings, and aircraft braking; it may also be used as a catapult energizer, rocket booster or landing craft booster.

Construction has now been completed on a $1-million addition to the G.E. Johnson City manufacturing facilities, which was announced early in the year by W. C. Heckman, general manager of the division. The addition is to provide complete controlled environmental facilities for systems being built by G.E. for the Air Force.

The Lamp Division, Nela Park, Cleveland, Ohio, which has pioneered many lighting devices for airports and aircraft, made an outstanding contribution to airline safety in 1953 with the development of a high-intensity rotating beacon to be mounted atop the vertical fin of an airliner's tail assembly. Light source for the beacon is a 4.5 in. diameter lamp of the sealed-beam type, which will indicate an airplane's presence at greater distances, both day and night, than do present standard lights.

Lycoming Div.
Avco Manufacturing Corp.

During 1953, the Lycoming Division of Avco Manufacturing Corporation, Williamsport, Pennsylvania, introduced a new four-cylinder, 150-hp engine known as Model O-320. Equipped with propeller governor drive, it is the power plant for two of the new smaller twin-engine airplanes, the Piper Apache and the Riley Twin Navion conversion. Use of this engine in these four-place, twin-engine aircraft makes possible low-cost, dependable transportation with twin engine safety.

Lycoming also made a license agreement with Piaggio in Italy for manufacturing the O-435-A six-cylinder, 190-hp and GO-435-C2 six cylinder, geared, 260-hp engines.

Marquardt Aircraft Co.

The Marquardt Aircraft Co., primarily a jet powerplant research and development organization, has approximately 1,100 employees, more than 900 of whom are in the engineering and manufacturing division. The remainder are divided among the other three divisions, administration, finance and customer relations.

The company offers engineering and test services and also is active in subcontracting work for airframe companies.

Marquardt was one of the pioneers in ramjet engines in this country under leadership of Roy Marquardt, president of the company and formerly director of aeronautical engineering at the University of Southern California, who in 1944 formed the organization for ramjet development. The resulting engines vary in diameter from 1 in. to 48 in. A 6 in. diameter engine is designed for helicopter use, while the quantity production type is the 20 in. diameter used on the Martin KDM-1 target drones.

The engines range from subsonic speeds to Mach 4.0. Most of them have been applied to the field of military guided missiles in surface-to-air and air-to-air categories, where the usefulness of the ramjet depends on the required speeds and ranges.

Marquardt anticipates that the ramjet will be the primary powerplant for long-range commercial aircraft at speeds exceeding 2,000 mph. It is known that work is under way on fixed geometry and also variable geometry self-accelerating ramjets.

Simultaneous with ramjet research and development there has been development on the subsonic pulsejet engine, used to pilot target drones. One, the Marquardt MA16, is the highest speed pulsejet in the United States. It has operational efficiency at Mach 0.45 and a ceiling of 15,000-20,000 ft.

In the afterburner field Marquardt began development work starting in 1945. When the Douglas Aircraft Co. began to develop the X-3 airplane, one of the main design problems it faced was to establish with reliable engineering data and tests how much more thrust could be obtained by using a combined gas turbine and afterburner installation. Late in 1946, Marquardt completed the development of a full-scale afterburner, successfully demonstrating that appreciable thrust augmentation for turbojet engines was possible.

Afterburner work in 1953 was principally in connection with classified engines.

From this work Marquardt successfully developed and produced exit nozzles, designed by afterburner engineers J. S. Winter and R. G. Laucher.

Another major outgrowth of Marquardt's engine activities has been development of ramjet accessories.

One problem has been powerplant control, since most ramjet powered vehicles are pilotless. The control system has the additional complication of having to provide the pilot's duties for control of the powerplant. Also from ramjet development came a turbine pump which operates by ram air coming into the ramjet engine, going out through the turbine and then dumping overboard.

Development of accessory drive units was done by means of the ram air turbine, connected through a gear box to an electrical alternator and/or a hydraulic pump. This same type unit can be used efficiently with bleed air from turbojet engines.

Marquardt has also developed advanced-design fuel nozzles for ramjets and afterburners.

From all of this Marquardt now has many accessory items available to not only the guided missile field but to the new supersonic fighter and bomber types of aircraft which require specialized emergency power units and equipment such as the power controls, turbine driven fuel pumps and refrigeration units.

Special factory equipment developed during the year for Marquardt Aircraft Co. was a special rotor mill. A major manufacturing problem, involving the machining of complicated rotor blades for a ramjet engine turbine, was solved by designing this milling machine to do the job.

The Marquardt rotor mill uses a complicated series of cams and a Fray all-angle cutting head turning at 1800 rpm. Cutting operations so far have been achieved by using end mills and rotary burrs. Materials used for the rotors to date are Chromolly steel and 24 ST aluminum.

Rotor blades are cut from a turned blank metal piece. They are machined with such precision that only a burring operation is required before final installation in a ramjet.

Air flow surfaces of the rotor blades are maintained to approximately 10 to 20 RMS finishes.

The Marquardt engineering divisions [engine, afterburner, and accessories] consist of more than 400 engineers and technical personnel—highly trained specialists in the fields of aerodynamics, thermodynamics, hydraulics, metallurgy, mechanical design, stress and weight, servo mechanisms and testing. The organization is qualified to perform both analytical and design services in such lines as burner development, combustion engineering, diffuser design, fuel and power controls, turbine-driven fuel pumps and auxiliary power units, pulse jet engines, aerodynamic research and design, product testing and evaluation and afterburners.

Engineering services also include the Marquardt jet laboratory. These testing facilities are designed for flexibility in operation and application and are particularly suited for evaluating and production testing full-scale components requiring large mass flows of air over widely varying ranges of temperature, pressure, and Mach number.

Instrumentation is adequate for recording both static and dynamic test data. The company also has facilities for full-scale testing of fuel pumping and metering devices, pre-flight checkout of completed engines, air turbines, and components.

The company's manufacturing department is organized for handling complete prime and subcontract programs of completed assemblies and products.

Among Marquardt's subcontracting activities in 1953, to be continued during 1954, was manufacturing ailerons for the Douglas Aircraft Company.

Pratt & Whitney Aircraft Div.
United Aircraft Corp.

During 1953 Pratt & Whitney Aircraft placed major emphasis on gearing its facilities for high volume production of its axial-flow turbojet engine, the powerful J-57. For the first time in its history, the company produced more than 50 percent of its engine power in jets. Rearrangement of manufacturing space representing some 3-million sq. ft. was accomplished by the end of the year in the main East Hartford, Connecticut, plant.

The first production J-57 engines were shipped in February. The J-57 was officially rated by the Air Force as "in the 10,000-pound thrust class." After more than a year and a half of flight testing in the Air Force's B-52 intercontinental bomber, powered by eight J-57's, Boeing Aircraft Company engineers declared, "it's the best brand new engine we have had in any experimental airplane, and it has done everything expected of it and more."

North American Aviation's F-100 supersonic fighter, powered by the J-57 with afterburner, exceeded the speed of sound in level flight on its first flight on May 25, 1953. This Air Force plane, designated the Super Sabre, has duplicated this performance many times since that date. In addition the F-100 made an unofficial speed run of 757.5 mph over the Salton Sea course on October 6, 1953.

The J-57 engine will also power the McDonnell F-101 Voodoo and the Convair F-102. Boeing Airplane Company is currently building a commercial tanker-transport designated Project "X" which will be powered by four J-57's. The prototype is scheduled to fly in mid-1954. The J-57 will also power two Navy aircraft, the twin-jet Douglas A3D attack bomber and the Douglas F4D Skyray carrier-based fighter.

The 5,700-hp Pratt & Whitney Aircraft T-34 turboprop moved towards quantity production with the first deliveries slated for 1954. The T-34 will be installed in four Lockheed Super Constellations, two for the Navy and two for the Air Force. Douglas is building a C-124 Globemaster to be powered by T-34's for the Air Force, and Boeing is equipping two C-97 transports twith the turboprops, also for the Air Force. Service testing is scheduled to start early in 1954.

The J-48 centrifugal-flow jet engine continued to be a high production item during 1953. The static thrust at sea level of the Navy models (without afterburners) was increased to 7,250 pounds, thus providing additional power for the Grumman F9F-5 Panther and the Grumman F9F-6 Cougar.

Another model of the J-48, equipped with an afterburner of Pratt & Whitney Aircraft design, powers the Air Force's Lockheed F-94C Starfire, an all-weather interceptor. Several squadrons of Starfires have been stationed at strategic locations as part of the network of air defense for important industrial cities.

Although no longer in production, the P&WA J-42 centrifugal-flow turbojet continued to perform well in service. In late September a J-42 passed more than 1,000 hours in military service before overhaul.

In addition to jet engine production at the main East Hartford plant, assembly of R-4360 Wasp Majors and R-2800 Double Wasp piston engines continued at a steady pace. By the end of the year more than 14,000 Wasp Major engines had been delivered. Total engine horsepower delivered by the company since its founding in 1925 passed the 235-million mark. This total was exclusive of spares and does not include World War II production of its licensees or the Pratt & Whitney Aircraft Company of Missouri.

Construction of three additional high-altitude engine test cells at the company's Andrew Willgoos Turbine Laboratory was completed during the year. The new additions increased the experimental test facilities of the company and enabled it to step-up its program of advanced jet engine design.

An addition to the company's Rentschler Airport hangar facilities was also completed. The new building provided more adequate shelter for servicing and modification of the large aircraft used in P&WA's experimental flight testing program.

Branch plants at North Haven and Southington, Connecticut, were in full production fabricating parts for the R-4360 Wasp Major and the R-2800 Double Wasp engines. These plants have a combined manufacturing area of more than 1-million sq. ft.

An important contribution to the expanded production of Pratt & Whitney Aircraft's jet and piston engines was made by its network of more than 5,300 subcontractors and suppliers. These subcontractors and suppliers were located in 34 states and about 83 percent of the firms were classified as small businesses. About 50 cents out of every dollar paid for P&WA engines went to the company's subcontractors and suppliers.

Pratt & Whitney Aircraft's licensing program to expand the production of P&WA engines beyond the capacity of its own organization continued during the year. The Ford Motor Company started shipments of the Wasp Major engines and by the year's end had delivered over 1,000 from its Chicago plant. Ford was also tooling up for production of the J-57 turbojet and is scheduled to begin deliveries during 1954.

Employment at P&WA rose to more than 34,000 by the end of the year. Three-shift production continued.

Production testing facilities also received special consideration. With the advent of new and more powerful engines, test cells had to be redesigned and to provide for a minimum of noise. Eight new cells, designed to handle the largest jet engines in production, were completed. These cells will also accommodate even more powerful engines which were under development. Experimental work on ramjet engines and an atomic engine continued throughout the year.

The P&WA service school, established in 1935, kept pace with the jet age during the year. The school was started to train key military and civilian personnel in the proper care and maintenance of P&WA engines in the field. In addition to continuing training courses in piston and early model jet engine maintenance, a new three-week course in familiarization and line maintenance on the J-57 was started in June. An Air Force sergeant was the first man to enroll in this course and he also became the 10,000th enrollee in the school's history.

Reaction Motors, Inc.

During 1953, Reaction Motors, Inc., designer, developer and producer of liquid propellant rocket engines, continued its rapid growth and leadership in the rocket industry. December marked the company's twelfth anniversary.

In the short time since its incorporation, RMI has achieved many significant firsts in rocket-powered speed and altitude flight. In October, 1947, the RMI-rocket-powered Bell (Air Force) X-1 airplane first propelled man faster than the speed of sound. The same series of RMI 6000 pound thrust rocket engines that powered the X-1 has since powered the Douglas (Navy) D-558-2 to a world speed record for piloted aircraft of 1,238 mph and a subsequent altitude record of over 83,000 ft. Engines of this same type power the Bell (Air Force) X-1A and the Republic (Air Force) XF-91 supersonic interceptor-type airplane.

In August, 1951, a Reaction Motors rocket-powered Martin (Navy) Viking sounding rocket rose to a record altitude of 135.6 miles, reaching a maximum speed of 4,100 mph. In December, 1952, another Viking equalled the earlier record. Previously, RMI rocket engines also powered the Consolidated Vultee (Air Force) MX-774 high-altitude rocket-sounding missile. The Fairchild (Navy) Lark is an RMI-powered subsonic missile.

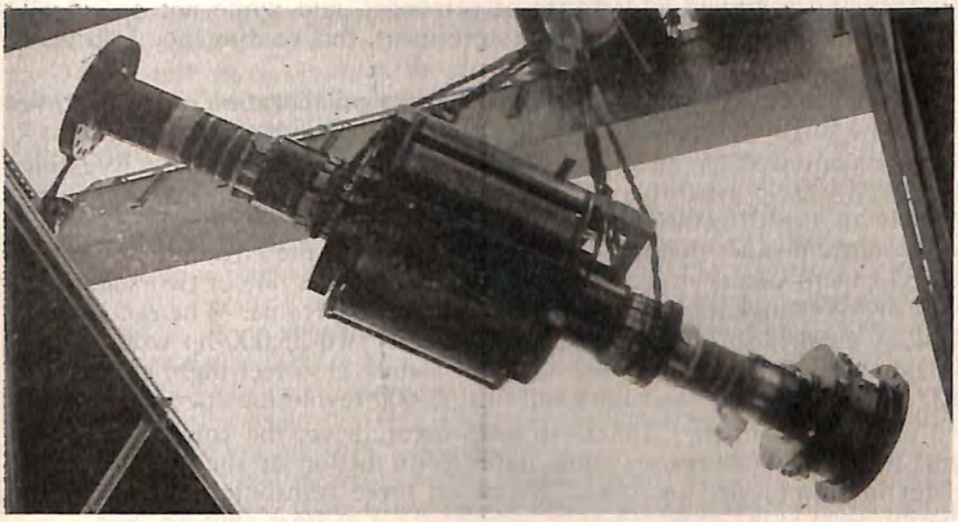
The number and scope of research and development projects has increased as the feasibility of rocket power has been demonstrated and its potential usefulness has been more clearly established. While the major work currently in progress is classified for national security, it can be reported that considerable advancement in the state of the art is being made.

A joint Navy-RMI $4-million construction program is now underway to provide greatly expanded and improved rocket facilities. The new plant will consolidate in one area the administrative offices and the manufacturing, engineering and research divisions. Nearly 200,000 square feet of specially equipped plant area will house these divisions on a 50-acre site near the present Rockaway facility. Test installations at Lake Denmark—seven miles from Rockaway—will be improved and expanded as part of the program.

The immediate task of RMI is to provide rocket engines of superior performance for the defense of the United States and the free world. Important by-products of this major assignment are the scientific data and industrial techniques from which the wider uses of rocket power will come. Development of advanced types of engines not only extends their practical limits for military uses, but points toward further civilian applications.

Westinghouse Electric Corp.

With aviation business representing the largest single industry activity of the company, the Westinghouse Electric Corporation completed its 37th year in the aviation industry with continued development and production of equipment for aircraft and air-borne operations.



Westinghouse's 83,000 hp motor for wind tunnel operation

Announcement was made in September that a new Westinghouse high-power, low-weight turbojet aircraft engine met its 150-hr. qualification test and was placed in production. This is the J46, an outgrowth of the highly-successful J34, and is intended for use in high-speed fighter planes. It will be used first in the new Chance Vought F7U-3 Cutlass. The J46 is 16½ ft. long, less than 3 ft. in diameter, and weighs approximately 2,000 lb.

To concentrate on perfecting new J46 models, Westinghouse will discontinue further development work on advanced models of the J40. Production of the current model J40, now being manufactured at the company's jet plant at Kansas City, Missouri, will continue.

On October 3, 1953, the Douglas F4D Skyray, powered by a Westinghouse J40 engine, established a new world's speed record. Four consecutive runs were made over a three-kilometer straightaway course at an average speed of 753.4 mph, 16 mph faster than the previous record.

Again, on October 16, 1953, the same Douglas F4D plane and J40 engine teamed up to break the world's speed record for a 100-kilometer course. This time, the Skyray averaged 728.1 mph, almost 20 mph faster than the previous mark.

Last summer, the Navy's Bureau of Aeronautics extended the allowable overhaul time for the Westinghouse J34 engine to 720 hours, an increase of 70 percent over the previous allowable time of 420 hours.

Westinghouse and Rolls-Royce, Ltd., Derby, England, signed an agreement providing for mutual technical cooperation for a period of ten years. Subject at all times to the approval of the governments of the United States and the United Kingdom, the agreement includes exchange of information on the design, development, and production of gas-turbine aero-engines and a limited interchange of personnel, and while not specifically designed as a manufacturing license agreement, this contingency is covered should it become advantageous.

The first application of the agreement is the collaboration of Rolls-Royce with Westinghouse in future development of Westinghouse jet engines.

Installation of the most powerful electric motor ever built—a Westinghouse 83,000-hp synchronous unit—completed the first major step in assembly of the 216,000-hp electric drive for the U. S. Air Force's new transonic and supersonic wind tunnels. Installed at the Arnold Engineering Development Center in Tennessee, the giant motor is one of two such units built by Westinghouse at East Pittsburgh, Pennsylvania. The second unit will be installed in the near future, along with two 25,000-hp wound-rotor induction motors. Each 83,000-hp motor stands 21½ feet high, and weighs 225 tons. Their 122-ton rotors will turn at 600 revolutions per minute.

In addition to the 216,000-hp four-motor drive, the rotating machine will have five compressors, now under construction at the Westinghouse plant in Sunnyvale, California. Work on these transonic and supersonic compressors is not expected to be completed for at least another year.

Although the machine will have the highest stored energy of any rotating mass ever built, it can be brought to a halt in about three minutes by using its wound-rotor motors as brakes, the energy being dissipated in liquid rheostats.

The transonic wind tunnel is scheduled for completion early in 1955. The supersonic tunnel will be completed in 1957.

Westinghouse has also been awarded a $1.2-million order by the National Advisory Committee for Aeronautics for electrical equipment to repower a 19-ft. wind tunnel at the Langley Aeronautical Laboratory, Langley Field, Va.

The existing subsonic tunnel structure will be converted into a transonic tunnel by replacing the present 8,000-hp motor and fan by a new 20,000-hp drive and fan. The new motor will be installed in the tunnel and be enclosed by the fan nacelle.

Westinghouse equipment also supplies air-conditioning and heating for standing aircraft, an innovation at the new Greater Pittsburgh Airport, Pittsburgh, Pa.

The supply system pipes conditioned air through underground ducts to a hose which connects to the underside of the fuselage. Housed in the basement of the airport Administration Building are heating and cooling coils, fans, and Precipitron air cleaning units—all Westinghouse equipment. The system can accommodate 31 planes at a time in addition to conditioning the Administration Building itself.

Use of mock-ups of aircraft electrical systems as a design and development tool, which began several years ago at Westinghouse, is now being extended. The two-engine a-c system mock-up in use at the company's aviation engineering laboratory, Lima, Ohio, for the past nine months is being enlarged and rebuilt into a four-engine setup with many new controls and other improvements to increase the versatility and speed of evaluating aircraft electrical systems.

A new line of three-phase motors for a-c systems for aircraft has been developed by the aircraft department of the Small Motor Division. These motors contain many novel features of construction, all aimed at achieving the ultimate in simplicity and economy of weight and space.

Ranging in size from 1/30 hp to 3 hp, their unusual total-enclosed, fan-cooled, explosion-proof construction features for mass-produced motors can be extended up to perhaps 10 hp. The four-pole motor (11,300 rpm at 400 cycles) with a four-inch diameter frame, develops 2½ hp, weighs 10 lb., and is only 7½ in. long outside the brackets. The ¼-hp member of the family is 2½ in. in diameter and weighs 2½ lb. These ratings are met at all altitudes up to 50,000 ft.

Variations of these motors are obtainable for special purposes. For example, a single-phase, 1/10-hp, 7300-rpm motor is used to drive an axial blower for cooling electronic equipment.

A new combination main contactor and circuit breaker for d-c aircraft systems weighs less than either device did as a single unit. Developed by Westinghouse engineers, the new combination unit weighs only 6½ lb. and occupies a space only 5¼ in. by 7 in. by 4¾ in., yet has a continuous current rating of 500 amperes and can interrupt 4,000 amperes, 30 volts, at 65,000 ft. The interruption is accomplished in about five thousandths of a second. For extra safety, the main contactor has two mechanical openings so that if one should freeze, a second remains to provide circuit opening.

A counterpart of this d-c contactor circuit breaker has also been developed for a-c systems. Its continuous current rating at 208 volts and at frequencies between 380 and 420 cycles is 175 amperes and it interrupts 3000 amperes in 0.02 sec. at 65,000 ft. The unit weighs 8½ lb. The device has a phase-sequence relay to prevent its connecting two circuits of opposite phase rotation. D-c power for its coils is obtained from a small selenium rectifier; no separate d-c source is needed.

Large computers, such as the Westinghouse Anacom, have played a major role in developing automatic flight control systems.

Fundamentally, a Westinghouse autopilot now goes through three phases of design. First, the system is completely simulated on a computer. Second, individual components are designed and substituted in a flight simulator. The newly-designed flight platform and the altitude simulator make this second phase possible. The flight platform consists of a table that rolls, pitches, and yaws just as the actual airplane does in flight. Controlling gyroscopes are mounted directly on the table.

The altitude simulator, as directed by the electronic computer, reproduces effective pressures as the simulated airplane flies. These two improvements allow the use of all the autopilot sensing devices, so that the complete autopilot system is represented. Thus, such variables as hysteresis, threshold sensitivities, and no-linearities of the measuring and sensing devices can be taken into account.

The final phase of autopilot design is the actual flight tests. With the aid of flight simulators, any trouble that occurs can be diagnosed quickly and corrected.

PROPELLER MANUFACTURERS

Aeroproducts, Allison Div. General Motors Corp.

For Aeroproducts Operations, Allison division, General Motors Corporation, 1953 was a year of substantially expanded production. Production on propellers for the C-119G started rolling just as Aeroproducts had settled into its newly doubled manufacturing area, providing a total of 500,000 sq. ft. of manufacturing, engineering and office area under one roof.

Aeroproducts also continued to supply propellers in ever-increasing quantities for the Douglas AD series aircraft.

In the field of turboprops, Aeroproducts' propellers piled up hundreds of hours of flight time on the Douglas A2D, Convair P5Y, North American A2J and the Allison Turboliner. By mid-year, large quantities of contra-rotating turboprop propellers were being produced for the giant Convair R3Y flying boat. It had also swung into production on a similar although smaller diameter propeller for the production A2D Skyshark. In addition, the Aeroproducts' propeller has been selected for the C-131C, military turboprop version of the Convair 340. This aircraft will utilize the Allison T-56 engine. It is expected that it will be the first Air Force sponsored Turboprop on flight status.

In the trainer field, the North American T-28's were being supplied with Aeroproducts' model A422-El propellers. Supersonic propellers, under development for both the Air Force and the Navy, were being readied for initial installations.

Aeroproducts also is currently devoting a portion of its engineering and manufacturing facilities to aircraft actuators. Both electro-mechanical and several designs of self-locking hydraulic actuators and emergency drive hydraulic servo mechanisms with electric emergency drive are being manufactured. The electro mechanical actuators meet requirements for loads above 1,000 lb. and for speeds of 50 to 200 in. per minute. These units incorporate indestructible slip clutches, closely held clutch brake-away limits and free fall release if required. Linear hydraulic actuators with electric overdrive designed to operate with a closed loop control are being manufactured for the F84F and F3H horizontal stabilizer control.

Variations of the Aeroproducts' basic self-locking actuator in which linear motion may be locked in infinitely variable positions are being applied to the control of wing incidence, jet engine orifice control, jet engine compressor vane control, landing gear or any actuator application in which it is desirable to lock hydraulic or pneumatic actuators at the time of fluid or air supply shutoff. Mechanically synchronized linear hydraulic actuators for flaps, cargo doors or any application where two or more parts must be moved simultaneously have also been developed.

Aeroproducts in 1953 also introduced a line of air driven accessories. This group is comprised of an emergency generator and emergency hydraulic pump. These accessories all operate on the windmill principle. The generator and the hydraulic pump are emergency devices applicable to all aircraft and are particularly suited to high speed fighter craft where heavy and cumbersome batteries and standby pumps can be replaced by compact, reliable units weighing 14 and 12 pounds respectively that can be triggered into the airstream when needed.

Hamilton Standard Div.
United Aircraft Corp.

Hamilton Standard, during 1953, completed its first year in a new plant adjacent to Bradley Field, in Windsor Locks, Connecticut. During the year the division sought to use the built-in efficiency of the new plant to reduce costs and expand its capacity to turn out additional new products other than propellers. It sought, also, to effect further refinements of its Turbo-Hydromatic propeller and to accelerate development and manufacture of aircraft equipment items which it was producing as the year started.

Of major importance to the division was its continued heavy commercial backlog for propellers. Delivery of 43E60 reversing Hydromatics continued to 37 airlines for use on such aircraft as Douglas DC-6A's and DC-6B's; Convair 340's and Breguet 763's. Also continuing were deliveries of the 22D30 Hydromatic for Beech D-18's.

In addition, almost all Lockheed Super Constellations ordered by the airlines were equipped with the 43E60 reversing Hydromatic.

Also of importance, commercially, was installation of the 43E60 reversing Hydromatic on the Douglas DC-7, 88 of which were on order from American, United, National, Delta-C. & S., Panagra, Eastern and Pan-American.

In the military field, propellers were in production or scheduled for the Chase C-123, Lockheed R7V-2, C-121C and other versions of the Constellation; the R6D and C-118 versions of the DC-6; the Boeing KC-97F, the Fairchild C-119C and C-119F versions of the Packet; the North American AJ-2 and T-28B; Lockheed P2V-5, Grumman AF-2W, AF-2S, S2F-1, UF-1 and SA-16A; Consolidated Vultee C-131A, and T-29B, C and D.

Of major significance during the year was increased evidence that the combination of propeller and gas-turbine engine offers excellent possibilities for use on transport and cargo type aircraft. The opinion grew, as a result of various engineering surveys, that the turboprop can provide most of the requirements for major improvements in airline service, including increases of more than 100 mph over present airline schedules. Moreover, it became clear, the turboprop aircraft can be operated at costs considerably lower than can the turbojet.

Hamilton Standard's work on its turboprop (the Turbo-Hydromatic) included development of a three-blade, high-rate-pitch-change propeller suitable for operation in the range of 900 to 1200 propeller rpm and 4500 to 6000 shaft hp. Laboratory tests on the development of the control, hub components, and spinner, and engine tests on a Pratt & Whitney T-34 engine disclosed that the functional and performance expectations have been met. Engine testing established the propeller's durability and will be continued to further prove the propeller's dependability. Flight tests on a turbine engine started before the end of the year while delivery of propellers for service testing on a Lockheed Super Constellation with Pratt & Whitney T-34 engine was expected to begin in 1954.

A second major propeller development was Hamilton Standard's work with blade shapes designed to retain at transonic and supersonic aircraft speeds the propeller's present high levels of efficiency. It was shown that thinner blades of improved aerodynamic design are entirely practical to build.

Of tremendous aid to these and other research projects were completely new test facilities which were placed in operation in June. Among the new facilities were two turboprop test cells, a jet engine test cell, a complete fuel control development laboratory, extensive pneumatic laboratory equipment and a dynamic and aerodynamic balancing laboratory.

Hamilton Standard continued to improve its position in the aircraft equipment field which it entered several years ago. A key to its auspicious start in this field is the diversified engineering staff which it had built up over the years in its propeller work. It was found that this engineering background, as well as the division's manufacturing experience and facilities, were admirably suited to the aircraft equipment field.

During the year more than 20 different aircraft models were using one or more of the division's equipment items—air conditioners, starters, fuel controls, hydraulic pumps, auxiliary power packs, and temperature controls. Among the aircraft: North American F-100, F86D and H; North American FJ-2 and 3; Lockheed F-94C and XC-130; Douglas F4D-1, A4D-1; Chance Vought F7U-3; McDonnell F3H-1, and F-101; Convair R3Y-1, and YB-60, and F-102; Boeing B-52A; Douglas RB-66; Republic F-84H, and a missile.

Among the engine builders using the division's equipment items were Pratt & Whitney Aircraft, Wright Aeronautical, General Electric, and, in Canada, A. V. Roe. The division's fuel controls were loaned to Plessy Corporation Ltd., in England, for installation in Rolls Royce engines. The division licensed de Havilland to build its air conditioners in England.

Through these efforts in the aircraft equipment field, Hamilton Standard, a world leader in propellers for more than 30 years, was winning a place of increasing importance in the field of turbine-powered aircraft.

Employment topped the 8,000 mark and construction was started on two additions to the plant which will increase the factory floor area by 60,000 sq. ft. One addition will house two big new tube reducing machines and a new hot form press ten times the capacity of the division's present steel blade equipment. The other will provide more space for the shipping department as well as extra manufacturing space. [Also see Curtiss-Wright under Engine Manufacturers.]

ACCESSORY MANUFACTURERS

Air Associates, Inc., of Teterboro, N. J., announced completion of a new hydraulic test stand in 1953. The new test equipment consists of two complete modern aircraft hydraulic systems and is being used for testing, adjusting and calibrating hydraulic units such as jet engine control valves, relief valves, unloader valves, pumps, and hydraulic cylinders.

As one of the leading manufacturers of aircraft control accessories, Air Associates with a staff of thirty-five research and development engineers, designs and manufactures a.c. and d.c. motors, electric actuators, screw jacks, and various hydraulic and pneumatic devices. The merchandising and distribution of more than 2,000 different kinds of aviation supplies and materials to airport operators, airlines, aircraft manufacturers, and overhaul operations is handled by the Aviation Supplies Division.

During the year, **Aircraft Radio Corporation,** Boonton, N. J., continued development work in the aircraft communication and navigation equipment field, along with associated test equipment. The company improved its VOR receiving equipment and produced a Standard Course Checker for quick and easy observation of the precision of the VOR course accuracy.

In keeping with present trends, **Aluminum Company of America,** Pittsburgh, Pa., in 1953 increased its productive capacity, installed equipment to produce larger, more intricate parts, and adapted to production sensitive testing equipment for the improvement of quality control.

Construction work was begun on a new Air Force Heavy Forging Press plant at Alcoa's Cleveland Works. When completed and in operation, the entire plant will focus its activity around two gigantic forging presses which are capable of exerting a pressure of 35,000 tons and 50,000 tons respectively and are from two to three times as large as any presses previously available for forging airframe parts.

Facilities are now being provided to produce ingots up to 10,000 pounds in weight and 1,000 sq. inches in cross-sectional area for use with these presses.

Another acquisition during the year was the new 14,000-ton extrusion press at Alcoa's Lafayette (Ind.) Works. Nearly three times as powerful as earlier extrusion equipment, the new press will make possible the extrusion of shapes having greater overall weight and substantially larger cross-sectional area than ever before produced.

A new three million pound stretcher has also been installed. Capable of handling pieces of metal up to 110 feet in length, the new stretcher will straighten shapes with a maximum cross-sectional area of 60 square inches. This new equipment can also be used for aluminum plate 36 inches wide.

Progress was also made during 1953 in the installation of a new $4.5-million rolling mill to produce extra wide tapered sheet and plate.

During 1953, Alcoa also expanded facilities at all Castings Division locations for producing accurate castings by an improved plaster technique. This method, which involves the use of mold elements made of plaster castings, is employed in connection with the green sand, dry sand and semi-permanent mold processes.

More than 20 ultra-sonic inspection units were in use in Alcoa's plants during the year. Although ultra-sonic equipment has been used chiefly for testing raw stock for wrought products, aluminum hand forgings and plate are also inspected as final products by this method. Methods are now being developed to permit the inspection of die forgings by ultra-sonic means. Die forgings usually have intricate surface contours that make them difficult, if not impossible to inspect by the usual contact method. If the parts are immersed in water or placed under a column of water, however, they can be inspected with ultra-sonic equipment from the surface of the bath.

A final development of importance was the expansion of aluminum producing capacity during 1953 at several of Alcoa's smelting works. The operation of additional capacity at Wenatchee, Washington, and Rockdale, Texas, plus a full year's production from expanded facilities started in 1952, was expected to boost Alcoa's 1953 primary aluminum production 30 percent over the previous year, to set a new all-time record high for company-owned plants.

Arcturus Manufacturing Co., Venice, Calif., continued during the year completion of its expansion program to make available to the west coast four new steam hammers ranging from 3,000 pounds to 16,000 pounds. Specializing in close tolerance forgings, a great deal of emphasis was put on the new high temperature steels and also titanium forgings.

Audio Products Corporation of Los Angeles, Calif., during the year expanded in the fields of design, development and manufacture of specialized electronic equipment for radar, navigation, communication and computation.

The firm processed prime and sub-contracts for both military and commercial applications, including air-borne radar relay equipment, and various units in the guided missile program, including FM-FM telemetering equipment.

Particular emphasis in 1953 was placed on miniaturized packaged circuits, PAKAP, the result of extensive research and development on the part of Audio Products Corporation engineers in designing and manufacturing of miniaturized packaged circuitry.

During the year the company continued development of the Modular System, which is a basic electronic tool to aid in the design and use of pulse methods for information transmission, storage, and computation. It consists of a highly flexible set of electrically and mechanically compatible units which are easily assembled and interconnected by patchcords to perform most of the basic pulse operations.

The Modulars relieve skilled and creative engineers of the concern with the design and development of more-or-less standard circuits such as amplifiers, pulseformers, binaries, electronic counters, gates, frequency dividers, and the like, and allows them to concentrate their entire efforts on specialized-function circuits or an entire system. The engineers can think and operate in "block diagram" terms and so are freed of circuit details.

The B G Corporation at 136 W. 52nd St., New York, continued manufacturing various model spark plugs for extensive use on engines requiring long reach shielded plugs, during 1953. The platinum electrode models are designed to furnish good nose scavenging to minimize the tendency toward lead fouling. The platinum electrode spark plugs assure improved lean mixture operation and more satisfactory cold weather starts.

In the piston engine field, B G also manufactures long reach and short reach shielded and short reach unshielded spark plugs, as well as spark plug elbows, ceramic terminal sleeves, gap setting tools, spark plug test sets and ignition harness test sets.

In the gas turbine engine field, the corporation is concentrating heavily on developing igniters, thermocouples and thermocouple harnesses for all of the major gas turbine engine manufacturers. The latest development in igniters is in the field of semi-conductors for use in conjunction with low tension capacitance discharge ignition systems.

In the field of gas turbine thermocouples and thermocouple harnesses, The B G Corporation has developed these items using a material which is especially resistant to failures due to excessive heat and vibration normally encountered in tailpipe areas. Through development over a period of the last two years, it has been possible to increase the life of the tailpipe thermocouples fifteen to twenty times.

Pyrotechnic leads have been added to B G's list of products. These are used in conjunction with fire detector and overheat systems for gas turbine engines. Also, B G has increased its line of special ceramics specifically for application in the electronics field.

At **Bendix Aviation Corporation,** notably in its Eclipse-Pioneer Division, 1953 was a production year second only to the all-out effort of World War II. Output soared to nearly 650 percent of the June 1950 or pre-Korean level. This was accomplished by a triple-barrelled program, including a thorough revamping of the Division's manufacturing set-up at its Teterboro, New Jersey, base of operations; whipping into shape an army of 19 subcontractors of complete Eclipse-Pioneer products and 2,300 first tier parts subcontractors; and increasing the effort of its satellite plants in Red Bank, N. J., Utica, New York, and Davenport, Iowa. By the end of the year the record was speaking for itself: Eclipse-Pioneer was producing, at a new-high, peace-time rate, high precision gyroscopic instruments for airplanes and missiles, and products as diverse and vital as self-contained fuel air combustion starters for jet engines, fuel flowmeters and totalizing systems. Generators, fault protection devices and space- and weight-saving liquid oxygen converter systems were rolling off the production lines in ever-increasing numbers. The number of Eclipse-Pioneer autopilots installed on post-war domestic commercial aircraft and on planes operated by foreign carriers was also at a new high.

Looking ahead, Eclipse-Pioneer has already embarked upon a program to enlarge its production capacity, as well as its research and test facilities Manufacturing capacity increased as the Division expanded into a new 103,250 sq. ft. structure.

To keep pace with the jet era, Eclipse-Pioneer constructed, at a cost of more than $1.5-million, a turbine facility designed to test air turbine driven accessories of almost any size, shape or description under operating conditions ranging from —100° F. to +750° F. and from sea level to 60,000 ft. altitude.

At year-end, the Division had a number of newly developed units ready for mass production. Among these were an eight-jet engine fuel flow totalizing system and an air turbine driven afterburner fuel pump. The totalizing system consisted of eight compact gravimetric type fuel flow transmitters (one for each engine), eight instantaneous rate-of-flow indicators, and one master totalizer indicator, which supplied total rate-of-flow indication for all engines as well as the total amount of fuel consumed.

Also in anticipation of the industry's post-Korean needs, the Division began production of high-precision rate and free gyros for guided missile applications. A directional gyro with a drift rate of less than three degrees per hour was being manufactured in production quantities.

The Division's success in producing gyroscopic instruments of outstanding accuracy in production quantities was due in no small part to a specially constructed glass enclosed temperature- and humidity-controlled room, equipped with special intakes which filtered the air coming into the room, and electronic air cleaners, which removed particles of dust, smoke and oil caused by normal machining operations. Scrap and debris were constantly removed by a special maintenance crew which kept the place literally gleaming. Custom-built precision machinery, such as a ten-ton Excello Four-Way Borer, permitted the machining of gyro assemblies and frames to tolerances as low as .0001 inch. A 14,000 lb. Lindner Jib Borer, which employed optical settings, could hold tolerances to an accuracy estimated at ±.00004. Within only a few months of full operation in this gyro machining room, the scrap rate had taken an 80 percent nose dive.

To increase the durability and scope of utility of the Division's tiny motor generators and delicate synchro-type units, Eclipse-Pioneer designed a complete line of these units with corrosion-resistant characteristics. The Division applied ultrasonics to the Autosyn production line: High speed sound waves, oscillating at frequencies slightly higher than the upper threshold of human hearing, were used to remove microscopic grit and dirt particles from the intricately wound, thumb-size units.

Among the new production items during 1953 was a special 400-ampere DC generator, designed to a 6½ in. diameter envelope for Republic's F-84. Built to operate continuously at 7500 rpm in the 300-400 ampere class, it runs over 6,000 rpm without having to be de-rated. A 500 ampere starter-generator, weighing 15 percent less, was also moving along the production lines.

In the starter field, E-P added to its wide selection with the development of a powerful, yet compact, air turbine starter with a high horsepower-to-weight ratio, for use with turboprop and jet engines. Deliveries of self-contained turbine type fuel air combustion starters, first of their kind to be made on a high volume basis, and for use with the Sapphire and J-73 engines, continued to roll off the production lines in increasing quantities. Manufacture of E-P's direct cranking electric starters also continued at a fast pace during the year.

The field of power supply generating equipment included the development of an air turbine driven 15 kva AC generator package, designed to supply constant (±5 percent at 400 cycles) frequency current. Also in the developmental stage was a complete line of AC generators, ranging from 9 to 60 kva, designed to meet the special requirements of high speed flight.

A new type load contactor was also developed, designed to transfer vital 3-phase loads as large as 50 kva from a main to an alternate source upon failure of the primary power due to line-to-line shorts or other faults.

Another Eclipse-Pioneer development during 1953 was a new gyro horizon indicator with dive angle indication and a 5 in. bezel that was designed to provide much greater ease of readability than earlier and smaller models. The instrument employed a self-contained rate gyro and had a switching means for using the pitch-to-bank erection method, which virtually eliminated turn error.

The Eclipse-Pioneer Polar Path Compass System, which successfully guided Scandinavian Airlines System on the world's first over-the-Pole commercial flight during the latter part of 1952, was again used successfully on additional Polar flights, notably the first commercial flight from Oslo, Norway, via the northwest passage to Tokyo.

A milestone in the history of the Friez Instrument Division of the Bendix Aviation Corporation was reached in March, 1953, when the one-millionth radiosonde was produced. The balloon-borne radiosondes produced today represent developments and improvements made over the last fifty years in soundings of the upper atmosphere.

The Friez Instrument Division has manufactured precision instruments for over seventy-seven years, and as long ago as 1926 built aerographs that were carried aloft by aircraft for upper air investigation. The Division manufactures the critical elements for the present radiosonde such as the thermistor temperature sensor, electrolytic hygrometer elements, printed circuit commutators and self-temperature compensating, pressure sensitive diaphragms. Special automatic calibration equipment has also been developed for use in mass production of radiosondes with improvement in calibration accuracy and tremendous savings over manual calibration means.

The Pacific Division of Bendix has been expanded to include four plants operating in the Los Angeles area, the latest being a 60,000 sq. ft. electronic manufacturing plant in North Hollywood. In addition, an engineering building of 22,000 sq. ft. has been constructed to provide space for increased engineering activities.

The Division manufactures hydraulic and electric actuating devices, telemetering, guided missile components, radar, sonar, electronic depth recorders, automatic boat steerers and other marine equipment.

During the year, the Airborne APS-42A Radar, for detecting storms and obstacles in a plane's course, was redesigned and has been adopted by the Military Services as the standard design.

Bendix-Pacific also developed standardized telemetering systems which are compact, light weight and extremely accurate. The flexibility and effectiveness of the Bendix-Pacific prefabricated telemetering systems has made them an ideal tool to speed up flight test programs for several airframe companies.

Bendix-Pacific is producing radar beacons which can be installed in a missile to provide a reinforced echo that is easily observed. These beacons, which weigh only 5½ lb., incorporate both a receiver and a transmitter, providing a powerful signal which is retransmitted in 2 microseconds. In addition to use in missiles, the Bendix-Pacific beacons simplify air traffic control problems, reduce the time of locating targets for airborne radar checkout and, in effect, increase the size of target drones to simulate larger aircraft. Bendix-Pacific has also developed an unusually compact light weight actuator which produces 100 inch-pounds of torque at a speed of up to 15 rpm. The basis of the development is new concentric square series motor. The unit operates in a temperature range of —65° to —160° F.

One of the outstanding 1953 research programs at Pacific Division has been the study of electron tube reliability. As a result of this research a tube panel has been established by the AIA.

Preliminary investigation disclosed that while the manufacturers were constantly increasing their knowledge and improving their techniques, an average of nearly half of the total number of subminiature tubes being supplied to users today contained one or more flaws that precluded their use as reliable tubes for guided missiles. This is not to say that it is known that a tube containing a flaw will certainly fail during a missile flight, but rather that it is an incipient failure. In production equipment, these incipient failures cannot be countenanced. Tube reliability must exceed 99.9 percent. Since tubes as they are presently manufactured cannot all be used, the problem is resolved into one of devising a means of culling incipient failures.

With this in mind, a program for inspecting, testing, and processing electron tubes was initiated. The program included four major processes or tests: burn-in, microscopic inspection, electrical testing, and vibration testing.

Results showed that the major causes for rejection are:

	Percent
1. Heater Insulation	54.5
2. Foreign Particles	18.2
3. Getter Faults	9.4
4. Heater-cathode Leakage or Shorts	12.5

The electrical inspection is conventional. Tubes are tested for characteristic parameters; transconductance, emission, heater-cathode leakage, inter-electrode leakage, and shorts.

Checking the field results of a reliability program is inherently difficult. However, for the period that the tube test program has been in operation, the indications of its effects have been very favorable. The pre-flight tube

Bendix-Pacific APS-42A airborne radar

failure rate has dropped to an insignificant figure. Account has been kept of several hundred processed tubes. The pre-flight failures have been less than .2 percent, and the flight failure rate less than .2 percent. Of 5,000 tubes found acceptable, 2,000 have been used in the field or in the laboratory. Twenty-two have been returned. Seventeen failed because of external causes, two were still good tubes, only three were actually tube failures.

A concentrated electronic development program has been integrated with the long established mechanical fuel control group to make effective use of the company's past experience in designing and building fuel metering controls for reciprocating and turbo jet engines at the Bendix Products Division, South Bend.

The Electronic Engineering Department is currently divided into three major sections — instrumentation, product design, and electronic control development. The instrumentation group develops new equipment specifically for use in the jet engine and control field. One new device recently disclosed through the SAE is the "Universal Test Control." This unit is an electronic control which incorporates an isochronous governor and a universally adjustable acceleration fuel schedule.

The universal test control has been used by the country's leading engine manufacturers, and has proven extremely valuable for determining the dynamic characteristics of new engines.

The pertinent information on engine operation is graphically presented by a precision recording system also developed by the instrumentation group. The recorder is direct writing and eliminates the time consuming work associated with developing and cross-plotting of data. The recording system is also adaptable to flow laboratory and computer analysis work.

The Product Group has developed a rather complete line of electronic temperature limiters and controllers. These units are currently being furnished in production and are used in combination with hydro-mechanical controls.

Bendix electronic equipment is designed conservatively and is capable of giving reliable performance under the extreme environmental conditions encountered by jet aircraft.

The Electronic Control Group is currently developing new controls for advanced type jet engines. The program is well underway and several prototypes have already been manufactured. It is Bendix's intent to integrate salient features of both the electronic and mechanical mediums to provide advance controls capable of extremely accurate performance.

The design of these new controls has been preceded by several years of intensive development and engine test work. The company is now offering electric as well as hydraulic controls to the engine industry.

Trends in the development of shock absorbing landing gear struts, wheels and brakes point toward new materials, new wheel designs and more efficient brake lining materials.

The Bendix Products Division is testing new higher strength steels which will better meet the exacting requirements of the increasingly heavy loads and higher take-off and landing speeds of modern aircraft.

Aluminum forgings which permit more favorable strength-weight ratios have replaced steel where feasible, in some landing gear designs and all-aluminum struts with chrome plated wearing surfaces have been in production for some time.

Space and weight savings are gained by combining steering and normal strut torque link functions when the torque link in the conventional nose strut is replaced by a new power steering mechanism introduced by Bendix in 1953.

Steering force is accomplished by power cylinders which replace the upper torque link, while the lower link remains essentially the same. This power unit is connected to the lower link at the knee by a ball and socket coupling with control provided by a control valve operated by the pilot.

For any ground operation a touch on a small lever located on a control box in the pilot's compartment will set hydraulic forces in motion to steer the airplane right, left or hold it steady for forward motion.

Provision is made in the unit to provide for shimmy dampening and maintenance is easy because of its simplified design and accessibility on the nose gear. This equipment has been specified for certain new airplanes.

Simplification and increased brake capacity are featured in a new wheel which uses one conventional and one large roller bearing nearly as large as the circumference of the wheel.

The large wheel bearing is installed on the inboard side of the wheel just under the wheel rim, eliminating the usual spokes and hub. This half of the wheel resembles a drum or flanged tube. The outboard wheel half is of conventional construction with a small bearing located in the hub and mounted on a regular axle.

By mounting the large diameter bearing around the circumference of the brake carrier it can be seen that the brake carrier serves a dual purpose, eliminating the necessity for duplication of structure. Therefore, all of the interior of this wheel is available for brake space, allowing larger brakes to be installed.

As with the conventional wheel, this Large Bearing-Small Bearing Wheel may be removed or installed without disturbing the brake assembly. The wheel is easily serviced. Laboratory tests and service experience have shown the large diameter bearing practical to use. It is widely accepted by bearing vendors as well as airplane contractors.

Production of the new cerametallic brake lining has been stepped up to meet military and civilian requirements. As was recently announced, the search for a new type of brake lining resulted in a combination of ceramic and metallic ingredients which will stand up under the extremely high temperatures that are unavoidable in high capacity brakes required by the newer types of airplanes.

This new material, which remains stable under all operating conditions, is retained in shallow metal cups taking the form of separate discs. These are fastened to the Bendix segmented rotor brake stators without the use of rivets or bonding processes.

The year 1953 marked an unprecedented year at the Bendix Radio Division of the Bendix Aviation Corporation for the development and marketing of new products for the aviation industry. Early in the year it was announced that Bendix would market the airborne Distance Measuring Equipment developed by the Hazeltine Electronics Corporation. The Bendix NA-5 DME unit comprises an "interrogator"—the airborne portion of DME—a pilot's range indicator, and an antenna weighing one-quarter pound.

Bendix Radio is now also manufacturing an 18-pound VHF aircraft receiver providing 360 crystal-controlled channels. The new receiver, the RA-18B, provides 50-kilocycle spacing and is designed as a companion to the famous TA-188BB transmitter, also a product of Bendix Radio. It is operated from a 27.5-volt dc or a 115-volt ac primary power source and is mounted in a standard JAN-A1-D (½ATR) form factor housing. Its sensitivity is better than 2.5 microvolts on all channels and the audio output is more than 200 milliwatts.

The first Bendix ASR-3 (Airport Surveillance Radar) system—one of 19 slated for use at major U. S. airports—was installed during the year at Baltimore's Friendship International Airport. Known as a Search or Surveillance System, the Bendix type ASR two-dimensional radar unit consists of a microwave transmitter, receiver and beam-shaped antenna with reflector system. It is used to detect the location of aircraft and obstructions in the vicinity of the airport within a 50 nautical mile radius and to provide information to the airport tower traffic controller so that air traffic can be efficiently and safely directed in the area.

Meanwhile, the first PAR-2 (Precision Approach Radar) system was installed at the Philadelphia International Airport. The unit will be installed at 14 other airports in the nation. The Bendix type PAR System, or Precision Unit, provides a means of tracking an airplane during a landing, compares its position with an ideal three-dimensional approach path, and displays the information on a CRT for the ground operator. The ground operator supplies corrective information in azimuth and elevation to the plane by radio-telephone. Also, the pilot is informed of his distance from the point of touchdown. Corrections for deviations from the proper approach thus can be made immediately by the pilot.

Since January, 1948, Bendix Radio has been engaged in a program of research and development leading to the design of a system of medium range missile guidance. Following guidance equipment development, extensive system operating tests were made. In 1951, tactical requirements dictated changes in the basic operation of the system. However, with modifications, most of the original components were usable in the new guidance unit for the Navy's Regulus missile, unveiled this year.

A new flush-mounted magnetic loop antenna for use with the Bendix radio compass has been developed by Bendix engineers, as well as a new VHF single channel ground station transmitter, the TG-19. This unit operates in the frequency range of 118.0 to 135.9 megacycles.

Bendix Radio is marketing a new ILS glide slope receiver. United Air Lines has placed an initial order for 79 units to be installed in DC-7's. The new glide slope receiver, the MN-100A, provides 20 channels, weighs less than 13 pounds and is mounted in a ½ATR housing.

Another new unit is a VHF single channel ground station receiver, the RG-9A. It operates in the frequency range of 118.0 to 135.9 megacycles. By changing one fixed capacitor, the frequency range can be increased to 152 megacycles. The unit weighs less than 20 lb.

Aircraft navigation and communications equipment orders amounting to approximately $750,000 were received from the Consolidated Vultee Aircraft Corporation in June. The amount involved represented one of the largest single orders ever received by Bendix Radio from an aircraft manufacturer for equipment of this type.

Specializing in ruggedized and special purpose electron tubes, together with rotating electrical equipment, such as dynamotors, inverters, motors and generators, the facilities of the Bendix Red Bank Division were expanded to include a new plant of 120,000 sq. ft. at Eatontown, New Jersey.

Apart from greatly increasing production of previous articles, the Division developed two new products of particular significance to the aviation field.

They are the type 32EO3-3 Inverter, the first of its kind capable of delivering full output at 50,000 ft. altitudes. Previously, it had been the policy of the military to derate units at the higher altitudes since it was not considered possible to mass produce inverters which would continue to give full output above 35,000 feet. Important also is the fact that this Bendix Inverter is small enough to fit into the space allotted for its use in aircraft. Other devices, capable of delivering full output at 50,000 foot altitudes, had been unusable because they exceeded allowable size and space requirements.

The Red Bank Division is likewise making the 2K50 Reflex Klystron in production quantities. This tube has received full JAN approval. The tube, a K band reflex oscillator, is designed for use as a CW oscillator over the range of 23,504 mc/sec to 24,464 mc/sec. It is thermally tuned over this frequency range by varying the grid bias voltage of a triode section incorporated in the metal envelope. The plate of this triode section is attached to the Klystron section and thermal expansion of the plate, caused by variations of plate current, is transmitted to the Klystron section causing a change of gap spacings and a corresponding frequency change. The tube must tune the prescribed frequency range in 1.2 to 2.6 seconds. Thermal tuning accomplishes tuning by circuitry rather than by mechanical means.

The wave guide coupling is accomplished by means of a tapered wave guide which couples to the cavity through a non-resonant iris. The guide tapers in the narrow dimension only, from the iris to a circular output window. External to the tube is an insulating window which permits the tube to be coupled directly to the guide by means of a second choke coupling. This construction makes it possible to operate the shell of the tube at a different potential from that of the guide. It is cooled by convection and may be mounted anywhere.

During the year new production records were set for the Scintilla Division's principal aviation products, which include ignition systems for both jet and reciprocating engines as well as for rocket motors, igniter plugs for jet and turbine engines, ignition analyzers, radio shielding harnesses, radio noise filters, switches, booster coils and electrical connectors.

A new plant was built for the manufacture of electrical coils and a 15,000 ft. addition was made to the sales and service building.

A vigorous engineering research program was responsible for interesting developments and new products, during the year, including jet ignition systems, ignition analyzers, electrical connectors and spark plug leads.

The TCN-9 jet ignition system was designed to operate at temperatures as high as 300° F. It is a compact system weighing only eight pounds and is particularly effective in the elimination of igniter plug fouling difficulties. It delivers sparks of high energy which are capable of igniting poor mixtures.

A new application for a jet ignition system is the Eclipse-Pioneer combustion starter developed for the Wright Sapphire engine. The TVN-11 system was designed for this application. This system incorporates fuel and air controls.

For the several models of small jet engines that are currently under development, a group of miniature jet ignition systems have been developed. Two of these are the TCN-1102, which incorporates a radio filter, and the TCN-1003, which does not have a filter.

In ignition analyzers, one of the most important developments is the 11-3365-1 model which is a simplified instrument for airborne installation. It is designed to provide maximum simplification of installation and maintenance. All controls have been rearranged for greater ease of operation and circuits redesigned to improve readability of patterns. The weight of this analyzer is somewhat less than that of previous models.

An environment-resistant electrical connector, identified as "Type E," has been developed to meet the extreme performance requirements of present day high altitude aircraft operation. This connector has successfully proven the ability to protect sensitive airborne electronic circuits from thermal shock, surface condensation and extreme vibration.

New type spark plug leads for several aircraft engines were developed and have been installed by major airlines.

Boston Insulated Wire & Cable Company of Boston, Massachusetts, during 1953 supplied the aircraft industry with a wide variety of its wires and cables which were developed for aircraft service. Of particular note are the high-temperature wires for power, lighting and communication circuits used where ambient temperatures exceeded 100° C.

BIW Type PFCGV-600 is available in sizes from 22 to 0 and its external coverings are such that when exposed to flame, they remain an insulator so that in case of fire in a plane or around an engine, the cable will not short-circuit.

Development work has continued toward the manufacture of special cables for fuel gauges where the insulated cable is actually immersed in gasoline without deterioration or change in electrical properties. Work has also been done in the design and manufacture of small diameter, small gauge wires for communication and instrument circuits where voltage drop is of little consequence.

Improved electrical shielding has been an important project and the company is now producing braid shieldings of lighter weight with greater degree of noise suppression of ignition circuits than formerly employed on aircraft.

Coaxial cables employing DuPont's teflon, the high-temperature low loss plastic, were manufactured by the company in a wide variety of sizes and types for aircraft use. With the growing use of electronics on aircraft and also in ground instruments, these cables are an essential adjunct to the successful operation of the equipment. An example of Boston Insulated Wire & Cable development is an antenna transmission and control cable for one of the large radar screen manufacturers. Another is for a new type altimeter approved in 1953.

The annual Aviation Ignition and Spark Plug Conference sponsored by

Champion Spark Plug Company attracts to Toledo every fall nearly 200 experts in a single phase of aviation technology—ignition.

The 1953 conference was attended by representatives of some 25 domestic airlines, including all major ones; a dozen foreign airlines (including the Scandinavian); 15 oil and chemical concerns plus the same number of manufacturers of ignition and allied parts. Also present were teams of engineers from the air forces of this country and Canada.

The **Clary Multiplier Corporation's** Aircraft Hardware Division, 425 East 54th St., Los Angeles, has added to its expanding list of products a complete line of aluminum aircraft control pulleys which have just been approved by the Air Force at Wright-Patternson AFB.

Designed for use in secondary, flight control and heavy duty systems, the pulleys, all nine of which were submitted and accepted, have been put into production. The aluminum pulleys have superior qualities of lighter weight, greater strength and durability.

Extensive tests proved that the aluminum pulleys each performed the required 50,000 revolutions without excessive wear on cables. Pulley wear in most tests was less than one-half the amount allowed by AN specifications.

The **Cleveland Pneumatic Tool Company,** at 3781 East 77th Street, Cleveland, Ohio, experienced in the design and manufacture of Aerol landing gear struts for all types of commercial and military aircraft its greatest production year.

The company met all scheduled gear requirements for the defense aircraft program, supplying gears which ranged from the smaller helicopter and fighter gears to those for the largest bombers and cargo transports. It produced gears for all of the large aircraft prime contractors. In addition, increased production of ball bearing screw actuators required the establishment of a new plant in Cleveland of approximately 50,000 square feet in area. The plant came into full production during the year.

Cleveland Pneumatic's Automotive Division continued the production of engine stands, dollies for hydraulic unit lifts and lift kits to meet the requirements of both aircraft and automotive engine manufacturers.

Much new equipment was added during the year.

A Baldwin Universal testing machine of 1,000,000 pounds capacity was installed in a specially-built, three-story structure and is in regular use for structural test research and proof-testing butt welded components.

Cleveland Pneumatic has acquired the largest hydraulic flash butt welding machine ever built in this country. This 140-ton piece of equipment has an upset force of more than 1,000,000 pounds. It has two pairs of welding jaws, each capable of handling material to 20 inches in diameter and exerting a grip pressure of 100,000 pounds. The machine has capacity for welding tubing as large as 30 inches in diameter and has a total welding area which exceeds 70 square inches.

In engineering research, Cleveland Pneumatic is at present producing for the United States Air Force an all-titanium fighter gear, and there have been several special applications of the liquid spring shock absorber which permits high performance in a relatively small cubical space.

The **Connecticut Hard Rubber Co.,** 407 East Street, New Haven, Conn., saw in 1953 a widening of the applications for Cohrlastic heating elements. These units consisting of nichrome ribbon embedded in silicone rubber glass fabric blanket have the advantages of being adaptable to complicated contours and of having very high thermal conductivity. This combination of properties along with the thermal stability of the silicone blanket have made possible the electric de-icing of leading edges, exhaust valves, external doors and small motors without undue strain on the aircraft power supply.

The increased production of parts, particularly silicone rubber parts achieved during 1952 was maintained in 1953. In addition the development of mounts with non-linear shock characteristics for engines, engine containers, accessories and instruments filled a long existing need. Production quantities of these mounts were fabricated for the aircraft engine field in 1953.

Tests on a new pressure sensitive tape called Temp-R-Tape were completed in 1953 and full production will be achieved early in 1954.

The **Dow Chemical Company,** of Midland, Mich., continued during 1953 to supply large quantities of Methylene Chlorobromide, designated by the Air Force as Bromochloromethane, as a fire extinguisher fluid for both planes and ground installations.

In addition to being a supplier of primary magnesium metal and alloy ingot to various aircraft foundries and other magnesium fabricators, Dow is one of the largest producers of magnesium sheet and extrusions, both for the aircraft industry and commercial users, with 4-hi coil mills in range of sizes from 36" to 84" wide and with extrusion presses ranging from 1700 to 13,200 ton. The mill is located on the Mississippi River at St. Louis. The company maintains a complete fabrication plant in which aircraft assemblies and airborne equipment of magnesium are now being produced.

In 1953 the Central Research Laboratories of **Thomas A. Edison, Inc.,** completed development of a revolutionary aircraft fire detection system designed to give complete protection against fire and overheat in engine nacelles and other closed compartments.

The fire detector itself is a flexible cable sensitive to flame at any point along its entire length. An engine nacelle can be equipped with 100 feet or more of cable so installed that some portion will always be touched by flame no matter where the fire may originate. The cable is in effect one continuous detector. It is also heat-sensitive and will respond repeatedly to a definite temperature characteristic.

The cable is coaxial. The center wire is the conductor which is surrounded by a thermistor-like compound that has near-infinite resistance at normal temperatures. As the temperature increases, the resistance of the compound decreases until, at the preset point, it becomes a conductor. Current then flows from the center conductor to the grounded outer sheather and a warning system is actuated.

Fletcher wing-tip tanks on Lockheed F-94

Boundary layer control was an important phase of research at **Fredric Flader, Inc.,** N. Tonawanda, N. Y. Specialized fans and blowers used in wing boundary-layer control, and development of unconventional aircraft powerplants, were major activities at Flader during 1953. Surveys were also conducted on air system variables in turbines, combustion systems, accessories and thrust nozzles.

The Flader testing laboratory at Toledo, Ohio, was the site of tests conducted on compressors, jets, superchargers, de-icing and anti-icing conditions, afterburners, etc. After a four-year research and development program, engineers of the company perfected an aircraft antenna system which reduces precipitation static to a minimum. The unit is now in production under the trademark "ANSTAT."

Fletcher Aviation Corporation, of Pasadena, Calif., continued steady production of external fuel and napalm tanks throughout 1953. In addition to this tank production, several experimental development programs were completed.

The Fletcher FD-25-B was completed, test flown and demonstrated on two trips to Washington, D. C., before both United States and foreign military officials. Construction of the Fletcher FD-25 was begun in Tokyo, Japan, by the Toyo Aircraft Corporation.

Purchase of basic patents covering "jet cooling" and muffling were completed between Professor Otto C. Koppen of M.I.T. and the Fletcher Aviation Corporation. The Koppen patent covers the basic concept of augmenter cooling.

A new concept of air-transportable vehicles has been developed at Fletcher. First public showing of the new Fletcher "Flair" amphibious vehicle was made at the National Aircraft Show in Dayton, Ohio, over the Labor Day weekend. Built in Pasadena, this new all-aluminum vehicle was designed for light weight air-lifting. It is powered with a 55 hp Fletcher-Porsche engine cooled by the new Fletcher "jet cooling" system.

In 1953 the **Ford Instrument Company,** Long Island, N. Y., carried on its pioneering work of developing, designing and manufacturing computers and weapon-control systems.

Missile guidance, air navigation, gunfire control, bombing, rocket firing, atomic reactor controls and many other computing problems were solved electronically, magnetically, electrically and mechanically.

Among the many instruments built by the company during 1953 was an Air Force computer occupying only one cubic foot, weighing less than fifty pounds and containing two thousand different items. It could operate over a temperature range of 125 degrees C. and could withstand radical changes in environments. All assemblies and sub-assemblies were interchangeable with respect to installation and performance. A time reference scale was derived from a tuning fork with maximum error of 0.02 percent.

A Bureau of Aeronautics computer was designed that contained 15 complete servo loops performing a multitude of computing functions. In addition to its own power supply, the computer contained 23 electronic amplifiers, 54 precision potentiometers, 16 motors, 12 synchros and a related quantity of switches, relays and assorted electronic hardware. It embodied a new approach to solving the heat dissipation problem. The entire unit, occupying a total volume of only 1.55 cubic feet, weighed only 75 pounds.

A Bureau of Ships computer was built for the dynamic conversion of coordinates. It contained nearly five thousand parts, no vacuum tubes, three magnetic amplifier servos, and occupied less than 2½ cubic feet. It was designed for shock resistance without shock mounting, and for immediate operation without requiring warm-up time.

Highlighting the company's research developments in 1953 were ultrasensitive magnetic amplifier circuits, and also transistor circuits able to operate satisfactorily over extended temperature ranges, significantly wider than the ones usually employed. These circuits were incorporated in several instruments designed for the armed services.

In manufacturing, Ford Instrument made significant advances in the production of three-dimensional cams, in the development and use of butt-brazed carbide tools, in the modification of the aluminum spot-welding process, and in production heat treating.

At the year's end plans were underway for the company's increased participation in the industrial field.

The **Garrett Corporation,** Los Angeles, recorded all-time highs in sales volume, net profit, manufacturing production and employment during the fiscal year ended June 30, 1953. Consolidated net profit was $3,084,984, being 3.2 percent of sales.

Sales volume reached $96,288,952, up 31 percent over the $73,696,520 reported for the previous fiscal year. Largest increases in sales were recorded by Garrett's manufacturing divisions—AiResearch Manufacturing Company, Los Angeles, and AiResearch Manufacturing Company of Phoenix, Arizona.

The AiResearch manufacturing divisions produced and delivered a total of 300,000 units of all types, a record high. These orders were well diversified among the nine major categories of proprietary aircraft accessories and complete components designed and manufactured by the company.

These divisions currently are producing 850 products in volume, a 13 percent increase over a year ago. The following products were manufactured in volume during the year: actuators, air turbine motors, air turbine starters, ammunition boosters, cabin pressure valves, cabin superchargers, cooling turbines, cowl flap and inlet screen systems, diverter valves, electronic computers, electronic temperature controls, gas turbines, gas turbine motors, intercoolers, miscellaneous air valves, oil coolers for jet engines, oil temperature regulators, oil thermostats, pneumatic thermostats and ram air turbines.

The company now occupies 790,000 square feet of floor space, with 88 percent of this space being occupied by the manufacturing divisions.

Production at the new Phoenix plant was up nearly 150 percent in average monthly dollar volume in comparison with shipments of a year ago. Production area of the Phoenix plant was increased by 15 percent during the year to include a new valve testing laboratory, three new turbomachinery test cells and a combination office-shop utility building.

The company's customer service activities, which encompass the overhaul, maintenance and repair of AiResearch equipment in service by mili-

AiResearch ram air turbine supplies emergency hydraulic power to aircraft control systems

tary and commercial customers, showed a substantial increase in volume.

AiResearch continued to expand its privately owned laboratories in order to keep pace with research, development and production testing of new products. Greatest demands for additional laboratory facilities came from the air turbine starter, air turbine motor and accessory valves programs.

The company laboratory facilities now occupy more than 65,000 square feet of floor space, including operations at Phoenix. At the latter plant, three new test cells for gas turbines and pneumatic equipment and a valve test laboratory were added during the year.

As the result of a work load which has doubled in some groups during the year, engineering personnel has increased 25 percent and the number of laboratory technicians increased more than 30 percent. Included in the Company's engineering departments are more than 700 mechanical, electrical and electronics engineers and technicians.

The research and development program is roughly divisible into four phases: (1) Production testing for equipment in work and coming off the assembly lines; (2) Development and design to solve immediate and specific customer problems; (3) Long-range research in the accessory field with emphasis on missiles, and (4) Development programs looking toward the adaptation of military products to commercial uses.

These are a few of the highlights in the past year's developmental program:

Refrigeration Turbine—10 years of research, development and production in this field have resulted in a product which can accommodate five times the weight flow of an equal size standard air turbine.

Cabin Pressure Regulators—In comparison with World War II B-29 cabin pressure regulators, today's product of equal capacity weighs 90 percent less and controls tolerances three times as fine.

Cabin Pressure Controller—The new AiResearch cabin pressure controller occupies but one-third the space and weighs only one-third as much as other currently used controls, combining the rate of change and altitude selectors into one simplified dial.

Ram Air Turbine—The new ram air turbine, another AiResearch first, supplies emergency hydraulic power to jet aircraft control systems whenever the main aircraft hydraulic system fails. A typical unit weighs only 15 pounds.

Pneumatic Temperature Control—The newly developed pneumatic temperature control is a lightweight, rapid response system which operates automatically and is adaptable to all aircraft systems. The controller weighs but half a pound, and the complete system under three pounds.

AiResearch's aircraft accessories have attained more than a billion hours of actual operation. Behind this record lies more than five and a half million hours of development from which have come the products that maintain the Company's position.

The past year's new products include: the first air turbine motor equipped with a variable area nozzle for airborne operation; a 5½-pound angle of attack and yaw computer for armament fire control systems; a new oil cooler with extended fins, a unique design and one of the most efficient yet produced; cabin pressure controllers which combine rate of change and altitude selectors into a single simplified dial; a lightweight induction generator suitable for aircraft and missile use; and a ram air turbine which supplies emergency hydraulic power to aircraft control systems.

In 1953, the Mechanical Division of **General Mills, Inc.,** Minneapolis, Minn., continued to design and manufacture high precision electro-mechanical instruments for aircraft use. The major portion of its activity was carried on under contracts from the Government and the major aircraft suppliers. The Manufacturing Department, which specializes in volume production of high precision equipment, was producing components for aircraft radio, navigation and bombing systems. The Engineering Research and Development Department continued its activities in the fields of high altitude vehicles and instruments, as well as aircraft test equipment, weapons and systems.

During the year, the employment of the division grew to approximately 2300 employees and operations continued on a two-shift basis with deliveries averaging in excess of $2-million per month.

B. F. Goodrich Co., of Akron, Ohio, developed the first high pressure tubeless tires for use on combat jet aircraft, which successfully completed preliminary flight tests on the Grumman F9F-6 Cougar early in the year.

Other Goodrich developments in the aviation field during the year include the Navy's new high-altitude pressurized suit, and a pneumatic deicer for highspeed aircraft.

The new pressurized suit allows pilots to abandon rocket or jet aircraft at altitudes near 100,000 ft., and creates an artificial atmosphere for the wearer, to sustain life until he plummets down to breathable air. Designed to inflate automatically, the suit permits pilots to fly at altitudes never before reached by man in powered flight.

As many air miles are now being flown by corporation executive aircraft as by scheduled airlines, **Grand Central Aircraft Co.** reported in describing the present work load on commercial airplanes at their Glendale, Calif., main base of operations. More privately operated, high horsepower, multiengined craft have been serviced in Grand Central's shops this year than any other time in the firm's quarter century of history. Repair, overhaul, routine maintenance or modification—even to complete custom-tailoring of interiors for accommodations of deluxe quality, are in work at the Glendale shops and hangars.

Types involved include old standbys like the Twin Beechcraft, Lockheed Lodestar and Douglas DC-3. They get a renewal of parts and emerge factory-new. Former bombers of B-25 and B-26 classes come forth as plush flying executive offices of super performance. Cargo carriers of C-46 and C-54 types take on new dependability to customer specification.

Also on the Glendale flight line are seen in work, Convair 240's, Martin 202's, Twin Beechcraft, Douglas DC-3's & DC-4's, Lockheed Lodestars, Lockheed Constellations, Douglas DC-6's and other late models.

Hardman Tool and Engineering Co., with three plants in the Los Angeles, Calif., area, has made rapid strides during the current year, with special emphasis placed on research and development work to keep abreast of rapid changes encountered in high-density coach seating. Weight reduction of all seats, greater comfort through styling changes offering more leg room, and greater strength required due to stresses imposed by faster flights have been among the company's goals.

A number of other specialty items manufactured by Hardman include shoulder-harness inertia reels, Monorail sun visor kits for cockpit installation, and headrest and cushioning projects.

Harvey Aluminum of Torrance, Calif., perfected a new aircraft structural aluminum alloy known as HZM100, to fiulfill two basic aircraft requirements; namely, resistance to stress corrosion and high mechanical properties. HZM100 permits engineers and designers to use smaller, lighter and stronger aluminum extrusions.

Successful hot extrusion of alloy steel shapes, another 1953 accomplishment at Harvey, is a significant step in the drive to produce elevated temperature-resistant materials for aircraft components, which formerly were fabricated by slow and costly machining methods.

Hufford Machine Co., Los Angeles, Calif., installed their Model 60. the largest stretch-wrap forming machine in the world, in North American Aviation's Columbus, Ohio division. Once adjusted for any given workpiece, the Model 60 repeats its cycle of stretching pressure, wrapping speed. extent of wrap and final setting pressure. These operations are under pushbutton control and each cycle exactly duplicates the original, insuring exact uniformity of parts.

With the advent of Hufford HYDRA-CURVE Haws for sheet forming, the Hufford stretch-wrap forming machines are able to effect additional economies.

Industrial Sound Control, Inc., of Hartford, Conn., made a major contribution to the aircraft industry's fight against noise. ISV pioneered in meeting problems involved in jet engine acoustics, with the development of "Soundmetal" panels, specially-designed mufflers for run-up testing, and new materials developed to withstand temperatures and velocities generated during jet engine tests.

The radical "Soundstream" acoustical treatment, uniting the "Soundstream" principle with panel and muffler design, is an ISC development.

During the year, **Jack & Heintz. Inc.,** Cleveland, Ohio, continued development of electrical accessories for aircraft: a-c and d-c generators, actuators, engine starters, special motors, control systems, and also accelerated its pioneering efforts on special projects anticipating future aircraft needs.

In designing new a-c and d-c generators for high-performance aircraft. company engineers solved heat and stress problems by: 1) careful selection and development of new materials and modification of design elements to effect maximum resistance to temperature and 2) increasing heat transfer areas.

In the past year, the outstanding examples of the success of this approach have been these Jack & Heintz "firsts": the F137 high-altitude motor-generator and the G128 high-speed d-c generator.

The F137 is the first unit in its volt-ampere rating to complete altitude testing and be released for production by the military. The 115-volt, 400 cycle, single phase unit is capable of 1500 va output at 50,000 feet and 20 deg. C. ambient temperature.

The G128 high-speed generator is actually one of a family of three new Jack & Heintz generators, the other two designated as G123 and G124. All three models are described as "true" 8000-rpm continuous duty, d-c generators. Need for a generator which can operate continuously at high speed stems from the characteristics of the high-speed accessory pads used on current jet engines. The higher jet engine speeds create heat and stress conditions too severe for present day generators which were designed primarily for reciprocating engines. Success of the G128 design is due largely to new materials and to a "straight-through" air path which provides for maximum cooling of the generator. This air path involves "opening" the commutator so that air is free to pass under the commutator and through the remainder of the armature.

The company is engaged in an extensive development program and a new series of alternators ranging from 30 kva through 160 kva will be ready for announcement soon. All units will be smaller and lighter than existing designs, and will generate 300 percent full-load current for three-phase short circuit. Speed ranges are from 4800 through 7200 rpm. New cooling methods are being developed for these units.

Sales for 1953 passed the $40-million mark as compared to sales in 1952 of approximately $29-million. The company employs more than 3500 people.

Kaiser Aluminum and Chemical Corp., of Oakland, Calif., has installed a 5,000,000 lb.-capacity stretcher at its Trentwood, Wash., rolling mill, for stretching high-strength aluminum alloy plate. First deliveries of plate processed on the machine have already been made to aircraft manufacturers. Purpose of the giant machine is to flatten the plate and to relieve residual stresses in the metal resulting from rolling and heat treatment. Material thus processed may be machined with a minimum of distortion, a great advantage to the airframe industry because of the trend toward use of machined, integrally-stiffened structures such as wing panels.

The **Ketay Manufacturing Corp.**, New York, N. Y., continued during 1953 in design, development, and manufacture of synchros, servo motors, and resolvers; miniature servo and gyro mechanisms for aviation control equipment; aircraft engine and navigation instruments; and automatic control systems.

During 1953, Ketay's five divisions occupied over 160,000 square feet and had a staff of 1,600. Early in 1954, the Long Island plant will commence operation. This plant will provide over 400,000 square feet of space for a staff of 500.

Research and development is presently being done on aircraft instruments and guided missile equipment, computers and automatic control equipment for fire control and autopilot systems. Precision electronic and electro-mechanical components such as synchros, servo motors, and resolvers of special configurations and miniature sizes which are resistant to humidity and extremes of temperature, amplifiers both electronic and magnetic, accelerometers, pickoffs, and gyros fall within the scope of this organization.

Kollsman Instrument Corporation, Elmhurst, N. Y., one of the first manufacturers of precision aircraft instruments in the United States, celebrated its twenty-fifth anniversary in 1953. By December 1953 the total plant and office area of the company exceeded 285,000 sq. ft. and the employment figure reached 3400. The total volume of business for 1953 was estimated at over $42-million as compared with $31.1-million in 1952.

In 1953 Kollsman shipped an average of 21,000 instruments a month, covering more than 250 different types. Shipments of periscopic sextants averaged 260 units a month. Production of sensitive altimeters, for which the company continues to be the prime producer, reached an average of 1500 a month. Among the wide range of products that left the Kollsman plants in large quantities are standard and sensitive airspeed indicators, tachometer indicators and generators, vertical speed indicators, manifold pressure gages, aviation compasses, pitot tubes, altimeter setting indicators, transducers, Synchrotel transmitters, as well as a variety of optical units, weather instruments, cabin pressure controls and special flight research units.

A plant for the assembling of special purpose motors and generators was opened in Woodside, Long Island. This plant provides over 11,500 sq. ft. of manufacturing area and is staffed with some 200 employees. A new plant for the manufacturing of machined parts of all types was also leased in Wyandanch, Long Island. Containing 40,000 sq. ft. of floor area, this facility has a capacity of approximately 750 employees. A new optics building, adjacent to the main plant in Elmhurst, Long Island, was also leased.

Lear, Incorporated, Los Angeles, Calif., reached new high marks in 1953 with estimated shipments of over $50-million and a backlog of orders in excess of $71-million.

Stepped-up activity at the Lear Grand Rapids Division included production of large quantities of the Lear F-5 automatic pilot and approach coupler systems for jet fighter aircraft. The Grand Rapids Division also was in volume production on Lear Vertical Gyro Indicator systems for installation in F-86D, F-89D, B-47, F-94, F2H, B-50, B-52, B-57, C-130, and C-131 aircraft. Production of the Lear Yaw Damper System was increased to meet added demands for the F-86D and the F9F-6.

The Lear-Romec Division, at Elyria, Ohio, produced a new line of electric motor driven submerged type fuel booster pumps, new submerged type electric motor driven turbine water pumps for piston engine use and for aircraft auxiliary water systems, a new line of one-, two-, and three-element lubricating oil and scavenge pumps for jet engines, improved dual pressurizing kits for antenna wave guide and radar transmitters and receivers designed for high altitude operation, a new series of pressure cut-off switches and isobaric relief valves for use in pressurizing kits, stainless steel air cylinders for the J-57 jet engine, new type electric motor driven de-icer alcohol and fuel scavenge pumps with dual seals designed for reduced fire hazard.

The all-time high in shipments from the LearCal Division at Santa Monica, California, included many new items of electronic aircraft communications, navigation, control and stabilization equipment. 1953 also saw development by LearCal of a new 560-channel VHF receiver, a new 360-channel VHF transmitter, and an automatic rudder control device for single-axis stabilization of light aircraft. During 1953 LearCal added to its list of products magnetic clutches, magnetic amplifiers, magnetic modulators, electronic test equipment, automatic altitude control units for Lear autopilots, and DC electric motors.

Two new Lear, Inc., divisions were organized during 1953: the General Development and Engineering Division and the Aircraft Service Division.

The **W. L. Maxson Corp.,** New York, N. Y., continued its research, development and production of electro-mechanical, electronic, electrical and hydraulic apparatus and equipment. Its work encompasses such fields as electric power drives, computers, servo-mechanisms, radar devices, aerial navigation-ordnance equipment, and instrumentation. Billings in fiscal 1953 were over $33-million, with an order backlog as of October 1 of $45-million.

The Aeronautical Division of the **Minneapolis-Honeywell Regulator Company,** Minneapolis, Minn., announced in 1953 the sale and initial production of the E-11 autopilot. A $16.8-million dollar order was announced in June for E-11 installations on the Northrop F-89D Scorpion and other still-classified aircraft. By providing the autopilot with couplers to radar and fire control systems these planes may automatically fly to the target, locate and attack it and "home" back to base. The E-11 is also used on the RB-66, the B-66 and Canada's CF-100.

Work was also continued on advanced autopilots under an Air Force research contract as well as on other autopilot systems for supersonic jet aircraft that are, themselves, still on the drawing boards.

During the year the company announced its Automatic Sequence Selector which enables a plane to take off, fly a prescribed course and land without a human hand touching the controls. Operating on the familiar punched-tape principle, the highly-intricate electronic "brain" programs the functions of the autopilot and the air-speed controls and actually functions as a master controller for the plane's control equipment.

Honeywell engineers also achieved improvements in helicopter control in their MH-21 which, in 1953, introduced entirely new stabilization concepts — among them "cyclic-stick steering" which eliminates all cockpit autopilot controls except an "on-off" switch.

Although Honeywell remains primarily a "systems" manufacturer in aviation, its 1953 activities in the development and production of components were also extensive.

The **New York Air Brake Company,** New York, N. Y., continued to supply both constant and variable delivery hydraulic pumps for the services and civil aviation, and maintained its continuing program of research and development during the year.

A new series 66W, in variable delivery configuration, was developed and found immediate application in rockets and guided missiles as well as conventional aircraft circuits.

A broad program of laboratory expansion was completed during the year. Research and test projects in the high temperature-high pressure fields are being conducted in cooperation with government agencies, hydraulic fluid and airframe manufacturers.

Other important developments include remote oil pilot control pressure regulation and an electrical control device for remote selective pressure control and pump unloading.

Design, development and qualification of new aircraft pressurization and temperature control equipment during 1953 enabled **Pacific Airmotive Corporation's** Manufacturing Division in Burbank, Calif., to better serve the requirements of the aircraft industry.

Airframe companies manufacturing medium and heavy jet bombers purchased large quantities of PAC's new solenoid-operated T-valve, designed for use in the high temperature engine sections of modern jet bombers.

During 1953, Pacific Airmotive Corporation also designed and developed a large cabin by-pass valve for use in the new delta-wing interceptor and fighter planes. The company also introduced the lightest cabin pressure regulator yet designed by any company. Another new PAC product designed for use on the lightweight fighter series is a cabin safety dump valve with silicone diaphragms. Weighing only 1.1 pounds, this valve can be purchased either with a pneumatic or a solenoid-operated remotely controlled dump system.

In the spring of 1953, PAC redesigned its mass flow and temperature control valve, greatly improving its function. The new design utilizes the mass flow principle and has won wide acceptance where precision automatic control of air flow and temperature is required in high altitude jet aircraft.

During the year, the **Parker Appliance Company,** Cleveland, Ohio, consolidated on the West Coast at the facilities of its subsidiary, Parker Aircraft Co., Los Angeles, Calif., all of Parker's aircraft activity with the exception of jet engine components.

The Company also during the year acquired Proof Industries Corporation's complete line of aircraft hydraulic components.

New developments for the company were: a new double-wall cylindrical accumulator; an improved probe and drogue design for the actual fueling contact in mid-air refueling operations; and a reasonably complete line of aircraft tank pressurization controls.

The **Pioneer Parachute Company, Inc.,** Manchester, Conn., in 1953 offered a new type of life-saving parachute called the Guide Surface Personnel Parachute which combines the reliability of opening of the conventional parachute with low opening shock, and great stability during descent.

This new parachute has the conventional canopy, with a specially shaped "guide extension" attached to every second gore. The guide surfaces are tilted under 45° to the direction of descent. They deflect the air flow in such a way that every deviation of the canopy from a straight descent causes a movement which directs the canopy back to its normal straight position. This principle keeps the parachute practically free from oscillation during descent. Since the jumper descends virtually straight down, he is able to land on his feet and lessen the risk of landing injury. Over 700 live jumps have been made, and no injury or discomfort was recorded.

Pioneer also makes 100 and 150 foot cargo parachutes that have made possible mass parachute drops of men and extremely heavy equipment.

Parachute design has had to keep pace with the development of new aircraft, and now almost anything that can go up in an airplane can come down safely in a parachute. It is a fact that modern striking power depends to a great extent upon parachutes both as cargo carriers and troop carriers, and today parachutes are relied upon to drop not only paratroops, but also guns, jeeps, blood plasma, food, everything that troops need to move forward in battle—when and where they are needed most, and without accident or damage. The Pioneer Parachute Company is outstanding in the building of these rugged, dependable cargo parachutes.

Another product of the company is the ribbon parachute, used as "air brakes" on 600 mile an hour Stratojet bombers. Ribbon 'chutes in various sizes are now standard equipment in jet planes for many important uses.

Reynolds Metals Company, 2500 South Third Street, Louisville, Kentucky, the second largest aluminum producer in the United States, has progressed steadily during 1953 in research and development of new aluminum products and processes.

At the Reynolds extrusion plant in Phoenix, Arizona, extensive development work has been conducted on rotor blades for helicopters in collaboration with the Jacobs Aircraft Company and the Rotary Wing Branch, Propeller Blade Laboratory of the Wright Air Developmental Center. Design studies and trial production have been completed on the application of aluminum extrusions to rotary helicopter blades and converter planes. Additional work is underway on extruded aluminum rotary wings for the Sikorsky Aircraft Company. Aluminum rotary tail sections have already been supplied to Sikorsky.

Integrally stiffened wing skin extrusions are being successfully straightened to very close tolerances. Developments in hydraulic straightening equipment have permitted Reynolds to straighten 24S-T4—four days after heat treatment—to the very close straightness tolerance .0042 inches.

Under Navy contract, work has begun at Reynolds McCook plant on a tapered sheet and plate mill. These new factilities are designed to meet the tapered sheet and plate requirements of the U. S. Navy Aircraft Program and will be completed in approximately two years.

Rheem Manufacturing Co., Downey, Calif., continued during the year to expand both its facilities and its diversified production of aircraft and engine components, sub-assemblies and specialized precision metal parts.

Production during the past year has continued to include a wide variety of sub-assemblies for major airframe manufacturers, including nose sections and rocket pods for the Northrop F-89D; nose sections, ducts and scoops for the Lockheed T-33 jet trainer; nose sections including rocket tubes and closures for the Lockheed F-94C; seats for both the T-33 and F-94C; nose sections for the long-ranging Navy P2V; and comparable assemblies for other manufacturers. Major emphasis has been on work with special steels and alloys requiring high temperature heat treatment and involving welding techniques.

In the guided missile field, the Aircraft Division of Rheem continued during 1953 to improve and expand upon techniques for high-speed forming and welding of components for missiles like the Nike, the Terrier, and others. Rheem sub-contracts on the Nike accounted for 38 separate components.

A separate department for complete production of jet engine afterburners was also established during the year. Starting in August on a contract for afterburners for the Westinghouse J-40-22, the Aircraft Division delivered its first unit within two months after tooling and personnel certification began. The afterburner assemblies, complete with auxiliary jet fuel system, involve several high-heat and corrosion-resistant alloys including Inconel "X," Inconel "W," Hastalloy, and Refractalloy.

The **Rohr Aircraft Corporation**, Chula Vista, Calif., spurred by production contracts for nine different types of power packages (complete engine assemblies) plus other assemblies including exhaust systems, wing tanks, fuel and oil tanks, fuselage sections, augmentors and other components for airplanes, both commercial and military, added new and larger facilities to meet its schedules in 1953.

The Company began its fourteenth year as aircraft manufacturers on August 20th, with a backlog of $180,000,000, expanded plant facilities, both in Chula Vista and Riverside, which brings its square footage up to 1,250,000; an employment total of 8800, of which 2100 are at Riverside, and a high volume of production.

Preliminary figures for the fiscal year, which ended July 31, showed Rohr Aircraft's sales for the 12-month period totaled $63,265,623, a gain of $21,945,439 over the previous year.

Rohr presently is engaged in the development for manufacture, or the production, of power packages installation of all types, reciprocating, compound, jet and turbo prop, for such well known manufacturers as Boeing, Lockheed, Convair and Douglas. The company, in addition to power packages, also is developing or manufacturing wing tip fuel tanks for Boeing's

B-52 and Lockheed's P2V, exhaust systems for North American's AJ-1 and Convair's B-36; aft fuselage section for the Boeing B-52, pneumatic system components for Boeing B-52, heater ducts, and numerous other aircraft components.

Advances have also been made in the field of research at Rohr. Special facilities for the hot forming of titanium have been installed and successful experiments have been conducted with various types of forming equipment. Distribution of heat to the different facilities was one of the major problems to be solved.

New uses for technical photography have been found, tending to speed production; statistical quality control improvements and techniques are reducing errors to a minimum, reducing the delay between inspection and production; rubber and related resilient materials, used in many Rohr applications, are being used for self-sealing fuel and oil tanks. Lock-O-Seals, a Rohr development, represent another specialized use for synthetic rubber; these, plus many other innovations for aircraft manufacture, which are classified information, are under constant study, with many of them already being used successfully.

Simmonds Aerocessories, Inc., of Tarrytown, New York, during 1953 demonstrated SARAH—Search And Rescue And Homing equipment. This is the miniaturized radio-beacon equipment designed primarily for the location of lost personnel. Developed originally in England, SARAH has been officially adopted by the R.A.F. and is currently undergoing an evaluation by the U. S. military services.

SARAH is designed to meet the requirements of rapid, accurate search over wide areas under all visibility conditions. It provides positive, continuous directional information with constant or increasing accuracy as the search craft approaches lost personnel. The equipment carried by the personnel includes a beacon, weighing 6 oz. with a folding antenna; a 12-oz. speech modulator and receiver for two-way communication between the wrecked personnel and the searching aircraft. Also included is a 32-oz. battery and a 2-oz. cable, making the total weight of the equipment 3¼ lbs. The beacon transmits a coded 243 megacycle pulse which is radiated from the folding antenna, which when erected, transmits an omni-directional radiation in the horizontal plane and an inverted cone pattern vertically. Peak power output of 16 watts provides a maximum range of 66 miles to a rescue plane at 10,000 feet altitude and 6 miles to a rescue ship if shipboard receiver antenna can be elevated to a height of 30 to 40 feet. Battery capacity is adequate for 20 hours of continuous operation.

Important advances in the field of capacitance type fuel gage systems, initially pioneered in this country by Simmonds Aerocessories, were completed by the company during the year. Outstanding among these was the development of a new type Fiberglas rolled tubing for use in the Pacitron fuel gage system currently being installed on high priority military aircraft and on a number of advanced types of helicopters.

During the year Simmonds also carried forward basic work on the explosion and fire suppression systems which originated with the work of the Royal Aircraft Establishment. The system utilizes capsules strategically placed in the aircraft which contain a suppressant fluid and which are connected by an electrical system By means of pressure sensitive elements, or by visual detectors, the system is triggered to scatter the suppressant fluid, thereby snuffing out the explosion or fire while it is harmless. Initial installations of these systems on high priority U. S. military aircraft were undertaken by Simmonds during the year.

Diversification of products keynoted **Solar Aircraft Co.** activities during the year. Solar, with plants at San Diego, Calif., and Des Moines, Iowa, is currently producing a wide variety of items for the industry, mostly stainless alloy products for high-temperature service. Major company products continued to be hot parts for piston and turbine-propelled engines. Major product developments during the year at Solar included ducting systems, ceramic coatings, gas turbine engines, and "Microjet," a pressure-sensing control for jet engines.

Sales and earning activities at Solar reached an all-time high in fiscal 1953, with a sales volume of $69.4-million.

Production of automatic pilots for the Air Force, Navy, and civil aircraft topped the list of activities for **Sperry Gyroscope Co.,** Great Neck, N. Y., during 1953. Just 40 years prior, on June 25, 1913, the world's first contract for a gyroscopic automatic airplane pilot was signed by the Navy and Sperry.

Automatic pilot deliveries during 1953 included the standard USAF-type E-4 (Sperry A-12) applied to all types of aircraft from blimp to jet, the A-12D for the Boeing B-47 Stratojet bomber, and two new types designed specifically for upcoming high-speed aircraft. In addition, an experimental rate automatic pilot based on new "vibratory gyro" developments was announced by the Navy, and is undergoing flight tests in a Grumman F6F fighter at the Sperry flight research center, MacArthur Field, L. I.

Unveiled after more than six years under security restrictions, Sperry QF-80 pilotless versions of the Lockheed F-80 jet played a colorful role in the Spring series of nuclear tests at Nevada Proving Ground. The Sperry robot system enables "NULLO" flight (no live operator aboard) under accurate control by radio and radar, worked by "beeper-pilots" on the ground, or in a distant DT-33 "director" aircraft. The pilotless jet takes off and lands by itself. and rigidly maintains any signalled compass course, altitude, or speed.

The special system that controls Navy's Regulus surface-to-surface missile is produced by Sperry for the Chance Vought Division of United Aircraft Corp. Heart of the control for launching Regulus from submarines, surface ships, and shore batteries, is a servo-gyro system designed especially for this project.

Production of Sperry engine analyzers attained new record volume during the year, with Eastern Air Lines heading a long list of commercial

Sperry-equipped F-80 is used in atomic tests

airline users of this protective device. Demand for this equipment continued throughout the year, from USAF, Navy, Army, Coast Guard, Marine Corps, engine manufacturers and many other industrial users.

At the **Steel Products Engineering Company** of Springfield, Ohio, precision gear assemblies continue to make up a major portion of the firm's output. The company is a major producer of helicopter transmission for Bell Aircraft Corp., Piasecki and Sikorsky. Two prototype transmissions were developed during the year, one being for the giant Piasecki H-16.

1953 saw the successful development of several new items such as air and gas turbine powered accessory drive transmissions, aircraft flap actuators, bomb hoists, and various gear reduction units of a special nature. Several of these items have now entered into quantity production.

South Wind Division of **Stewart-Warner Corporation**, Indianapolis, Indiana, during 1953 expanded its product lines as a result of a greater overall concentration on mobile heat transfer equipment. Included in the aircraft products are combustion type heaters, all other types of heat transfer equipment, and inert gas generators.

In addition, South Wind has placed added emphasis on its acticvities in the field of contract manufacturing as related to component parts for airframes and aircraft engines.

Further development of new combustion type heaters for aircraft personnel and cargo compartment heating, thermal anti-icing, and airborne and ground preheating continued during 1953.

Another important function has been the development of new types of heat transfer equipment for uses which have arisen due to the higher temperatures encountered in advanced jet aircraft designs.

The facilities for sheet metal fabrication in South Wind's half-million square foot plant, and the years of specialization in this field have made it possible for South Wind to make a great contribution to the aircraft industry in supplying such component parts as tailpipes, compressor stages, inner combustion liners, oil reservoirs, variable nozzles, combustion chambers, outer combustion liners, high pressure ducting, and afterburner sections.

Sundstrand Aviation Division of **Sundstrand Machine Tool Co.,** Rockford, Illinois, continued in 1953 to manufacture and develop Constant Speed Drive Systems and several types of hydraulic pumps for the aircraft industry.

New constant speed drive systems have been developed by the company to meet the requirements of turboprop and turbojet engine applications. Production began on the 60KVA Cartridge-Type Drive, qualified in the past year on the J-40 engine, and also scheduled for one version of the J-71 engine. The Cartridge-Type drive is designed as an integral part of the engine gear box and operates on the engine oil system.

Two Sandwich-Type Drives, which mount on a suitable engine pad and in turn support the alternator, are operating on two types of missiles. One of these drives is of the radial-piston configuration, the other is of the axial-piston type. Drives of this general type are also being applied to two versions of the J-71 engine and are scheduled to fly in aircraft by mid-1954.

Swedlow Plastics Company, the country's oldest and largest custom fabricator of monolithic and laminated transparent glazing materials, increased facilities at both their Los Angeles, California, and Youngstown, Ohio, plants.

The acquisition of the facilities, personnel, methods and techniques of the Sierra Products Company was announced. In addition, a "know-how" contract was signed with Societe Nationale de Construction Aeronautiques du Sud-Ouest of Paris, France, to indirectly serve the French Union Territories.

Contracts from airframe manufacturers and Air Materiel Command supplemented their continual research and developments on new transparent glazing materials, "stretched acrylics," and canopy and windshield edge attachments. Bullet-resistant plastic armor plate and a post-formable laminate manufactured continuously from Fiberglas and acrylic resins, was added to their growing list of standard plastic laminates.

Thompson Products, Inc., Cleveland, Ohio, reported that the company's sales to aircraft customers for the first nine months of the year were well ahead of the corresponding period in 1952. Aircraft sales for the year were expected to exceed by a considerable margin the $200-million figure reached in 1952, which was highest in the company's history.

Among the aircraft products manufactured by Thompson in large volume are jet engine blades, rotor and stator compressors, turbine wheels and nozzle diaphragms; fuel, fuel booster and other air and engine driven pumps for jet and piston engine planes; sodium cooled exhaust valves; and coaxial switches and other electronic components for aircraft use.

A new plant in Willoughby, Ohio, was added to existing facilities of the company that turn out jet engine assemblies.

A government contract was awarded to the company to build and operate a jet engine test laboratory on the shore of Lake Erie, east of its huge "Tapco" plant in Euclid, Ohio.

The company expanded its activities in the field of electronics by associating itself financially with a newly formed research and manufacturing concern, Ramo-Wooldridge Corp., which will be located in Los Angeles, Calif.

A new world speed record for jet planes was established in the Thompson Trophy Event of the National Aircraft Show held at Dayton (Ohio) Municipal Airport in September. Brig. Gen. J. Stanley Holtoner, USAF, of Edwards Air Force Base, California, achieved the new mark by piloting his F-86D Sabre around an 8-pylon 100-kilometer closed course at 690.118 mph.

Transco Products, Inc., of Los Angeles, California, manufacturers of coaxial switches, air valves, antennas and related accessories, expanded their product line during 1953 to include manual coaxial switches, rotary actuators, and butterfly type air valves.

Production of selector and transfer switches for coaxial cable increased steadily throughout the year. These switches provide low loss performance throughout the range of 0—10,300 mc.

During the year, development work on a new line of fractional horsepower rotary actuators was completed. These actuators were designed for use in 28 volt d.c. and 115 volt 60 cycle and 400 cycle a.c. systems.

Production of valves for use in aircraft air conditioning systems has shown a marked increase over the year. Activity in antennas and transmission line components has also increased.

Environmental and electrical test facilities for the expanded line of switches, actuators, valves and antennas were acquired during the year.

Automatic flight manual controls, harness assemblies, rocket mounts and antennas were produced in increased volume and accounted for the balance of the year's production.

Vickers, Inc., 1400 Oakman Boulevard, Detroit 32, Michigan, designs and manufactures all of the major accessories necessary for the assembly of complete 3000 PSI Aircraft Hydraulic Systems. These products are supplied to the aircraft industry as individual assemblies or as complete systems.

Activity at the El Segundo, California, branch was increased during 1953. In order to provide prototype products quickly for the west coast airframe manufacturers a branch engineering group was established.

The Vickers Pump control valve illustrates the trend to simplified hydraulic circuits. This new accessory incorporates a relief valve, a temperature control valve, a firewall shut off, a pump shut off and a pressure transmitter. Plumbing is minimized; initial costs are reduced; installation and repair is simplified, and system weight is reduced.

Another new Vickers product is the automatic constant speed motor.

This is a conventional motor with a special valve incorporated in the fluid lines connection plate. The weight increase is negligible but the new feature causes the motor to operate at a pre-established rate of rotation regardless of variations in the fluid flow to the motor.

One of the largest known variable displacement pumps for aircraft (15 gpm @ 1500 rpm) was released during 1953 for use on the new Douglas DC-7 aircraft. The new pump is a cross-center design which flows oil in either direction wtihout changing the direction of rotation of the pump. This pump is part of the cabin air conditioning control system. The Vickers complete line of variable displacement pumps also includes a small unit with a delivery of only .61 gpm at 1500 rpm.

Aircraft Hydraulic pumps and motors were also used on the new Jet Engine Simulator design which was completed at Vickers during 1953. This device is a testing machine which reacts to a jet engine fuel control in the same manner as an actual jet engine. Dynamic testing of the fuel control on the new stand will supplement static tests while costing only two percent of the cost of such tests on an actual engine.

In November of 1953 Vickers Inc. sponsored the third Transport Aircraft Hydraulic Conference. This meeting is provided as a service to the airlines and designed to assist them in gaining the highest possible reliability for their hydraulic systems at the least possible cost. The meeting is conducted by an airline representative and the subject matter is chosen by the participants.

Weber Aircraft Corporation, Burbank, Calif., continued during the year 1953 emphasis in the field of research and development of their own products. Principal items developed and tested during this year were ejection seats for two large production bombers and one large production fighter.

Also during this year Weber obtained a development contract from Wright Air Development Center to design a standard galley for use in various aircraft by the Military Air Transport Service (MATS). These aircraft include among others, the C-97, C-118, C-121 and C-131.

The company also continued development of new fixed pilot and crew seats, as well as personnel seats. All of these Weber products continued to be in good demand and are currently being used in various airplanes manufactured by Boeing, Convair, Douglas, Fairchild, Lockheed, as well as requirements directly for the Air Force and Navy.

During 1953 the **Franklin C. Wolfe Company,** Culver City, Calif., expanded facilities almost threefold for production of its standard line of sealing devices for bolts, studs, screws, and other fastening items, sold and manufactured under the trade name "Lock-O-Seal."

1953 also saw this company introduce several new sealing devices.

While the Franklin C. Wolfe Company manufactures many standard sealing devices, it is also recognized for developing sealing designs. Several hundred prime and sub contractors throughout the industry used the company's sealing design service and sealing design consultation to develop effective sealing methods for products and assemblies.

It is through one of these contracts that the company participated in one of the most significant developments in the industry in recent years, namely, making practical the design of integral tanks. Working in cooperation with Rohr Aircraft Corporation a method of practical, effective sealing was developed which has successfully passed all tests to which it has been subjected. Several airframe manufacturers have included the integral tank sealing system in new aircraft now scheduled for production.

Wyman-Gordon Company during 1953 put into operation a 7,000-ton press at the press forging plant it operates for the Air Force in North Grafton, Mass. The Air Force is expanding the press plant facilities to include a 35,000 ton press and a 50,000 ton press.

Since World War I, Wyman-Gordon has been one of the largest manufacturers of aircraft forgings in the world. Over a period of many years much important research work has been done by the company on the forging of aluminum and magnesium alloys. With the expansion of its North Grafton, Mass., plant to include the 35,000-ton and 50,000-ton presses, production of forged aluminum and magnesium parts many times larger than any heretofore possible will be accomplished. In the field of hammer forgings, Wyman-Gordon also continues at the forefront of forging development.

During 1953 increased quantities of turbine discs were forged from high density alloys. The increased interest in titanium has steadily stepped up production demands of titanium alloy forgings for jet engine applications.

Zenith Plastics Co., Gardena, Calif., celebrated its tenth anniversary in 1952. The company has grown in the ten years of its existence from a small fabricator of ducts for aircraft to the manufacturer of the largest plastic parts ever built.

Finishing touches are put on Zenith radome for Lockheed WV-2

The USAF RC-121C, a radar picket version of the Lockheed Super Constellation, uses large bulging radomes housing height finding and search radar. The radomes, manufactured by Zenith for Lockheed, are highly complex structures designed electrically as a part of the microwave radiating system, and must be held within very close thickness tolerances.

Zenith continued as custom molders of reinforced plastics, and contributed to the development of finishes for glass cloth as a reinforcing material, to the point where reinforced plastics are now being regularly used in aircraft semi-structural applications, and are being seriously considered for primary structure.

CHAPTER TWO

Department of Defense

AIR VICTORY IN KOREA, expansion of both production and operating units elsewhere abroad, economies at home, and record-breaking flights all over made 1953 another banner year for military aviation in the United States. Added to these was the aircraft industry's major contribution for the year—a peacetime year's production peak of 12,000 defense planes as 1953 drew to a close.

Progress in rocketry, introduction of new planes into the defense battery, and continued work with A- and H-bombs rounded out the year.

The air victory in Korea was unchallenged as hostilities ceased. All flying services contributed their share to the achievement—Air Force, the Navy's Bureau of Aeronautics, the Marines, and the Army. Most significant, perhaps, was the combat record. It was summed up at year-end by Secretary of the Air Force Harold E. Talbott when he said:

"Our air-to-air combat record in Korea will go down in history as one of the great annals of the Air Force. We maintained a superiority of 13 MiGs shot down for every F-86 lost. Air support for our ground forces performed by Republic Thunderjets, our F-84 fighter-bombers, the Douglas B-26 and the Boeing Superforts, was the decisive force in the Korean war. There is no doubt in my mind that without this air power our ground troops would have been driven off the Korean peninsula in the early part of the war."

Navy and Marine pilots rounded out their Korean tour of duty with increased bomber tonnage, dropped principally by the Chance Vought Corsairs and Douglas Skyraiders. Grumman F9F Panthers and McDonnell F2H Banshees also figured in the dispatches till shooting stopped.

Marines also made news with helicopter activities, both for transport of combat troops over difficult terrain, and in rescue and ambulance work. Army rivalled the Marines in the helicopter field and continued expansion of lightplane combat and reconnaissance missions.

Air Force

Records led the news in the Air Force. On the heels of the Republic Thunderjet score in Korea, 17 of the fighters, with the aid of mid-air refueling, flew non-stop from Turner AFB, Georgia, to Lakenheath, England.

On the same day, August 20, the longest overwater flight by jets—again Thunderjets—ended at Nouasseur, French Morocco, early on the afternoon of August 20, when Strategic Air Command's 31st Fighter Wing landed nonstop from Turner AFB, Albany, Georgia.

The Republic F-84 Thunderjets under command of Colonel David C. Schilling did the 4,500 miles, refueling enroute, at an average speed of 435 mph. The plane cruises at 600 mph, but refueling cut down the average. Boeing tankers were used for the mid-air refueling.

All distance and endurance records for jet aircraft were shattered in 1952 by a Boeing B-47 Stratojet bomber, it was disclosed late in the spring of '53. The records were made by a non-stop, 12,000 mile, 24-hour flight, helped by in-flight refueling. The big 6-jet, 185-000-pound plane was refueled three times by tanker aircraft. It carried a 10,000-pound dummy bomb which was dropped halfway on the flight. Pilot for the Stratojet was Lt. Col. Russell E. Schleeh.

The B-47, powered by six General Electric J-47's, continued to set new records during 1953. Among these was an unofficial trans-Atlantic crossing of 4 hr. 45 min., flying the 2933 miles from Limestone AFB, Maine, to Fairford RAFB, England, at an average 617.4 mph. Two other B-47 models made their appearance during the year. One, the RB-47E, became the world's fastest day or night long-range photo reconnaissance production airplane. Another modification — designated the KB-47B — was the changeover of the standard model into the world's first jet-powered aerial tanker.

Among the sensational new planes introduced by the Air Force was the stiletto-like Douglas X-3, designed for experimental work at extremely high speeds. Too late in the year to come up with any records, the X-3 is anticipated as a headline record-breaker during 1954.

First production model of North American Aviation's F-100 Super Sabre came off the assembly line late in October. The plane is the first jet fighter, scheduled for operational use, to exceed the speed of sound in level flight.

New orders and an expanded production program for the 600-mph-class Douglas B-66 twin-jet bombers were announced by the Air Force late in October.

Procurement expanded on Boeing's B-52 heavy jet bomber when the Air Force ordered a second source of supply at Boeing's Wichita, Kansas,

Boeing B-52 Stratoforts on test for USAF

plant. Cost to bring this acceleration of deliveries was estimated at $250-million for tooling. Accelerated production was ordered at the same time on the supersonic F-100.

By September, the Air Force was also able to announce successful completion of the preliminary phases of an aerial refueling project, using a converted B-47 medium jet bomber as a tanker aircraft for the first time. Boeing Airplane Company and Flight Refueling, Inc., worked with the Air Force on the two-year-old project. A modified Stratojet can be converted from a bomber to a tanker and back again as required under filed operating conditions. Slight modifications were required for the receiving plane, another B-47, but the Air Force announced that all production models were being equipped for refueling in flight.

During the summer, there was successful development of the B-36 as a carrier for fighter-type aircraft, in this case the Republic F-84. Both aircraft have modifications which enable them to take off and land as a single unit, and the F-84 can be retrieved as well as released while the mother plane is in flight.

Successful first flight of the Martin B-57 Night Intruder was announced in July. Flight lasted 46 minutes. The twin-jet, Wright J-65 powered bomber was piloted by O. E. (Pat) Tibbs, Martin chief test pilot.

Foreign contracts with friendly nations were signed abroad to build aircraft under the direction of the USAF in Europe. Typical was an agreement involving $22.5-million with the Italian government for assembly and eventually manufacture of North American F-86's.

A dramatic announcement came in November, revealing that Pratt &

Whitney's J-57, in quantity production and powering the Boeing's B-52 jet Superfortress and the Air Force North American F-100 Super Sabre, plus the Convair F-102, had an official rating in the 10,000-lb. thrust class, making the big turbojet one of the most powerful powerplants ever built.

Research continued in high gear on guided missiles, but most of the work was top secret.

Summing up activities in this field, Lieut. Gen. D. L. Putt, heading the Air Research and Development Command, USAF, said for accomplishments to date:

"Improvements made in rockets and their application since the end of World War II fall into four categories:

"We have improved rocket fuels, especially the liquid type, although not sufficiently to make an appreciable difference in our struggle for better fuel economy.

"We have improved materials, both for the rocket powerplants and the vehicles which they power, which will permit better performance, greater speeds and ranges.

"We have improved the designs of both rocket power plants and the vehicles which they power, resulting in further gains.

"Most important—we have made considerable improvement in the guidance and control of rockets and pilotless aircraft."

The Air Force moved another step forward in the nuclear field by assigning a contract to Lockheed Aircraft Corporation for a preliminary design study on nuclear-powered aircraft.

Although the Air Force high command faced reduction of its 143-wing target in favor of economy, increase in the number of wings was accomplished during 1953.

Economies were in evidence all during the year. In June, Secretary of the Air Force Harold E. Talbott announced the reduction in the Air Force heavy press program from 17 to 10 as part of the economy program. The number of presses was believed to be more than needed, and techniques in using them had to be developed, the Secretary added. In September, a realignment was made to place the final responsibility for all phases of materiel in the hands of a single deputy chief of staff. This appointment went to Lieutenant General Orval R. Cook, whose materiel duties were expanded to include responsibility for research and development procurement. Plans to reduce civilian forces from 313,000 to approximately 306,000 were announced in April.

Seven subordinate headquarters of the Air Materiel Command were eliminated before the end of the year to achieve savings and promote efficiency.

Top Air Force personnel news was the retirement of General Hoyt S. Vandenberg, USAF Chief of Staff, who was succeeded by General Nathan F. Twining. General Vandenberg retired June 30.

AF had 130,000 officers on June 30, programmed a call for 9,500 recent ROTC graduates for the following fiscal year. An estimated 6,500 would be separated from the Air Force in that period, 1,900 by request. The floor on pilot training was broadened in November, when it was opened to civilian high school graduates.

Major part of the pilot training program continued under contract to fixed-base civilian operators of the Aeronautical Training Society.

Now in addition to the ATS standardization school at Goodfellow AFB, there are nine contract schools in operation: Anderson Air Activities, Malden Air Base, Malden, Missouri; California Eastern Air Ways School, Columbus Air Base, Columbus, Mississippi; Darr-Aero-Tech, Marana Air Base, Marana, Arizona; Garner Aviation Service Corporation, Bartow Field, Bartow, Florida; Graham Aviation School, Marianna, Florida; Hawthorne School of Aeronautics, Spence Air Base, Moultrie, Georgia; Serv-Air Aviation School, Stallings Air Base, Kinston, North Carolina; Southern Airways School, Bainbridge Air Base, Bainbridge, Georgia; and Texas Aviation Industries School, Hondo Air Base, Hondo, Texas. At these schools each cadet gets 140 hours of flight training, 20 of them in a PA-18 (Piper) aircraft and 120 hours in the heavier T-6 (North American) trainer, a 600 hp airplane.

Outstanding among 1953 training trends was the success of "Operation Tiger" under Lt. General Robert W. Harper, Commanding General of the Air Training Command at Scott AFB, Belleville, Illinois. The program sought to encourage pilots to favor jet duty rather than duty on piston aircraft.

As a result, 80 percent of the pilots now want to fly the jets. At some schools the figure is as high as 90 percent.

In December, the Civil Air Patrol, under Major General Lucas V. Beau, celebrated its twelfth anniversary. Pilot training continued at an accelerated rate, with more than 300 members of the Air National Guard accepted for pilot training during the third quarter of the year. Candidates successfully completing the course will be commissioned.

North American F-86D's Retractable Launching Unit

Typifying the trend toward an all-jet Air Force was the fall delivery of F-86 Sabrejets to the Air National Guard. These followed deliveries of more than 200 jet fighters and trainers to guard units—F-80's, F-84's, and T-33's. By mid-year, 1954, plans called for partial jet equipment in 60 of the 87 guard tactical squadrons.

An Air Guard of approximately 53,000 men is planned by July of next year, and an eventual ceiling of 85,000.

Outstanding in 1953 Air Force recognition of civilians were Exceptional Service Awards to Donald W. Douglas, president of the Douglas Aircraft Company, James H. Kindelberger, chairman of the board of North American Aviation Corporation, and Frederick B. Rentschler, chairman of the board of United Aircraft Corporation. Each received an engraved medal, a citation with the Secretary of the Air Force seal, and a certificate signed by the secretary for their achievements in producing airplanes and aircraft equipment during the last 40 years.

Naval Aviation

Naval aviation sponsored work leading to the world's all-time speed record made late in 1953. BuAer also returned other records to this country during the year, and announced steam catapults for aircraft carriers, designed to make possible use of newer-type jets, plus canted carrier decks to enhance ease of carrier operations and safety.

A money-saving guided missile also figured in 1953 Naval Aviation news.

A plane carrying the Navy insigne made the world's all-time speed record late in the year when the Douglas 558-II Skyrocket, flown by NACA test pilot Scott Crossfield, scored 1,327 mph at 35,000 ft., twice the speed of sound at that altitude. The Skyrocket took off from a mother B-29.

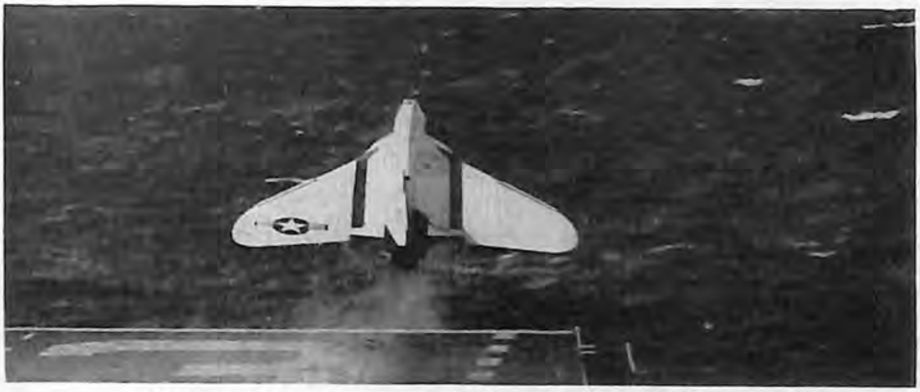
Navy's Douglas F4D Skyray carrier-based interceptor, piloted by Lt. Comdr. James B. Verdin, flew a 1.863 mile course at an average speed of 753.4 mph, roaring through the regulation passes (two downwind and two upwind) a scant 100-200 ft. above the heads of spectators at the Thermal. California, test.

A Westinghouse J-40-WE-8 engine, with afterburner, powered the Skyray with 11,000 lbs. of thrust. In his fastest pass over the course Commander Verdin scored a speed of 761.4 mph.

The record is of particular significance as the first established by a carrier-based plane. Arresting hooks and other necessary equipment for carrier deck landings, and folding wings required for deck storage, generally render a Navy fighter less efficient speedwise than its land-based counterparts.

Other records established by the F4D during the year were closed-circuit and 100-kilometer marks.

The AD-6 Skyraider, also Douglas-built, was unveiled, and Navy sources say it is expected to carry on the work of its predecessor, the AD-4,



Catapult launching of Douglas X4D-1 Skyray

capable of takeoff carrying a useful load of 14,941 lbs.--3000 lbs. over its own basic weight.

The McDonnell F3H Demon passed its carrier qualification tests aboard the Coral Sea, and North American's AJ-2 Savage was flown from carrier decks. The one-man swept-wing fighter FJ-2 Fury (Navy version of the USAF F-86 Sabre) also underwent carrier tests.

Under further test was the XF2Y Sea Dart, Convair's delta-wing interceptor. Fitted with an advanced type of ski for rough-water landings, the XF2Y was demonstrated on San Diego Bay during the summer.

An anti-submarine patrol bomber, the Lockheed P2V Neptune, got a speed boost with the development of the P2V-5 model with two pod-mounted Westinghouse J-34 jet engines, each delivering 3400 lbs. thrust, supplementing the P2V's two Wright 4-3350-30WA turbo-compound engines.

The jets can be turned on independently and utilize the same type high-octane aviation fuel as the turbo-compound engines. The pods are detachable and easily installed, requiring only three bolts to hold them in place.

Helicopter rescue work figured prominently in Naval aviation, with Sikorsky HO3S and HRS-1 helicopters in use off decks of Essex-class carriers in Korean waters.

Also in use were the Douglas F3D night fighter Skynight, and the R7V-2, an early-warning model of Lockheed's Super Constellation.

The "canted deck" principle was demonstrated on the carrier Antietam, and was so successful that permanent bridges like that of the Antietam will be installed on all Forrestal-class carriers, with retractable bridges removed and the "canted" or angled-deck principle applied. Instead of a single longitudinal runway, the new deck incorporates two decks set at an angle to the centerline of the ship. Landing aircraft are thus prevented from crashing into parked planes and causing damage if arresting gear fails.

Another important carrier-deck development during 1953 was the steam catapult. Carrier-based planes have been catapulted off the flight deck since the beginnings of Naval aviation, to effect acceleration from a standstill to flying speed within 150 to 200 ft. Launching operations for jet aircraft present further problems, because jets require longer takeoff runs than reciprocating-engine aircraft.

Hydraulic or compressed-air catapults formerly in use required large masses of moving parts and huge inertial forces.

The steam catapult, unveiled in December, will permit wide expansion of carrier aircraft performance.

The Navy's lighter-than-air patrol craft, the ZP4K, was under construction at Goodyear Aircraft Corp.'s Akron, Ohio, plant in 1953.

The ZP4K incorporates Navy's latest developments for anti-submarine warfare.

The blimp has a helium capacity of 527,000 cu. ft. Powerplant consists of two radial aircooled engines which drive two 11 ft. 6 in. full-feathering controllable-pitch reversible propellers.

Navy continued active in the helicopter field and introduced Bell's tandem-rotor design, the XHSL-1. This flew successfully early in the year and became a production model for Navy anti-submarine activities.

Navy's outstanding contribution in the guided missile field had both scientific and economic values. This was the Navy-sponsored Chance Vought Regulus, a missile that can be launched on either land or shipboard. By a recovery system worked out by Navy and Chance Vought, the Regulus may be used a number of times, thereby saving a fortune in research dollars.

Marine Corps Aviation

The Marine Corps continued in 1953 to integrate its ground and air components into a more closely knit team by activation of the first Marine Provisional Air-Ground Task Force in January. Parent command for ground troops is located at Camp Pendleton, California, with aviation units based at Marine Corps Air Station El Toro. Units rotate every six months between the mainland and Kaneohe Bay, Hawaii, where the Task Force is based.

Marine fliers got recognition for their part in the air war over Korea, with the First Marine Aircraft Wing receiving its second Korean Presidential Unit Citation from ROK President Syngman Rhee in June.

At the end of hostilities in Korea, the Wing had flown more than 114,500 sorties, dropped over 91,000 tons of bombs, and shot 34-million rounds of ammunition. Hundreds of Marines, wounded in northeast Korea, owe their lives to evacuation by transports and helicopters of the Wing, and hundreds more owe their survival to brilliant close air support.

Marine helicopters were used in Desert Rock V, atomic tests in Nevada in the spring. The blast at Yucca Flat was the signal for Marine helicopter pilots to move as close as possible to "Ground Zero" in the first helicopter

Radar-equipped Marine F-30 Sky Knight

atomic maneuver in history, testing the practicability of softening up enemy forces with atom bombs 4,000 yards ahead of advancing American troops.

Marines developed helicopter assault tactics, and initiated the use of transport helicopters in Korea.

Commandant General Lemuel C. Shepherd Jr. announced the development of the XHR2S, a Sikorsky helicopter large enough to carry 26 fully combat-equipped Marines—representing a ten-fold increase in helicopter payload in the past six years.

Helicopters now in use by the Marine Corps include the HRS assault transport as well as Sikorsky's HO5S and HO3S and Bell's HTL observation craft.

A Marine set the unofficial world's altitude record in 1953. Lt. Col. Marion E. Carl, flying the Navy's rocket-powered D558-II Skyrocket, reached 83,235 ft. The new record was made during tests of a new Navy high-altitude pressure suit at Edwards AFB, California. NACA cooperated in making the record flight possible.

The tiny, swept-wing Skyrocket, powered by four Reaction Motors rockets, blasted well beyond the sound barrier within seconds of launching. The record remains unofficial because the Federation Aeronautique Internationale, sanctioning body for official world records, specifies that aircraft have to take off from the ground under their own power, and the Skyrocket was ferried up to 34,000 ft. by a mother-plane B-29.

Marine aviators flew Navy fighters including the Grumman F9F Panther, McDonnell F2H Banshee, and Douglas F3D Skyknight into Korean combat. The Douglas AD Skyraider was used as an attack plane by the Marines, along with the Chance Vought AU Corsair, no longer in production after a brilliant 15-year combat history.

Transports in Marine Corps use during the year included the R4Q Fairchild Packet, designated the C-119 by the Air Force, and Douglas R4D Skytrain and R4D Skymaster transports.

Fliers were trained in North American SNJ's and Lockheed Shooting Stars—designated TV by the Navy.

On the high-echelon Staff level, Marine Aviation got a boost when Assistant Commandant for Air and Director of Marine Aviation General W. O. Brice received his third star in August, 1953. The office was upped to a three-star billet at that time.

Army Aviation

Spurred by the records made in Korea, Army aviation took a new lease on life and expanded.

Records completed by year-end, 1953, indicated that Army pilots alone flew half a million hours in Korea, including 140 combat missions and hundreds of reconnaissance flights for artillery. Forty planes were lost, and 15 pilots were killed in action.

Helicopters continued to hang up new records for ferrying soldiers and supplies over difficult terrain and to high ground. Aero-medical activities included flying 16,000 casualties from the battlefields.

CHAPTER THREE

Industry Research

THE REVOLUTION IN highspeed aircraft design and production continued through 1953 with the accent on titanium, miniaturized electronic components and more elaborate fabricating machines and techniques. The cost of industry research and development continued to climb during the year as increasingly expensive test equipment and more elaborate research techniques were required to ferret out scientific secrets. The following company-by-company reports give typical directions of the industry's accelerating research and development activities.

Aerojet General Corp.

An extensive research program on solid propellants culminated in the first successful smokeless propellant. Sponsored by the Navy, the program led to the new 15KS-1000 JATO. In addition to being smokeless, the new JATO weighs less and has improved handling and storage characteristics.

In the rapidly expanding field of liquid-propellant rockets, one research program, sponsored by the Air Force, has resulted in the development and successful flight-testing of a radically new rocket engine.

Considerable progress has also been made in research programs dealing with missile guidance problems, and with underwater engines.

Bendix Aviation Corp.

The year 1953 saw completion of Eclipse-Pioneer Division of Bendix Aviation Corporation's test facility for turbine driven accessories. Constructed at a cost of more than $1.5 million on its own plot within the 102-acre site of the present Teterboro Division, the completely self-sufficient facility was designed to test turbine-driven accessories of every conceivable size, shape and description. It includes a main equipment building, which houses all of the machinery and primary control equipment, and a test cell building in which the actual testing takes place.

The equipment building contains over 3,000 hp of equipment including a primary stage 1,750 hp five-stage centrifugal exhauster; a secondary stage, 500 hp, two-stage rotary exhauster; a 600 hp six-cylinder double-acting reciprocating compressor and a three-stage freon-brine refrigeration system. Primary control of such test services as exhaust vacuum, air pressure, air temperature and brine temperature is established at the console control in the equipment building. Secondary control of these conditions for specific tests, in addition to control of fuel temperature, and fuel tank pressure and vacuum, is possible from the control room of the test cell building itself. The test cell building consists of twin test cells separated from the control room and its dual controls by heavily reinforced 18-inch concrete walls designed to withstand a one atmosphere shock explosion.

Innovation in the field of production was Eclipse-Pioneer's specially constructed glass enclosed temperature- and humidity-controlled air conditioned room for the actual machining of precision gyro parts. While it had been customary practice for years for manufacturers of precision products to perform assembly work under rigidly controlled atmospheric conditions, machining operations heretofore had been carried out under normal shop conditions. The new production technique, coupled with the use of new custom-made high precision machine tools, resulted in an 80 percent reduction of the previous scrap rate of gyro parts within only a few months after the facility was in full operation.

Boeing Airplane Co.

One of the outstanding behind-the-scenes accomplishments during the year was Boeing's disclosure that it is now using concrete for non-adjustable jig parts in the manufacture of the B-52. The original test jig—for the B-52's stabilizer—has been in use for a number of months in the Stratofortress production line.

The jig itself is steel with the base and supporting members made of concrete. Two stabilizer jigs have been mounted on this one base reducing by one-third the amount of factory floor originally allowed to accommodate two such jigs. Construction of this first jig was made in one-fourth the time required for a comparable steel base and with more accuracy and at one-third the cost. Besides a central ten-ton concrete "tower" there are twelve smaller piers stepped up in size at the same angle as the trailing

Gyro parts are machined in glass-enclosed, temperature and humidity-controlled laboratory room at Bendix Eclipse-Pioneer Division

edge of the B-52 stabilizer. The concrete foundation is surmounted by the adjustable steel part on which final assembly of the stabilizer takes place.

Costing about three-fourths the price of conventional jigs, the new concrete unit already has shown itself to be superior in some respects to its predecessors. Engineers are especially pleased with the new jig's stability, pointing out that the very mass of the supports has a dampening effect on outside vibrations which prevents jarring of precision-set parts. Its low expansion factor tends to minimize the troublesome variations in alignment which result when steel jig supports are subjected to changes in temperature.

Another major technological development by Boeing during the year was the completion of its $1.5-million modification to its Seattle wind tunnel. Plans begun in 1949 became an actuality in April when the tunnel resumed its regular tests. Capable of speeds in excess of the speed of sound, Boeing's wind tunnel is the only privately-owned facility of its size in the country in the supersonic range. It also is capable of operation in the highly complex transonic speed range.

To make possible the high speeds, a 36,000 hp motor was added to the existing 18,000 hp motor in the Boeing wind tunnel and a new 72-blade two-stage fan with an 18-foot-diameter tear-drop nacelle was installed. Also added were a new cooling system, strengthened walls and a new eight by twelve-foot test section corseted by a steel pressure cap and two sets of doors which permit even the heaviest models to be hoisted into place by an overhead crane.

The tunnel itself consists of a rectangular tube with ducts at the first turn for drawing in cool air to offset the heat caused by the friction of the air against the walls. At the point where it narrows down to the test section entrance the air is traveling at about 100 mph and must accelerate rapidly to get through. Here a new principle developed by NACA scientists and improved upon by Boeing engineers makes possible acceleration of the air through the section at a rate above the speed of sound.

Despite the cost of modifying the tunnel, Boeing expects that the great extent to which it will be used and the inestimable value of the information it can provide will more than pay for it within two years' time.

Continued investigation into possible applications of the Boeing Model 502 gas turbine engine resulted in yet another use for this 200-pound 175-hp engine. In its new capacity the turbine is used as a ground power unit for starting the engines of jet aircraft.

The power supplied by the Model 502 is utilized to drive a two-stage centrifugal air compressor and produce 140 air horsepower. This compressed air is channeled through the airplane's duct system to an air turbine starter which is geared directly to the jet engine.

Boeing is in pilot production of this version of the engine with a limited number already in use by the Air Force. One model of the compressors delivered to the Air Force utilizes two turbines in pairs while the rest are single Boeing turbine type.

During 1953 Boeing also formed a manufacturing research unit believed to be the first of its kind in the industry. The unit carries on independent research as well as working on problems brought to it by production shops. Working out entire tooling processes and building sample tools and fixtures also is part of the unit's function and its entire operation is integrated closely with representatives from other departments concerned with manufacturing.

Establishment of a horseshoe-type final assembly line at the company's Renton, Wash., plant aided in paring KC-97 Stratofreighter production below anticipated costs during the year. The line doubles back on itself, as compared with the parallel lines previously used, permitting final assembly of aircraft without moving personnel from place to place.

Borrowing from radio and television manufacturers, Boeing came up with a process for making electrical circuits by means of a photo-engraving process. Used mainly for the production of small-sized circuits, the process involves photographing an engineer's drawing of the circuit using a vinylite base film for the negative. The image is then transferred by standard engraving methods to an enamel-coated copper plate bonded to one side of a piece of phenolic insulation board. The engraving process hardens the enamel immediately under the lines of the drawing. The excess enamel is then washed away and the plate put in an etching tank which dissolves all but the enamel-covered lines of the wiring circuit on the phenolic board.

Holes are drilled through the board and the required electronic devices affixed to the back with pins connecting them to the wiring circuit on the other side. The whole board is then dipped in a solder bath soldering all the connections at once.

Also in the aircraft wiring field was Boeing's disclosure of a universal internal wire support to replace the old-style wire clamps.

The new supports—known as "tombstones"—are made of a nylon plastic and consist of six small upright crosses three-quarters of an inch high on a flat base. Bundles of internal wiring may be fastened to the crosses by opening the bundle enough to insert the cross, then squeezing it back together and tying with a piece of string. The tombstones effect substantial savings in aircraft production by accommodating wire of varying sizes thereby doing away with the necessity of stocking various-sized clamps, besides weighing less and being cheaper to produce.

Research by Boeing into the field of plastics resulted in the development of a new material, called Dunnlew, which has been used to make dies and has replaced steel in a number of cases. It also is being utilized to set drill bushings and template headers, form apply-trim templates, cast master gauges and make joggle dies.

Dunnlew will bond to metal, glass, wood, Fiberglas and many other materials without pressure or heat treatment. Shear strength from a simple contact bond is 3,750 psi.

The liquid plastic hardens in about eight hours and reaches full strength in 48 hours. It retains its strength and hardness at temperatures ranging from below zero to 100 degrees F. It has a compression strength without yield of 36,000 psi and joggle dies made of the plastic will form 0.625-in. aluminum in a 90-ton press. Fiberglas drill jigs may be changed to meet engineering changes in a short time by using Dunnlew where previously an entire new drill jig had to be made. The old bushings on the drill jig are drilled out, leaving oversized holes. New bushings are placed on pins in the metal part, the drill jig is placed over it in the required position and plastic is poured around each bushing. As soon as the plastic hardens, the drill jig, including the bushings, may be lifted and is ready for use.

Cessna Aircraft Co.

A Research and Development Department was founded in 1952. A project recently completed by this department was the installation of a Boeing 502-8 turbo-jet engine in a modified L-19 Cessna Bird Dog. This XL-19B was first flown in November, 1952, and marked the first time a light airplane had been flown with a turboprop engine. A project of installing a Continental "Artouste" turboprop engine in the L-19 is nearing completion. When completed this aircraft will be designated the XL-19C.

A very important project is well underway to apply the principle of boundary-layer-control to both fixed and rotary wing aircraft. While information on this project is restricted, boundary-layer-control can be described as a system which increases control performance at slow speed and reduces take-off and landing distance. Two types of boundary-layer-control systems were installed on standard Model 170's and test flown, providing the industry with an example of efficient research which afforded maximum results at a minimum of time and cost.

A revolutionary propeller V-belt drive has been used successfully on a Cessna 170 to greatly reduce engine noise and vibration and increase airplane performance. Developed by Cessna Aircraft Company, Wichita, Kansas and the Goodyear Tire & Rubber Company, it was proved after more than 1,000 hours of service testing. The new drive produces a plane with a minimum of engine and propeller vibrations, a lower noise level inside and out, and greater efficiency from a larger, steeper pitched, slower turning propeller. For the flight tests, a modified McCauley propeller was chosen. This propeller was 92 inches in diameter and had a 70-degree pitch which is considerably greater than that of propellers used on standard Cessnas. The V-belt driven prop showed a 12 per cent increase in rate of climb in a series of sawtooth climb conditions made by Cessna test pilots. In addition. the V-belt drive with offset propeller shaft allowed the use of a larger propeller without sacrificing prop tip to ground clearance.

Consolidated Vultee Aircraft Corp.

The Pomona Division is engaged in a comprehensive program of research, development, and production of guided missiles for the U. S. Navy Bureau of Ordnance. This program includes weapons, systems analysis, and the preliminary design of new and improved guided missiles systems. Beyond these statements, nothing additional may be reported, because of security restrictions.

Convair's Daingerfield Division, or the Ordnance Aerophysics Laboratory as it is nationally known, is operated for the U. S. Navy Bureau of Ordnance under the technical direction of The Johns Hopkins University Applied Physics Laboratory. OAL is primarily engaged in the development and testing of supersonic ramjet-powered guided missiles for the Bumblebee program. The OAL also conducts considerable developmental test work for the Navy's Bureau of Aeronautics and the U. S. Air Force.

Located on 23 acres of government-owned land, the Laboratory consists essentially of a supersonic wind tunnel, two sea-level ramjet engine test cells, a high-altitude ramjet engine test cell, and the necessary supporting groups, including shops, electronics and instrumentation, photographic, facility and design, and accounting. Utilities for the Laboratory—compressed air, electricity, water, and steam—are furnished under a contract with the Lone Star Steel Company.

At the San Diego Division, aircraft research projects included water-based types for the Navy, supersonic types for the Air Force, and turboprop transports for commercial operation. In connection with several classified projects, wind tunnel studies were conducted in the company's San Diego laboratory; the Southern California Cooperative tunnel, Pasadena; the Naval Ordnance Laboratory, Silver Spring, Md.; and the NACA supersonic tunnel, Langley Field, Va.

Flight research studies were made with the XP5Y-1 turboprop seaplane, XF2Y-1 delta-wing Sea Dart and the YF-102 supersonic delta-wing all-weather interceptor.

Approximately 300 electronics engineers in the division were engaged on special research projects. Work involved the evaluation of novel missile guidance systems, the development of special purpose instrumentation for use at aircraft and missile test ranges, and the design and construction of special purpose electron tubes.

Convair's laboratories are equipped with electronic analogue computers, which permit the rapid analysis of new stabilization and control systems. Part of the development activity was directed toward design and fabrication of special purpose digital and analogue computers.

Radar system development has been one of the long-range programs at Convair, San Diego. During 1953, noteworthy progress was made in the design and production of special-purpose lightweight units. Servomechanisms components and complete auto-pilot type servomechanisms were developed for the armed forces.

The missile development program at San Diego included the full range of airframe configuration and propulsion systems, from subsonic vehicles to supersonic missiles powered by ram jet, solid, and liquid rocket engines. Field test crews were assigned to several missile test bases throughout the country.

Major emphasis in the electronics field was placed upon development of airborne mapping radars, radar homing sets, and systems for tracking and guidance of long-range missiles.

At least two major programs at the Fort Worth Division during 1953 are bellwethers of future activity in the aircraft industry. They are the "weapons system management" concept as applied to the development of a supersonic bomber and proposals for a spare-parts philosophy applicable to the B-36.

The first program, also known as the "single prime contractor policy" —SPCP—places with Convair the responsibility for delivering to the Air Force, in toto, a supersonic bomber, including all its related ground equipment, training aids, spares, and the like.

This policy—unique when applied to a weapons system of this type— calls for Convair to find, develop, buy, and install all of those items of equipment (except engines) which under previous concepts have been referred to as government-furnished aircraft equipment.

The second program at Fort Worth relates to the continued support of the B-36 through it future operating history as far as spares and bits-and-pieces are concerned. This program, in the proposal stage, is based on the formulation of a long-range spares-requirement program in which the items and quantities are specifically listed in regard to their consumption.

General Electric Co.

The year 1953 witnessed continued expansion of research and development facilities, including a new and modern component development facilities at Evandale. These facilities will establish principles and limitations arising in the research and development of aircraft gas turbine engine components.

The year also saw the announcement of plans to construct a $1.8 million combustion laboratory as an addition to the company's huge Research Laboratory at the Knolls in Schenectady. As the ninth major building on the site, it will aid scientists in obtaining knowledge needed to produce more powerful gas turbines for aircraft and other applications.

Most directly connected with aviation equipment testing is the company's Flight Test Center in Schenectady where a "test fleet" of jet and propeller-powered aircraft constantly probe the sky over the eastern half of the United States. Some of the current military test planes are equipped to make complete systems tests. Jet engines are slung from bomb bays, armament systems are set up in the fuselage, autopilots and radar systems are mounted in the planes' noses.

G-E engineers call it "integrated testing." Instead of testing aviation gear piecemeal, a complete system is put through its operation paces. Once in the air, the test equipment in the aircraft determines system performance under flight conditions. Then, while instruments measure responses, automatic recording equipment notes individual component performance under actual flight conditions. Later the results are passed on to design engineers who make whatever system changes are needed to assure best over-all performance.

Out at Muroc, California, where flight test facilities are maintained at Edwards Air Force Base, contributions were made toward increasing thrust of the J-47 turbojet engine and improving the new electronic fuel control system which allows one-throttle thrust selection.

The network analyzer in Schenectady permits ideas to be "flight tested." For example, before and after an aircraft electrical system is built, engineers check it out under actual operation conditions to save expensive "de-bugging."

A power distribution system, for example, is first flown on a network analyzer. Electrical circuits for the plane are cranked into the board and the idea is worked over until the analyzer okays it. The Aircraft Systems Test Laboratory gives the proposed design another tough workout before individual components are tested for installation.

In conjunction with the Analytical Division a great deal of work has been accomplished in determining the power requirements of AC systems during faults and overloads. This aids in the application of generator drives, particularly the air turbine drive where the power available is greatly reduced during low energy conditions of the bleed air, such as engine idle and ground operation.

A detailed study of electric power systems for a proposed jet transport has been completed. This study has added immeasurably to a knowledge of the procedures and requirements for applying various types of drives for electric generating systems. It has also shown a need for improved engine data as to the effects of power extraction on performance. This work is now being carried forward with various engine manufacturers.

The advanced level of reliability demonstrated by the J47 engine has justified a simplified testing procedure which will yield further substantial savings. This method, considered to be an outstanding development and departure from conventional practice of industrial testing of production jet engines, consists of "strip testing" or disassembly of one production engine in every 10 after being subjected to company tests. The "stripped" engine is reassembled and tested again prior to shipment. Prior practice has required that each engine be strip tested after its initial test runs. A high "perfection rate" in past performance of GE J47 jet engines has made the strip testing method possible.

Notable advances have been made in solving some of the fabricating problems associated with titanium alloys. Heat treatments are being devised to improve the properties of present titanium alloys—making them more suitable for aircraft usage, and there has been some progress in welding of titanium alloy sheets. Application of titanium alloys has been extended to some parts of the new GE J73-3 production engine.

A giant electronic "brain" capable of solving complex mathematical problems, arising in the engineering and scientific calculations as applied to the improvement of jet engines, has been installed at the Evendale Plant and has been in operation since the middle of 1953. The primary and major function of this electronic calculator is to solve complex problems for Aircraft Gas Turbine Division and Company Divisions.

Designated as the Type 701 Electronic Data Processing Machine by the International Business Machines Corporation, who build and rent the calculating machines, the electronic "brain" is capable of performing more than 16,000 additions and subtractions or more than 2,000 multiplication and division operations per second.

Over at the Aeronautic and Ordnance Systems Division in Schenectady, much attention has been focused on miniaturization of flight control system components and increasing reliability of present systems and systems components.

Miniaturization has been applied in the development, during 1953, by division engineers in joint cooperation with engineers of McDonnell Aircraft to improve an automatic pilot. A 20 percent weight reduction in the device's amplifier has been achieved through the use of subminiature tubes and magnetic amplifiers. G-E engineers also report that such tubes have simplified cooling problems in the autopilot.

Its weight saving factor is considered to be the prime advantage of miniaturization. Another example of miniaturization is the use by division engineers of dip coatings on amplifiers which employ printed or etched wiring. The amplifiers were formerly embedded in casting resins. This innovation reduced the unit size and brought about a 30 percent weight saving.

Increased system reliability is evidenced in the development of a flight control system, called the FC-5, designed to meet the high performance, supersonic characteristics of aircraft scheduled for production beginning in 1955. The development resulted from joint research efforts of the military services, the aircraft industry, and General Electric engineers.

Long range development plans call for use of magnetic amplifiers in computers, autopilots, target designators, jet engine controls, and gunfire control systems, as design developments improve their performance. Two standard types, full and half-wave, are being tested on a prototype basis at present.

Kollsman Instrument Corp.

During the past year, the Research and Engineering Laboratories of the Kollsman Instrument Corporation continued a long range program aimed primarily toward the supplying of instruments and systems for the precise automatic control of manned aircraft, and toward the centralization of flight data.

Computers designed for use in conjunction with automatic navigation systems and with equipment such as bomb sights, gun sights, and automatic pilots, are among the important projects. Strides have also been made in the development of systems such as automatic sextants, ground and aircraft gun fire control equipment, and equipment for ground position indication and aircraft control.

Numerous electronic problems in radar and radio transmitting and receiving equipment have been assigned by the military to the rapidly expanding Radio Communications Engineering Section at Kollsman.

Because electronic components have to be tailored to the demands of particular instruments and computers, electronics is becoming a growingly important facet of instrumentation at Kollsman. During 1953 the company met with marked success in its investigation and application of magnetic amplifier and transistor circuits in computer applications.

Since precision optics are being incorporated into more and more systems, research in this field has been exceptionally active. During the year the optical engineering staff launched diversified types of sextants, including a sealed unit which reduces the possibility of fogging in the instrument and thus insures high performance. Development of a sky compass is also nearing completion. Designed primarily for use in the Polar regions when the sun and stars are not visible for celestial fix, this new type compass will be used interchangeably with the periscopic sextant and is designed to set into the universal sextant mount.

The complete engineering complement of Kollsman reached 360 persons in 1953.

Lockheed Aircraft Corp.

Lockheed engineers have perfected heat-treating and processing procedures which make it possible, for the first time in the aircraft industry, to effectively use standard, deep-hardening 4340 steel with a tensile range of 260,000-280,000 psi. Formerly utilized at 180,000-200,000 psi, 4340 steel achieves its maximum efficiency at the new, higher strength level. Vital aircraft parts, such as cargo and passenger plane landing gear, are now being made stronger, yet lighter, through use of the 40 percent higher psi steel.

Improvement of wind tunnel facilities for testing airplane engines with more than twice the thrust of the mightiest current jet is under way at Lockheed. The company's power plant test facilities are being increased to accommodate future jet engines up to 23 feet in length and developing up to 24,000 pounds of jet thrust—far bigger than the power plant of any plane flying today. Besides testing full-sized jet engines, the improved tunnel can accommodate piston, compound and turboprop engines with 10,000 hp.

Another Lockheed "first" during 1953 was the production of steel aircraft parts by extrusion. The company developed a single-step process for extruding hot steel into complicated aircraft shapes and is now using a steel extruded part in a production model airplane. The new process, performed on a 1,650-ton horizontal hydraulic press, was developed under a research contract awarded to Lockheed by the Air Materiel Command of the United States Air Force.

Specially modified to afford increased ram speed and an improved container configuration, the standard extrusion press does in one operation what formerly required a series of costly milling procedures.

Company research engineers are now using a recently completed $130,000 "blizzard" tunnel to improve methods of eliminating ice from airplanes. The new icing wind tunnel, first such scientific tube west of the Mississippi, creates man-made ice storms for testing parts of high-performance jet models now under development, as well as improved equipment for aircraft already flying.

A pioneer in the development of integrally stiffened "one-piece" surface units for aircraft, Lockheed has designed and is currently testing a new type integrally stiffened structure. Present integrally stiffened units, which can be produced by machining or extrusion, are unidirectional. Company research engineers are developing forging techniques, utilizing a 300-ton hydraulic press, which will incorporate additional stiffening elements in the transverse direction. Preliminary tests indicate that this configuration, which assumes the appearance of an oversized "waffle," will improve the shear-carrying capacity of the surface panels.

In October, 1953, Lockheed announced that it was conducting a preliminary design study on nuclear-powered aircraft under a contract with the United States Air Force. No details could be revealed as to the scope of the Lockheed project.

The Glenn L. Martin Co.

What may prove to be one of the most important developments in aerial bombardment was disclosed during the year when announcement was made of a rotary bomb door, which had been developed as part of the XB-51 program.

The door forms part of the underside of the fuselage of the airplane and is removed on dollies for loading. When bombs of various sizes are loaded, the door is rolled under the airplane and hoisted into position by three standard bomb hoists. After proper electrical contacts are made, the airplane is ready to take off on its assigned mission.

When the target is approached, the door revolves 180 degrees on trunnions located at either end and the bombs become externally carried stores. There is no yawning bomb bay cavity as in the conventional designs, and there is no need for the airplane to slow down to become a stable platform from which to launch the bombs.

Release of the bombs is aided by two air-actuated plungers which push the bombs clear of the airplane, the noses being held by radius arms to prevent their being blown back by the airstream. By this method of launching, tumbling of bombs is eliminated.

After the bombs have been dropped, the door is revolved back to its original position. Bombs up to 4,000 lb. may be carried. It was revealed that the Martin Rotary Bomb Door has been incorporated into the design of the B-57 Night Intruder being built in "considerable numbers" for the U. S. Air Force.

Perfection of a new method of bonding "Honeycomb" sandwich materials through use of pressure and heat from an "electric blanket" was announced. This new equipment was designed especially to bond multicurved parts, in which the center portion, made of aluminum foil formed like a bee's honeycomb, has metal faces curved to the same shape, bonded to both sides through use of a liquid bonding agent. The result is a piece of great strength but light weight. Honeycomb is also used extensively in aircraft for decking, bulkheads, doors and other parts.

A new "T" tail with control surfaces atop the stabilizer was placed on a P5M-1 Marlin seaplane for flight testing prior to incorporation as a permanent change. Smaller and lighter in weight than the conventional tail, the "T" offers many other advantages. It will become a part of the Navy P5M-2 Marlin series of seaplanes expected to go into production in 1954.

Although a weapon already in service with tactical units training at Patrick Air Force Base, Florida, the B-61 Matador pilotless bomber continued to be the subject of advanced research and development, with the result of a far superior weapon at year's end.

Development of electronic equipment for such diverse uses as weather detection, fire control and all-weather airplane operations occupied the attention of several hundred engineers during the year, with many promising results forecast. A highly specialized group of engineers is conducting pure research into many fields of electronics and improvement of many products such as printed circuits, and subminiature systems. Uses of nuclear energy are being investigated.

North American Aviation, Inc.

In the North American-pioneered concept of production in its simplest forms, design and production engineers turned to extended use of integrally stiffened skins. In one airframe, detail parts in certain major assemblies were reduced over 90 percent and major fastenings were reduced from 53 fastenings per square foot to 0.7 per square foot.

The increased milling necessary for the larger, integrally stiffened skins, demanded a mill capable of variable angle horizontal milling and quick adjustment, for milling ribs of variable depth and width. The problem was solved by designing a horizontal, beam-type mill, utilizing a static cutting table, manual beam adjustments for angle cutting, and beam cams for automatic contourings. The single purpose mill was constructed at an estimated one-sixth of the cost of modifying a suitable general purpose mill.

A 350-ton Hufford stretch wrap press, developed by North American as the result of a study contract to determine projected stretch press requirements, was installed at the company's Columbus, Ohio, plant in June, 1953. The huge machine, now in use, has a maximum pull of 703,720 lb., a die mounting area 95 in. high and 84 in. deep and is capable of stretch forming aircraft alloys 72 in. wide, ⅜ in. thick and a maximum 168 in. long. Capability and efficiency of the machine are being studied through current operations.

An increasing demand during the year for blind riveting, complicated by variable hidden structures, prompted the development of an electronic mass sensor capable of actuating work movers and impulsing drilling and riveting operations with plus or minus accuracy of 0.005 inch. The result, "Probolog," was the first application of an electronic device of its type to a riveting machine.

The problem of blind riveting grew as a result of North American-developed one-piece aluminum grids which replaced multiple component internal construction of thin wing panels. These long, waffle-like sections of contoured aluminum are sandwiched between outer and inner wing skins of the FJ-Fury and F-86H Sabre Jet. Grid sections shift slightly during heat aging, creating a problem of accurate rivet location after the grids are covered with metal skin.

Briefly, the electronic mass sensor, or Probolog, directs the movement of the wing section across the work table until the exact center of each grid bar lies beneath the drill head. A Probolog impulse then actuates special attachments to the automatic drilling and riveting machine which complete the drill, countersink and rivet movements.

Probolog was designed for North American by the Shell Development Company after an alternate method of blind riveting was abandoned because of its bulkiness. Production engineers for North American estimate the electronic riveter speeds machine riveting of wing sections ten times over previous conventional methods.

In the electronics research and development field, a miniature intercommunication system which eliminated the traditional dynamotor mechanical source of electrical power was developed for installation in the Navy T-28B trainer. Power for the four-pound unit is drawn from a 28-volt, direct current source. The unit, 3¾ in. high by 5¾ in. wide and 7⅜ in. deep, provides six channel communication. Amplifiers and other integral units are packaged for plug-in maintenance without disturbing wiring or internal components.

Electronic progress also was made with the development of a compact fire- and crash-proof airborne tape recorder designed to record cockpit conversation during a flight, communications with the ground, and data on pressure, altitude, time elapse, vertical acceleration, air speed, and direction. The 18-lb. unit fits snugly into wing roots or luggage compartment. The unit is equipped with a 1,200 foot magnetic tape that will record 10 hours continuously.

In rocket research, North American designed an oxygen-alcohol fuel burning rocket engine capable of generating 50,000 lb. thrust. Built to propel a "test sled" laboratory produced by the Cook Research Laboratories, the rocket engine can accelerate the sled from a dead stop to over 1,500 mph in 4.5 sec. while travelling 5,500 ft. The propulsion system is adaptable for aircraft takeoff boosts.

Northrop Aircraft, Inc.

Development of a highly effective thermal anti-icing system in the U. S. Air Force Northrop F-89D Scorpion which ducts hot air from the engines to various surfaces to prevent or remove ice formations was announced by Northrop engineers during the year. The system prevents formation of ice on the windshield, wing, empennage, wing tip rocket pods, engine air intake duct leading edge surfaces, and the engine forward frame compartments located in the engine air inlet ducts.

Northrop engineers point out that in addition to the anti-icing system's overall effectiveness, lack of maintenance problems and dependability, the clean lines of the airplane are not disturbed by external attachments, as occurs in the use of boots or blankets attached to leading edges for anti-icing. The volume of super-heated air used in the F-89D anti-icing systems is sufficient to provide heat for 30 average-sized five room homes.

Lead time for the design of new aircraft control systems has been substantially reduced as the result of a new production technique utilizing "electronic building blocks" developed at Northrop. The "blocks" are individual segments of automatic flight control systems such as those in the advanced sideslip stability augmenter used to keep the F-89 steady as an aerial firing platform. Each separate component can be prefabricated as a "plug-in" assembly. More highly developed parts can be inserted in the systems when ready, thereby increasing the capabilities of production aircraft. In addition, Northrop engineers say that a "store room" of components can be maintained (through continued research and development) and various newly-developed components combined to obtain the desired result.

Engineer adjusts main control panel of Northrop fuel system test laboratory to check simulated altitude performance

Indicative of the advanced design thinking at Northrop is the fact that the company during the year established a special titanium committee to accelerate incorporation of the new "wonder metal" in company designs.

Because of its high strength-weight ratio, titanium offers a solution to many of the heat and stress problems being encountered in design of future fighter-type aircraft, and the purpose of the Northrop committee is to determine the possibility of using titanium in current and future design projects.

Electrical systems of the F-89D airplanes are being subjected to rugged tests under every known environmental and electrical condition with the aid of a new test device developed at Northrop. The testing mechanism is a detailed mock-up of the Scorpion's electrical power system and part of the airplane's distribution circuits. The entire mockup is moved into an extreme temperature altitude chamber for realistic simulation of atmospheric conditions. Electrical tests performed on the layout include voltage regulation, component compatibility and system stability, system and component cooling, overvoltage protection, paralleling characteristics, fault clearing ability and fuse coordination.

These tests are first conducted at sea level and room temperature conditions. After a satisfactory system has been perfected, the entire system including the generator or alternator is installed in the altitude chamber for environmental testing. Secondary tests are conducted under conditions of plus 160 degrees Fahrenheit and minus 65 degrees at sea level, minus 65 degrees at 50,000 feet simulated altitude, and an altitude-temperature cycling test to determine if the components will "breathe" and consequently freeze or corrode. In addition to these tests, simulated battle damage, such as severed or shorted cables and other difficulties can be set up and corrected under varied conditions.

Cost savings of $1 million were obtained by the development of cam action punch press dies to form stainless steel ends for hot air ducts used in the F-89. These rings are made of #321 and #347 stainless steel and vary from one in. to 5¼ in. in diameter. Because they had to be fabricated to extremely close tolerances, the accepted and conventional way of manufacturing them was to machine them from heavy wall tubing stock. Use of punch press forming in lieu of machining for these parts has resulted in a reduction of fabrication time from up to three hr. to less than five min. per part.

Included among Northrop's versatile computing equipment are three Card-Programmed Calculators, originally conceived by company personnel and built to Northrop specifications. They solve complex problems in aerodynamics, flutter vibration, stresses and weight distributions, saving many thousands of hours of engineering time.

One of the latest developments at Northrop's computing center is the combination of portions of two Card-Programmed Calculators, which has increased computing speeds to a minimum of four times and on some jobs as much as 15 times as fast as a single CPC. Machine techniques alone have not accomplished all of the gains due to computing at Northrop. In almost every type of work computed, a thorough examination has been made on the engineering methods used. These methods have been revised and streamlined before the work has been put into the automatic computing equipment. The combination of machine modification to fit the problem, and problem revisions to fit the machines has resulted in the reduction in elapsed time in engineering analysis. One example is the reduction of the elapsed time necessary to do one dynamics landing analysis from six weeks when done manually to eight hr. when done on the Northrop automatic computers.

In Northrop's new fuel test laboratory, engineers can stand on the ground and observe fuel mechanisms operating under temperatures from 160 deg. to the thin, 85-degree-below zero atmosphere found at 80,000 feet. Heart of Northrop's fuel research laboratory is a giant control board and three auxiliary test panels which automatically record data on environmental conditions supplied to the test chambers and on the operation of the fuel system as it is subjected to a wide range of flight conditions. Flight maneuvers can be simulated on the testing apparatus by a tilting control device that allows the entire fuel system mock-up to be shifted to correspond to the motion of an airplane in flight.

Republic Aviation Corp.

Republic's new $750,000 research laboratories have been in constant use during 1953 on a variety of projects from experimentation with advanced designs and materials to testing and improvement of equipment already in use. Among the many projects carried on were: structural and functional tests of the F-84F canopy, investigation of transverse rather than longitudinal stiffeners in fuselage tank areas, testing of synthetic oils at temperatures up to 500 deg. F. and continued tests on heavy aircraft forgings, pioneered by Republic.

The company's development of improved control devices contributed to the utility of the flying tail, the one-piece, horizontal slab that is replacing conventional stabilizers and elevators in very-high-speed aircraft. As designed for the F-84F Thunderstreak, Republic's control system for the flying tail includes a hydraulic damper and an "increased mechanical advantage shifter." These devices are linked to the hydraulic system which, actuated by the pilot's control stick, gives the pilot "power boost" for the flying tail. One of these devices screens out improper, impulsive stick movements which the pilot might inadvertently exert on the flying tail. The other mechanism increases stick movement relative to flying-tail movement, providing, in effect, an adjustment for additional fineness and ease of control.

Many problems in the fabrication of titanium assemblies were analyzed and solved during 1953. Perhaps the greatest difficulty was encountered in forming operations. In two assemblies, a fuselage amunition box and ammunition feed chutes designed for the Thunderstreak, about 50 percent of the component parts were formed by using the relatively unexplored method of hot forming. In these operations high temperature heat was applied by either one of two methods. One method utilized the relatively high electrical resistance of titanium by passing a high amperage electrical current through it. The other method utilized an electric air furnace. A third possible method of hot forming, electrically heating the dies of form blocks, was also explored.

In all of the cold forming required, new bend radii, angles of springback and die clearance limits had to be determined. Other extensive investigation went into machining and welding of titanium with positive results. Production of titanium ammunition boxes and chutes for the Thunderstreak will provide a weight saving of 17.6 lb. per plane. Other applications of titanium are expected to result in the near future from Republic's research.

Further metallurgical research led to a 20 percent reduction of the weight of the engine shroud. The stainless steel sheet was rigidized, a process which raises a three-dimensional pattern on the sheet material by passing it through a special set of rollers. These rollers produce a textured surface of greater flexural rigidity than the flat sheet, enabling the gage of the shroud to be reduced without affecting its structural strength.

During the year Republic continued work cooperatively with Simmonds Aerocessories, Inc., and Fireye Corporation in the development of an automatic protective system for fires and explosions in aircraft. This development looks toward saving weight allocated to protective features of fuel tanks, thus enabling increased range or maneuverability of aircraft.

The system makes use of a sensing device which "sees" immediately even the smallest amount of infra-red rays given off at the onset of a fire or explosion. This sensing device automatically triggers plastic capsules which shoot out an extinguishing mist at 300 fps, smothering incipient fires or explosions in fractions of a second, before they can cause damage.

In the field of plastics Republic research has been extensive. Typical of the rapid advancement in plastics is the radio access door in the F-84F. Made of a glass cloth-polyester conglomerate, the piece is a 12 sq. ft. panel molded with solid integral beads. The piece carries a built in antenna, providing cleaner lines for the "F" and permitting fuselage design hitherto impossible.

A complete plastic wing-tip has been developed which weighs only four and a half lb. and can support 4,800 lb. of load. The wing-tip is molded in one piece from plastic resins poured over six layers of glass cloth. It will provide a weight saving of six lb. per Thunderstreak and saves several operations necessary to assemble the multi-piece aluminum tip.

In plastic tool development, steel rule dies made with epoxy resin have proved their value over all-metal counterparts. Use of these dies has resulted in time and labor savings and they hold up better than all-metal ones.

Ryan Aeronautical Co.

During 1953, Ryan was permitted to disclose information concerning the Ryan Firebee targetless drone. America's newest and highest performing pilotless target plane, the Firebee, is sponsored by the Army, Navy and Air Force and represents several years' intensive work by Ryan engineering. A swept wing, jet propelled, pilotless aircraft, the Firebee is an achievement in the field of electronics, high temperature metallurgy and aerodynamics.

Ryan engineers designed the Firebee for high speed and altitude performance comparable with that attained by full-scale jet fighter planes. Remote control permits the Firebee to be flown out of sight and to be maneuvered to simulate a pilot-flown, high-speed aircraft. A specially devised two-stage parachute arrangement, tucked in the Firebee tail, permits its recovery without damage. Recoveries can be accomplished up to speeds of 600 miles an hour and may be automatically timed or activated by command.

During 1953, Ryan engineers have also designed a primary-basic training airplane, powered by jet engine and a new side-by-side piston-engined training plane. Designated "Model 59," the jet trainer was designed for either of two power plant configurations; a twin French Marbore 351 jet arrangement or a single Allison 520-C1 power plant. Ryan's new military trainer, with piston engine, is designated "Model 72" and is designed to utilize the Continental 225 hp. O-470-A engine.

This year, Ryan has started production on streamlined aluminum fuel tanks for the Boeing KC-97G Stratofreighters. These huge fuel cells have extremely high strength-weight characteristics and very few component parts. Similar to the Ryan designed fuel tanks for the Boeing 47-B bombers, the new tanks are also spot and seam welded and designed without longitudinal members and few bulkheads. This type of fuel tank design has proved eminently satisfactory.

In the field of electronics, work has consisted of miniaturization of tubes, transistors and other dwarfed components and development of methods of cooling these tiny, hot electronic parts as they perform their functions.

Ryan technicians have developed a new technique for producing stress-free wave guides by electroforming. This laboratory method produces a "sound-dead" guide that is entirely free of residual stresses. Since the parts cannot be heat treated, this is a major advantage because they can be silver-soldered without exhibiting the slightest tendency toward warping.

Recently, Ryan technicians designed and built a new, ultra-sensitive control which will automatically maintain velocity, acceleration, altitude, temperature, pressure, humidity or almost any other condition within extremely close limits. Perfected in response to the need for a compact flight control for testing pilotless Ryan aircraft at high speeds, the unique new device will have hundreds of applications. It is an electronic-type mechanism which is positive in operation and unaffected by vibration and temperature change.

Outstanding work was accomplished in the electric resistance welding of "super alloys" used in jet engine components. Because of their poor thermal conductivity and high coefficient of thermal expansion, these alloys are extremely sensitive to cracking when heated and cooled during welding procedures. By special studies, Ryan has achieved a modification of welding machines which has resulted in stepping up the permissible welding speed more than 100 percent, with the crack-sensitive alloys. This has accelerated the production of inconel x, Haynes Stellite No. 25 and other metals used in afterburners, tail pipes and jet engine components.

Another Ryan technique, announced recently, is expand forming. Ryan engineering have designed and built three huge expand mandrels to stretch cylindrical sections of aluminum alloy and stainless steel to exact dimensions.

Used in huge Ryan fuel tanks, afterburners, tail cones and other jet engine components, the new technique is a simpler and more economical method of getting exact-size circular sections. The parts are welded into shape and then stretched to exact dimension by the machine. In order to obtain mandrels powerful enough to stretch heavy gauges of stainless steel, Ryan designed one machine which can exert a radial force of 4,800 tons. Using this technique, Ryan simply welds these sections slightly smaller than required and then stretches them to exact size so that they mate perfectly with other large sections.

Ryan has successfully flame-sprayed cermets (metal-ceramic combinations) on stainless steel, inconel and other high temperature alloys. Cermets have such high fusing temperatures that they cannot be applied to most metals in the way in which ceramic coatings are by high temperature furnaces. The furnace temperatures required are too high for the metals, themselves, which form the base structure. Consequently, flame-spraying offers a method of applying these cermets because flame-spraying momentarily heats the cermet to fusing temperature and allows it to be applied to the metal without raising the temperature of the metal to any substantial degree.

This year, Ryan has applied high temperature ceramic coatings to large structures, for the first time, such as liners for afterburners. Here they are performing a most unusual function. They insulate the walls of the afterburner from the deteriorating blasts of the jet stream of hot gas being projected through the afterburner. By so doing, they materially extend the life of the afterburner. The liners, themselves, are of very thin material and would last just a short time if they were not protected. By applying a thin coating of high temperature ceramic on both sides of the liners, they are insulated against the temperature effect and the whole combination is a successful means of extending afterburner life.

This year Ryan has announced a new alloy, Rynalloy, which has been created to perform a special high temperature function. Rynalloy is a heat- and corrosion-resistant, cast alloy designed for temperatures up to 1800° F., with Ryan ball and socket exhaust system joints. Rynalloy has a specially prescribed formula which gives it a coefficient of thermal expansion suitable to match that of the stainless steel tube to which it is welded.

Rynalloy is being used in thousands of Ryan ball and socket joint systems where it successfully serves under temperatures up to 1800° F. This is substantially higher than the temperatures which can be sustained by other commercially available metals which have the required coefficient of thermal expansion.

The Ryan engineering laboratories are continuing their research with titanium under two new contracts which Ryan was awarded this year from the Air Force and the Navy.

This year the Ryan development laboratories have continued their research in methods of fabricating 21 high temperature alloys which are used for the most tortuous aircraft engine applications. Ryan builds high temperature parts from all of these 21 metals and, therefore, has to devise special methods of welding, forming, machining, heat treating, and fabricating parts from these metals—many of which are still in the experimental field and little used by other manufacturers.

Westinghouse Electric Corp.

One important aircraft electronic development of the Westinghouse Air-Arm Division is the combination search, fire control, and tail-warning radar for a night fighter jet plane. This radar unit, four times more powerful than its predecessor, searches for and follows a target until the object is relatively close. Then a second radar unit is energized and tracks the target automatically, giving the pilot computed directions and distance to the enemy craft. A feature of the equipment is that all the time the pilot is following one target, all sides are watched by radar.

Another Westinghouse-engineered improvement offers rain protection for alternators. With alternators now located up front on the nose of jet engines, air, along with fog or rain, passes directly across the exciter, its commutator, and through the alternator itself. Water on windings may be quickly converted to steam and pass on out, carrying with it some of the machine's heat. However, water on the slip rings and commutator causes rapid fluctuations in brush drop, which results in severe output voltage fluctuations, and perhaps reversal of exciter polarity.

This problem has been solved by sealing off the front of the machine where the commutator and slip rings are located and allowing the stream of air, and water, if any, to pass outside of the exciter core and then flow through the alternator and out. Baffles create enough turbulence to cool the shrouded current-collecting mechanism.

Because the rotor of an alternator may lengthen by almost 1/16-in. as it passes from one extreme of temperature to another—an expansion far more than ball bearings can absorb—various mechanical and rather complicated means of compensation have been required in the past.

An improved and simple answer to this expansion problem has been developed by Westinghouse engineers. At one end of the rotor is a fixed ball bearing of the usual type. At the other end is a roller bearing. The outer race of the roller bearing, slightly longer than the rollers, is secured to the stator, and the inner race and rolls are mounted on the rotor shaft. The rotor, with the inner member of the bearing, is thus free to move lengthwise in the outer race, which is part of the stator.

Using water-vapor cooling, the output of a 400-amp. d-c generator has been increased to 500 amp., and this output can be attained at all altitudes. The liquid, which is a mixture of water with chemical to depress the freezing point, is introduced through the shaft at the commutator end and is sprayed on the underside of the commutator bars. Surplus liquid passes on into the rotor and outward through special passages in the core, absorbing heat and vaporizing along the way. The magnetic parts exposed to liquid are protected against corrosion.

The rapid increase in the use of a-c power has required much continued research to develop basic elements necessary for successful system operation. The elements developed by Westinghouse aviation engineers have been combined in panels for controlling the a-c generator and the a-c system, which follows the philosophy proved highly successful with the d-c systems.

For instance, the control panel for one three-phase generator, of either narrow or wide speed range, now weighs only 12 lb. and occupies a space only six by six in. by $15\frac{3}{16}$ in. Many functions are served by the components within this space: a relay for opening and closing the generator field circuit when necessary; protection for either ground or line faults; generator overvoltage protection; overvoltage lockout relay; a means of indicating to the pilot or flight engineer the loss of electrical power; a relay that permits the generator to build up voltage independent of the 28-v. battery system; a means of flashing the exciter field should voltage build-up be impossible because of an accumulated commutator film or loss of residual magnetism; a transformer-rectifier unit as a source of 28-volt power for performing control functions on the panel; and provisions for checking, in the plane, the operation of protective relays. The panel employs the keyed plug-in, quick-ejector construction, similar to that previously developed by Westinghouse for d-c systems. and materially reduces on-the-ground time for airplanes because the control panel may be conveniently replaced with one which has been bench-checked.

Other control panels are available for use with multiple-generator systems, for aircraft that have both a-c and d-c systems, and for aircraft where a simplified control is acceptable.

The result of several years of intensive research, the magnetic amplifier has in a brief time permitted the development of a superior regulator for a-c generators for airplanes.

The outstanding features of the magnetic-amplifier regulator are that it is a completely static device and almost entirely indifferent to the wide swings of environmental conditions encountered in airborne operations. Once adjusted, the performance of the Magamp regulator remains constant regardless of what the plane is called on to do.

CHAPTER FOUR

The Government and Aviation

Civil Aeronautics Administration

AN AVERAGE OF 44,000 PLANE movements every 24 hours were handled by airport traffic control towers operated by the Civil Aeronautics Administration during fiscal 1953. The total of 16,214,716 movements handled by these towers is an indication of the general increase in flying piled up throughout calendar 1953.

More people flew into and out of this country in fiscal 1953 than came and went by sea; scheduled air carrier operations set new records; and the air transportation industry for the first time employed in excess of 100,000 persons.

With Chicago Midway Airport leading, the 10 busiest towers in the country were Miami, Wichita, Cleveland, Los Angeles, Denver, Atlanta, Dallas, New York LaGuardia and Washington.

Encouraging evidence of expansion of all weather flying, through the use of improved navigational aids was revealed in the CAA's figures of "fix postings" along the airways. These are reports made by aircraft en route along the airways, especially in cases where they are flying under instrument flight conditions. The number of these reports is an accurate measure of the use of the airways, by air carrier, other civil aircraft and military aircraft. For fiscal 1953, the total of these fix postings over the whole country was 14,329,408, compared with 12,635,817 for fiscal 1952. While other civil aircraft registered but a slight increase in fix postings, 1,068,065 for 1953 and 1,004,060 for 1952, air carrier and military showed respectable increases: Air carrier from 7,792,671 to 8,636,660, and military from 3,839,086 to 4,624,683.

Again the airlines stayed within less than 2 points of complete 100 percent regularity through the use of the excellent airways aids and their own increased experience.

Against a total of 25,019,742 passengers carried in 1952, an estimated 31,981,000 were carried in 1953, and they flew an estimated 18 billion passenger miles, as against 12½ billion passenger miles in 1952.

Again as in recent years, domestic and international carriers made good safety records, although they found it impossible to beat the all-time low record of 1952 of .4 passenger fatalities per 100 million passenger miles. In 1953, the accident rate, as estimated by the Civil Aeronautics Board, just before this book went to press, was 0.5 per 100 million passenger miles, based on an estimated 18 billion passenger miles at year end. The rate for International carriers in 1952 was 3 passengers per 100 million passenger miles, as against the record in 1953 of an estimated 0.1.

In 1953, the domestic scheduled airlines showed an increase of 14 percent in the ton-miles of express and freight carried, and increased to 70,632,663 in ton-miles of air mail carried. Express and freight ton-miles in international operations for the year increased .1 percent and ton-miles of air mail increased to 23,491,624.

Of the 2,800,000 persons who traveled between the United States and foreign countries in the year ending June 30, 1953, 1,714,000 traveled by air, and 1,112,000 on the surface. Ten thousand more traveled by surface than in fiscal 1952, but those who traveled by air numbered 185,000 more than in the previous year. Of these air travelers, 68 percent used U. S. flag carriers.

The airlines continued to increase the size of their fleets of large-capacity airplanes as in previous years. By the end of 1953 there were 587 four-engined planes in service on the domestic lines. This number has been incrasing steadily since 1945 when there were but five planes of such size in service. The number of smaller, two-engined planes increased in 1953, to 813 as compard to 791 in 1952.

Helicopters, freed of the military grasp by the ending of the Korean police action, inspired much more planning for their civilian use. The Civil Aeronautics Board had 47 applications on hand at the end of the year for scheduled use of helicopters, and a feature of the situation was that applicants projected fairly long cross-country routes in addition to the purely local services in metropolitan areas. A New York to Philadelphia service, one from Detroit through various Ohio cities, another from El Paso to San Antonio are typical of many in the list. A 1953 speed record of 146 miles an hour for a helicopter and test flights of a military machine with a potential passenger-capacity of 40 for commercial use were indications of the changing attitude toward rotor-winged craft.

The helicopter throughout 1953 inched its way further into the category of work aircraft. The "whirligig" aircraft continued to do newsworthy things, such as transporting a church piece by piece to the bottom of the Grand Canyon; killing rats on city dumps and weeds that choked canals; flushing cattle from dense mesquite at roundup time; and the delivery of New York Port Authority executives from downtown offices to metropolitan airports and business men from factory yard to factory yard.

The three established scheduled mail runs using helicopters continued to pile up experience, and to make records. In the second quarter of 1953, Helicopter Air Services in Chicago carried 8,128 ton miles of mail; Los Angeles Airways carried 14,599 ton miles; and New York Airways, Inc., carried 11,798 ton miles. In New York, passengers began using the helicopter taxi service beween downtown and the airports, and between airports.

CAA safety agents watched early helicopter operations, and collaborated continuously with manufacturers in planning for wider use of the versatile vehicle.

In April Frederick B. Lee, experienced pilot and formerly Deputy Administrator, became Administrator of Civil Aeronautics. After an interesting career in private flying, and war experience in the training of pilots and preparing of instrument flight text books, he joined the CAA in 1946 as program planning officer, becoming deputy administrator in 1947.

Reorganization of the CAA from 10 regions to seven was completed, the seven continental regions being reduced to four. At the same time, certain functions in Washington and in the field were changed and consolidated in the interests of economy.

The CAA continued its policy of delegating authority to experts within the industry to carry out routine safety supervision work, and at the end of the year some 5,600 were performing these duties, with the CAA studying the legal procedures by which additional safety tasks could be handled effectively by the industry.

During the year the CAA's special group studying the problems of certification and operation of jet-powered aircraft completed its task of making special studies of foreign jet-powered commercial aircraft and military aircraft with possible application to civil uses. The CAA has certificated six turbojet engines to date, with outputs ranging from 800 to 10,000 pounds' thrust.

Registered civil aircraft increased during 1953 to a total of 91,000. There were 33,370 student pilot certificates issued and 34,200 private certificates. These figures represented increases over the 1952 figures.

Around the world the CAA continued its technical assistance to friendly countries and in areas where U. S. carriers require airway aids, and served as advisors in many capacities to officials of many countries.

In spite of strenuous efforts by manufacturers of competing systems, the year showed a substantial number of installations abroad of U. S.-developed types of navigational aids sponsored by the International Civil Aviation

Organization (ICAO). Progress was particularly encouraging in the European area, where certain U. S. airway aids now are manufactured on license arrangements, and where the CAA uses a fully-equipped DC-3 aircraft to demonstrate and flight check these aids.

The CAA staged the second Aviation Leadership Institute in the summer, in cooperation with the Air Transport Association and the Aircraft Industries Association.

The CAA issued several publications of interest and practical use to the industry. A booklet, "The Airport Terminal Building," was designed as a guide to designers of new airports; a release on how to use the airborne VHF equipment was aimed toward the increasing number of private owners who are ready for transition to 100 percent VHF airways.

Increasing speeds of transport aircraft kept high emphasis on the adequacy of position lights for aircraft, and the CAA's Technical Development and Evaluation Center at Indianapolis made good progress in improving such lights. High intensity lights for use on the rotor tips of helicopters were under development also, and the flashing, "ambulance-type," revolving red light for aircraft was coming into general use by the airlines. Lights on the ground were further developed, a major move being that at Milwaukee where a manufacturer installed a runway lighting system which virtually met the Center's scientific analysis of the ideal runway light.

The Center also evaluated the effectiveness of some 95 materials for use in making crash-proof fuel tanks for aircraft, and developed a rational method of determining the loads imposed on wing tanks in crashes.

The Federal Aid Airport Program was suspended at the end of fiscal 1953 for purposes of a complete re-examination of the part the Federal government should play in airport construction and improvement. The CAA's personnel conducting this program was reduced from 1,000 to 109, and 184 projects that had been processed for the year, totalling $10,618,000 in Federal funds were moved onward toward completion. A special advisory committee was appointed by the Secretary of Commerce to examine the aspect of Federal aid for airports, and to recommend future policy in this field.

Typical of its responsibilities in far places of the world, the CAA began in 1953 to build permanent type residences for government personnel on Wake Island, important stopping point for trans-Pacific air carriers. The fortunate circumstances of no fatalities resulting from a severe hurricane on Wake made construction of these buildings imperative.

The year saw the end of the trail for a famous old plane, the Boeing 247-D, known as "Adaptable Annie" at the Indianapolis Center. After a long career as a racing plane, a scheduled air carrier vehicle, and an executive transport, the plane was put into a wide variety of uses at Indianapolis where her name was earned. The Administrator turned her over as a historic plane, to the National Air Museum of the Smithsonian Institution where she will be displayed when suitable quarters for the museum are provided.

National Advisory Committee for Aeronautics

The year 1953, in addition to being the Golden Anniversary of powered heavier-than-air flight, was a milestone in aeronautical research; it marked the first time that, using the fruits of postwar laboratory work, a tactical airplane had repeatedly attained supersonic speeds in level or climbing flight.

Accomplishment of faster-than-sound velocities by an airplane now in production and soon to be assigned to tactical units of the Air Force—the North American F-100 Super Sabre jet fighter—underlines the great progress made in aeronautics during the past decade. In this extraordinarily difficult task of developing practical military airplanes capable of operating at supersonic speeds, the military services, the aircraft industry, and the NACA, the nation's aeronautical research establishment, have been working as partners.

Ten years ago, the maximum speed of airplanes was slightly over 500 miles an hour. To talk at that time about speeds of 1300 or 1400 miles an hour seemed but wishful thinking. Since then, the progress made has been enormous. In 1951, Douglas Pilot William Bridgeman, flying a special research airplane which his company had constructed under Navy contract and with NACA cooperation, reached a speed of 1,238 miles an hour, nearly twice the speed of sound at the altitude he was flying.

To provide the necessary tools, the giant wind tunnels, for the research, development and testing tasks of learning how to design and build tactical aircraft which would fly at such fantastic speeds, studies were begun in 1944 which evolved into what has since become known as the Unitary Wind Tunnel Plan. As finally written into law in 1949, and subsequently implemented by appropriations totaling about $250-million, the Plan calls for construction of three large supersonic tunnels, one each at the NACA's Langley Aeronautical Laboratory, Ames Aeronautical Laboratory, and Lewis Flight Propulsion Laboratory, one such tunnel to be operated by the Navy, and two large propulsion facilities and a gas dynamics laboratory at the Air Force's new Arnold Engineering Development Center at Tullahoma.

During 1953, procedures and operating controls, to insure widest possible use of the Unitary Plan tunnels in the manner envisioned by the planners of ten years ago, were nearing final form. And before the end of 1954, the first of the Unitary Plan supersonic wind tunnels is expected to be completed.

In order to study problems of flight at supersonic speeds, the NACA has had to develop varied and complicated research equipment. These include continuous-operation type tunnels, with test sections ranging in size up to 8 ft. by 6 ft. and with speeds extending to Mach numbers of 2 (twice the speed of sound) or more; free-flight rocket-powered models capable of speeds up to Mach numbers of 4, and various intermittent wind tunnels and air-jets which extend the Mach number range up to 9. Special ballistic techniques have been used to study problems at Mach numbers as high as 20, equivalent to more than 15,000 miles an hour, at sea level.

Two research facilities at the Langley Laboratory which went into initial operation in 1953 are the 8-foot transonic pressure tunnel, and the gas dynamics laboratory.

The new transonic facility is the third large wind tunnel at Langley used in the study of problems in this speed range. Compared to the other 8-foot tunnel at Langley, which can operate only at atmospheric pressure and in which only the speed can be varied, the new tunnel with its completely closed circuit is much more flexible in operation. Not only can speed be varied while the tunnel is operating, but also pressure and temperature.

Clean, dry air is stored under compression in a tank farm consisting of a large number of specially-built steel bottles manifolded together. The capacity is 20,000 cubic feet, and at the 5,000 psi storage pressure, the air weighs about 250 tons, and has a density of about ⅓ that of water. Heating devices can bring the air to a maximum temperature of 1040° F before use.

The facilities of the Langley gas dynamics laboratory have been so designed as to provide the necessary versatility to permit study of many fundamental problems related to very high-speed flight. These include flow around wings and bodies, stability of various body shapes, air inlets for supersonic aircraft, characteristics of air at very high temperatures, and effects of unsteady air flows on aerodynamic shapes. Altitudes up to 200,000 feet may be simulated, and speeds up to a Mach number of 9 attained.

The specially designed research airplanes, the product of the cooperative effort by the military services, the industry and the NACA, are being assigned an expanded mission, it was announced in 1953. In addition to continuing their fundamental role of exploring flight problems in the transonic and supersonic speed ranges, they now are being used for flight testing of design features suggested by research to solve or soften some of the troubles which aircraft experience at these speeds. Here, investigations can be conducted under controlled tunnel air conditions to study independently the effects of compressibility and scale effect through the transonic speed range.

Such operation is made possible by auxiliary equipment which pumps, cools, and dries the tunnel air. A compressor with 10,000 cu. ft./min. capacity is used to vary tunnel pressure from ¼ atmosphere to 2 atmospheres. Air drying equipment, used in conjunction with an 80 ice-ton refrigeration system, assures that air in the tunnel itself will be properly conditioned. Power for the tunnel is supplied by a 25,000-hp induction motor. New types of control systems make possible regulating tunnel speed to within ¼ of 1 percent, and temperature to within 2°.

Langley's gas dynamics laboratory is used in studying fundamental aspects of the problems of flight at very high speeds and altitudes. Because much of the work here is exploratory in nature, it was decided that test runs measured in minutes or even seconds would suffice. This permitted use of intermittent blowdown tunnels and air-jets which could be operated from a stored-air supply, rather than continuous-operation tunnels requiring as

NACA engineer checks supersonic ramjet engine for test

much as 200,000 hp. to attain the desired Mach numbers, which would be enormously expensive.

Air at high pressures and high temperatures is needed for the work conducted. The high pressures are necessary to achieve large-scale effects, and the high temperatures to avoid air liquifaction at the high Mach numbers, and also so that heat-transfer problems can be investigated.

Since the historic first supersonic flight by the Bell X-1 in 1947, the research airplanes have had a vital function in the coordinated research effort to attain the basic knowledge leading to practical faster-than-sound flight. Because of the complexity of some of the anticipated high-speed problems, it was realized they could be properly assessed only by actual flight. For example, when the Douglas D-558-II became longitudinally unstable at high speeds (the highest announced speed attained is 1,327 mph) it was experiencing a difficulty which had been anticipated from theoretical and wind-tunnel studies. Such instability, which would impair seriously the effectiveness of a combat airplane, could be thoroughly evaluated in flight by the D-558-II because of its capability of attaining the speeds at which this trouble was expected to develop.

Wind-tunnel research has indicated that several devices might be helpful in alleviating stability troubles, and these are being flight-proven. One such modification is the "fence." When installed on the wings of the D-558-II, fences serve to retard the tendency of air moving close to the wing surface to flow outward, and thus improve stability. The tests made with wing fences installed have shed considerable light on how similar investigations, in the wind tunnels, should be evaluated in the light of flight experience.

Another such design modification, based on a different aerodynamic principle, is the leading-edge chord extension of the wings. These extensions also have been flight tested on the D-558-II, and their effectiveness in improving stability is currently being analyzed and compared with predictions based on wind-tunnel data.

The third device is perhaps the oldest and best known, because it has been used in improving the stability of swept wing airplanes at low speeds. Leading-edge slats are installed on the wings, permitting the air to flow freely in the slot between the wing and the slat. This modification now is being investigated on the D-558-II in the transonic and supersonic ranges to determine whether it will be similarly effective at the higher speeds.

The capabilities of such devices with respect to other wing shapes were also under study, it was announced. The Bell X-5, equipped with wings whose sweep can be altered from 20° to 60° in flight, is being used in this work. The sweep range of the X-5 brackets the wing angles currently of interest for transonic and supersonic flight.

Two new airplanes have recently been added to the group of high-speed, specially-designed airplanes being used in the research program. One, the Douglas X-3, was announced during 1952; the other, a specially instrumented Boeing B-47 Stratojet bomber, was announced during 1953 as being pressed into service for flight studies of the interrelated aerodynamic and structural problems which are associated with the high-speed flight of large aircraft.

With missiles being flown at Mach numbers of 4 or higher, and with airplane speeds constantly being projected farther into the supersonic range, it was obvious in 1953 that the problems of aerodynamic heating, or skin friction, have become among the most important and urgent in aerodynamics. At sustained flight at a Mach number of 4 at 40,000 feet, the skin temperatures of a missile can rise to 900° F.

The basic problem can be divided into two parts: (1) the determination of the dependence of the heat inflow or rate of heating on the factors that govern it, and (2) the effect heating has on the structure, particularly when subjected to high aerodynamic forces. Progress has been made on both phases of this problem.

In studying the rates and manner in which aerodynamic heat flows into the skin of missiles and aircraft structures at various speeds, it has been necessary to devise new research techniques which would enable precise reproduction, on the ground, of the manner in which this takes place at speeds up to a Mach number of 4, and other investigations are being conducted on aerodynamic heating up to Mach numbers of 10, or 6600 mph at altitude. If such speeds were maintained, the temperature rise would approach 7000° F.

Perhaps the most obvious effect of aerodynamic heating is the reduction in basic strength of the materials used in aircraft and missile construction. This in itself is serious enough, but other problems arise which appear even more complex. One such problem stems from the fact that at high temperatures, materials tend to creep. That is, under the action of an unchanging load, the material stretches. In an airplane structure, for example, its useful lifetime might be limited by excessive distortion of the wings after continued flight at high temperatures. Depending on the temperature and load, the creep lifetime of a structure can vary between thousands of hours and only a few seconds.

An entirely different structural effect of aerodynamic heating occurs when an aircraft or missile structure is subjected to very rapid heating and portions of the structure undergo rapid changes in temperature. What happens, of course, is that the temperature distributions in the structure become uneven, causing thermal stresses and buckling, which can change its effective stiffness and tendency to flutter. Whether an airplane will flutter or not depends, in addition to aerodynamic considerations, upon its vibration characteristics which in turn depend on the stiffness properties of the structure. With stiffness lowered by aerodynamic heating, an airplane which otherwise was flutter free might suddenly develop flutter and be destroyed.

Recent development of turboprop and turbojet engines which have a very high power to weight ratio has quickened interest in the possibilities of designing aircraft which will possess both the vertical rising capabilities of the helicopter and the high speeds of conventional airplanes. The NACA, during 1953, gave attention to one of the most serious problems inherent in the concept of a vertically rising airplane, how to provide adequate stability and control during hovering and transition flight.

To produce direct lift for hovering flight, it is necessary to accelerate air straight downward. This can be done either by rotating the propellers through 90° as the airplane goes from normal forward flight to hovering, or it can be accomplished by deflecting the wings and flaps, by a sort of Venetian-blind arrangement, so that the slipstream is turned straight downward while the propellers remain in their normal attitude. It is the latter well-known concept for obtaining direct lift which the NACA has been using to simplify the study of stability and control problems.

By use of a Venetian-blind vertical-rising model, pitch, roll, and yaw control problems can be studied effectively. Yaw control is obtained by moving the flaps so the slipstream is deflected slightly backward from the vertical on one side and forward on the other side. Roll control is obtained by varying the pitch of the outward propellers differentially to increase the velocity of the downward-deflected slipstream on one side, and reduce it on the other. A rate-sensitive artificial stabilizing device, to provide additional damping in pitch, has been installed in the model to overcome unstable pitching oscillation characteristics.

One of the major problems confronting the designer in 1953 was to learn how to keep drag as low as possible, thus to obtain maximum speed with the power plants available. This, of course, is a problem that has been basic since the advent of the airplane, but today the possible gains, or losses, can be multiplied many times.

In the past, the difference between an optimum design and one second best, assuming the same power, might at most be only a few miles an hour. Today, the difference may be measured, literally, in hundreds of miles an hour. The state of the art in 1953 was being expanded so rapidly that no longer was there a substantial time margin between the acquisition of research data and the application to aircraft design.

The aircraft designer of 1953 was faced with a most difficult challenge, how to make effective use of new aerodynamic knowledge, almost as rapidly as it was being provided by the NACA and other research organizations, without compromising the almost equally difficult structural and weight requirements.

Among the major problems is flutter, which has been greatly aggravated by higher operating speeds and the designs by which these speeds are obtained. Basically flutter is vibration of some part of the airplane, excited by imposition of air loads. In World War II and before, flutter often involved a coupled bending torsion action of the wing. This type of flutter could be effectively restrained or avoided at the relatively low speeds of the day. It is still with us, but in addition, numerous other types of flutter are causing great concern.

By 1953, when flutter is mentioned, it has become necessary to specify what type. It might be bending-torsion, bending-pitching, one-degree-of-freedom-control, skin or panel, or chordwise. All types of flutter may become rapidly destructive. In the past it often was possible to design an airplane so its flutter speed—the lowest speed at which flutter occurs—was well beyond its top operational speed. With the high operational speeds now contemplated for the types being designed in 1953, there may be little if any margin between the predicted flutter speed and the expected operational speed.

Aeronautics Section
Library of Congress

Major achievement of the year was the completion by the Division staff of the editing of the Wright manuscripts in the Library and their publication as *The Papers of Wilbur and Orville Wright* by the McGraw-Hill Book Company. At the time the Wright papers were deposited in the Library of Congress in 1949, Oberlin College joined the Wright executors and Library officials in establishing in the Library the Wilbur-Orville Wright Memorial Fund and in arranging for the organization and editing of the manuscripts—the project of which this publication is the culmination. The two-volume publication contains more than 1,200 pages of text and 236 illustrations (halftones, line cuts, tables, charts, and diagrams). It includes all the correspondence between Wilbur Wright and Octave Chanute (1900-1910) ; most of the 33 Wright diaries and notebooks (1900-1919) ; excerpts from Chanute's letters to other persons about the Wrights; and the Wrights' correspondence with other members of their family and with scientists and others concerned with aeronautics. Also included in the publication are extracts from the diaries of the Wrights' father, Bishop Milton Wright, and selected articles, lectures, and other writings of Wilbur and Orville Wright. All the materials are annotated and six appendices summarize the technical and historical information scattered throughout the papers. An extensive bibliography and index complete the work which constitutes a permanent tribute to American inventive genius as exemplified by the life and achievements of the Wright brothers.

Weather Bureau

The Weather Bureau this year completed the first phase of the in-service pilot briefing training program introduced in 1952. Personnel engaged in pilot briefing duties, and many others, have now completed the intensive training course designed to increase briefing knowledge and improve briefing techniques.

The basic aviation forecast service has been greatly extended by providing much more forecast information on Service A teletypewriter circuits than heretofore. Previously most aviation weather forecast information was transmitted on Service C, a teletypewriter service not as uniformly available at local airports and aircraft operations offices as Service A. Service A users now have aviation forecasts and winds aloft analyses and a large number of terminal forecasts in addition to the observational data and the limited number of terminal forecasts previously provided.

Development of improved ceiling and visibility measuring devices and new observational techniques to provide pilots wth up-to-the-minute information when landing during low visibility conditions is continuing as a joint Air Navigation Development Board-Weather Bureau project. Runway observations at Washington National Airport were made throughout 1953 by means of remote-reading instrument equipment. These observations were used in routine aircraft operations on the instrument runway. Similar installations were planned during 1953 for all major New York terminals.

To increase the accuracy and amount of upper-air data, self-tracking wind-finding equipment was installed at several stations and plans were made to furnish this equipment to other stations. The network of radar storm detecting stations was expanded and a program was initiated to make radar weather reports available to pilots in flight for guidance through storm areas.

The Bureau is continuing the use of its Cessna 190 airplane for in-flight and on-station checking of aviation weather service.

Department of Agriculture
Forest Service

The Forest Service, U. S. Department of Agriculture, uses aircraft in connection with the protection and management of 150 National Forests, located in 40 States and in Alaska and Puerto Rico. Chief uses include the transportation of men and supplies during forest fire emergencies, fire detection and aerial reconnaissance of going fires, supplying remote and inaccessible stations, aerial survey, reseeding or revegetation of burned-over and denuded areas, spraying for insect control, and search and rescue. In

1953, the Forest Service owned and operated 17 single-engine, fixed-wing aircraft. In addition, the services of approximately 250 commercially owned and operated aircraft were chartered or contracted for at various times.

Use of fixed-wing aircraft by the Forest Service in 1952 totaled 10,705 hours. This included 2,739 flights, totaling 3,078 hours, by Forest Service airplanes; 3,736 flights, 7,505 hours, by commercial planes under contract; and 46 flights for 122 hours by aircraft of the Armed Services. Use of helicopters (commercially operated under contract) amounted to 76 hours.

A total of 8,148 fire-fighters and other passengers were transported during the year. Cargo transported totaled 529,087 pounds, of which 272,795 pounds was air freight (delivered at nearest airport), and 248,144 pounds was paracargo dropped by parachute.

The Forest Service's "smokejumper" corps of parachute-jumping fire-fighters, maintained during the fire season for service in National Forests of the western states, totaled 267. During the year, the smokejumpers made 836 jumps to 267 fires. They worked a total of 2,603 man-days on fires. Estimated savings due to smokejumper use amounted to $1,291,200.

For the fifth year, the Forest Service participated in an aerial spraying project for the control of spruce budworms in Oregon. This was a cooperative project, with U. S. Bureau of Entomology and Plant Quarantine, the State of Oregon, and private forest land owners participating. Approximately 371,000 acres were sprayed under contract in 1953. A total of nearly 3,161,000 acres have been sprayed in this project. The Forest Service and the Bureau of Entomology and Plant Quarantine also cooperated in aerial spraying of 120,000 acres on National Forests in Montana, and 11,280 in the Cibola National Forest in New Mexico for control of spruce budworms. Some 400 acres infested with pine butterfly were sprayed experimentally in the Boise National Forest in Idaho. In Wisconsin and Michigan, 11,280 acres of coniferous plantations were sprayed for control of spittlebugs and sawflies. All of these projects were carried out by contract.

Department of the Interior
Fish and Wildlife Service

Fifty-seven aircraft were owned and operated by the Fish and Wildlife Service, Department of the Interior, during fiscal year 1953. Eighteen of these were amphibians: 10 Grumman Goose planes and 8 Grumman Widgeons. Twenty-five were Pipers: Supercubs, Pacers, J 3 C's and J 5 C's. Seven were Boeing YL 15 observation planes; 2 were Stinson V 77's; 2 were Cessna 170's; and 1 Flying Station Wagon, 1 Aeronca Chief and 1 Twin Beechcraft complete the list.

These aircraft played a major role in such Service field activities as surveying waterfowl, planting waterfowl feed, controlling noxious vegetation, protecting agricultural crops from depredation, hunting predatory animals, conducting big-game and fur-animal censuses, and patrolling in connection with the enforcement of game and fishery laws.

Fifty-six Service personnel holding letters of flight authority flew more than 12,000 hours in operations in the United States, Alaska, Canada, Mexico, Cuba, Puerto Rico, Haiti and the Dominican Republic. Periodic flight checks were made to assure proficiency and familiarization with the aircraft.

The maintenance and repair of Service aircraft operating in the United States are handled through commercial shops. In the Territory of Alaska, however, where 40 Service planes operated during the year, the Service maintains overhaul and repair shops of its own.

Federal Communications Commission

The Aeronautical Radio Services (ARC) division of FCC reported a total of 39,315 authorized aircraft radio stations at the end of the fiscal year, June 30, 1953. Of that number, nearly 28,000 were private aircraft.

Also under FCC jurisdiction are twelve flying school radio stations, 101 flight test stations, 327 aeronautical advisory stations, and 380 aeronautical public service radio stations.

Aeronautical Radio Services provide the necessary radio facilities for communication essential in connection with aircraft operation and safety in the air.

The FCC has continued its participation in the various inter-agency coordinating and policy groups, both on a domestic and international scale. Among these groups are the Air Coordinating Committee (ACC), Radio Technical Commission for Aeronautics (RTCA), and the International Civil Aviation Organization (ICAO).

Post Office Department

The fiscal year ending June 30, 1953, showed a continued increase in the use of the air services. Over 1,367,000,000 pieces of domestic letter mail were transported, an increase of approximately 43,100,000 pieces, while there were over 18,000,000 pieces of air parcel post carried, an increase of approximately 1,400,000 pieces.

The total weight of air mail including air parcel post was approximately 76,000,000 pounds, a decrease of about 1,000,000 pounds under the previous year.

During the fiscal year 1953, a total of over 15,600,000 pounds of United States mail, including about 2,000,000 pounds of air parcel post and other articles, was transported by air to foreign and overseas destinations, showing an increase of over 1,100,000 pounds.

Foreign air parcel post service is now available to 95 countries. Air service for other articles, that is, prints, samples, newspapers, etc., is now available to 96 countries.

Bureau of Entomology and Plant Quarantine
U. S. Department of Agriculture

During 1953, insecticides to control grasshoppers were distributed by contract and Bureau aircraft over 706,266 acres in the West; 551,038 acres were treated to control Mormon crickets in the Western States; and some 180,000 acres in the Northeast were treated to protect forests from gypsy moth. In Oregon and Montana, 491,000 acres and in Canada 1,800,000 acres of forest were sprayed by aircraft to control the spruce budworm in 1953. These control programs were cooperative with many agencies.

Plant quarantine inspectors examined during 1952 more than 78,000 airplanes carrying over 1½ million passengers. More than sixty thousand lots of contraband plants or plant products were intercepted during these inspections. Much of this material contained insect pests and plant diseases and was destroyed.

In experimental research, aircraft were used in applying insecticides for control of white-fringed beetles, forest insects, grasshoppers, Mormom crickets, and in dispersing screwworm flies for use in biological studies.

Cooperative experiments to kill Japanese beetles in airplanes showed that a commercially available, medium-pressure, throw-away dispenser containing standard insecticide aerosol G-651 or military stock low-pressure aerosol is effective against the beetle.

Two new developments by an entomologist-chemist research team may lead to improvements over aerosol and residue spray treatments now used in airplanes to prevent accidental carriage of insect pests to new locales. One of them is a transparent residue with long-lasting qualities, obtained by adding a chlorinated polyphenyl to lindane. The second development is the use of lindane vapors in the plane. A filter screen impregnated with crystalline lindane is placed in the air conditioning duct. Study of their possible adaptation and safe use on commercial and military planes is being carried out cooperatively with the U. S. Air Force and the U. S. Public Health Service.

An airborne mist blower—a new type of spraying device attached to a helicopter—has been developed for control of the smaller European elm bark beetle, a vector of the Dutch elm disease fungus. It was found that sprays applied with this device gave as good results as those applied by hydraulic sprayers. Helicopter spraying provided heavier spray deposits in the tops of trees than hydraulic sprayers and eliminated spray run-off. However, spray deposit in the lower parts of the crowns of trees was less when helicopter sprays were applied.

Advantage can be taken of crosswind drift to reduce the cost of aerial grasshopper control on rangeland. This was demonstrated by tests of spray applications on 40-acre plots. The distance between each airplane run over the plots was twice the usual 65-foot interval. Direction and height of flight were chosen so as to take advantage of wind drift. Grasshopper populations were virtually eliminated.

Research shows that insecticidal spray deposits from low-flying aircraft vary greatly in any one flight, both laterally across and longitudinally along the line of flight. The variations primarily result from aerodynamic forces generated by the flight of the plane.

Spray patterns may be significantly modified and improved by modification in the spacing of nozzles and use, within the zone affected by the propeller slipstream, of fine sprays inboard in combination with coarser sprays outboard.

The Bureau cooperated with the Civil Aeronautics Authority in developing a high lift wing with square tips for use on Stearman aircraft. It showed few differences so far as basic spray patterns are concerned, except that spray caught in the wing-tip vortices is not carried so high as with the stock Stearman. With identical nozzle arrangements, there was apparently a wider effective swath with the high-lift plane. Although this re-designed aircraft performed satisfactorily, it was found that an undesirable longitudinal instability existed; however, development of the wing encouraged several companies to design and merchandise similar wings.

An aerial spray application of very fine atomization and 100 percent overlap, with 1.8 pounds of actual nicotine per acre, gave about 80-percent control (considered satisfactory) of the bean aphid on trellised beans in the Willamette Valley of Oregon.

Air Coordinating Committee

The Air Coordinating Committee, established in 1946, Executive Order 9781 of the President to coordinate Federal policy in the field of aviation, is composed of members from the ten Government Departments or Agencies having an important interest in aviation. On March 11, 1953, the President designated Robert B. Murray, Jr., Under Secretary of Commerce for Transportation, as Chairman of the Air Coordinating Committee. The other members are: Samuel C. Waugh, Assistant Secretary of State for Economic Affairs; Earl D. Johnson, Under Secretary of the Army; James H. Smith, Jr., Assistant Secretary of the Navy for Air; Roger Lewis,

LOW-COST AIRPOWER

"The creation of superior U. S. air power, capable of protecting our aerial frontiers and enhancing our national security, is a cooperative venture in which every American taxpayer plays a part.

"The new and complex aircraft required to defend the free world must fly farther, faster and higher, with ever-increasing bombloads and far greater firepower.

"As performance and resultant costs have increased, the military services and the aircraft industry have intensified their continuing cost-reduction campaigns. It is not only essential to our national economy to keep our air power costs at a minimum, but in the industry's view is also good business practice based on the American free enterprise and free competitive system."

—Adm. DeWitt C. Ramsey, USN (Ret.)
President, Aircraft Industries Association

Assistant Secretary of the Air Force; H. Chapman Rose, Assistant Secretary of the Treasury; John C. Allen, Assistant Postmaster General; Oswald Ryan, Chairman of the Civil Aeronautics Board; J. Weldon Jones, Economic Advisor, Bureau of the Budget (non-voting); and Col. Alvin B. Barber, Consultant for Transportation, Office of Defense Mobilization (non-voting). The Executive Secretary is Lee Moore.

At the request of the President, the Committee is in the process of making a comprehensive survey of aviation policy and is preparing a statement of present U.S. policies in the primary areas of aviation, for the President's consideration and approval.

During the year, further coordination was effected for domestic and foreign civil aviation requirements for new aircraft, maintenance, repair and operating supplies (MRO) for both air carrier and non-air carrier aircraft.

The Air Coordinating Committee has reviewed its policy regarding governmental support for a rigid airship development program in the light of recent technological developments and present day economic conditions. It reaffirmed earlier conclusions and concluded that if any development program is undertaken to determine the commercial utility of a large rigid airship it should be undertaken by private enterprise initially, with the grant of Federal support, if any, only after the necessity and practicability of such support is more apparent than at the present time.

Activities of the Committee in the economic field internationally have included studies and recommendations in ICAO regarding the joint international financing of air navigation facilities and services, also the elimination of important deficiencies in such facilities and services. It has continued work on international airport and airway user charges; a multilateral system for exchange of commercial rights in international air transport; and standardization and liberalization of restrictions or obligations imposed on other than scheduled services. The U. S. reviewed the technical need for ocean weather stations and advised ICAO that it had no civil requirements for such vessels and would withdraw from the ICAO program at the termination of the present agreement by June 30, 1954. The Committee reconsidered its policy regarding the provisions of facilities and services on island bases and territories of the United States insofar as that policy applies to Wake Island. In the legal field, the Committee's work included preparation of the U. S. position for the 9th Session of the ICAO Legal Committee, devoted to the revision of the Warsaw Convention. In accordance with established policy, where pertinent aviation problems have been involved, the Committee has continued to advise the Export-Import Bank regarding proposals for financing by the Bank of foreign air services and the export of aeronautical equipment.

The Committee approved and promulgated national standards prescribing the configuration of airport approach lights. A comprehensive review of U. S. international airworthiness policy is in progress as is consideration of a new international phonetic alphabet for use in air/ground communications. The Committee also prepared U. S. positions for seven international aviation conferences including two regional air navigation meetings—one at

Melbourne and one in the Canary Islands—as well as a general air navigation conference which was held at ICAO Headquarters, Montreal.

Aeronautical recommendations pertaining to the location and height of television towers were submitted to the Federal Communications Commission for consideration. Radar air traffic control operational evaluation was completed in the Washington Area and extension of such use of radar was recommended on a nation-wide basis. Meanwhile implementation of the coordinated very high frequency electronic system, and associated procedures for the U. S. Common System of Air Navigation and Traffic Control continued. In this regard, commencement of the first stage of decommissioning of the low frequency four-course radio navigational ranges was approved by the Air Coordinating Committee.

An important revision to the U. S. National Policy on Long Distance Navigation system is in final stage of consideration, possibly looking forward to ultimate use of a newly developed system recently released by the U. S. Air Force. An important study concerning the avoidance of aircraft collision with the terrain was completed. Recommendations were approved for the trial of special procedures in metropolitan areas of high density air traffic with the view to reducing the mid-air collision hazard. Also in this regard, the Society of Automotive Engineers was requested to determine methods for improving aircraft cockpit visibility. The ACC advised the Air Navigation Development Board as to the operational requirements for Helicopter navigation, as well as revised characteristics for an Air Traffic Control Airborne Radar Safety Beacon system and associated ground components, and an operational evaluation thereof.

The Committee continued coordination of joint use of airports by civil and military agencies, including planning, construction, modification, maintenance and operation. In this regard, anticipatory action by the Airport Use Panel was successful in resolving many problems before they became crucial.

Civil Aeronautics Board

The five-member Civil Aeronautics Board operated during 1953 for the first time in its 15-year history with a Republican majority. Substantial increases took place in volumes in all categories of air traffic. The expansion of air coach travel, both internationally and domestically, was making air transportation available to lower income groups.

Under the President's Reorganization Plan No. 10 the Board assumed responsibility for the first time for disbursement of payments to the airlines in regard to the subsidy element of mail rates, with the Post Office still making the payments for the compensatory or service element in mail pay.

The Board also established final mail rates upon petition of the Postmaster General for the carriage of first-class mail (3¢ postage rate) between Chicago and Washington, and Chicago and Newark/New York. Such mail is transported on a nonpriority, space-available basis for an experimental period of one year from October 1, 1953. The Board further decided that it is legally empowered to authorize by exemption the carriage and payment for this type of mail by air carriers other than holders of certificates authorizing the carriage of mail.

In the mail rate field, the Board in the Pioneer Airlines mail rate case, established a policy against underwriting losses stemming from substitution of trunk-line type transport aircraft of greater capacity than the Board considered reasonable for a local air carrier.

New York Airways began passenger operations in its helicopter service, under the authorization previously received from the Board in 1951.

Safetywise, the Board indicated that for the scheduled domestic and international airlines, the year 1953 probably was one of the safest, so far as passenger fatalities were concerned.

CHAPTER FIVE

The Airlines

AMONG THE MILESTONES signalizing the Golden Anniversary of powered, controlled flight, two are worthy of especial mention.

Family fare, coach and tourist passengers flying on the domestic scheduled airlines in 1953, at press-time, were expected to account for more than four billion passenger miles, as against the 1949 (first full year of scheduled reduced-fare operations) figure of 741,645,000 passenger miles—an increase of more than 400 percent.

The introduction of tourist-class air travel into the trans-Atlantic picture reduced the cost of this type of travel by as much as 50 percent. The average trans-Atlantic air fare in 1945 stood at about $600 for a one-way crossing. In 1953, it was down to two-thirds of that level for first-class travel ($395) and down more than 50 percent for tourist travel ($275).

Instrumental in the increasing movement of aircraft and their contents across international borders has been the constant fight on the part of the scheduled airlines against red tape. Their efforts, in conjunction with those of the International Air Transport Association (IATA) and the International Civil Aviation Organization (ICAO), have reduced, since 1949, the time required to clear passengers and cargo at gateway airports on the North Atlantic route by 75,000 man-hours per year. The cost of producing document forms has been cut as much as 30 percent. The number of man-hours necessary to complete documentation in airline offices has been reduced 35 percent on the routes between the Americas and 40 percent in North Atlantic routes, the latter alone representing a saving of 60,000 man-hours per year. At the same time, the cost of visa fees for clearance documents has been reduced by 50 percent on Europe-Far East routes and 35 percent on routes between the Americas.

U. S. scheduled airline traffic figures for the first six months of 1953 indicated that the growth in scheduled airline operations is a continuing trend. The 15-million passengers carried by the scheduled airlines during that period was an increase of more than 18 percent over the same period in 1952. Moreover, it was estimated that the scheduled airlines would have flown in excess of 31-million passengers by the end of 1953. Mail ton-mileage was up 2.7 percent, while the volume of cargo (express and freight) registered a gain of 11.5 percent over the first six months of 1952. Estimates indicated that year-end figures would show that the scheduled airlines had flown more than 180-million pounds of air mail. With regard to air freight, Emery Johnson, vice-president and general manager of Air Cargo, Inc., predicted that a "record-shattering 275 to 300 million ton-miles of air freight will be carried by U. S. domestic airlines during 1953." To meet this increasing volume of traffic through 1954 and succeeding years, the scheduled airlines have on order 189 of the latest model, high-performance piston aircraft currently available.

There follows a comparative table showing traffic statistics for the major scheduled airlines during 1952 and 1953 (estimated).

U. S. DOMESTIC TRUNK LINE STATISTICS

	1952	Estimated 1953	Percent Change
Revenue Passenger Miles (000)	12,120,789	14,666,155	21.0
Revenue Passengers	22,768,174	26,752,605	17.5
Revenue Plane Miles	411,423,871	471,080,332	14.5
Mail Ton Miles	68,296,296	70,413,481	3.1
Express Ton Miles	40,375,164	48,127,195	19.2
Freight Ton Miles	117,128,101	132,839,138	13.3
Operating Revenues	$768,014,593	$922,385,526	20.1

INTERNATIONAL

	1952	Estimated 1953	Percent Change
Revenue Passenger Miles (000)	3,019,059	3,438,708	13.9
Revenue Passengers	2,362,059	2,751,799	16.5
Revenue Plane Miles	103,399,070	110,637,004	7.0
Mail Ton Miles	27,713,051	30,484,356	10.0
Express Ton Miles / Freight Ton Miles	72,627,275	71,029,475	— 2.2
Operating Revenues	$314,918,902	$346,095,873	9.9

Allegheny Airlines

Under a plan, approved by the Civil Aeronautics Board on January 8, 1953, those corporate assets allocated to the Engineering and Research Division of All American Airways were transferred to a new company named All American Engineering Company. Pursuant to stockholders' approval at this same meeting, the Airline Division changed its name to Allegheny Airlines, Inc.

Allegheny Airlines' certificate was renewed by the CAB in April of 1953 through 1956 and the line's routes were extended to include Cleveland, Ohio; Erie, Pennsylvania; and Huntington, West Virginia.

In April, Leslie O. Barnes was elected President of the company succeeding Robert M. Love who became Chairman of the Board of Directors.

The National Safety Council again presented Allegheny the Aviation Safety Award in recognition of 91,381,000 passenger miles operated through 1952 without a passenger or crew fatality.

While traffic increased substantially, outstanding achievement for the company was the development of $15,674 during the nine months ending September 30, 1953, as compared with a loss of $124,386 in the same period of 1952.

American Airlines

During 1953 for the first time in the history of the domestic airlines, American flew more than 3-billion passenger miles.

The record month was June, when American became the first airline to fly in excess of 300-million passenger miles in a single month. Passenger mile volume during the months of July, August and September also was in excess of this figure.

Another passenger record was set on July first, when American flew over 12-million passenger miles in one twenty-four hour period.

Airtourist traffic was responsible for the greatest passenger traffic increase in 1953. By July, the volume of Airtourist capacity had increased 100 percent over July of last year, and plans for a substantial increase in Airtourist service in 1954 were underway, including service to several additional cities. All of American's Airtourist DC-6's have been converted to 80-seat capacity.

Late in 1953 the first nonstop transcontinental service in both directions was inaugurated by American with the new DC-7, providing coast-to-coast service in less than eight hours. By year-end, American had on order 25 of these planes, which cruise at 365 miles per hour at an altitude of 25,000 feet, can carry nearly 14,000 pounds of cargo, and are powered by four Wright R-3350 Turbo-Compound engines of 3,250 horsepower.

Airfreight ton miles flown by American during the first nine months of 1953 were 38,226,841, 16 percent greater than for the same period in 1952. During the summer, the airline placed in scheduled transcontinental service three DC-6A Airfreighters, the first such aircraft built without windows. Powered by four Pratt and Whitney 2,400-horsepower engines, this airplane can carry 30,000 pounds of cargo 310 miles an hour in its 5,000 cubic feet of unobstructed cargo space. It has a maximum cruising range of 2,600 miles.

The first of the DC-6A's was delivered to American on June 29, and flown from Los Angeles to New York with a record load of more than 25,000 pounds of cargo.

Air express traffic increased 15.6 percent and air mail ton miles were up 2.5 percent during the first nine months of the year over the comparable period in 1952.

The company's net income for the year 1952 was $12,514,000, largest in the company's history. For the first six months of 1953, net income was $6,658,150, as compared with $5,099,518 in 1952.

With additional deliveries of airplanes during the year, American's fleet on September 30 was composed of 50 DC-6's, twelve of which are 80 passenger Airtourist planes, 25 DC-6B's, 77 Convairs, three DC-6A Airfreighters, 13 DC-4 Airfreighters and one DC-4 70-passenger airplane. With completion of the order on the 25 DC-7's next year, American's fleet will total 194 aircraft.

In April, to take care of its increasing volume of internal communications, American Airlines and the Long Lines Department of the American Telephone and Telegraph company unveiled a new, completely automatic teletype system. The system, called the 81-D-1, features automatic switching among circuits, automatic priority to urgent messages and automatic pushbutton addressing of air-to-ground messages.

Braniff International Airways

On June 20, 1953, Braniff marked its twenty-fifth anniversary. A system-wide observance of the date took place from Minot, North Dakota to Buenos Aires, Argentina, with President T. E. Braniff cutting a birthday cake at the Dallas Love Field base in one of the airline's big hangars.

Braniff and United Air Lines inaugurated their interchange service between Seattle, Washington and Houston, Texas on September 27th. This DC-6 service is a direct flight between the Pacific Northwest and the Southwest United States. Braniff crews fly the DC-6 between Houston, Dallas, Oklahoma City and Denver, where United crews take over and fly the plane via Salt Lake City, Boise, and Portland to Seattle.

A program to streamline its entire overhaul operation, and develop precision maintenance wherever possible is currently under way at Braniff's 54-acre Dallas, Texas base.

Braniff's objective is three-fold, to reduce maintenance costs, better utilize the company's skilled man power, and replace hand-work with precision maintenance in every shop on the base where such a change-over is practical.

Pioneering in the field of international flight service, Braniff, on November 2, 1953, inaugurated DC-6 tourist flights twice weekly to Buenos

Aires, Argentina. These flights combine first-class and tourist class service in the same DC-6 airplane and also provide the first DC-6 service offered by any carrier to La Paz, Bolivia and Asuncion, Paraguay.

Capital Airlines

By year's end an estimated two and a half million passengers had flown Capital Airlines.

At the end of September, 1953, 1,700,000 passengers had flown 542,374,527 revenue passenger miles as compared to the same period the year before when 1,489,891 passengers flew 467,316,043 revenue passenger miles. For the entire year of 1952 Capital carried over two million persons.

Some of the increase in business was due to the over-all upswing in airline transportation but the answer to much of the growing traffic could also be found in Capital's intensive selling of special charter flights and vacation packages.

By mid-November the airline announced that for the first time in its history, charter business amounted to over $1-million in revenue.

In mid 1953, Capital inaugurated one of the first major experiments in installment payment plan for the purchase of air transportation. A "pay-after-you-go" seven day all-expense vacation to Bermuda was introduced Pittsburgh. The idea later spread to other cities on the Capital system. Travelers made application and purchased the package tour at the offices of their travel agents or Capital Airlines. The total price covered round-trip air fare, a choice of hotels. meals, sightseeing trips and ground transportation between airport and hotel at Bermuda.

On September 4, the Friday before Labor Day, Capital hit a new high in daily passenger revenues when $119,114 was recorded. The previous high was $115,367 on Friday. June 2 of the same year.

In June, Capital was presented with the aviation safety award by the National Safety Council.

As the first airline ever to sponsor a television network show, Capital Airlines contracted to carry the "weather" sequence of the Dave Garroway show "Today." Capital's messages, aimed at strengthening the airline industry, reach an audience of an estimated 3-million.

Capital Airlines entered into a contract with Lockheed Aircraft to purchase an additional five Constellation planes. Three of the new aircraft were delivered during 1953 with the balance scheduled for the first few months of 1954. When the order has been completed, Capital's fleet will consist of a total of 62 airplanes.

A new method for processing and cleaning spark plugs was introduced by Capital during the year. The operation enables one man to clean, gap, test and wrap 9000 spark plugs each month as compared to the 4000 monthly previously handled by a staff of four men. Centralization and consolidation of procedure played an important part in establishing this new set-up.

A city passenger bus was converted into an engine test cell by Capital during 1953. Insufficient space for a needed engine test cell prompted this move, cutting installation costs considerably. The remodeled bus has a frame to hold the engine to be tested with all the instruments for checking set on a dial immediately behind the driver's seat in the remaining half of the bus cabin. When an engine is to be tested, it is mounted and the bus is driven to a remote edge of the airport apron for the six hour test.

Capital celebrated its twenty-sixth anniversary in 1953. Jose Deang was named Man of The Year at ceremonies held in Washington in May. The 35-year-old instrument testing specialist received the award for his contributions in the field of instrument testing machines.

The airline is now operating free of subsidy. Mail payments are based on a service-rate. As of the end of September 1953, the airline had transported 8,922,095 pounds of mail as compared to 8,004,716 during the same nine months period of 1952. Air Express poundage amounted to 13,794,-989 for the first nine months and air freight handled totaled 11,448,923 pounds. For the same period 1952, air express reached 10,553,843 pounds while air freight amounted to 11,195,701 pounds.

Operating income for the first nine months of 1953 exceeded the same period in 1952 by $1,648,355. Operating income for the first three quarter period in 1953 amounted to $2,704,438 while during the corresponding period in 1952 it was $1,056,083.

Earnings per share for the first nine months of 1953 were $1.60 as compared to $1.17 per share for the same period in 1952.

Net profit was $1,261,229 for the first nine months of 1953 after a provision for Federal taxes of $1,267,000, as compared with a net profit of $916,343 after a provision of $204,000 Federal taxes for the same period in 1952.

Total operating revenue for the nine month period this year amounted to $34,348,952 as compared to last year's three-quarter figure of $29,484,532.

Total number of passengers carried also showed a sharp increase. As of September 30, Capital had carried 1,699,548 persons 542,374,527 revenue passenger miles while last year in the same period 1,489,891 persons flew 467,316,043 revenue passenger miles.

Central Airlines

Central Airlines, a scheduled, local service carrier serving 18 cities and towns in Texas, Oklahoma and Kansas, marked 1953 as its best year since its inception on September 15, 1949.

The airline during the year began a beverage service on all of their DC-3 flights and installed fans in the cabins of its aircraft to make passengers more comfortable. Also, late in 1953, the company announced that it would man all of its aircraft with stewardesses.

Central Airlines, whose headquarters is at Meacham Field, Fort Worth, Texas, for the fourth consecutive year received The National Safety Council aviation award for having completed a year of operation without accident or injury to passengers or crew.

Continental Airlines

Continental Air Lines in 1953 opened a new interchange service with United Air Lines between Tulsa, Wichita, Denver and the Pacific Northwest, and chalked up increases in passengers carried, passenger revenue and air freight.

DC-6 planes first flew over the CAL-UAL interchange on September 15. One round trip daily is made over the new route. Denver is the exchange point for airliner crews, with Continental personnel flying the Denver-Wichita-Tulsa segment.

Passenger revenue rose 11.5 percent for the first six months of 1953, compared with the first six months of 1952. Number of passengers carried was 6.78 percent greater than the number of passengers who flew on Continental planes during 1952.

Total passenger revenue for the first six months of 1953 was $4,473,978, compared with $3,874,836 for the same period of 1952. Passengers carried totaled 180,321 for the first six months of 1953, compared with 168,871 passengers flown for the same period of 1952.

Continental noted a 7.22 percent increase in ton miles of air freight flown during 1953. In the first six months of 1953, ton miles were 400,132. In the same period of 1952, ton miles amounted to 373,189.

Boosted by the sale of Convair 240 aircraft, Continental Air Lines' net income also rose during the first six months of 1953. By June 30, net income amounted to $1,040,204, compared with $88,940 for the same period of 1952. The 240's were replaced by a fleet of Super Convair 340 planes.

Net income without the sale of the Convair 240 aircraft was $47,878 for the first six months of 1953, compared with $88,939 for the same period of 1952.

With the sale of Convair 240's, net income for this first six months is equivalent to $2.60 per share, compared with 22 cents per share on the income of the first six months of 1952.

Decreases were noted in mail and charter revenues. There was a 24.3 percent decrease in mail revenue. Mail revenue was $449,319 for the first six months of 1953 and $660,004 in 1952. Charter revenues dipped from $141,668 for the first six months of 1952 to $3,408 for 1953. The drop was caused by the operation of a leased DC-4 for military charters in 1952, but not in 1953.

On July 15, Continental celebrated its 19th anniversary. The airline has flown a total of 2,089,204 revenue passengers and 759,629,963 revenue passenger miles (through August), in its 19 years of operation.

The airline was awarded during 1953 the Aviation Safety Award for 1952 by the National Safety Council. The award was made in recognition of the airline's perfect safety record in 19 years of service. Continental has never had a fatal accident.

Most unusual cargo during 1953 was shipment after shipment of live ladybugs. The insects were destined for Southwestern farmers plagued by crop-destroying Japanese beetles and for Texas cottonfields threatened by green bugs.

Delta-C&S Airlines

On May 1, 1953, the Civil Aeronautics Board formally transferred the routes of Chicago & Southern Air Lines to Delta Air Lines, Inc., and authorized the combined company to operate as Delta-C&S Air Lines.

April was the heaviest month in the history of Delta in number of passengers carried. During April, preceding the merger of Delta and C&S, total Delta passengers exceeded 100 thousand for the first time in any single month. The previous record was 99,981 passengers carried in March. The goal now for the combined system is 200,000 passengers in a single month.

For the seventh straight summer Delta-C&S offered all-expense packaged vacations to Miami Beach and Nassau. The 1953 summer package, effective from April 15 to November 30, offered accommodations at a choice of eight hotels and was expanded to include many additional entertainment features, planned especially for the large number of repeat vacationists.

In addition, the airline offered low-cost packaged Aircruises to Havana and Varadero Beach, Cuba; Kingston and resorts on the north shore of Jamaica; Port au Prince, Haiti; Ciudad Trujillo, Dominican Republic; and San Juan, Puerto Rico.

The third edition of Delta-C&S illustrated guide to Greater Miami was published in 1953.

For the second summer, Delta-C&S continued its non-stop DC-6 Chicago-Miami aircoach service during the summer months, and it operated with an average of 80-85 percent of its seats occupied.

Aircoach service between Atlanta and Dallas was inaugurated March 1, 1953, with new Convair 340 equipment; and on September 1, 1953, aircoach service was inaugurated between Chicago and New Orleans with Constellation equipment. On September 27, 1953, aircoach service was inaugurated between Detroit and Dallas with Convair 340 equipment.

Late in 1952 Delta took delivery on the first of 20 Convair 340's and the first scheduled flight was inaugurated March 1 between Dallas and Atlanta. Delta and C&S had both ordered 10 of the new ships, with delivery during 1953, making a total fleet of 20 Convair 340's at a cost of $12 million. The twin-engine 44-passenger ship is an advanced version of the Convair 240, which has been flying since 1947. It is pressurized and air-conditioned, has a built-in forward ramp, and a self-service baggage rack for passengers who prefer to handle their own baggage.

Also, the company's order of four DC-7's, scheduled for delivery in 1954, was increased to 10, representing a total investment of $17.5 million.

Delta-C&S set an unofficial speed record when it inaugurated its first non-stop service between Chicago and New Orleans on September 27. Captain Lonnie Shannon flew the 870-mile route in 2 hours, 36 minutes at an average speed of 335 miles per hour, with Constellation equipment. Scheduled time is 3 hours, 25 minutes.

The Delta-C&S merger agreement called for the exchange of $10,695,846 of Delta's one and one half percent debentures for 509,326 shares of C&S stock outstanding. These were issued on May 1, 1953, and exchanged for C&S stock. For each share of C&S stock, the stockholder received approximately $21 worth of debentures. Under the conversion privilege the debentures could then be exchanged (at the option of the holder) for Delta common stock at the rate of one share of Delta stock for $35 of debenture.

The entire merger case, involving thousands of pages of testimonies, was completed in approximately a year's time.

A new expansion and improvement program costing approximately $200,000 was completed during the year at the Delta-C&S General Office and overhaul base in Atlanta. The program included new construction as well as renovation and air conditioning of the general office building and additional buildings just leased by Delta-C&S. Total new space for offices, 29,100 feet; for maintenance and warehouse, 20.100.

Eastern Air Lines

Commemoration of the 50th Anniversary of Powered Flight, celebration of its own 25th Anniversary, and an important change in management were top events in 1953 for Eastern Air Lines.

On May 1, Eastern marked the passage of a quarter-century since its predecessor company, Pitcairn Aviation, inaugurated airmail service between New York and Atlanta—a seven-city, 792-mile route which grew into the present-day network that covers 12,745 route miles servicing 93 cities in 24 states and Puerto Rico. In flying equipment, the airline has grown from the eight original open cockpit Mailwings that became known as the "pony express of the air," to a fleet of 103 modern airliners, with 16 additional compound-engine equipped Super-Constellations to be received by the early spring of 1954.

Eastern celebrated its 25th birthday with simultaneous festivities in all of its system cities, re-enactment of the first Atlanta-New York airmail flight in the same type of plane by the same pilot, Captain Gene Brown, who blazed the route back on May 1, 1928, and the inauguration, at Baltimore, of a "Span of Flight" air show which subsequently was presented at 31 other Eastern system cities. This free demonstration of the progress of aviation featured a unique collection of ancient aircraft: a 1910 "Pusher" biplane very similar to the linen-and-bamboo kite flown by the Wrights at Kitty Hawk; a 1917 Spad, sistership of the famous French fighter flown by Captain Eddie Rickenbacker against the Germans in World War I; and one of the original Pitcairn Mailwings.

Eastern also passed another milestone when on October 21 it carried its 25 millionth passenger.

The big management news came when Captain Eddie Rickenbacker, who took over the leadership of Eastern Air Lines fifteen years ago, announced directors' approval of the management team he had developed to guide the airline in the future.

As a result of the elections which took place at a special meeting of the company's Board of Directors, Captain Rickenbacker became Chairman of the Board, while still retaining his position as Chief Executive Officer and General Manager of Eastern Air Lines which he has held since the organization of the present company in 1938.

Elected to succeed him as President was Thomas F. Armstrong, 51, who joined the original company as an apprentice bookkeeper in 1928.

Eastern earned in the first nine months of 1953 a net of $2,795,911, or $1.13 a share after normal Federal income taxes, as compared with the adjusted net profit of 72 cents a share for the same period in 1952.

This adjustment of the previous year's net from .74, as reported, to .72 reflected the distribution of 83,029 shares of capital stock through the Employee Stock Purchase Plan completed in December of 1952, bringing the total stock outstanding to 2,478,601 shares.

The provision for Federal income taxes for the first nine months of 1953 was $9,729,000 compared with $5,938,000 covering the same period the year before. Gross revenue of $111,344,108 showed a 26.3 percent increase over the $88,143,434 for the comparative period of 1952.

Operating expenses for the nine months totaled $98,819,197 contrasted with $80,431,559 for the same three quarters of 1952. The operating ratio between revenue and expenses, including depreciation but before taxes, was 89.3 for the first nine months of 1953 as compared with 91.7 for the 1952 period.

Depreciation charges of $13,252,995 for the nine months were 47 percent greater than the $8,986,402 allocated to this account during the first three quarters of 1952.

While revenue plane miles were increased only 12 percent to 57,659,000, revenue passenger miles were increased to 1,973,060,000, a gain of 30 percent.

Revenue passengers carried increased 25 percent to a total of just under 3¾ million for the first nine months.

The net profit as reported did not include profits realized from the sale of the balance of aircraft replaced by the 60 new 40-passenger Silver Falcons which, with 13 new 88-passenger Super-Constellation airliners, are now in regular operation.

Flying Tiger Line

The Flying Tiger Line reported gains for an all-time high in revenues during 1953. Domestic common carriage and charter airfreight increased more than 60 percent.

Company officials executed an agreement in March, 1953, with Slick Airways, Inc., to merge with the Flying Tiger Line. Approved by stockholders of both companies, the merger proposal is now awaiting action by the CAB.

Gross revenues for the year totaled $25,735,679 for a gain of 18 percent over the previous year's gross. At the end of the year, the company was operating a fleet of 26 C-46 aircraft and eleven DC-4 aircraft, plus one DC-6A leased on a month- to-month basis.

In addition to pushing the development of the airfreight business over its certificated route, the Flying Tiger Line was a civilian contributor to the Pacific Airlift in support of military forces in the Far East. In the year just past, Flying Tiger DC-4s committed to the Airlift increased the number of flights accomplished by 23 percent.

Hawaiian Airlines

On November 11, 1952, Hawaiian Airlines completed 23 years with a perfect safety record, the longest period of safe operation of any airline. Hawaiian was the first airline to receive the National Safety Council's 22 year award and has maintained its perfect safety record to date.

Hawaiian's passenger traffic was up 6.58 percent during the first eight months of 1953. During the period January through August 1953, Hawaiian carried 273,613 revenue passengers as compared with 256,731 revenue passengers carried during the same period 1952. Hawaiian's addition of new 44-passenger air-conditioned pressurized Convair 340's to scheduled service plus an increased influx of tourists from the mainland played a large part in the traffic increase.

Mail carried during the first eight months of 1953 amounted to 275,934 pounds, an increase of 17.6 percent over the 234,496 pounds carried during the same period in 1952.

Cargo carried by Hawaiian was up 21.84 percent, with 13,453,440 pounds of revenue carried during the first eight months of 1953 as compared with 11,042,074 pounds carried during the same period in 1952.

Hawaiian now has five 44-passenger Convair 340's, seven 24-passenger Douglas DC-3's and three Douglas DC-3 cargoliners in scheduled operations with more than 60 flights daily between the six major Hawaiian Islands.

Helicopter Air Service

Forty communities in the Chicago area were served during 1953 by Helicopter Air Service, Inc., which flies approximately 1200 miles per day on northern, western, and southern routes.

Operating a fleet of six Bell 47D helicopters, the company also carries air mail from the Chicago Municipal Airport to the roof of the Main Post Office, Van Buren St., Chicago. Thirty-six trips were being operated daily on this "shuttle" route during the year.

Helicopter Air Service has set a safety record for helicopters of 25,000 hours in the air, covering 1,350,000 miles, without accident.

Future plans contemplate the transportation of air mail, air express and passengers on an expanded route system. The route pattern will, however, remain essentially a local "short-haul" system.

Lake Central Airlines

Lake Central Airlines celebrated its fourth anniversary of continuous scheduled flight operations late in 1953. During its first four years, the local-service airline has grown from a company employing approximately 25 employees and covering about 200 route miles, to an organization that employs a staff of 300 spread over five states with a total route mileage of 1500 miles.

Approximately 20 million revenue passenger miles were flown by the company between January and October 31, 1953, without an accident fatal to crew or passengers.

The first ten months of 1953 showed a 60 percent increase in passenger boardings over the number for the same period in 1952. Since the inception of scheduled flight operations, each successive month in 1953 brought a substantial increase in passengers boarded, and during at least one day each month, a new record in boarding was established. The most recent daily boarding record was set on October 21st, an increase of 4.5 percent over the previous record made September 18, 1953.

As passenger loads increased, express and freight also climbed. Three Douglas DC-3's were purchased by Lake Central from Braniff International Airways and placed into service in April, 1953.

During the latter part of November, the Line's certificate for air mail route No. 88 was extended by the Civil Aeronautics Board until January 1, 1956. CAB had previously extended Lake Central's certificate for Route No. 88 on December 30, 1952, but at that time issued a show-cause order as to why the certificate should not be extended to January 1, 1956. The recent decision was a result of the show-cause order.

Lake Central plans to use seven aircraft to provide the frequency of service proposed over its system. Over two milion scheduled miles carrying 70,406 passengers are estimated for the year. The airline is presently conducting research studies to determine the possibility of further route expansion and improved scheduling.

National Airlines

For the first time in its 20 years' history, National Airlines will be operating hourly daytime schedules between New York and Miami, the company announced in '53. They will be flying this route with the new DC-7. Four of the DC-7's were ordered by NAL during the year to be placed in service in January of 1954.

In addition, National has recently inaugurated new 280 mile-per-hour Convair 340 service throughout Florida, around the Gulf of Mexico and along the Atlantic seaboard to New York. The Miami-based air carrier has received delivery on eight of these twin-engined, 44-passenger aircraft.

With these 12 new aircraft, National will be able to service nearly three times as many air travelers in 1954 as in 1953.

The 50th Anniversary of Powered Flight, celebrated in 1953 throughout the world, was marked by National with several "air age" developments of high importance.

A giant new six-bay hangar at New York's Idlewild airport was turned over to the airline by the Port of New York Authority. NAL's big DC-6's and DC-7's will be serviced at this new facility at the northern terminus of their system.

A new million dollar engine overhaul base was recently opened by National in Miami, Florida. Engine overhaul operations for National's 33-city system will be carried on there.

In the fall of 1953 National was delivered an 8-passenger Sikorsky S-55 helicopter. The airline will inaugurate a new type air service with the helicopter, feeding passengers in and out of major terminals in southern Florida.

Twenty years ago the airline had one 142-mile route between St. Petersburg and Daytona Beach, Fla., operated with two 4-passenger, single engine Ryan aircraft. Net profit for the fiscal year ended June 1953 topped $4 million and National now has a fleet of nearly 40 aircraft, with yearly revenue passenger miles climbing to the billion mark.

North Central Airlines

The number of passengers carried on the North Central system in the first nine months of 1953 exceeded by 9,910 the number of passengers carried during the entire year 1952.

In September the company attained a system-wide revenue passenger load factor of 51.02 percent, highest since the airline replaced its original fleet of Lockheed 10A aircraft with larger DC-3 equipment in spring, 1951.

During that month the airlines' 21-seat DC-3 Northliners carried an average of 10.7 persons at all times on all flights. The all-time high was 55.72 percent set in August, 1950, when the company (then called Wisconsin Central Airlines) was flying the smaller 9-place Lockheeds.

The airline carried 23,369 revenue passengers in September, an increase of 31.5 percent over September a year ago when 17,770 persons were carried.

In attaining the new high in passenger loads, the airlines' fleet flew an aggregate 393,670 miles, completing 99.33 percent of all flights scheduled.

During the year, North Central extended its routes 372 miles, bringing its total unduplicated route mileage to 2,659.

Early in November, 1953, the company commissioned another DC-3 transport, bringing to 19 the total number of aircraft in its fleet.

Twice this summer, the airline has figured dramatically in emergency shipments of Gamma Globulin. On July 21 and 22, the airline flew top priority 1,000 pounds of the serum from Detroit to Marquette, Mich. The $200,000 supply was injected in 10,000 youngsters in Marquette county, in the upper peninsula of Michigan. In August, the airline carried a similar shipment to St. Cloud, Minn., for an "Operation Lollipop."

On Aug. 20, the life of a nine-month girl was saved when an iron lung was dismantled at Chicago and put aboard a North Central DC-3 for Marquette.

Northwest Orient Airlines

Northwest Orient Airlines, the name adopted by the company to stress the importance of its operation to the Far East, underwent a major change of management when Harold R. Harris became president and chief executive officer early in 1953. He succeeded Croil Hunter, who became chairman of the board.

Shortly after he assumed the presidency, Harris directed negotiations for a bank credit of $21 million which enabled the company to pay off a previously incurred indebtedness for aircraft and to finance an order for six Lockheed Super-Constellations. Delivery of this fleet is expected to begin late in 1954.

Meanwhile, a leasing arrangement was entered into for the acquisition of a fleet of Douglas DC-6B's. The first of these planes went into operation in late 1953. These new aircraft supplement service by Northwest's fleets of Boeing Stratocruisers and Douglas DC-4's and 3's.

Early in 1953 Stratocruiser service was extended to the Philippines, so that the "Orient Express" operated over the entire 9,270 miles between New York and Manila. Non-stop service was inaugurated between Seattle and Chicago, also between Portland and Chicago.

Management was reorganized to provide more adequate control and administration of the company's expanding affairs. Since Northwest's trunk line falls into two general geographical areas, a Continental and an International division were set up. To direct and co-ordinate the work of the two divisions, a system chief executive office was established, with headquarters in New York City.

Revenues, as well as passenger, mail, express and freight volumes for the first eight months of 1953, the period for which figures were available, compared with the corresponding period of 1952. Estimates, based on these figures, indicated similar increases of 1953 over the previous year.

Total operating revenue for the first eight months of 1953 amounted to $41,384,999, compared with $35,601,239 for the like period of the previous year. Net profit was $1,131,973, compared with $243,361 for the first eight months in 1952. Figures for the eight months of 1953 and 1952 were as follows: Mail, 3,277,739 revenue ton miles and 3,025,574 ton miles respectively; express, 1,273,621 and 1,224,210; freight 7,576,315, and 7,259,511.

For the first time in its history, Northwest had a million passenger year, an increase of approximately 20 percent over the 1952 total of 938,000.

Institution of non-stop flights between Seattle and Chicago resulted in the setting of new speed flight records between these Pacific coast and midwest cities; the latest was four hours and forty-four minutes.

The airline received from the National Safety Council an award for flying 1,367,239,000 passenger miles without a passenger or crew fatality in passenger carrying operations during 1952.

In addition to its regular commercial airline operations, Northwest continued its activities as a prime contractor in the Korean airlift, transporting military personnel and material. When part of Japan was inundated by unprecedented rains. the airline flew supplies to the flooded areas.

Ozark Air Lines

On September 26, 1953, Ozark Air Lines completed its first three years of scheduled operations with a 55 percent increase in number of passengers carried in the first eight months of this year as compared with the corresponding period of 1952.

On October 16, 1953, Ozark carried 624 passengers, setting a record for the largest number of passengers carried in a single day since operations began three years ago.

Ozark is asking the Civil Aeronautics Board to strengthen its route structure by extending its service to more than a dozen new cities and by authorizing new segments from Kansas City to Columbia, Missouri, Paducah to Louisville, Paducah to Nashville, and others.

Ozark is the youngest of the fourteen local service airlines in the country. Local and feeder type air service was inaugurated by CAB after World War II as an experimental effort to extend the benefits of scheduled air transportation to the smaller cities of the United States. This local service airline industry is recognized today as an important part of the country's air transportation picture.

In June of 1953, Ozark was awarded a plaque by the Nationl Safety Council in recognition of its safety record. Since commencement of operation up to the present date, Ozark has boarded a total of 235,076 passengers along its routes and completed a total of 36,052,274 passenger miles flown without accident to passenger or crew. Approximately 1,937,779 pounds of air express and 1,270,144 pounds of air mail have been carried since operations began three years ago.

At the present time, Ozark maintains a 91.10 percent average of on-time performance (within fifteen minutes of the published schedule.)

Pan American Airways

In June, 1953, the Military Air Transport Service lifted the secrecy off the Pacific Airlift story. As of that time, Pan American, one of the airlift's prime contractors, and other airlines which are PAA's subcontractors, had flown 32 million miles and 2,300 Pacific crossings to deliver to Korea 104,000 passengers, 20 million pounds of cargo—including a million and a half pounds of blood—and eight million pounds of soldier mail.

One of the most remarkable "cargoes" was carried during Operation Fox Peter (for "Fighters, Pacific"). In Fox Peter the civil airlift moved the entire 31st Fighter Escort Wing, including its spare engines, ground personnel, tools and even its records by air from Albany, Georgia, 9,000 miles across the United States and the Pacific. In a few days the 31st was fighting in Korea.

Three months later, the entire operation was repeated when this Wing was brought back and replaced by the 27th Wing from Texas.

In October Pan American's Pacific-Alaska Division announced that, early in 1954, it is going to put PAA's version of the Douglas DC-6B (the Super-6) on its U.S.-Alaska route. This will cut flight times between Seattle and Alaska's major cities by twenty-five percent.

Late in 1953, Pan American filed with the CAB a program of trans-atlantic general air cargo rate reductions, introducing in the Atlantic trade the concept that large shipments should travel at low rates. PAA proposed reductions of 45 percent for shipments of 1,100 pounds and over.

An executive of the company predicted the new rates would increase the cargo business across the Atlantic by 50 to 60 percent.

Pan American has on order three Comets (Mark III) for delivery in 1956 and an option on seven more. In July of 1953 the airline began getting delivery of a new group of 27 Douglas Super-6 Clippers (DC-6B type). Deliveries are expected to be completed in June, 1954, at which time Pan American will have a fleet of 45 DC-6B Clippers. Three DC-A all-cargo Clippers are also on order. Delivery of these is expected early in 1954.

Pan American-Grace Airways, Inc., has contracted to purchase five Douglas DC-7s for delivery by mid-1955.

During 1953 Pan American cut an average of seven hours off its 18-hour Tokyo-Honolulu schedule by flying the Pacific jet stream—a wind with a velocity of 80 to 100 miles per hour at 17,000-25,000 feet and a top recorded velocity of 450 mph.

The record jet stream flight, Tokyo-Honolulu, was flown by PAA Captain Mark Orr; time: 9 hours, 48 minutes.

On April 1, 1953, PAA extended its transatlantic tourist service to Beirut, and, on October 1, further extended it to Calcutta and New Delhi in India. Pan American expects to complete a round-the-world low-fare circuit next spring, providing government approvals are forthcoming for tourist fares in the Pacific. The new service will link up the transatlantic-to-India tourist service and the tourist service to Hawaii that Pan American inaugurated in December, 1952.

Trans World Airlines

During 1953, Trans World Airlines established the first non-stop transcontinental air service in the history of commercial aviation and set new records in virtually every phase of its global operations.

Predictions that 1953 would be a record year for airline traffic were borne out by TWA figures in every department. An estimated total of nearly 3 billion passenger miles were flown by the end of the year, as compared to 2,315,000,000 passenger miles in 1952.

Domestically, TWA's routes from coast to coast across the United States accounted for an estimated 2,405,285,000 passenger miles—more than 1952's system total, and 27.8 percent above the domestic figure for 1952. International passenger miles flown were estimated at 521,600,000, for a 20.5 percent increase over the previous year.

Greatest increases were recorded in TWA's low-cost Sky Tourist service. At the end of September, preliminary figures showed a 248 percent increase in the number of passengers carried via this type of service on TWA's trans-Atlantic routes to Europe and the Middle East, as compared to the first nine months of 1952. Domestic Sky Tourist passenger service gained more than a hundred percent for the same period.

During the summer of 1953, several large groups of travelers took advantage of Sky Tourist fares to fly to Europe via TWA. Among these were the 142 persons, mostly women factory workers from the Fort Wayne, Indiana, plants of General Electric, who took a three-week vacation in Europe. They were the largest number of civilians ever to fly the Atlantic as a group.

During 1953, TWA also set some new highs for passenger miles recorded on a single day. On August 16, the airline flew a total of 10,687,602 passenger miles throughout its entire system. On July 1, it reached a new high for domestic routes with a total of 8,364,662 revenue passenger miles. On September 13, that record was bettered by a domestic passenger mile figure of 8,493,843.

At the end of September, total revenue ton miles were up 26.7 percent over the corresponding period in 1952. Mail ton miles were up 10.3 percent; express ton miles 26.5 percent; freight ton miles 20.3 percent.

On October 6 TWA, with three other airlines, began an experiment with the United States Post Office Department in carrying regular mail by air between New York and Chicago and Washington and Chicago. If this experiment proves successful, the service will be extended throughout the nation.

Preliminary figures from TWA for the first nine months of the year showed that express ton miles in the United States alone had increased 35.7 percent over the same period in 1952, while domestic air freight ton miles showed a 27.1 percent increase. The introduction of additional four-engine all cargo flights on September 27 enabled TWA to expand its total cargo ton lift on domestic routes still further. TWA also scheduled two weekly trans-Atlantic and international all-cargo flights.

Cargo service within Europe was facilitated by the addition of two new Speedpaks for use on passenger planes. This made a total of six Speedpaks in service by TWA in Europe.

During the year TWA strengthened its route structure, both domestically and overseas. An interchange service with Delta-C&S made possible the first one-plane through service between Houston and Pittsburgh. And the addition by TWA of new twin-engine Martin service to ten Western cities provided fast, frequent connections with transcontinental routes.

Sky Tourist service between Washington and San Francisco was inaugurated March 1. On April 1 two more transcontinental Sky Tourist flights were added to TWA's daily schedules.

During 1953 TWA filed a brief with the Civil Aeronautics Board requesting a renewal of its presently certificated routes from India and Ceylon to Shanghai, with authority to extend its operation 1100 miles to Tokyo. Citing the importance of building U. S. influence throughout Asia, TWA called for a reaffirmation of U. S. international air policy providing two round-the-world American flag services.

During hearings on this petition, a TWA official predicted that more than 15,000 passengers would be carried annually around the world by American flag carriers if the extension is granted. He also proposed the lowest round-the-world air fares in history: approximately $1200, more than $500 lower than present first-class air fares over the same route.

The rising demand for air service in the Far East prompted TWA to add Ceylon to its route early in the year. A second weekly flight to the island republic was scheduled in August.

One of the biggest stories of the year for TWA was its purchase of twenty new turbo-compound Super Constellations to be used on international flights to Europe as well as coast-to-coast service in the United States. The new planes will expand TWA's Constellation fleet to nearly 100. Deliveries are scheduled for the spring of 1955.

In October, TWA inaugurated the first non-stop coast-to-coast service by any airline. Daily flights in Super Connies carried passengers from Los Angeles to New York in eight hours.

Preliminary financial figures for the year indicated a gain in earnings during the first half of 1953. TWA's net income after taxes, for the first six months, was $2,633,196, an increase of 21 percent over the 1952 first-half earnings.

On January 1, Warren Lee Pierson, Chairman of the Board of TWA, was named chairman of the United States Council of the International Chamber of Commerce. Ralph S. Damon, TWA President, was named "National Management Man of the Year" by the National Association of Foremen.

TWA was one of the airlines to receive the 1953 National Safety Council Award. In connection with this award, officials pointed to the nearly five billion passenger miles flown by the airline without a fatality on its 33,000 miles of routes.

United Air Lines

United Air Lines flew an estimated 2,715,000,000 revenue passenger miles and 3,900,000 passengers in 1953, setting new company records in both departments. Each 1953 figure, based on actual nine-month and estimated fourth-quarter totals, represent an increase over 1952 of approximately 13 percent.

Air cargo totaled approximately 59,000,000 revenue ton-miles, off slightly from 1952. Making up the cargo total were almost 20,000,000 ton-miles of air mail (off 8 percent), 27,550,000 ton miles of air freight (up 1 percent) and 11,230,000 ton miles of air express (up 9 percent).

Peak day of the year came on June 20 when United carried 13,600 passengers and flew 9,785,000 revenue passenger miles.

During the year, the airline added Scottsbluff, Nebraska, to its 78-city, 13,250-mile coast-to-coast, Pacific Coast and California-to-Hawaii system. Applications also were brought before the Civil Aeronautics Board to let the company serve Buffalo, Rochester, Syracuse, Pittsburgh in New York and Pennsylvania; Dubuque, Waterloo, Sioux City, Rockford, Clinton, Mason City, Fort Dodge in Illinois and Iowa. As we went to press, the company also had asked for permission to serve 17 other cities on three new routes across the nation.

In September, United began operating interchange service with Continental Air Lines and Braniff International Airways, providing one-plane through service from the Pacific Northwest to Wichita, Tulsa, Oklahoma City, Dallas, Fort Worth and Houston, via the Denver gateway. Before the CAB, United continued its fight to be permitted to operate non-stop flights between the Pacific Northwest and Chicago. United's restriction denying it the right to carry local passengers between Las Vegas and Los Angeles was lifted.

In 1953, the airline expanded its fleet to 170 planes, including delivery of the last of its 21 four-engined Douglas DC-6Bs and approximately three-quarters of the 55 twin-engined Consolidated Vultee Convairs it has on order.

In April, 1954, United expects to begin expansion of its fleet with delivery of the first of 25 Douglas DC-7s. United's DC-7s will accommodate 58 passengers and carry more than 10,000 pounds of baggage, air mail, freight and express.

By the end of 1953 Mainliner Convair service had been introduced to 49 cities along United's system. For the first time the company used four-engined DC-6s, featuring wide-aisle, two-abreast seating, for air tourist flights. With this service expanded from coast to coast and to Hawaii, air tourist planes by year end were providing 25 percent of United's available seat miles. Most publicized flights during the year were the non-stop "Executive" schedules "for men only" between Chicago and New York.

In August, United completed its 15,000th flight on the California-Hawaii route.

On October 1, 1953, the airline terminated its Korean Airlift contract. During 39 months of service, the company flew 1,000 round trips between San Francisco and Tokyo, carrying approximately 25,000 servicemen. Material flown across the Pacific included 262 tons of ammunition, 355 tons of whole blood and medical supplies, 3,000 tons of mail and 4,000 tons of military freight. United has flown more than 13,000,000 plane miles for the military.

To maintain pin-point control of its increased schedules, United opened a payload control center in Denver. From this base, now the nerve center of the Main Line airway, operation and loading of the company's 210 daily flights are controlled. United's 76,600 yearly flights mean that Mainliners average one landing or take-off per minute.

United currently is studying a "mechanized air dock," which would be equipped with Whiting Loadair tracks, conveyor belts and other devices for mechanized loading and unloading all aircraft. The device would eliminate the many vehicles now needed at each airline ramp position.

Now ready is a program to increase aircraft service efficiency through installation of underground fuel and electric power facilities at major terminals to eliminate need for gas trucks and ground power units.

A two-year building program at United's San Francisco maintenance base is now under way. About 160,000 square feet of shop, office and hangar space will be added to the present base. Plans include construction of two more hangars which will enable the handling of 27 planes monthly.

Late in the year the company received the first of four Curtiss-Wright flight simulators. The four "electronic aircraft," ordered at a cost of $43 million, will be exact replicas of the nose section of the four-engined DC-6 and the twin engined Convair. They will be used to train new pilots, to up-grade more senior pilots, to maintain the proficiency of the pilots generally and to let entire United crews train as teams.

Development of a new type of airborne weather-detection radar unit was undertaken by the Radio Corporation of America in cooperation with United. Goal is to provide commercial airlines with a radar system designed exclusively for weather mapping.

To handle the additional accounting made necessary by increased traffic, final plans were drawn and ground broken for a one-story building at United's quarters at Chicago. The building, which will have 50,000 square feet of floor space, will accommodate 614 of United's 14,800 employees.

Biggest stories of the year along the Main Line were the scores of POW's who flew home by United. Biggest cargo news was United's participation in the Post Office Department's experiment of carrying first class mail by air between New York-Newark and Chicago and between Washington, D. C., and Chicago. United asked and received a service rate of 18.66 cents per ton mile between New York and Chicago, and 20.04 cents between Washington, D. C., and Chicago, the identical rates proposed by the Post Office. Such rates are designed to provide air transportation for first class mail on a space available basis at no greater cost to the Post Office than by surface transportation.

While United does not expect jet transports to be flying extensively in schedule in the U. S. before 1960, the company's planning section is gaining experience in jet operation through "project paper jet," an imaginary operation in which two simulated jets have been streaking east and west on United's routes daily for over a year. These hypothetical sprints are planned with the precision of actual flights. The imaginary planes, designed on paper by United, carry from 70 to 80 passengers, crews of five and up to 8,000 pounds of cargo. They cruise at 550 miles per hour at an average altitude of 40,000 feet, and can land on present runways at New York, Chicago, Los Angeles and alternate airports.

CHAPTER SIX

Utility Airplanes and Helicopters

PRODUCTION of utility airplanes continued to forge ahead in 1953, reaching a total of approximately 3,800 by year-end. This was a thousand units over the 1952 total and almost double the 1951 output. The Civil Aeronautics Administration reported that the total active civil aircraft fleet now numbers about 54,000.

Most of these are light aircraft operated for business, industrial and agricultural purposes. A small percentage are used for pleasure and sport—once the largest single use for light planes. Others are used for instructional and charter purposes.

The rapid and continuing adaption of the light airplane for serious economic purposes prompted the industry, over a year ago, to rename itself the "Utility Airplane Industry" in place of the personal or light plane industry as in the past.

A substantial number of the civil aircraft are multi-engined. In fact, more of these larger planes are owned and operated for business purposes alone than are operated by the airlines. Recent Aircraft Industries Association figures cited that for every airliner there are about 35 personally-owned or business-owned aircraft operating in the United States.

In addition to the several hundred larger multi-engined aircraft in the civil fleet, there are four main types of utility airplanes:

First, the one- or two-place, having a gross weight of 1,500 pounds or less. Powered with 65 to 125 hp engines, these planes have speeds ranging from 70 to 125 mph. In this group are found aircraft most often used for instruction, for agricultural purposes, and for sport flying.

Next, three- to four-place, weighing from 2,200 to 2,700 pounds. Powered by 125 to 175 hp, the planes in this category fly a greater number of cross-country miles. Cruising speeds range from 110 to 175 mph. Such aircraft are extensively used in all types of general aviation.

Third, the four- to five-place, having a gross weight of from 2,200 to 4,600 pounds. Powered by engines of from 175 to 300 hp, these planes can cruise at 140 to 200 mph, and are generally called executive aircraft.

Fourth, five- to nine-place, twin-engined light transports. Powered by 250 to 500 hp engines, cruise between 150 to 200 mph. They have four to seven hours' endurance with airline type navigational aids.

Most significant development for the helicopter industry during 1953 was the promising outlook of helicopter usage on commercial airways. A special Air Transport Association Committee, after an exhaustive survey of the possibility, came up with these conclusions:

The helicopter will enable the airlines, for the first time, to effectively compete time-wise with all forms of surface transportation in the huge short haul intercity market;

Total operating costs of projected transport helicopters can approach those of present twin engine aircraft. Profitable operation, however, may require higher load factors or higher passenger tariffs;

Limited fleet operations of multi-engine transport helicopters of 30 to 50 passenger capacity can be achieved by 1959-1960; and

Before transport helicopters can be successfully integrated into scheduled airline operation, a system of heliports and communication and navigational aids peculiar to helicopters must be developed.

By year-end, one airline, National, had announced the purchase of its first helicopter. And a manufacturer, Piasecki, had unveiled the world's largest transport helicopter. Designated the YH-16, it can carry 40 passengers and with minor modifications could go into scheduled operation almost immediately.

Another significant event for the helicopter industry during 1953 was the inauguration of the first regularly scheduled helicopter passenger service in the New York area. Inter-airport passenger service was begun between LaGuardia, Idlewild and Newark airports. Other helicopter mail operations in Los Angeles and Chicago continued to expand, but neither has yet added a passenger service.

Although at present helicopters represent only a small segment of the U. S. aircraft industry, six helicopter manufacturers are presently in active production on 15 models. Current helicopter industry employment is about 14,000 and the annual helicopter industry payroll is approximately $52-million. In the seven years since the first certificated U. S. helicopter

Helicopters play major role in Korean airlift

was flown, the nation's manufacturers have produced approximately 3,000 helicopters.

A wide variety of models in various stages of design, development, or actual flight testing were reported by manufacturers during the year. These range in size from one- to 60-place craft and are powered by piston, gas generator, turboprop, and tip-jet units.

A variety of uses were also listed. One company noted that it was rendering profitable service in the following typical fields: fogging to kill insect pests, spraying to control weeds and parasites, dusting to increase crop yields, inspection of power and pipe lines, construction in rugged terrain, surveying for oil and minerals, government assignments of wide variety, and aerial patrol and executive transport.

The helicopter also proved itself in combat. By the end of the war, the Army alone had airlifted from the battlefield over 16,000 casualties. In addition to their aero-medical services, helicopters moved combat troops and hundreds of tons of supplies over difficult terrain in incredibly short periods of time—and often were able to transfer personnel and material to commanding mountain heights inaccessible by other means of transportation. Because of its peculiar adaptability, the military services are placing increasing emphasis on helicopter development.

With the end of the war in Korea, the vast civil fleet of the country—both utility airplanes and helicopters—stands ready for any emergency. In the event af war, it will take its place beside the military. During peacetime, it performs life-saving civilian services where it often is the only means of rapid and dependable transportation.

CHAPTER SEVEN

Planes in Production

TWO significant patterns of aircraft producton were clear during the year: the final domination of the aircraft production picture by jet aircraft, which—for the first time—comprised more than half the total, and the persistence with which the staid, old piston-engined transport continued to pour from U. S. production lines into the world's markets.

In the jet field, a landmark was reached during the year when the first aircraft capable of flying steadily in level flight at supersonic speed, the North American F-100 Super Sabre, reached production quantities. This fabulous airplane signals the attainment of a design goal first clearly indicated in the closing months of World War II. Throughout the ensuing seven years the speed of jet fighters has increased steadily as such unorthodox—but now familiar—additions as swept wings, afterburners, power-boosted controls and fully-automatic internal equipment enlarged their capacities.

A signal achievement of the year, too, was the entry into production of the most powerful airplane ever built: the incredible Boeing B-52 Stratofortress. This monster strategic bomber is pushed through the air by a phenomenal 140,000 hp—more than a battleship and the equivalent of *sixteen* wartime Boeing B-29 bombers in power. In terms of destructive power, however, the B-52 is incomparable with the wartime B-29; the latter dropped a single atomic bomb while the B-52 can carry many times as many in its cavernous bomb bay.

Production during the year featured the first U. S. transport to enter airline service capable of flying at more than 400 mph—the speed of our top-ranking fighters at the outbreak of World War II. The Douglas DC-7 inaugurated the first scheduled transcontinental non-stop passenger service late in the year—but not before its friendly rival, the Lockheed Super Conestellation, had turned the trick in the eastward direction only. These two proud airliners not only gained but have held aloft for half a decade American dominance of the world's airline equipment. Despite the glamour of the foreign jet airliners, these two great U. S. transports continue to carry the vast majority of the civil airlift of the world.

Behind these front-page leaders of the production picture, however, moved the less-glamorous military and civil aircraft that continued their steady model advance with improved features, new engines and increased performance outlined in detail on the following pages.

AERO DESIGN AND ENGINEERING CO.

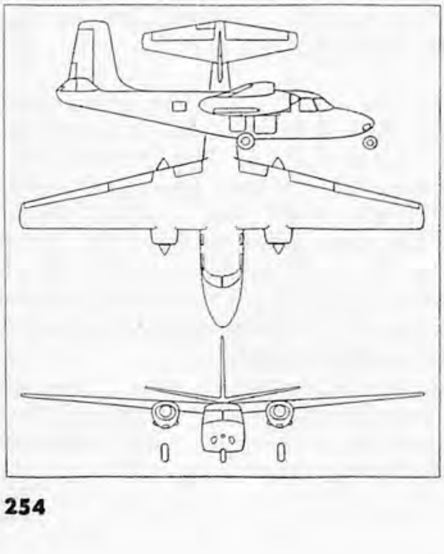
Oklahoma City, Okla.

New Aero Commander

A 5 to 7 place, closed land high-wing monoplane. CAA TYPE CERTIFICATE: TC 6A1. MANUFACTURER'S MODEL DESIGNATION: 520.

DATA

POWERPLANT: Two Lycoming GO-435-C2-B, 260 hp. FUEL CAPACITY: 150 gal. PROPELLERS: Hartzell constant speed full feathering. FLAPS: Semi-Slotted. GEAR: Retractable tricycle.



SPECS

SPAN: 43 ft. 10 in. LENGTH: 34 ft. 2.5 in. HEIGHT: 14 ft. WEIGHTS: EMPTY, 3,650 lb.; GROSS, 5,500 lb.; USEFUL LOAD: 1,850 lb. WING LOADING: 22.7 lb. per sq. ft. BAGGAGE: 350 lb.

PERFORMANCE

SPEEDS: MAXIMUM, 211 mph; CRUISING 197 mph at 10,000 ft. STALLING, full flaps power off, 60 mph; full flaps power on, 40 mph; no flaps, 67 mph. RATE OF CLIMB: 1,750 ft. per min. SERVICE CEILING: 24,000 ft. RANGE: 850 mi.

REMARKS

At the end of 1953, 140 Aero Commanders were operating throughout the world. Since the first production model was delivered in January, 1952, it has set an enviable record for performance, safety and economy of operation. Today, the Oklahoma City plant has undergone expansion and is now producing eight airplanes per month. The Commander's high wing design provides several advantages besides an inherent stability, including exceptionally good visibility for passengers, as well as pilot, and ease of access to the cabin. The advantages realized through new design principles used in the Commander were demonstrated in May, 1951, when a propeller was removed from one of the engines, the plane was taxied on to the runway, taken off and flown non-stop from Oklahoma City to Washington, D. C. The Commander is available as a passenger, rescue, cargo, or executive transport.

BEECH AIRCRAFT CORP.

Wichita, Kans.

Beechcraft Model D35 Bonanza

A 4-place, closed, land, all metal, low-wing monoplane; normal and utility category. CAA TYPE CERTIFICATE NUMBER: TC 777. MANUFACTURER'S MODEL DESIGNATION: D35.

DATA

POWERPLANT: Continental E-185-11, 205 hp at 2,600 rpm. FUEL CAPACITY AND CONSUMPTION: 39 gal. (59 gal. with auxiliary tank); 9.5 gal. per hr. at 175 mph. OIL CAPACITY: 2½ gal. PROPELLER: Beech electrically controlled continuous variable pitch, series 215 (all metal). FLAPS: NACA slotted. GEAR: Retractable tricycle.

SPECS

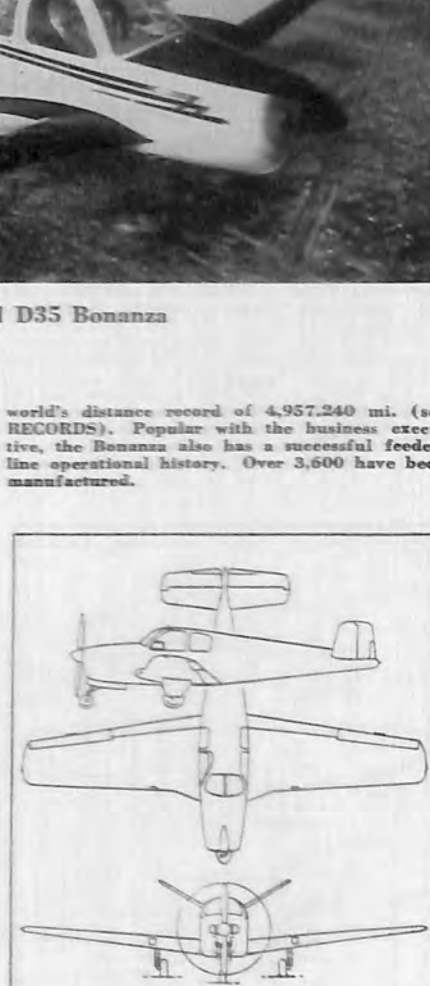
SPAN: 32 ft. 10 in. LENGTH: 25 ft. 2 in. HEIGHT: 6 ft. 6½ in. WEIGHTS: EMPTY, 1,650 lb.; GROSS, 2,725 lb.; USEFUL LOAD, 1,075 lb.; WING LOADING, 15.35 lb. per sq. ft. POWER LOADING: 14.74 lb. per hp. BAGGAGE: Maximum, 270 lb.

PERFORMANCE

SPEEDS AT SEA LEVEL: MAXIMUM, 190 mph; CRUISING, 180 mph at 8,000 ft., STALLING, 55 mph (with flaps). RATE OF CLIMB: 1,100 ft. 1st min. SERVICE CEILING: 18,000 ft. RANGE: 775 mi. at 10,000 ft. at 165 mph (1,180 mi. with auxiliary tank).

REMARKS

The Bonanza holds the lightplane non-stop world's distance record of 4,957.240 mi. (see RECORDS). Popular with the business executive, the Bonanza also has a successful feeder-line operational history. Over 3,600 have been manufactured.

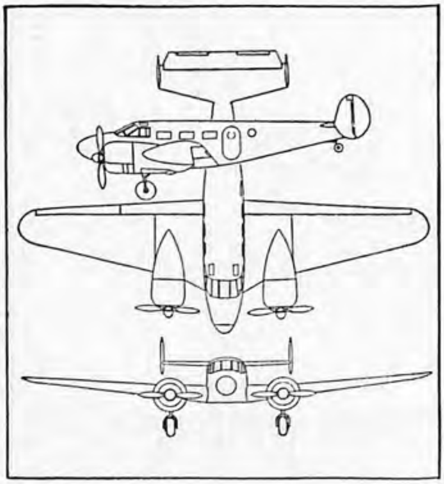


Twin Beechcraft executive transport

A twin-engine 8-place, executive type, all metal, low-wing, land monoplane; normal category. CAA TYPE CERTIFICATE NUMBER: TC 765. MANUFACTURER'S MODEL DESIGNATION. D18S.

DATA

POWERPLANT: Two Pratt and Whitney Wasp Jr. R-985, 450 hp at 2,300 rpm. FUEL CAPACITY AND CONSUMPTION: 206 gal.; 32.6 gal. per hr. OIL CAPACITY: 17 gal. APPROVED PROPELLERS: Hamilton Standard Hydromatic 22D30. FLAPS: Plain 45 deg. GEAR: Two wheel retractable.



SPECS

SPAN: 47 ft. 7 in. LENGTH: 33 ft. 11½ in. HEIGHT: 9 ft. 2½ in. WEIGHTS: EMPTY, 5,770 lb., hydromatic; GROSS, 8,750 lb., hydromatic; USEFUL LOAD: 2,980 lb. WING LOADING: 25.07 lb. per sq. ft. POWER LOADING: 10.92 lb. per hp.

PERFORMANCE

SPEEDS: MAXIMUM, 230 mph at 400 hp.; CRUISING, 211 mph at 10,000 ft. at 300 hp. RATE OF CLIMB, 1,190 ft. 1st min. SERVICE CEILING: 20,500 ft. RANGE: 750 to 1,500 mi. depending on fuel arrangement.

REMARKS

World-famous for its many commercial and military versions of the model 18 twin-engine transport trainer, Beech Aircraft is the world's largest producer of light transport and twin-engine trainer aircraft. More than 90 percent of the U.S. bombardiers and navigators, and about 50 percent of the multi-engine pilots were trained in the more than 7,000 military versions of this model manufactured during World War II. Current commercial models have many post-war improvements, a number of seating arrangements, and a wide selection of interior styling. More than 980 have been manufactured since V-J Day.

Beechcraft Model B50 Twin Bonanza

A six-place, high-performance, twin-engine, cantilever low-wing monoplane. CAA TYPE CERTIFICATE NUMBER: 5A4. MANUFACTURER'S MODEL DESIGNATION: Model 50.

DATA

POWERPLANT: Two Lycoming GO-435-C2 engines, takeoff rating 260 hp. at 3,400 rpm. FUEL CAPACITY AND CONSUMPTION: 134 gal. (88 main inboard wing tanks—46 auxiliary outboard wing tanks), 22.8 gal per hr. OIL CAPACITY: 12 quarts per engine. PROPELLERS: Beechcraft Constant Speed B200-116; Beechcraft Feathering 214-101. FLAPS: NACA slotted. GEAR: Retractable tricycle.

SPECS

SPAN: 45 ft. 3.375 in. LENGTH: 31 ft. 6.468 in. HEIGHT: 11 ft. 4 in. WEIGHTS: EMPTY, 3,800 lb.; GROSS, 5,500 lb.; USEFUL LOAD, 1,700 lb. WING LOADING: 19.87 lb. per sq. ft.; POWER LOADING: 11.46 lb. per hp. BAGGAGE: 200 lb. maximum allowable, rear; 100 lb. maximum allowable, forward.

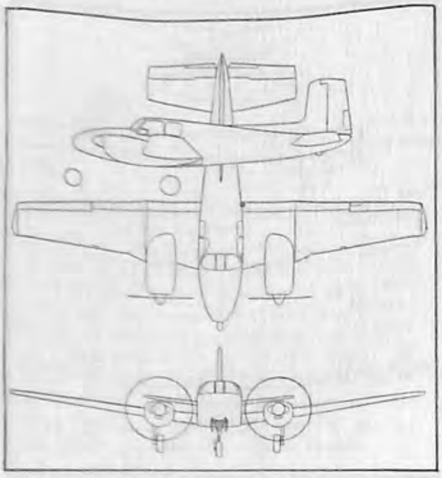
PERFORMANCE

SPEED AT 2,500 ft.: MAXIMUM, 205 mph; CRUISING, over 192 mph at 10,000 ft. at 65 percent power; STALLING, 69 mph. RATE OF CLIMB: 1,500 ft. per min. SERVICE CEILING: 20,000 ft. RANGE: 1,088 mi. at 10,000 ft. at 50 percent power.

REMARKS

The Beechcraft Twin-Bonanza made its initial flight on November 15, 1949.

The Model B50 is the same basic configuration as the Beechcraft USAF L-23A, now in service for the United States Army Field Forces. According to the manufacturer's engineering reports, the structural and operational standards to which the Model B50 have been tested are far in excess of those required by governmental agencies. To illustrate the extra strength built into the Model B50 the company points out that all the structure has been tested to an 8G flight load factor (equal to carrying a 10-ton bridge) to prove the desired safety over and above the required load factors.



CESSNA AIRCRAFT CO.

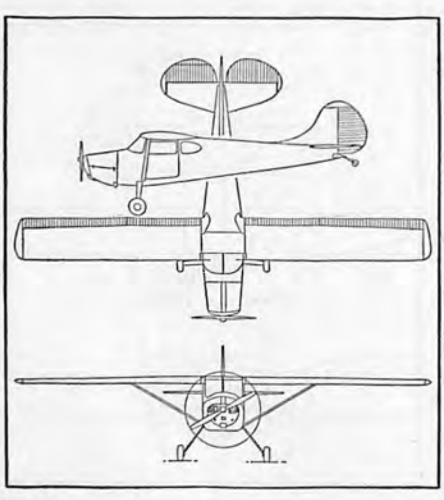
Wichita, Kans.

Cessna's 1954 Model 170

A 4-place, closed, all-metal, land or seaplane, high-wing monoplane, normal and utility category, CAA TYPE CERTIFICATE NUMBER: TC 799. MANUFACTURERS MODEL DESIGNATION: 170B.

DATA

POWERPLANT: Continental, C-145-D, 145 hp. FUEL CAPACITY AND CONSUMPTION: 42 gal., 7.5 gal. per hr. OIL CAPACITY: 2 gal. FLAPS: Slotted edge, 40 deg. GEAR: Fixed two-wheel, steerable tailwheel.



SPECS

SPAN: 36 ft. LENGTH: 25 ft. HEIGHT: 6 ft. 7 in. WEIGHTS: EMPTY, 1,205 lb.; GROSS, 2,200 lb.; USEFUL LOAD, 963 lb.; MAXIMUM PAYLOAD, 696 lb. WING LOADING, 12.6 lb. per sq. ft. POWER LOADING, 15.5 lb. per hp. BAGGAGE: Max. allowable 120 lb.

PERFORMANCE

SPEEDS AT SEA LEVEL: MAXIMUM, 140 mph; CRUISING, 120 mph; STALLING, 52 (with flaps), 58 mph (without flaps). RATE OF CLIMB: 690 ft. 1st min. SERVICE CEILING 15,500 ft. RANGE: 540 mi.

REMARKS

The rear seat of the 170 can be removed in three minutes to provide added cargo space. There is a wide range of optional eqiupment including skis, seaplane floats, crosswind wheels for single strip all-wind conditions, stretcher for ambulance use, blind flight hood, spraying equipment, and provisions for oblique or vertical aerial photography and mapping.

Cessna's new 180

A 4-place, closed, all-metal, land or seaplane, high-wing monoplane, normal and utility category, CAA TYPE CERTIFICATE NUMBER 5A6. MANUFACTURER'S MODEL DESIGNATION: 180.

DATA

POWER PLANT: Continental, O-470-A, 225 hp. at 2,600 rpm. FUEL CAPACITY: 60 gal. APPROVED PROPELLERS: Hartzell Model HC-82XF-1, McCauley Model 2A36. FLAPS: Slotted, edge, 40 deg. GEAR: Fixed 2-wheel, steerable tailwheel.

SPECS

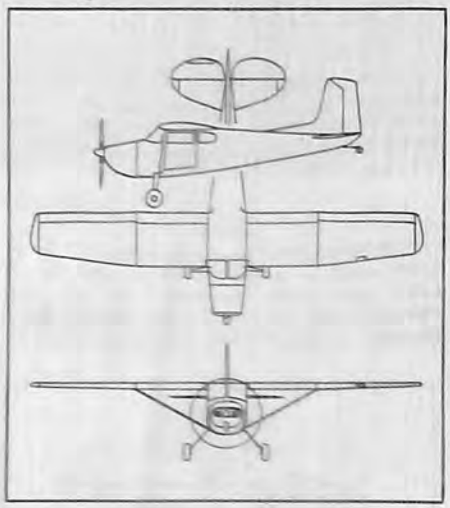
SPAN: 36 ft. LENGTH: 26 ft. HEIGHT: 7 ft. 6 in. WEIGHT: EMPTY, 1,460 lb.; GROSS, 2,550 lb.; USEFUL LOAD, 1,090 lb.; MAXIMUM PAY LOAD, 711 lb.; WING LOADING, 14.6 lb. per sq. ft.; POWER LOADING, 11.3 lb. per hp. BAGGAGE ALLOWABLE LOAD, 120 lb.

PERFORMANCE

SPEEDS AT SEA LEVEL: MAXIMUM, 165 mph; CRUISING, 150 mph.; STALLING, (with flaps) 55 mph; STALLING (without flaps) 60 mph. RATE OF CLIMB: (sea level) 1,150 ft. per min. SERVICE CEILING: 19,800 ft. CRUISING RANGE: 675 mi.

REMARKS

The Cessna 180 was dedicated in commemoration of the 50th anniversary of powered flight. This new model has the same general configuration as earlier models, but with a larger powerplant and other refinements, has been able to increase its cruising speed by close to 30 mph.



CESSNA 180

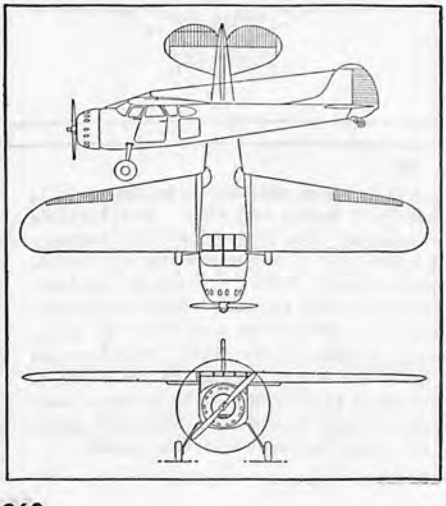
One of the things that has made the automobile industry the largest in the world is its constant creation of a seemingly infinite variety of models and styles. Any highway today is proof of the variegated tastes of the motorist. The personal aircraft industry did not really get into quantity production until it took this vital cue from the automobile makers: provide plenty of models for the customer's choice. A firm believer in this business philosophy is Cessna Aircraft Corp. Two years ago the company offered the potential plane owner his choice of models varying from 90 to 300 hp—but even this wide range of power was not enough. Last year the company introduced the Model 180, whose 225 hp engine nestled it neatly in between the 145 hp of the Model 170 and the 240-300 hp of the big 190-195 series. The experiment proved the adage and the Model 180 is now a leading model in the Cessna line. Now Cessna is looking closely at other "in-between" engine powers, convinced that many other customers are ready for just the "right model.

Cessna 190-195 Series

A 5-place, closed, land or seaplane, all-metal, monoplane, normal and utility category. CAA TYPE CERTIFICATE NUMBER: TC 790. MANUFACTURER'S MODEL DESIGNATION: 190 - 195.

DATA

POWERPLANTS: Jacobs R-755B2, 275 hp at 2,200 rpm, or Jacobs R-755A2, 300 hp at 2,200 rpm. FUEL CAPACITY: 80 gal. OIL CAPACITY: 5 gal. APPROVED PROPELLERS: Hamilton Standard 2B20 hub with 6135A-15 blades. FLAPS: Split type, 45 deg. GEAR: Fixed 2-wheel, steerable tailwheel.



SPECS

SPAN: 36 ft. 2 in. LENGTH: 27 ft. 4 in. HEIGHT: 8 ft. WEIGHTS: EMPTY, 2,030 lb.; GROSS, 3,350 lb.; USEFUL LOAD, 1,320 lb.; MAXIMUM PAY LOAD, 802 lb.; WING LOADING, 15.3 lb. per sq. ft.; POWER LOADING: 12.2 lb. per hp and 11.2 lb. per hp. BAGGAGE ALLOWABLE LOAD: 220 lb.

PERFORMANCE

SPEEDS AT SEA LEVEL: MAXIMUM SPEED (275 hp), 175 mph; (300 hp), 180 mph; CRUISING SPEED: (275 hp), at 7,000 ft., 70 percent power, 163 mph; (300 hp), at 7,000 ft., 70 percent power, 165 mph. STALLING: (with flaps), 61 mph., (without flaps), 62.5 mph. RATE OF CLIMB: (275 hp.) 1,140 ft. per min.; (300 hp) 1,210 ft. per min. SERVICE CEILING: (275 hp) 17,600 ft.; (300 hp), 18,300 ft. RANGE: over 750 miles (300 hp); 700 miles (275 hp).

REMARKS

The 195 has a roomy interior and is widely used as an executive airplane. The first model in this series was approved in 1947 and has been manufactured every year since with minor modifications. The armed services still have a number in use designated LC-126A.

CONSOLIDATED VULTEE AIRCRAFT CORP.

San Diego, Calif.

Convair-Liner 340

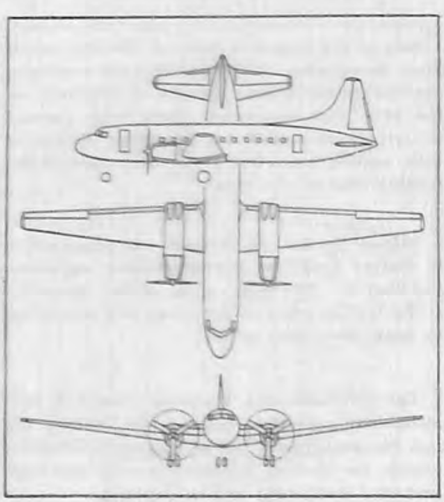
OUTSTANDING FEATURES: The pressurized Convair-Liner 340 is based on the design of the Model 240. The 340, however, is largely a new airplane, having more wing area, a longer fuselage, a higher gross weight, more powerful engines, and many interior design improvements.

A further development of the 340 was disclosed by Convair toward the end of 1952, with the announcement that a Convertible version was being offered to airlines. With a passenger capacity of 56 compared to 44 in the standard model, the Convertible offers a 27 percent increase in payload. Installed on rails, the seats can be locked into different positions simply and quickly, providing a wide range of flexibility for carrying full loads of passengers or combination payloads of passengers and cargo.

Wingspan of the 340 is 13 ft. 7 in. greater than the 240 and wing area is 103 sq. ft. more.

Airline pilots and Convair engineers collaborated in designing the 340 flight deck. Two basic requirements for maximum safety and convenience were spaciousness and wide-angle vision.

The 340 door utilizes the same basic main-entrance door and co-acting folding stairway installed on the 240. To make the 340 more convenient for the operator, the stairway is located on the left-hand side. The door and stairway installation is completely hydraulic compared with the hydraulic door with air boost on the 240.



A high-pressure hydraulic system on the 340 provides power for nose-wheel steering, wing-flap operation, landing gear extension and retraction, wheel brakes, windshield wipers, main entrance door and stairway operation, and a ground blower.

The pressurization system utilizes a centrifugal type air compressor mounted on the accessory drive section of the right-hand engine. Fresh air is taken in through a ram-air inlet in the right-hand wing leading edge. It is compressed by the unit and delivered through ducting to units of the air-conditioning system where the air is modulated to the desired temperature.

The fuselage structure is designed for an ultimate differential pressure of 8.72 psi. Normal operating maximum is 4.16 psi. This pressure differential permits a sea-level cabin at an airplane altitude of 8,900 feet or a cabin altitude of 8,000 feet at an airplane altitude of 20,000 feet.

The 340's electrical system consists of a 24-28 volt single-wire installation, incorporating two 12-volt storage batteries and a generator driven by each engine.

Integral fuel tanks are designed in each wing of the 340, with a total capacity of 1750 gallons. The tanks are located between the two wing spars, outboard of the engine nacelles.

One of the unique features of the 340 powerplant installation is the use of engine exhaust augmenters which were introduced originally on the 240. Two augmenters (long tubes encased by cylindrical muffs) are located in the top of each nacelle, extending from the engine to the trailing edge of the wing.

Heated air for the thermal anti-icing system is derived from the engine exhaust augmenter installation. The hot air is ducted internally to the leading edges of the wings and empennage to keep them free of ice.

The full-feathering Hamilton Standard Propellers are reversible to slow the landing run and for maneuvering on the ground. Propeller blades are de-iced electrically. An automatic propeller feathering system is used.

The 340 is designed so that turboprop engines can be installed with a minimum of modification and expense as soon as gas turbine engines are available for commercial operation.

POWERPLANT: Two Pratt and Whitney R-2800-CB-16, two speed 18 cylinders. Take-off power (wet), 2,400 bhp at 4,000 ft. and 2,800 rpm. Take-off (dry), 2,050 bhp at 6,000 ft. and 2,700 rpm. Take-off (dry) alternate, 1,950 bhp at 8,000 ft. and 2,800 rpm. Max. continuous rating: Low blower, 1,800 bhp at 8,500 ft. and 2,600 rpm; High blower, 1,700 bhp at 14,500 ft. and 2,600 rpm. FUEL CAPACITY: 1,750 gal. APPROVED PROPELLERS: Hamilton Standard Hydromatic, 3 blades, automatic full-feathering and reversible; diameter 13 ft. 1 in.

WINGSPAN: 105 ft. 4 in. WING AREA: 920 sq. ft. LENGTH: 79 ft. 2 in. HEIGHT: 28 ft. 2 in. WEIGHTS: GROSS, 47,000 lb.; EMPTY, 28,850 lb. USEFUL LOAD: 18,150 lb.

PERFORMANCE: Maximum speed, 314 mph. Crusing speed at 20,000 ft. (1,200 bhp engine) and 45,000 lb., 284 mph. RANGE: 1,260 mi. with 45,000 lb. and 1,500 lb. fuel reserve. SERVICE CEILING: 26,000 ft. TAKEOFF: 4,675 ft. at sea level and 47,000 lb. RATE OF CLIMB: 1,220 ft. per min. at sea level and 46,725 lb. FUEL CONSUMPTION: 208 gal. per hr. at normal power.

PRODUCTION on orders totalling close to 200 340's continued during the end of the year at Convair's San Diego plant. By that time more than 22 airlines had ordered this model, bringing the total operators of Convair-Liner 240's and 340's to about 35. More than 100 transports were delivered during the year. United Air Lines' orders totaled 55, the largest number purchased by one airline. Others include: Braniff Airways, Inc., Continental Air Lines, Delta-Chicago & Southern Air Lines, Hawaiian Airlines, National Airlines, Northeast Airlines, Aero O/Y (Finland), Aeronaves des Mexico, Avensa (Venezuela), Cia Mexicana de Aviacion, Garuda Indonesian Airways, KLM Royal Dutch Airlines, Philippine Airlines, Servicos Aereos Cruzeiro Do Sul (Brazil), Jugoslovenski Aerotransport, Arabian-American Oil Co., The Texas Co., Pratt & Whitney, Real Transportes Aireos (Brazil), Lufthansa, and Phillips Petroleum Co.

DOUGLAS AIRCRAFT CO., INC.

Santa Monica, Calif.

Douglas DC-6B transport

CAA TYPE CERTIFICATE AND DATE: TC 6A4, Apr. 11, 1951.

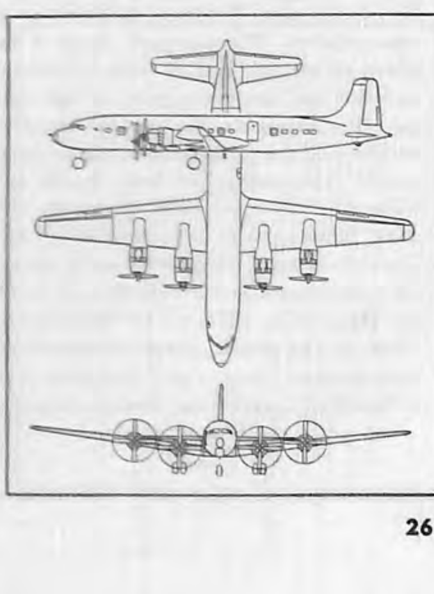
OUTSTANDING FEATURES: All of the proven features and systems of the basic DC-6, with a number of improvements are incorporated in the subsequent DC-6B version. Cabin pressurization is increased to 25,000 ft. flight altitude with 8000 ft. cabin altitude pressure. Cabin air flow has also been increased for added passenger comfort. Increased flow of cabin air also is available at customer option. Interior configurations range from 44 passenger luxury sleeperettes to 89 passenger high density planes.

ENGINEERING PERSONNEL: Edward F. Burton, chief engineer; J. R. McGowen, chief project engineer.

NOTES: First step in the evolution of the DC-6B was the prototype DC-6A Liftmaster, designed to carry either commercial or military cargoes. Fuselage of the standard DC-6 was lengthened five feet, gross weight increased to 100,000 lbs. and horsepower of the engines raised correspondingly. After flight testing and demonstrating the cargo configuration, it became apparent that the same aircraft with passenger interior accommodations would be an attractive airliner with passenger-mile operating costs even lower than the DC-6. Since January 1, 1951, DC-6As have been ordered by seven airlines and DC-6Bs have been ordered by 22 airlines.

FLIGHT CREW: Pilot, co-pilot, flight engineer on domestic flights. Navigator and radio operator added for over-water operations.

POWERPLANT: Four Pratt and Whitney R-2800CB-16, 2,400 bhp each (with CB17, 2500 bhp with water and 115 octane fuel). Normal rated power, 1,900 bhp each. **NORMAL FUEL CAPACITY:** 4,248 to 5,530 gal. **OIL CAPACITY:** 140 gal. **PROPELLERS:** Hamilton Standard reversible. **WING SPAN:** 117 ft. 6 in. **LENGTH:** 105 ft. 7 in. **HEIGHT:** 28 ft. 8 in. **GEAR:** Fully retractable tricycle using two sets of dual-type main wheels mounted aft of the center of gravity, and a steerable nosewheel. **WEIGHTS:**



Maximum take-off gross weight, 100,000 lb. with CB16 engines. (107,000 lb. with CB17 engines and auto-feather props); structural design landing gross weight, 85,000 b. to 88,200 lb. WING LOADING (Gross weight, 100,000 lb.): 68.4 lb. per sq. ft. (Gross weight 107,000 lb.) 74 lb. per sq. ft. POWER LOADING (Take-off power at 100,000 lb): 10.4 lb. per BHP.

PERFORMANCE: Maximum cruise power high blower, 1200 bhp, 323 mph with a gross of 85,000 lb. at 22,700 ft.; 315 mph with a gross of 90,000 lb. at 22,400 ft.; and 284 mph with a gross of 101,300 lb. Sixty percent sea level maximum continuous power at 10,000 ft.; 284 mph with 85,000 lb.; 279 mph with 90,000 lb. and 271 mph with 100,000 lb. TAKEOFF: C.A.R. field length sea level, 85,000 lb.; 3,620 ft. 3,130 with CB-17) 90,000 lb., 4,200 ft. (3,600 with CB-17) 100,000 lb. 5,690 ft., and 107,000 lb., 5,910 ft. with CB-17 engines. LANDING: C.A.R. field length sea level 85,000 lb. 4,995 ft.; 88,200 lb., 5,160 ft. SERVICE CEILING: 27,000 ft. with 85,000 lb. RANGE: 3,720 miles with 3,992 gal., 4,970 miles with 5,512 gal.

DC-6B's delivered to date: American Airlines, Arabian American Oil Co., Pan American World Airways, Pan American Grace Airways, Philippine Airlines, Royal Dutch Airlines (KLM), Scandinavian Airlines System, Swissair, United Air Lines, Canadian Pacific Air Lines, Compania Mexicana de Aviacion, Continental Air Lines, National Air Lines, Sabena, Transports Ariens Intercontinentaux de Maroc, Western Air Lines, Slick Airways and Flying Tiger Lines.

DC-6B's on order: Alitalia, Australian National Airlines, Linea Aerea Nacional de Chile, Linee Aree Italiane, North American Airlines, and Japan Air Lines.

The DC-6A (Navy R6D-1—USAF-118A) is similar to the DC-6B with the following exceptions: The airplane is primarily manufactured as a cargo airplane having a payload of 30,150 pounds and a cargo space of 5,000 cu. ft. It has a forward as well as aft cargo door to permit simultaneous unloading and loading operations. The forward door is 91" long x 67" high, and the aft door is 124" long x 78" high. The interior has cargo tiedown points on a 20" grid pattern in the floor and also tiedown rings in the wall of the cabin. The cabin is pressurized to provide an 8,000 ft. cabin altitude at 20,000 ft. flight altitude. Temperatures are controllable from 40 deg. F to 85 deg. F for perishables.

Military versions being delivered for the Navy and the Air Force also include convertible features permitting their use as troop transports or hospital airplanes accomodating approximately 78 persons.

DOUGLAS DC-6B

The smooth, exterior lines of the DC-6B are the extreme of simplicity but they conceal the costly and complex internal equipment needed for its safe and efficient flight. Only one of these illustrates the enormous amount of engineering, research and development required. The passenger riding in the DC-6B cabin enjoys virtually perfect atmospheric conditions at all times. To do this requires that in hot weather the cabin be cooled, in cold weather warmed, at high altitude, pressurized, on damp days dehumidified and when sitting on the ramp be heated or cooled even with the entrance door open. Pressurizing the cabin requires engine-driven compressors mounted in each outer engine nacelle. This compression heats the air so that it must pass through an intercooler on warm days or the unit shut off and the air passed through a combustion heater on cold days. If the air is to be refrigerated it passes through an expansion turbine. To provide a complete choice, clean, fresh air is drawn in through a separate air scoop. The cabin air is maintained at the equivalent of an 8,000-ft. atmosphere regardless of the height of the plane up to 25,000 ft. In the event the plane goes still higher, or an emergency occurs in this system, oxygen equipment is available for each pair of seats and for the crew members. This is only one of the dozens of tough, engineering problems that have to be solved to create the simple, pleasant experience of a modern airline trip.

Douglas DC-7 Transport

CAA TYPE CERTIFICATE AND DATE: 4A10, Nov., 1953.

OUTSTANDING FEATURES. All the proven features of the DC-6 series plus additional features are carried in the DC-7. Cabin pressurization permits 25,000 ft. altitude with 8,000 ft. cabin pressure. The -7 has a 12 percent increase in cabin airflow over the DC-6B. Interior configurations range from 65 passenger luxury accommodations to 95 passenger high density planes.

ENGINEERING PERSONNEL: Edward F. Burton, chief engineer; J. R. McGowen, chief project engineer.

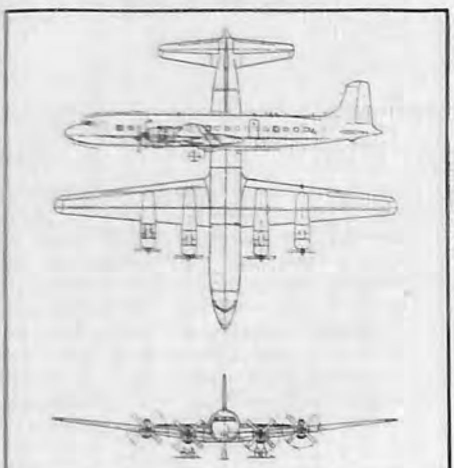
FLIGHT CREW: Pilot, co-pilot, flight engineer on domestic flights. Navigator and radio operator added for over-water operations.

POWERPLANT: Four Wright R-3350 Turbo-Compound engines rated at 3,700 bhp each. **NORMAL FUEL CAPACITY:** 4,512 to 5,512 gal. **WING SPAN:** 117 ft. 6 in. **GEAR:** Fully retractable tricycle using two sets of dual-type main wheels mounted aft of the center of gravity and a steerable nosewheel. **WEIGHTS: MAXIMUM TAKEOFF GROSS**, 122,220 lb. with auto-feather props; **STRUCTURAL DESIGN LANDING GROSS**, 95,000 lb. to 102,000 lb.; **WING LOADING** (gross, 122,200 lb.), 83.6 lb. per sq. ft.; **POWER LOADING**, (122,000 lb.), 9.4 lb. bhp.

PERFORMANCE: Maximum cruise power, high blower, 1,800 bhp, 102,000 lb., at 23,500 ft., 357 mph. **LANDING C.A.R. FIELD LENGTH:** 6,510 ft. at sea level and 122,200 lb. **SERVICE CEILING:** 27,100 ft. with 102,000 lb. **RANGE:** 3,625 mi. with 4,512 gal. or 4,450 with 5,512 gal.

REMARKS

The new DC-7 made history when it began the first transcontinental non-stop scheduled airline service in both directions across the United States. A dream of airline executives for a quarter-century, a passenger may now have a leisurely lunch in New York and dinner in Los Angeles. The trip takes only 7½ hours, but the time difference in the westward direction results in the passenger losing only 4½ hours according to local times in making the 2,460-mile trip.

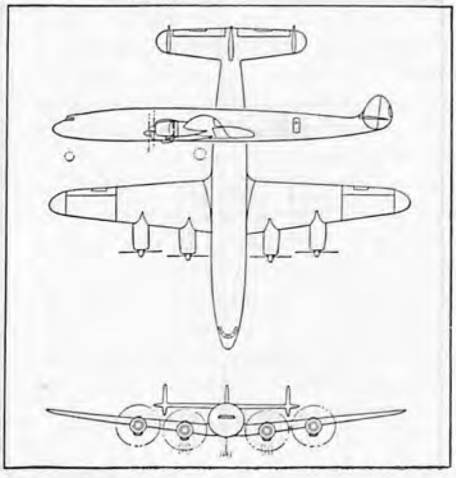


LOCKHEED AIRCRAFT CORP.

Burbank, Calif.

Lockheed Super Constellation

The Lockheed Super Constellation is the newest member of a four-engine transport family born 10 years ago. It is the first transport to use Wright turbo-compound engines. Lockheed aimed the turbo-compound Super Constellations, which have a maximum gross take-off weight of 133,000 lb., to carry more pay-load at faster speeds over greater distances at less cost than any other transport.



Twenty-six airlines are or soon will be equipped either with Constellations or Super Constellations, along with the U. S. Air Force and Navy. Military services also use Super Constellations for both transport and special radar purposes.

Design on the original Constellation was started in 1939. The first model, still owned by Lockheed, flew January 9, 1943. During World War II it became the C-69 military transport. First flight of a production model of the Super Constellation was on July 14, 1951. The first compound-powered Super Constellations entered service in 1953.

Present Constellation operators also flying or awaiting delivery of Super Constellations include Eastern Air Lines, Air France, KLM Royal Dutch Airlines, Qantas Empire Airways Ltd., Linea Aeropostal Venezolana, Air India International, Trans World Airlines, Aerovias Nacionales de Colombia, Cia. Cubana de Aviacion and El Al Israel Airlines.

Other airlines ordering Super Constellations include Seaboard & Western Airlines, Pakistan

International Airlines, Trans Canada Air Lines, Braathens South American & Far East Airtransport, Iberia Lineas Aereas Espanolas, S. A., Empresa de Viacao Aerea Rio Grandense, Northwest Orient Air Lines, Thai Airways, Ltd. Constellations are in use by British Overseas Airways Corp., Pan American Airways, South African Airways, Delta-Chicago and Southern Air Lines, Capital Airlines, California-Hawaii Airlines, and Panair do Brasil.

More than 271 Constellations and Super Constellations have been built. With around 50 Super Constellations delivered by the end of 1953, total orders approximated 90 yet to be completed.

The Super Constellation will accommodate from 47 to 99 passengers. Military versions will carry 106 and a crew of 4. Model 1049B Super Constellations are freight models, with payload capacity of 34,700 pounds trans-Atlantic and 37,000 pounds domestic. Its cost per ton mile is estimated at about 5 cents. Main cargo compartment is 84 feet long, total cargo volume 5568 cubic feet. It has cargo doors fore and aft.

Super Constellations first equipped with Wright C18CA1 or CB engines can be converted to Wright C18DA1 compound engines, the type employing exhaust turbines for increased efficiency and power. Lockheed has plans whereby Super Constellations can use turboprop engines. Four turboprop planes designated (N) R-7B2, (AF) C-121C already have been ordered by the U. S. military services. Commercial and military orders assure continuous production at least through mid-1955.

ENGINEERING PERSONNEL: Hall Hibbard, V. P., Engineering; C. L. Johnson, chief research engineer. J. J. Johnson, project engineer.

PASSENGER ACCOMODATIONS: Various seating arrangements are used by the different airlines flying Constellation-type transports. The latest commercial Super Constellations, featuring a wholly new interior designed by Lockheed engineers with the counsel of industrial designer Henry Dreyfuss, call for a minimum of 47 seats and a maximum of 99; military transports can carry up to 110, including crew. Super Constellations are pressurized to maintain 5000-foot pressure at 20,000 feet. The new aircraft contain improved heating and refrigeration equipment.

CARGO FEATURES: Passenger Super Constellations have 65 percent more cargo capacity than their companion Constellations. They have 424 cubic feet in the lower aft compartment and 269 cubic feet forward. Constellations have 280 cubic feet aft and 154 cubic feet forward.

SPECS

FLIGHT CREW: In domestic operations, pilot, co-pilot and flight engineer; in overseas operations, a navigator-radio operator is added; on certain long-range flights, additional relief crew members are carried.

POWERPLANT: Wright Turbo-Cyclone C18DA1 engines. FUEL CAPACITY: 6,550 gallons. APPROVED PROPELLERS: Hamilton Standard 6903A-0 or Curtiss 858-2C4-0. WING SPAN: 123 ft. LENGTH: 113.5 ft. HEIGHT: 24.7 ft. GEAR: Tricycle, fully retractable, steerable nosewheel.

WEIGHTS: EMPTY, standard interior, 71,000 lb.: GROSS: 133,000 lb. USEFUL LOAD: 62,000 lb. MAXIMUM PAYLOAD: approximately 24,000 lb. WING LOADING: 80.5 lb. per square ft. POWER LOADING: 10.2 lb. per hp.

PERFORMANCE

Speeds: MAXIMUM, more than 370 mph at 19,000 ft.; CRUISING: 320-340 mph at 20,000 ft. STALLING SPEED: 94 mph at sea level. RATE OF CLIMB: 630 ft. per min. at sea level and maximum gross. TAKEOFF: 3380 ft. LANDING: Over 50-foot obstacle to full stop, 3400 ft. SERVICE CEILING: 27,600 ft. fully loaded. RANGE: 4820 mi.

SUPER CONNIE

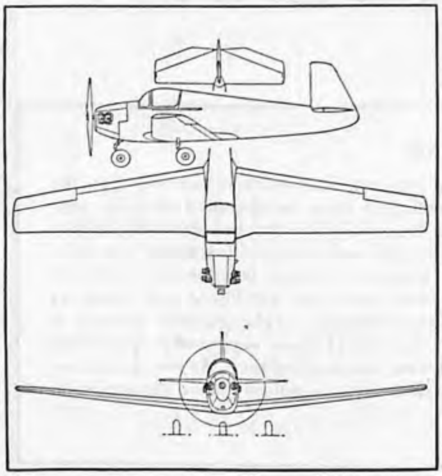
The Lockheed Super Constellation is a living rebuttal to those who believe that the military and civil airplane are two different breeds and must be accorded entirely separate lines of development to be practical. The Super Connie ignores such arguments and is going about its business as not only both civil and military transport but as a tactical airplane as well. The big, four-engined transport is now in economic, efficient service with a variety of scheduled airlines and with both the Air Force and Navy as cargo and passenger carrier. In addition, the Early Warning "radar picket" version is being supplied both the Air Force and the Navy. Yet all of these supposedly specialized duties are being performed by the same basic airframe and powerplant. Maybe specialization in transport design is badly needed, but the successful Lockheed Super Constellation certainly doesn't know it.

MOONEY AIRCRAFT, INC.

Kerrville, Tex.

Single place Mooney

A 1-place, closed, land monoplane, normal and utility category. CAA TYPE CERTIFICATE NUMBER: TC 803. MANUFACTURER'S MODEL DESIGNATION AND DATE OF APPROVAL: M-18L, Mar. 15, 1949: FIRST DELIVERY: March, 1949.



DATA

POWERPLANT: Lycoming 65 (Customer furnished only) or Continental, 65 hp. FUEL CAPACITY AND CONSUMPTION: 16 gal. with 6½ gal. auxiliary tank optional, 3½ to 4½ gal. per hr. APPROVED PROPELLERS: Flottorp Models 63L60 and 65A66. FLAPS: 16½ deg. GEAR: Tricycle retractable.

SPECS

SPAN: 26 ft. 10½ in. LENGTH: 17 ft. 7¼ in. HEIGHT: 6 ft. 2½ in. WEIGHTS: EMPTY, 500 lb.; GROSS, 850 lb.; USEFUL LOAD, 350 lb. WING LOADING, 8.9 lb. per sq. ft. POWER LOADING, 13.1 lb. per hp. BAGGAGE, FULL SEATS AND TANKS: 75 lb.

PERFORMANCE

SPEEDS AT SEA LEVEL: MAXIMUM, 138 mph; CRUISING, 125 mph; STALLING, 40 mph. RATE OF CLIMB: 1,090 ft. 1st min. SERVICE CEILING: 19,400 ft. RANGE: 500 mi.

REMARKS

300 flying hours covering approximately 36,000 miles for $674.00 which includes fuel, oil, maintenance, and insurance is claimed by the manufacturer. The Mooney line is now complete including Model M-18LA with Lycoming engine, Model M-18C with Continental power. The Deluxe model of each includes starter, generator and position lights.

Manufacturer will sell airframe only if desired.

PIPER AIRCRAFT CORP.

Lock Haven, Pa.

Latest Cub

A 2-place, closed, land or sea, high-wing monoplane. CAA TYPE CERTIFICATE: TC 1A2. MANUFACTURER'S MODEL DESIGNATION AND DATE OF APPROVAL: PA-18, Nov. 18, 1949. There were two models of the 1952 Super Cub, 95 and 125, the agricultural model.

DATA

POWERPLANT: (95) Continental, 90 hp; (125) Lycoming 0-290-D 108 hp. FUEL CAPACITY: 18 gal. 36 gal. optional.

SPECS

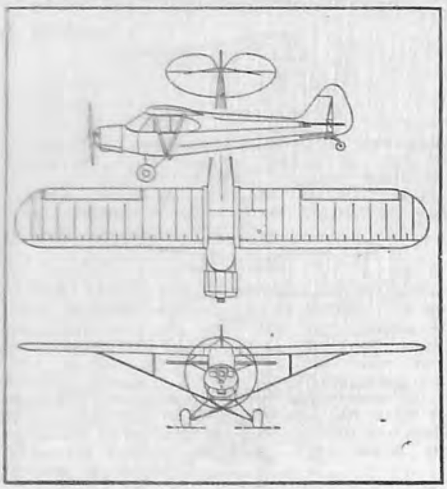
SPAN: 35.3 ft. LENGTH: 22.4 ft. HEIGHT: 6.7 ft. WEIGHTS: EMPTY (95) 800 lb.; (125) 845 lb.; GROSS: 1,500 lb. USEFUL LOAD: (95) 700 lb.; (125) 655 lb., WING LOADING: 8.4 lb per sq. POWER LOADING: (95) 16.6 lb. per hp.; (125) 12 lb. per hp.

PERFORMANCE

SPEED: MAXIMUM (95) 110 mph; (125) 123 mph; CRUISING: (95) 100 mph; (125) 108 mph; STALLING: (95) 42 mph; (125) 38 mph. RATE OF CLIMB: (95) 624 ft. per min.; (125) 870 mph. SERVICE CEILING: (95) 13,500 ft.; (125) 17,100 ft. CRUISING RANGE: (95) 360 mi.; (125) 250 mi.

REMARKS

The Super Cub models for 1953 were designed for a number of jobs among them dusting and spraying, small field operations and patrol work. The 125 can leave the ground after a run only six times its fuselage length. With full flaps, it can be slowed down to 33 mph. A square center-section eliminates cross tubing for more headroom, and behind the rear seat there is a cargo hold measuring 10 cu. ft. entirely free of structure which can be enlarged to 18 cu. ft. by removing the rear seat. The Army designation is L-21.



Piper Tri-Pacer

A 4-place, closed, land high-wing monoplane, normal category. CAA TYPE CERTIFICATE NUMBER: TC 1A4. MANUFACTURER'S MODEL DESIGNATION: PA-22.

DATA

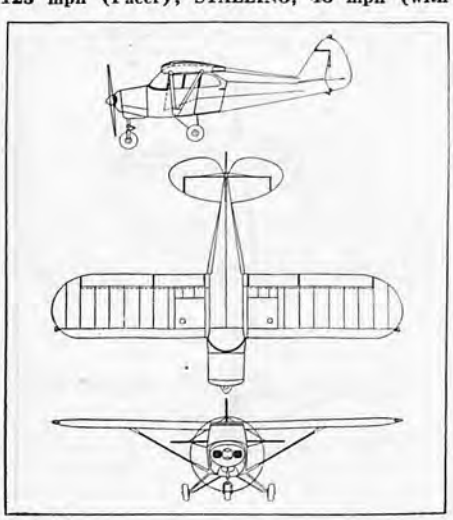
POWERPLANT: Lycoming O-290-D2 135 hp. FUEL CAPACITY AND CONSUMPTION: 36 gal., 7.7 gal. per hr. OIL CAPACITY: 2 gal. APROVED PROPELLERS: Either an Aeromatic or Sensenich controllable pitch. GEAR: Tricycle, steerable nosewheel.

SPECS

SPAN: 29.3 ft. LENGTH: 20.4 ft. HEIGHT: 74.5 in. WEIGHTS: EMPTY, 1,005 lb.; GROSS: 1,950 lb.; USEFUL LOAD: 910 lb., 945 lb. (Pacer). WING LOADING: 13.2 lb. per sq. ft. POWER LOADING: 14.4 lb. per hp. BAGGAGE: 50 lb.

PERFORMANCE

SPEEDS AT SPEED LEVEL: MAXIMUM, 137 mph, 139 mph (Pacer); CRUISING, 123 mph, 125 mph (Pacer); STALLING, 48 mph (with flaps). RATE OF CLIMB: 800 ft. per min. SERVICE CEILING: 15,500 ft.



REMARKS

The Pacer line continued during the year with two models; the standard Pacer and the Tri-Pacer. Both models have the same configuration with the exception of the gear. Addition of the nosewheel to the Tir-Pacer has cut about 2 mph from its performance, but otherwise there is little difference between the two.

PIPER TRI-PACER

Tricycle landing gears and retractable landing gears seem to be synonymous in these highly technical days and it is a rare airplane that has one and not the other. Just such a rare airplane, however, is the Piper Tri-Pacer, which was designed to accommodate those pilots who prefer a tricycle landing gear and yet meet the stringent production and selling cost requirements of all Piper airpalnes. Engineers have long been baffled by the fact that the third wheel, which is suspended on its own mount under the engine, costs the four-place personal airplane only two mph in speed and a reduction in climb, ceiling and takeoff performance that disappears within the limits of the accuracy of engineering calculation. Like the bee that can't fly, the Tri-Pacer continues to ignore the protestations of engineers that its exposed nosewheel comprises a substantial drag penalty and blithely completes its trips within pennies of the operating cost of its conventional tractor Pacer counterpart.

MILITARY

The following list of military aircraft includes, so far as possible, only those in production during the year. All material for this section, including pictures and 3-view drawings, has been compiled from data supplied from the military or manufacturers.

BEECH AIRCRAFT CORP.

Wichita, Kans.

Beech T-34A Trainer

TYPE: Trainer. DESIGNATION: (AF) T-34A.

DATA

POWERPLANT: One Continental O-470-13 engine rated at 225 hp at 2600 rpm; FUEL CAPACITY AND CONSUMPTION: 50 gal. (two 25 gal. internal wing tanks), 10.4 gal. per hr. at 60 percent power; OIL CAPACITY: 12 qt.; PROPELLER: Beech 278-101 constant speed 2 blade; FLAPS: NACA single slot; GEAR: Retractable tricycle.

SPECS

SPAN: 32 ft., 10 in.; LENGTH: 25 ft. 11 in.; HEIGHT: 9 ft., 7 in.; WEIGHTS: EMPTY, 2,170 lb.; GROSS, 2,900 lb.; COMBAT WEIGHT, 2,775 lb.; USEFUL LOAD: 730 lb.; WING LOADING: 16.03 lb. per sq. ft.; POWER LOADING: 12.89 lb. per hp; MAXIMUM ALLOWABLE BAGGAGE: 100 lb.

PERFORMANCE

SPEED at sea level: MAXIMUM, 189 mph; CRUISING, 173 mph at 10,000 ft. with 60 percent power; STALLING, 54 mph. RATE OF CLIMB: 1,230 ft. per min. SERVICE CEILING: 20,000 ft. RANGE at 10,000 ft. with 60 percent power: 735 mi.

REMARKS

The T-34A is a high-performance trainer with excellent maintenance provisions. Its operational costs are low. The high seating arrangement, plus tricycle gear, offer good ground and in-flight visibility. The low noise level cockpit is excellent for dual instruction and separate canopy hatches provide greater safety for landings. It is equipped for full panel instrument flying and armored versions are available for gunnery missions. First flight, December 2, 1948.

BELL AIRCRAFT CORP.

HELICOPTER DIVISION

Fort Worth, Tex.

New twin-tandem Bell HSL-1

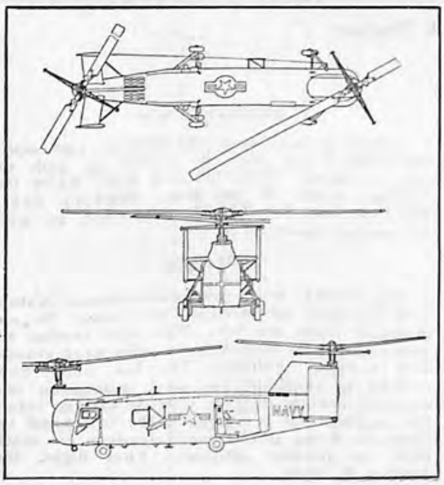
TYPE: Helicopter. DESIGNATION (NAVY) HSL-1.

DATA

POWER PLANT: Pratt & Whitney R-2800, 1900 hp.

REMARKS

All performance data and specifications are restricted. This model designed for anti-submarine warfare. Will be equipped with submarine detection and destruction devices.



BELL HSL-1

Just as the Wright Brothers viewed their airplane solely in its peaceful application, so, too, did helicopter enthusiasts dream for decades of the boon to mankind the ability to hover motionless could become. Like the airplane the Wrights invented, however, this same hovering ability of the helicopter has been put to a warlike use: anti-submarine warfare. The fixed wing aircraft, searching the sea for subs, must remain in motion at a speed of not less than 100 mph and this seriously curtails its ability to detect subs lying quietly below the surface. The helicopter, however, can hover motionless while it lowers sensitive detection equipment into the water and patiently surveys the depths for miles around. The Bell HSL-1 is the first designed-for-the-purpose helicopter to go into production and to be scheduled for service in the grave business of anti-submarine warfare.

Bell H-13G for the Army Field Forces

TYPE: Helicopter. **DESIGNATION:** (N) HTL Series; (Army Field Forces) H-13G.

DATA

POWERPLANT: Franklin 6V4-200-C32. 200 hp. **FUEL CAPACITY:** 40 gal. **OIL CAPACITY:** 2 gal. **GEAR:** Skids, twin floats or skis.

SPECS

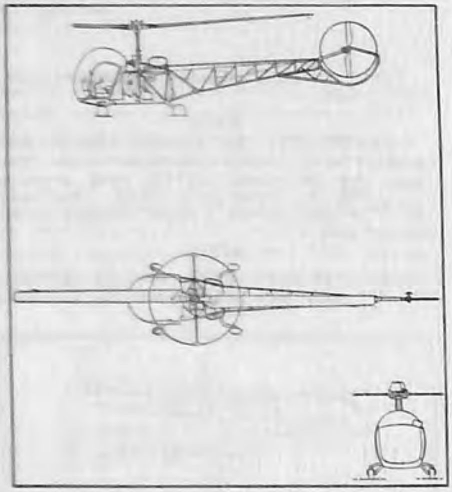
MAIN ROTOR DIAMETER: 35 ft. 1½ in. **ANTI-TORQUE ROTOR DIAMETER:** 5 ft. 9 in. **LENGTH:** 41 ft. 5 in. **WEIGHTS:** EMPTY, 1,409 lb.; GROSS, 2,350 lb.; USEFUL LOAD, 941 lb.; MAXIMUM PAYLOAD, 680 lb. **ROTOR DISC LOADING:** 2.43 lb. per sq. ft. **POWER LOADING:** 11.7 lb. per bhp.

PERFORMANCE

SPEEDS AT SEA LEVEL: MAXIMUM, 90 mph; CRUISING, 77 mph. **RATE OF CLIMB FULLY LOADED:** 800 ft. per min. **SERVICE CEILING:** 10,900 ft. **RANGE:** 215 mi.

REMARKS

Standard Bell design available as commercial model (47G) but is furnished Navy as HTL series and Army Field Forces as H-13G equipped for training, rescue, 5-place evacuation, 3-place liason, observation, 2-place instrument training, assault and cargo. All other data are classified.



BELL H-13G

To the esthetically-minded, the Bell H-13 helicopter has gone steadily backward in its design. The original version of this famed helicopter came equipped with a beautifully-styled, fully-enclosed cabin and a fuselage that snugly embraced its engine. But it was not long before the more practical users started taking parts off the H-13 in favor of more freedom for such duties as dusting, pipeline patrol and mountain-top supply. Before long the Army had caught the fever and asked Bell to delete such normal appendages from future production. Ultimately, even the wheels disappeared and today's Bell H-13G—the one that saved hundreds of lives in Korea—is the barest framework of a flying machine. But throughout this transition from a luxury liner to a rugged man-of-all-work, the H-13 retained its basic performance, utility and capacity for doing its job—and ignored the protests of the esthetes.

BOEING AIRPLANE CO.

Seattle, Wash.

Boeing B-47E Stratojet

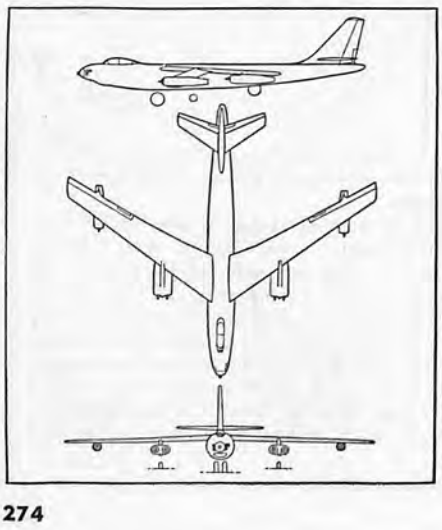
TYPE: Medium Bomber. **DESIGNATION:** (AF) B-47E.

DATA

POWERPLANT: Six General Electric J-47 turbojets each rated at 5,800 lb. thrust. Provision for 18 integral RATO units rated at over 1,000 lb. thrust each. **GEAR:** Dual main wheels in tandem with a single outrigger under inboard pod.

SPECS

SPAN: 116 ft. sweepback, 35 deg.; **LENGTH:** 106 ft.; **HEIGHT:** 28 ft. **GROSS WEIGHT:** over 185,000 lb. **NORMAL BOMB LOAD:** over 20,000 lb.



PERFORMANCE

MAXIMUM SPEED: "600 mph class." **SERVICE CEILING:** Over 40,000 ft. **RANGE:** More than 3,000 miles.

REMARKS

The B-47 Stratojet is the fastest operational bomber in the world. The first XB-47 flight took place in December, 1947, after four years of developmental work. Among the features of the B-47 are the thin flexible wing which has a drooped appearance on the ground changing to a slight dihedral in flight. Pilot, co-pilot and navigator-bombardier-observer make up the crew with pilot and co-pilot riding tandem. On February 8, 1949, a Stratojet set an unofficial transcontinental speed record of 3 hr., 46 min. from Moses Lake AFB, Washington, to Andrews AFB, Md., averaging 607.8 mph. A Stratojet made the first jet flight over the North Pole September 20, 1951 and another flew a special 12,000-mile non-stop mission with the aid of aerial refueling in 24 hr. March 23-24, 1952. On July 28, 1953, a Stratojet of the 305th Medium Bomb Wing set an unofficial transatlantic record of 4 hr., 45 min. flying the 2,933 miles from Limestone AFB, Me., to Fairford RAFB, England, at an average speed of 617.4 mph. A new model, the RB-47E, was completed during the year. It differs from the standard version in having a longer nose, more windows and air-conditioned camera compartment in place of bomb bay. Equipment includes intervalometers for continuous pictures of large areas, optical viewfinder and photocell shutters actuated by flash illuminents for night aerial photography. First production model, B-47A, completed March 1, 1950. Current production model is the B-47E. All other data are classified.

Boeing B-50D Superfortress

TYPE: Medium Bomber. **DESIGNATION:** (AF) B-50D.

DATA

POWERPLANT: Four Pratt and Whitney R-4360, 3,500 hp each at takeoff. **PROPELLERS:** Curtiss Electric 4-blades fully reversible full feathering **GEAR:** Tricycle retractable; all dual wheels.

SPECS

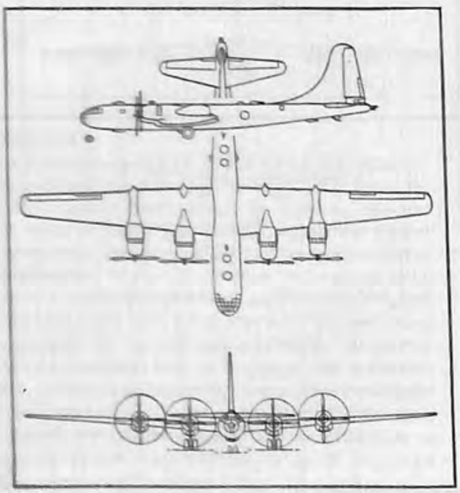
SPAN: 141 ft. 3 in. **LENGTH:** 99 ft. **HEIGHT:** 32 ft. 8 in. **GROSS WEIGHT:** 170,000 lb. **BOMB LOAD:** 28,000 lb.

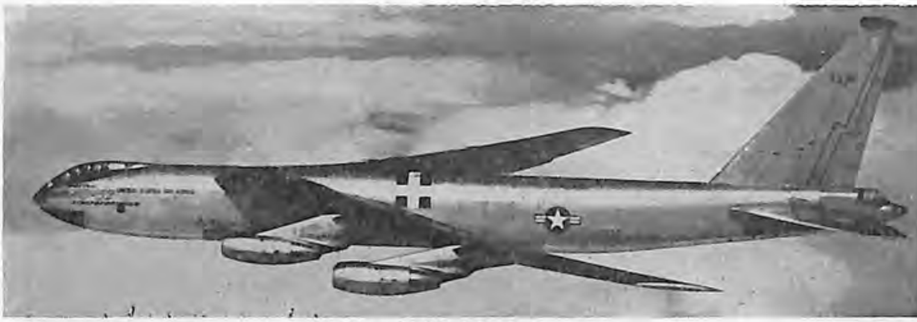
PERFORMANCE

SPEEDS: MAXIMUM, over 400 mph; **CRUISING SPEED,** approximately 300 mph. **SERVICE CEILING:** Over 30,000 ft. **RANGE:** 4,000 mi. with 20,000 lb. bomb load.

REMARKS

Serving with the USAF as its standard reciprocating-engined medium bomber, the B-50D differs from earlier models in that provision is made for the installation of either a 700-gallon droppable fuel tank or a 4,000 lb. bomb under each wing. B-50Ds also are equipped for aerial refueling with the Boeing Flying Boom system. Boeing delivered the first B-50 to the Air Force in October, 1947. Other production models of the Superfort included the RB-50s, photo and weather reconnaissance airplanes, and TB-50s, bombing and navigational trainers. The latter, specially modified inside, are used to train the bombardier-navigator-observer crew members of today's jet bombers such as the B-47 Stratojet. Normal crew is 11. Boeing entered fully into jet bomber production with the delivery of the last Superfort, a TB-50H, to the USAF's Air Training Command on Feb. 28, 1953, having built a total of more than 4,250 Superforts—B-29s and B-50s—over a ten-year span.



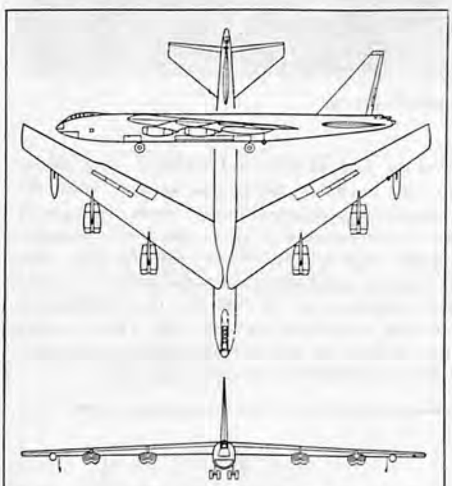


Boeing B-52 Stratofortress

TYPE: Heavy Bomber. DESIGNATION: (AF) B-52.

DATA

POWERPLANT: Eight Pratt & Whitney J-57 turbojet engines. GEAR: Eight main wheels in tandem with single outrigger wheels near wing-tips.



SPECS

SPAN: 185 ft., sweepback, 35 degrees. LENGTH: 153 ft. HEIGHT: 48 ft. GROSS WEIGHT: Over 300,000 lb. Capable of carrying nuclear devices. Production models designed for aerial refueling.

PERFORMANCE

Can be described only as a very high speed, long-range heavy bomber. CREW: Classified. SERVICE CEILING: Over 50,000 ft.

REMARKS

Two experimental prototypes of this airplane underwent Boeing and Air Force test programs during the year. First Stratofortress to fly—the YB-52—made its initial flight April 15, 1952, six years after Boeing was awarded an Air Force contract for the engineering study and preliminary design of the new bomber. The airplane was ordered into quantity production as the Air Force's standard heavy bomber even before the first flight of the YB-52. Boeing started building production B-52s at its Seattle, Wash., plant and the company's Wichita Division has been named as the second source for production. Prototypes have pilot and co-pilot riding tandem. Production models will have side-by-side seating. All other data are classified.

BOEING B-52

The Air Force faced a serious problem in transforming the strategic bomber into the jet age. The fighter and medium bomber designers had done the job almost painlessly but the problem of flying 10,000 miles with a 10,000-lb. bomb load on jet engines wasn't nearly so simple. Since a jet engine uses roughly twice as much fuel—everything else being equal—as the piston engine, obviously the transition required twice the fuel load. This staggering additional weight (more than 30 tons) necessitated greater wing area if takeoff and landing performance was to remain the same and this, in turn, meant still more weight. At one point the gross weight of the XB-52 was pushing upward towards 500,000 lb. However, by the use of engines of greater economy than originally planned, reducing the required range requirement, recognizing that a handful of atom bombs—weighing only a few thousand pounds—is infinitely more destructive than a heavy tonnage of conventional bombs and making arragements for in-flight refueling, Boeing engineers produced a strategic jet bomber weighing only a little over 300,000 lb., a respectful figure to be sure, but one well within present operating requirements.

Boeing KC-97G Aerial Tanker with Flying Boom

TYPE: Convertible tanker-transport. **DESIGNATION:** (AF) KC-97G.

DATA

POWERPLANT: Four Pratt & Whitney R-4360-59 Wasp Major engines, 3,500 hp each at takeoff. **PROPELLERS:** Hamilton Standard four-blades, full feathering, fully reversible. **GEAR:** Tricycle, retractable; dual wheels throughout. **PRESSURIZATION:** Entire plane fully pressurized maintaining sea level pressure up to 15,000 ft. airplane altitude and 8,000 ft. cabin pressure at 30,000 ft. airplane altitude.

SPECS

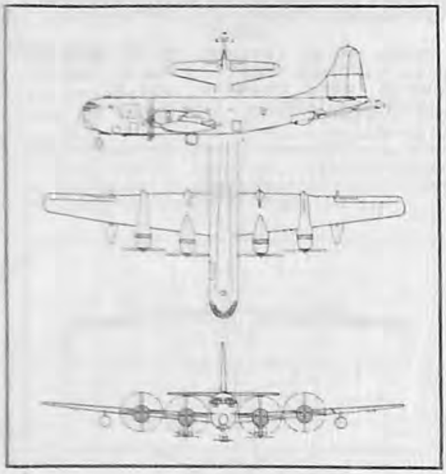
SPAN: 141 ft. 3 in. **LENGTH:** 110 ft. 4 in. **HEIGHT:** 38 ft. 3 in. (foldable). **GROSS WEIGHT:** 153,000 lb. **MAXIMUM WEIGHT:** 175,000 lb.

PERFORMANCE

SPEEDS: Maximum, 375 mph. Cruising, over 300 mph. **SERVICE CEILING:** More than 35,000 ft.

REMARKS

Flying Boom, controls and boom operator's station mounted as a single unit or pod which can be easily removed. Internal fuel tanks located so that airplane may also carry cargo while in the tanker configuration. By removing pod and installing cargo doors in its place, the airplane can serve as a cargo, troop or hospital transport. In this configuration it can carry supplies and equipment including light tanks, artillery up to 155 mm howitzers, ambulances, 2½ ton trucks, jeeps or combinations of these, or 96 fully equipped troops or 69 litter patients, medical atendants and supplies. Normal crew is five. First XC-97 flew November, 1944. KC-97A prototype tanker revealed December, 1950. Current production model, KC-97G. Chief differences between G and earlier models is the provision for two droppable wing tanks and the relocation of internal fuel tanks. G models now complementing earlier KC-97Es, KC-97Fs and C-97As in service with the Strategic Air Command and Military Air Transport Service. All other data are classified.



BOEING KC-97G

Converting the famed Boeing Stratocruiser transport, with its cavernous interior, to a flying tanker was something of a routine job. As the KC-97, the aerial refueling plane was simply the transport with huge fuel tanks anchored along its cargo floor. But such a jury arrangement made it an "either-or" airplane and both cargo and refueling tankage could not be carried simultaneously. Hard-driving SAC commander General Curtis LeMay asked for a C-97 that could do both jobs at once. Result: the KC-97G, which carries its refueling load under its cargo floor, which is freed for fast transit of bulky freight without removing fueling tanks.

CESSNA AIRCRAFT CO.

Wichita, Kans.

Cessna L-19A for Army Field Forces

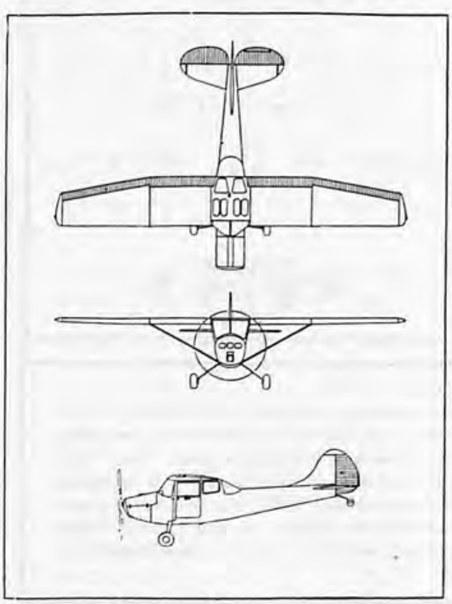
TYPE: Liaison. DESIGNATION: (Army) L-19A.

DATA

POWERPLANT: Continental, 0-470-11, 190 hp. FUEL CAPACITY: Two 21 gal. wing tanks.

SPECS

SPAN: 36 ft. LENGTH: 25 ft. HEIGHT: 7.5 ft. WEIGHTS: EMPTY, 1,448 lb.; GROSS: 2,100 lb. WING LOADING: 12.1 lb. per sq. ft. POWER LOADING: 11.05 lb. per hp.



PERFORMANCE

SPEEDS: CRUISING at 5,000 ft. 29 percent hp, 104 mph; OBSERVATION, 46 mph. TAKE-OFF: Over a 50 ft. obstacle on a sod field, 560 ft. LANDING: Over a 50 ft. obstacle on a sod field, 600 ft. RATE OF CLIMB: Sea level, 1,290 ft. per 1st min. SERVICE CEILING: 22,900 ft. ENDURANCE: With 20 gal. fuel, 3.1 hr.

REMARKS

Early in June, 1950 Cessna came out the winner in the Army Field Forces' observation reconnaissance competition, with the first order amounting to 400 planes. This has been followed by a steady stream of orders for this model. The evaluation program was divided in two parts; one at Wright-Patterson AFB for a technical evaluation by the Air Force, and the other by the Army Field Forces at Fort Bragg for the Service testing.

The L-19A Bird Dog is all-metal, has a wide door opening and ample rear cockpit and baggage space that can be used for stretcher installation. Cruising speed up to 145 mph at optimum altitude is claimed. Flaps are the high-lift type and extend rearward as they are lowered. Maximum flap travel is 60 degrees. All other data are classified.

An experimental development of this model, the XL-19B is essentially the same airplane as the L-19A except for the substitution of the Boeing 502-8 turboprop engine. The McCauley fixed pitch propeller, currently installed in the L-19A was reworked and adapted to the spline shaft gear reduction box by the use of a special propeller hub. Minor modifications included a new cowl design and revised instrumentation. After work on the XL-19B, Cessna received a contract to develop the XL-19C which is similar to the XL-19B except for modifications to the fuel system, engine installation, cowl and instrumentation. The Continental Artouste I engine and gear reduction unit, fitted with a Hartzell constant speed variable pitch propeller was adapted to a modified L-19A fuselage. Production continued on the L-19A during the year.

CHANCE VOUGHT AIRCRAFT, INC.

Dallas, Tex.

Last Corsair version, the F4U-7

TYPE: Fighter. DESIGNATION: (N) F4U-7.

DATA

POWERPLANT: Pratt and Whitney R-2800-32W, 2,300 hp at takeoff. FUEL CAPACITY: 234 gal. OIL CAPACITY: 33 gal. PROPELLER: Hamilton Standard, FLAPS: Slotted, 50 degree travel. GEAR: Conventional retractable.

SPECS

SPAN: 40 ft. 11¾ in. LENGTH: 34 ft. 6¼ in. HEIGHT: 14 ft. 9½ in. WEIGHTS: EMPTY, 10,099 lb.; GROSS, 13,297 lb.; USEFUL LOAD, 3,198 lb. WING LOADING, 42.35 lb. per sq. ft. POWER LOADING, 8.86 lb. per bhp.

PERFORMANCE

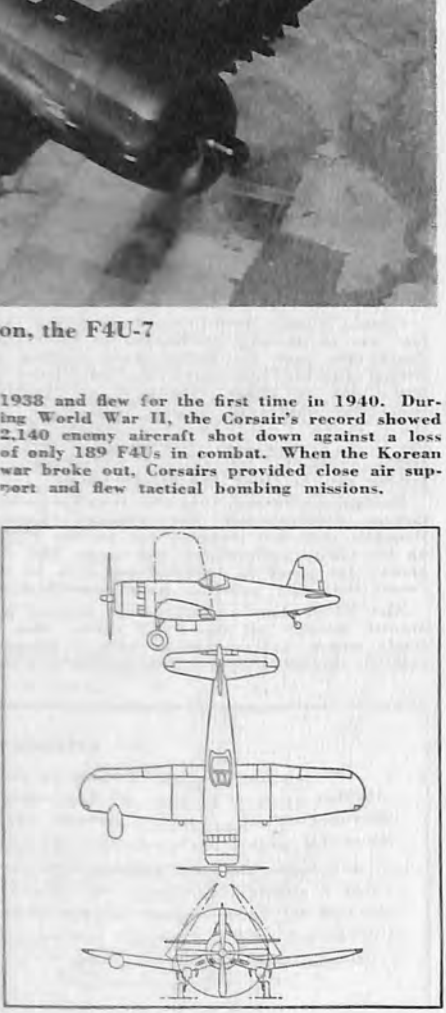
SPEEDS AT SEA LEVEL: MAXIMUM, 379 mph; CRUISING, 227 mph; STALLING, 110 mph. RATE OF CLIMB: 4,340 ft. per min. SERVICE CEILING: 41,100 ft. RANGE: 1,270 mi.

REMARKS

In February, 1953, Chance Vought Aircraft closed out an era of piston-engine fighter aircraft that began in 1917. The last Chance Vought Corsair, an F4U-7, was delivered to be turned over to the French Navy under the Mutual Defense Assistance Program.

The 12,571st Corsair to be built was the Navy's last piston-engine fighter airplane. No other fighter in the history of U. S. aviation had remained in production so long and none had been in first-line combat harness longer.

The Corsair went on the designing boards in 1938 and flew for the first time in 1940. During World War II, the Corsair's record showed 2,140 enemy aircraft shot down against a loss of only 189 F4Us in combat. When the Korean war broke out, Corsairs provided close air support and flew tactical bombing missions.



Carrier-based F7U-3 Cutlass

TYPE: Fighter. DESIGNATION: (N) F7U-3.

DATA

POWERPLANT: Two Westinghouse J46-WE-2 turbojets. GEAR: Tricycle retractible.

REMARKS

Chance Vought Aircraft's twin-jet F7U-3 Cutlass was in quantity production in 1953 and, during the year, the Dallas, Tex., division of United Aircraft Corporation received a letter of intent for an attack version of the tailless, swept-wing shipboard fighter being built for the U. S. Navy. The F7U-3 was designed to give the U. S. Fleet a fast carrier-based fighter offering superior high altitude performance, a greater rate of climb and greater range.

Having established that the sweptback-wing, tailless configuration was efficient, Chance Vought's engineers concentrated in the F7U-3 on increasing performance and range. The airplane's top speed is classified but it is in the "more than 650 miles an hour" classification.

The F7U-3 has a dual power control hydraulic system "all the way," rather than a single power control system with a separate manual control system. Each system is completely independent of the other, offering a maximum of reliability.

The engineers went all out to provide ease of maintenance, aiming to reduce to a minimum the amount of time the fast fighter will have to spend on the deck. Large access doors on the outside of the fuselage in the console area permit work to be performed in the consoles without getting into the cockpit. Other access doors are located opposite the rudder pedals. All consoles are removable as units. The electronics and gun compartments are easily accessible. Engine servicing procedure calls for aft removal. Maintenance and servicing operations have been simplified by running all electrical lines on the right side of the airplane and all hydraulic lines, with a few exceptions, on the left side.

The Cutlass design uses two vertical stabilizers and rudders at the trailing edge of the wing. "Ailavators," combined ailerons and elevators, provide longitudinal and lateral control. Leading edge wing slats replace the conventional landing flaps for low stalling speed essential for carrier-based aircraft.

The first production model of the original F7U-1 Cutlass flew March 1, 1950, as the culmination of years of development and flight testing of experimental models. Deliveries to the Navy followed. The first flight of the F7U-3 took place December 20, 1951.

CHANCE VOUGHT F7U-3

The fabulous Vought Cutlass is the only jet fighter that has flown with three different kinds of engine. Its first version used the Westinghouse J34 turbojet and the improved F7U-3 production version was scheduled to use the more powerful Westinghouse J46 engine but production difficulties resulted in the airplanes pouring from the factory faster than the engines were being delivered. As a result, the Air Force provided a number of Allison J35 engines for temporary use and the first F7U-3's were powered by these engines during their early service tests. Now, however, the J46 engines are rolling down the line on schedule and the -3's are flying with their third engine type aboard.

CONSOLIDATED VULTEE AIRCRAFT CORP.

San Diego, Calif.

Convair RB-36H 10-engine bomber

TYPE: Heavy bomber. DESIGNATION: (AF) B-36H.

DATA

POWERPLANT: Six Pratt and Whitney pusher-type, R-4360-53, 3,800 hp each. Four General Electric J-47 jets, 5,800 lb. static thrust each. FUEL CAPACITY: More than 21,000 gal. carried in integral fuel tanks within the main wing box spar. OIL CAPACITY: 1,200 gal. PROPELLERS: Six Curtiss Electric, reversible, 3-bladed, 19 ft. diameter. GEAR: Tricycle, dual-wheel nose gear, 4-wheel truck main gear.

SPECS

SPAN: 230 ft. LENGTH: 162 ft. HEIGHT: 46 ft. 9 in. WEIGHTS: MAX. GROSS, approx. 358,000 lb. WING LOADING, 58.3 lb. per sq-ft.

PERFORMANCE

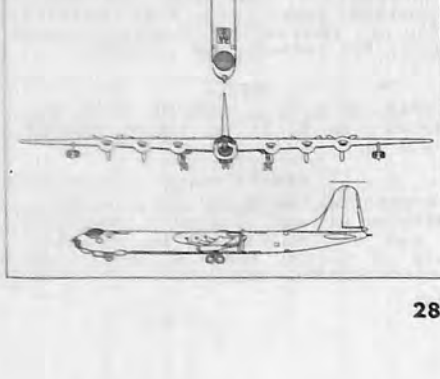
MAXIMUM SPEED: Over 435 mph (AF figure). SERVICE CEILING: over 45,000 ft. RANGE: 10,000 mi. with 10,000 lb. bomb load carried halfway. DESIGN BOMB LOAD: 10,000 lb. MAXIMUM BOMB LOAD: 84,000 lb.

REMARKS

The B-36, world's largest bomber, is designed to carry out long-range bombardment and reconnaissance missions from American bases.

In 1941, Convair won an Air Force design competition for a plane with a range of 10,000 mi., carrying a 10,000-lb. bomb load halfway. A contract for two experimental models was awarded on November 15, 1941. A letter of intent for 100 B-36s was awarded on July 23, 1943. Start of actual construction of the first experimental model, the XB-36, was the end of 1942, following transfer of the full-scale wooden mockup from San Diego, Calif., to Fort Worth, Tex.

Shop orders for the first production model B-36s (the A models) were released in October 1943; but because of emphasis on B-24 and



B-32 programs at Convair's Fort Worth division, releases of shop orders on a full-scale basis did not begin until after VJ Day in 1945.

First flight of the experimental XB-36 was on August 8, 1946. First flight of the A model was on August 28, 1947. First flight of the B model (with six 3,500-hp engines instead of 3,000-hp) was on July 8, 1948. First flight of the D model (with four jet engines in addition to six reciprocating engines) was on March 26, 1949. First flight of the F model (with six 3,800-horsepower piston engines and four jet engines) was on November 18, 1950. First flight of the H model (with various refinements, including a two-station flight engineers' panel) was on April 5, 1952.

Quantity production of B-36s began in 1948 and is scheduled to continue until late 1954. Current production models develop the equivalent of more than 44,000 hp—six 3,800-hp piston engines and four jet engines each developing 5,200 lb. of thrust. Mounted in pairs in a pod beneath the outer wing panels of each B-36, the four jet units provide additional power for takeoff, improve the rate of climb, raise the service ceiling, and increase the plane's speed.

The Air Force has returned earlier models to Convair, for installation of four jet engines, snap-action bomb bay doors, and various other improvements, making them comparable in performance to B-36s fresh off the assembly line.

Deliveries of RB-36 reconnaissance airplanes began in 1950. Externally, the RB-36 closely resembles the B-36 bomber; but internally, the RB-36 carries the large cameras and other special equipment needed in long-range high-altitude reconnaissance. In the RB-36 forward bomb bay, for example, are 14 different cameras, including one with a 42-in. focal length lens.

In 1953 the Air Force announced the successful development of the B-36 as a carrier of a full-sized combat aircraft, extending the utility of the B-36 even further. The B-36 can launch and retrieve the F-84 jet in flight. Basic objective of the project is to provide the Air Force with the capability for long-range high-speed reconnaissance. All other data are classified.

Convair T-29C, Flying Classroom

TYPE: Trainer. Designation: (AF) T-29C.

DATA

POWERPLANT: Two Pratt and Whitney R-2800-99W, 2500 hp each. FUEL CAPACITY: 1,500 gal. PROPELLERS: Hamilton Standard 3-blade, full feathering and reversible.

SPECS

SPAN: 91 ft. 9 in. LENGTH: 74 ft. 8 in. HEIGHT: 26 ft. 11 in. GROSS WEIGHT: 43,575 lb.

PERFORMANCE

SPEEDS: MAXIMUM 295 mph at 13,500 ft.; CRUISING, 247 mph at 20,000 ft.; STALLING, 92 mph. ENDURANCE: 6.4 hr. at cruising. RATE OF CLIMB: 20,000 ft. in 17.5 min. SERVICE CEILING: 23,500 ft.

REMARKS

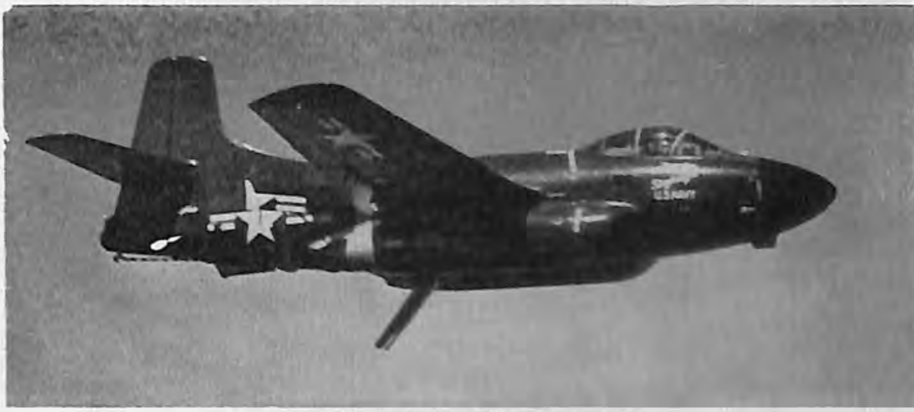
Dubbed the "Flying Classroom," the T-29C is a modified version of the Convair 240 Convair Liner. It is used as a navigational bombardier trainer and carriers 14 students plus instructors and crew. Radar training equipment provides för three students with instructors. Other special equipment includes three astrodomes, 18 antennas and standard radar unit under the fuselage. The T-29B is pressurized.

A fleet of C-131A air evacuation transports, based on design of the T-29B, was ordered by the Air Force in 1952 . . . Various arrangements of litters and seats can be installed. First deliveries will be made in 1954.

T-29D special bombardier trainers are also in production at Convair's San Diego division. The "D" is similar in general design to the "C." Interior arrangement is different, with stations for 7 plus crew.

DOUGLAS AIRCRAFT CO., INC.

Santa Monica, Calif.



Douglas twin-jet F3D Skyknight

TYPE: Fighter. **DESIGNATION:** (N) F3D-2.

DATA

POWERPLANT: Two Westinghouse J-34 (24C). **GEAR:** Nose-wheel type.

SPECS

SPAN: 50 ft. **LENGTH:** 45 ft. 6¼ in. **WEIGHT, EMPTY:** 15,000 lbs. **GROSS**, 24,650 or 26,750 with wing tanks.

REMARKS

Preliminary design was begun on this two-place fighter early in Sept. 1945, and on Mar. 23, 1948, it made its first flight. During 1949 and 1950, it went into full scale production at Douglas' El Segundo Division.

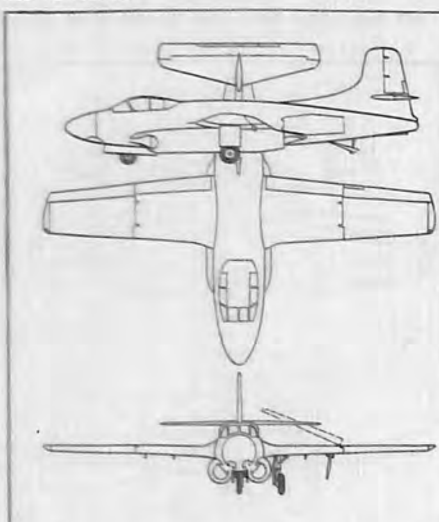
The F3D-2 Skyknight is a carrier-based jet night fighter with advanced radar equipment embodying features of search, automatic gun-firing and tail warning aids. Combat flights with the F3D have demonstrated that interception of bombers in daytime or at night in all kinds of weather at altitudes of over 40,000 feet is practical with this airplane. This model can fly at high speeds for great distances, and at high altitudes, making it adaptable as an attack-fighter, long-range patrol or reconnaissance airplane or as a long-range escort fighter.

A special system of cockpit lighting to prevent glare is used. All instrument letters and numbers are etched in transparent lucite on panels lighted from the rear with a red light. Emergency pilot escape is by an underside bail-out chute similar to a slide fire escape. Speed brakes are hydraulically operated and extend outward from the fuselage just forward of the tail.

Production of the speedier, more powerful F3D-2 which used improved J34 engines, commenced in 1951 and continued through June, 1953, although final delivery to the Navy was scheduled for later in the year. The F3D-3, a projected swept wing version, was never put into production.

The F3D, flown from ground bases by the Marines in Korea and off carriers by Navy pilots, become the world's first jet to shoot down another jet in night combat on Nov. 2, 1952, when two Marines shot down a Russian made YAK-15. Subsequently, it became the Navy's leading night fighter in total number of "kills" in the Korean war.

The F3D carries a heavy load of fuel for long-range operations and a full complement of 20 mm. cannons and bombs. All other data are classified.



Douglas AD-6 Skyraider

TYPE: Attack. **DESIGNATION:** (N) AD-6.

DATA

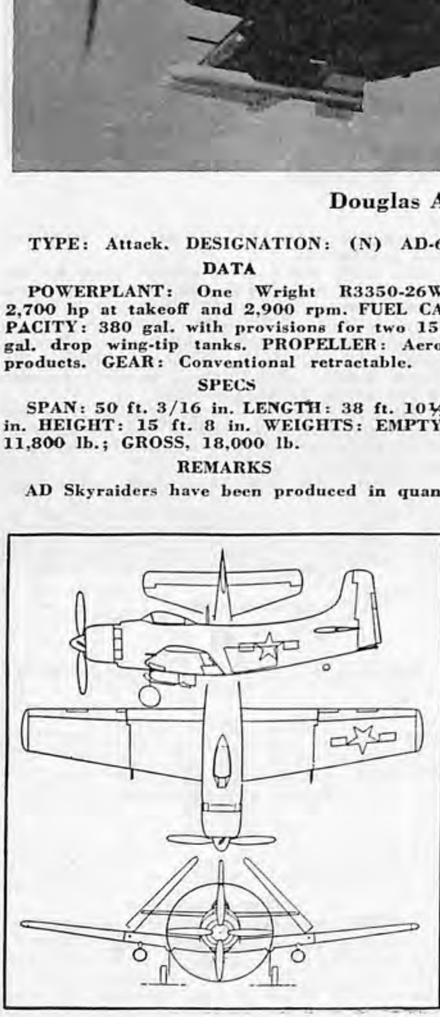
POWERPLANT: One Wright R3350-26W, 2,700 hp at takeoff and 2,900 rpm. **FUEL CAPACITY:** 380 gal. with provisions for two 150 gal. drop wing-tip tanks. **PROPELLER:** Aeroproducts. **GEAR:** Conventional retractable.

SPECS

SPAN: 50 ft. 3/16 in. **LENGTH:** 38 ft. 10½ in. **HEIGHT:** 15 ft. 8 in. **WEIGHTS: EMPTY**, 11,800 lb.; **GROSS**, 18,000 lb.

REMARKS

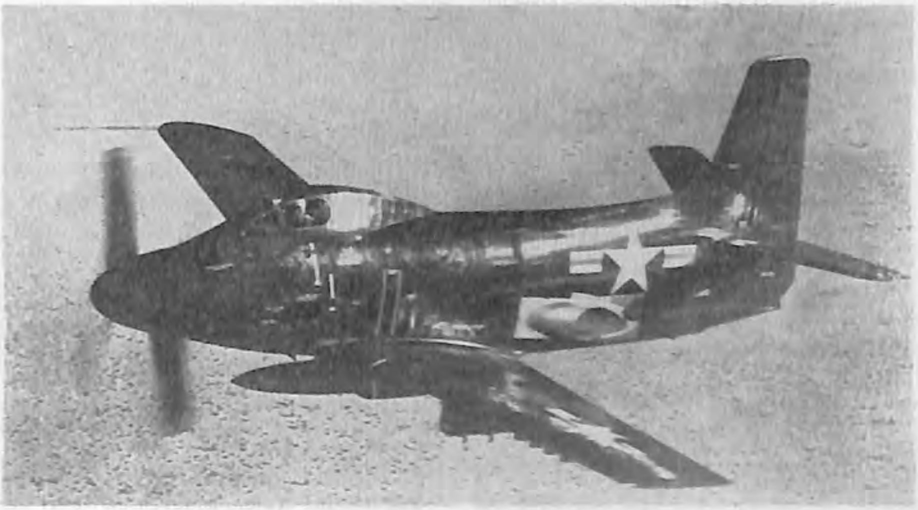
AD Skyraiders have been produced in quantity at Douglas' El Segundo Division, including AD-1s, -2s, -3s, -4s, -5s and -6s, since late 1945. Numerous versions have been designed and produced, ranging from attack-dive bombers, night attack, radar counter-measures, airborne early warning, anti-submarine, and target towing to the extremely different AD-5 "Multiplex" which can perform over a dozen distinct jobs. Although the basic AD (other than AD-5) is a single place airplane, the Q (countermeasure) version has accommodations inside the fuselage for an additional radar operator, while the W (special search equipment) and N (night operations) versions can carry two extra crew members.



An AD-4 set a new world record for loads carried by a single-engine aircraft on May 21, 1953, when it carried a bomb load of 10,500 lb. and a useful load of 14,941 lb. Its basic weight was 11,798 lb. Originally produced to meet a 1,000-lb. load spec, ADs regularly carried 8,000 and 9,000-lb. bomb loads off carriers in Korea. On July 10, 1953, in San Francisco, it was revealed that AD-4B Skyraiders are equipped to carry atomic bombs and had been in operation aboard Navy carriers for nearly a year.

AD-5s went into production at Douglas' El Segundo Division in July, 1953.

The "Multiplex" version of the Skyraider is being produced in three models—the AD-5 day attack which can be fitted with any one of five conversion kits for performance of specific tasks not ordinarily assigned to an attack type aircraft, AD-5N, and AD-5W. The 500-pound conversion kits make the AD-5 particularly adaptable to carrier usage and can be easily installed in just a few hours to turn the single-engine long range bomber into a 12-place, high density transport with a face-to-face seating arrangement; one-ton cargo plane; plush, six-place VIP transport with seats facing aft; or a four-litter ambulance. All other data are classified.



Douglas A2D-Skyshark

TYPE: Attack. DESIGNATION: (N) A2D-1.

DATA

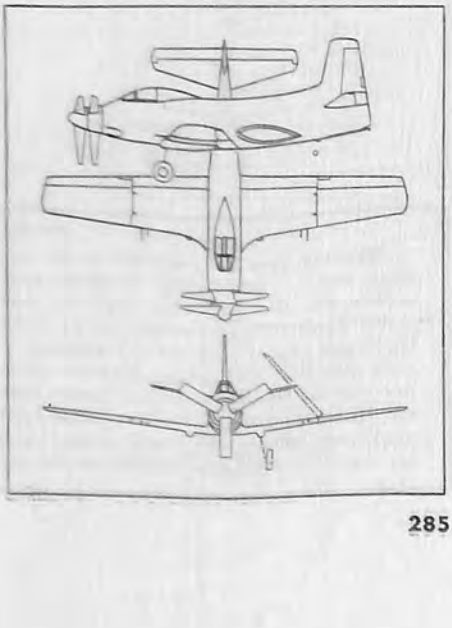
POWERPLANT: One Allison T40, rated at 5500 hp for takeoff. GEAR: Conventional retractable. PROPELLERS: Counter-rotating Aeroproducts, six-bladed.

REMARKS

The first American attack airplane to use a turboprop power plant, the A2D is more powerful than some World War II four-engine bombers. The pilot location in the A2D is far forward to permit maximum vision for carrier landings, and the cockpit is designed for increased resistance to crash loads. Cabin pressure and cooling are provided by an expansion turbine type system. A Douglas-developed upward ejecting seat permits safe escape at this airplane's high speeds. The A2D's T40 engine has two identical turbine power sections connected to a reduction gear by extension shafting, all mounted as a single unit. Either power section may be operated independently of the other for more economical use of fuel, or together for maximum speed and high altitude performance. Large jet exhausts are located in either side of the fuselage about three-quarters of the overall length back and below the elevator level.

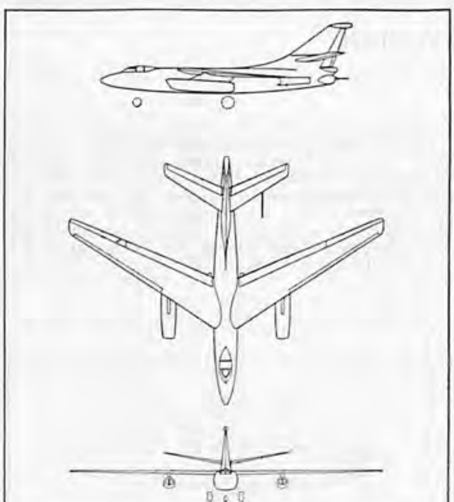
The Skyshark with its huge counter-rotating propellers is unique in its combination of an extremely short takeoff, high operating altitude, a high speed approaching that of jet fighters, an unusually high load carrying ability. These characteristics make it particularly well suited as a general purpose, carrier-based attack or ground support aircraft.

This model was successfully flown for the first time on May 26, 1950, but due to prolonged development of the engine, did not enter line production at Douglas' El Segundo Division until 1953. In October, 1953, continued development work on the engine prompted the Navy BuAer to halt production temporarily. All other data are classified.



Douglas A3D carrier based bomber

TYPE: Attack bomber. **DESIGNATION:** (AF) B-66 (N) A3D-1.



DATA

POWERPLANT: Two Pratt & Whitney J57s. **GEAR:** Nose-wheel type. **WINGS:** High, swept and folding. **TAIL:** Rudder folds over.

REMARKS

The XA3D-1 (with Westinghouse J-40 engines) was first flown on October 28, 1952. The A3D-1 with J57s, first flown on September 16, 1953, is the most powerful airplane ever designed for carrier operation. Built to perform in the 600 to 700 mph. class, the twin-jet can fly combat missions at altitudes above 40,000 ft. It can also be used at low level for mine laying or can be adapted aboard a carrier for photo reconnaissance. It has an internal bomb bay capable of holding the largest type bombs, torpedoes, or other munitions used aboard Navy carriers. Engines are encased in pods suspended from both wings, and both the wing and tail fold for compact handling and storage aboard carriers. Pressurized cabin accommodates a crew of three—pilot, pilot-bombardier and gunner-navigator. The A3D has a simple slide-type escape chute like that used in the F3D Skyknight and also an upper ditching hatch. It also has hydraulic dive brakes in the sides of the fuselage. Although the A3D is the Navy's largest bomber, it is small and light in proportion to its missions. The as-yet unnamed swept-wing jet entered production at the Douglas El Segundo Division in January, 1953. The B-66 and RB-66, Air Force versions of the A3D, are in production at Douglas' Long Beach Division. Specifications and all other data on the A3D are classified.

DOUGLAS A3D

This big, new Navy bomber almost found itself without a home mid-way through its early stages. World War II ended with the Navy putting 45,000-ton carriers into service and the next step, logically, was a 60,000-ton class to accommodate bigger, faster, harder-hitting aircraft. As part of a coordinated program, the Navy ordered the big "super carrier" and the new Douglas twin-jet bomber to operate from it. Everything went smoothly until former Secretary of Defense Johnson summarily cancelled the carrier—leaving Douglas' new, big bomber with no place to go. Wisely, the Navy continued the A3D program, despite loss of its carrier. The swept-wing bomber has progressed nicely and, happily, the "super carrier" program has now been restored. Now the planes are ready for their first landing on the new U.S.S. Forrestal early next year.

Douglas C-124C Globemaster cargo transport

TYPE: Cargo. DESIGNATION: (AF) C-124C.

DATA

POWERPLANT: Four Pratt and Whitney R-4360-63, 3,800 hp at takeoff. FUEL CAPACITY: 11,000 gal. OIL CAPACITY: 330 gal. PROPELLERS: Curtiss Electric 3-blade, reversible. FLAPS: Douglas full span, deflector vane, double slotted 40 degrees. GEAR: Tricycle, dual main and nosewheel.

SPECS

SPAN: 174 ft. LENGTH: 130 ft. .05 in. HEIGHT: 48 ft. 3.6 in. WEIGHTS: EMPTY, 101,340 lb.; DESIGN GROSS, 185,000 lb.; DESIGN USEFUL LOAD, 78,096 lb.; DESIGN PAYLOAD, 56,096 lb. WING LOADING: 73.8 lb. per sq. ft. POWER LOADING: 12.3 lb. per bhp.

PERFORMANCE

Performance figures for the C-124C are restricted. The following are for the C-124A.

SPEEDS: MAXIMUM, 298 mph at 20,800 ft.; CRUISING, 264 mph at 13,600 ft.; STALLING, 99.5 mph with 160,000 lb. gross; RATE OF CLIMB AT SEA LEVEL, 800 ft. per min. with 175,000 lb. gross. SERVICE CEILING FULLY LOADED: 22,050 ft. RANGE: 6,280 mi.

REMARKS

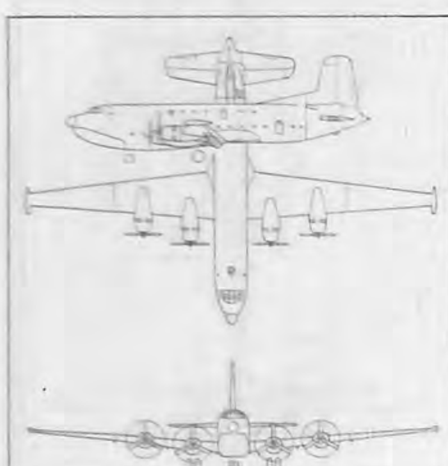
The C-124C is a new model in the Douglas Aircraft Company's C-124 series of cargo and troop transports being delivered under AF contracts. It continues to be the largest airplane in production in its category.

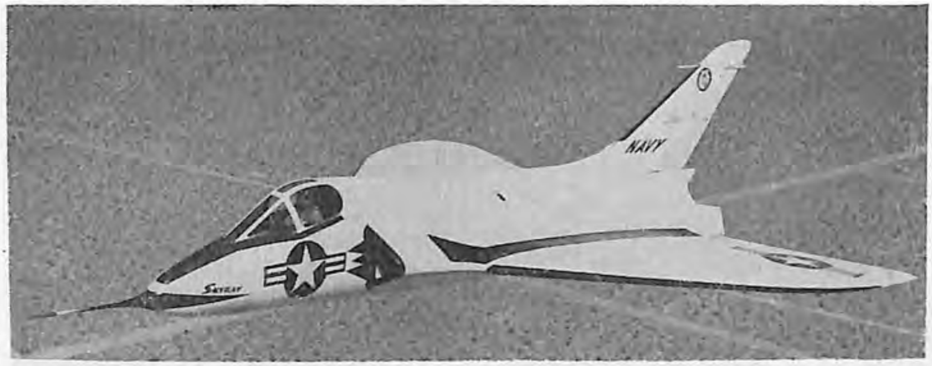
It is equipped to handle pieces of cargo as large as 130 in. wide by 140 in. high through the opening in the nose (which will accommodate 94 percent of all Air Force and Ground Force equipment). A hydraulically operated ramp to the door provides a 17- degree slope for easy loading. The ramp can be varied in width to accommodate vehicles of different tread. It is stowed in the fuselage nose below the crew compartment.

There is another loading door amidships in the underside of the fuselage which can take cargo measuring 89 in. wide, 155 in. long and 85 in. high. This cargo hold is stressed for 16,000 lb. Loading is speeded by the use of an electrically operated elevator. A folding upper deck, hinged at the fuselage, is divided into segments and is supported by stanchions. With the upper deck in position a truck can back into the nose opening and load both the upper and lower levels at the same time. Included in the loading facilities are two electrically powered traveling cranes, each able to lift 8,000 lbs.

The Globemaster can be converted into a two-deck troop carrier able to carry 200 troops and their equipment, or as a hospital plane, 127 litter patients and their attendants.

Quantities of both the earlier C-124A and the current C-124C models have been ordered by the AF and are doing world-wide service in diversified fields for MATS, SAC and TAC. All other data are classified.



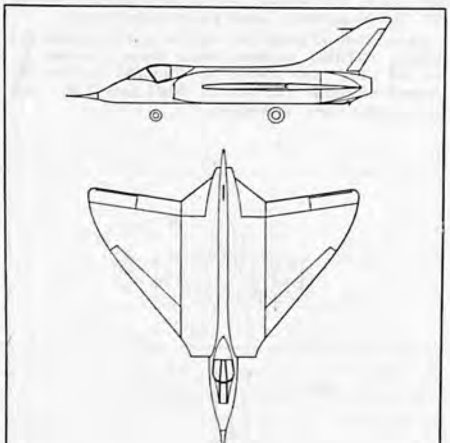


Douglas F4D Skyray

TYPE: Interceptor fighter. DESIGNATION: (N) F4D-1.

DATA

POWERPLANT: One Westinghouse J40 WE-8 in X-models; more powerful jet engine (designation restricted) in production models. WINGS: Modified delta, no horizontal stabilizer.



REMARKS

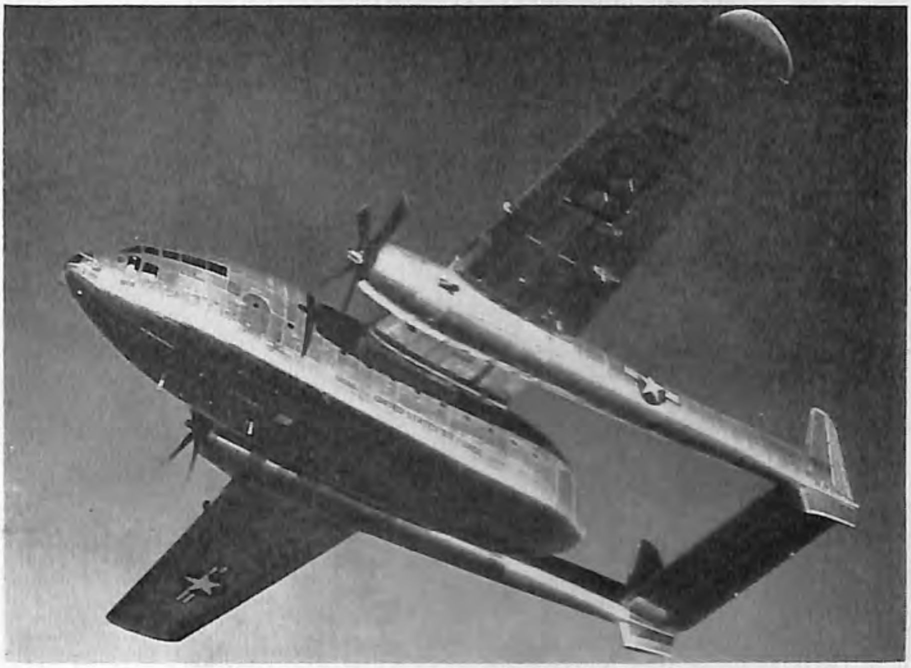
Named the Skyray because of its resemblance to the ocean dwelling manta ray, the F4D is a supersonic fighter capable of climbing extremely fast to ultra-high altitudes to intercept enemy aircraft. On October 3, 1953, the F4D regained the world's official speed record for the United States when Lt. Cmdr. James B. Verdin, USN, averaged 753.4 mph in four straight passes over a three kilometer (1.863 mi.) course at the Salton Sea near Thermal, Calif. Another world mark was returned from Britain on October 16 when Douglas test pilot Robert O. (Bob) Rahn flew the same F4D over a 100 kilometer (62.1 mi.) closed circuit course at Edwards Air Force Base, Muroc, Calif., at 728.110 mph. The record breaking F4D had a J40 engine with afterburner and flew with a normal combat configuration.

First flown on January 23, 1951, the F4D completed carrier qualification tests in 1953 at Patuxent River, Md., Naval Test Center and went into production for the Navy at Douglas' El Segundo Division where it also was designed, in August, 1953. First production models will come off the line in early 1954.

The F4D's slender nose extends forward from its unorthodox wing to provide a cockpit with maximum visibility. Its delta like wing provides a low aspect ratio, maximum sweep, and minimum thickness. Air scoops are situated in the wing at either side of the fuselage, and elevons on the trailing edges of the wings combine the functions of ailerons and elevators. It has an unusually low stalling speed, is lighter than many ground fighters, and is the first carrier based airplane ever to hold the world's speed record. Specifications and all other data are classified.

FAIRCHILD AIRCRAFT DIVISION

Hagerstown, Md.



Standard troop-carrier, Fairchild C-119G

TYPE: Cargo and Troop Carrier. **DESIGNATION:** (AF) C-119G; (N) R4Q-2.

DATA

POWERPLANT: Two Wright R-3350-30 3,500 hp at takeoff. **FUEL CAPACITY:** 2,624 gal. in four tanks. **OIL CAPACITY:** 120 gal in two tanks. **PROPELLERS:** Aeroproducts, four bladed, full feathering reversible. **FLAPS:** Slotted. **GEAR:** Tricycle, hydraulically retractable.

SPECS

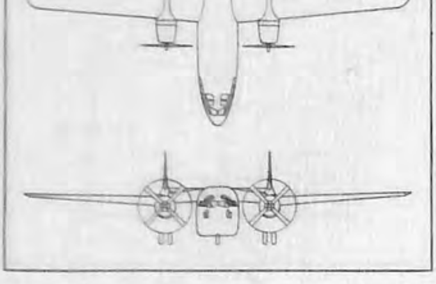
SPAN: 109.3 ft. **LENGTH:** 86.5 ft. **HEIGHT:** 26.5 ft. **WEIGHTS:** MAXIMUM GROSS, 74,000 lb. **WING LOADING:** 51.5 lb. per sq. ft. at maximum gross. **POWER LOADING:** 10.6 lb. per bhp at maximum gross, maximum power.

PERFORMANCE

SPEEDS: MAXIMUM, 295 mph at combat weight; **STALLING:** 85 mph. **RATE OF CLIMB:** 1,200 ft. per min. at maximum gross at military power. **SERVICE CEILING:** 30,200 ft. at combat weight, military power. **RANGE:** Combat range with 18,000 lbs. cargo, 1,750 mi. Ferry range, standard, 2,650 mi.

REMARKS

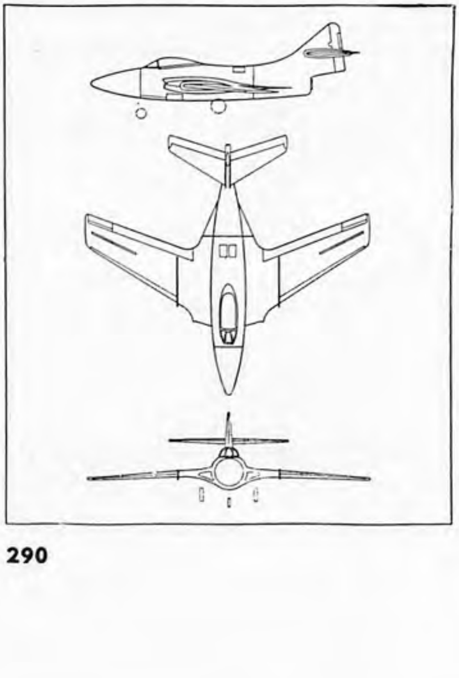
The C-119G, newest of the series, made its appearance in 1953. Now the standard medium troop and cargo carrying transport for the USAF, and in use with the RCAF, and Belgian and Italian air forces. Flying Boxcars have been in continuous production since 1944, when the first C-82 flew.



GRUMMAN AIRCRAFT ENGINEERING CORP.

Bethpage, L. I., N. Y.

Grumman's sweptwing F9F-6



TYPE: Fighter. DESIGNATION: (N) F9F-6.

DATA

POWERPLANT: Pratt & Whitney J48-P-8, 7,250 lb. thrust. GEAR: Tricycle.

SPECS

SPAN: 36 ft. 5 in. LENGTH: 41 ft. 7 in. HEIGHT: 15 ft. GROSS WEIGHT: More than 20,000 lb.

PERFORMANCE

MAXIMUM SPEED: More than 650 mph. SERVICE CEILING: 50,000 ft. RANGE: More than 1,000 mi.

REMARKS

The sweptwing F9F-6 has replaced the F9F-5 on the production line. The -5 was flown in Korea by the Navy and Marines and the final Navy records showed that it had accounted for 15 Russian-built MiG 15's without a loss. The F9F-6 is much faster than its predecessor but still maintains about the same low landing and takeoff speed essential for carrier operation. Basic armament is comparable with that of other Navy jet fighters. This new design was put into production less than five months from the date of the first prototype flight. All other data are classified.

Grumman Albatross for rescue operations

TYPE: Transport and utility. DESIGNATION: (AF) SA-16A, (N) UF-1, (USCG) UF-1G.

DATA

POWERPLANT: Two Wright R-1820-76 engines, 1,425 hp at takeoff. PROPELLERS: Hamilton Standard, 3 blade. GEAR: Tricycle retractable.

SPECS

SPAN: 80 ft. LENGTH: 61 ft. 4 in. HEIGHT: 24 ft. 5 in. SPEEDS: MAXIMUM, 270 mph; CRUISING, 225 mph.

REMARKS

The Albatross claims a "first" in aviation history—the only airplane in production that successfully operates from land, water, ice or snow. Previously, a complete gear change would be necessary for an airplane to operate from these different surfaces.

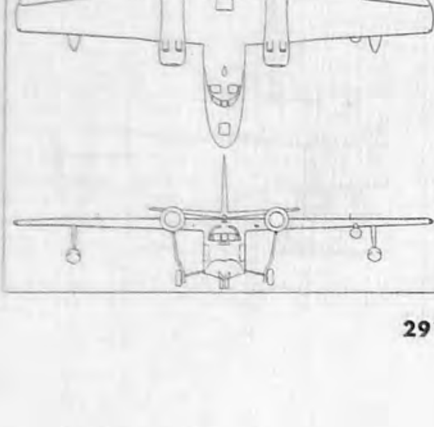
The Air Rescue Service of the USAF conceived the idea of one airplane with triphibian landing features. The Air Materiel Command laid down the specifications, and Grumman undertook the design and development of the airplane.

Successful snow tests were conducted in Feb. and Mar. 1951.

The Albatross was originally produced as a utility amphibian under an experimental contract from the U. S. Navy. The majority of the production models, however, are delivered to the Air Rescue Service of the Air Force. A smaller amount go to the Navy and Coast Guard.

The Albatross saw extensive rescue service in Korea during the war.

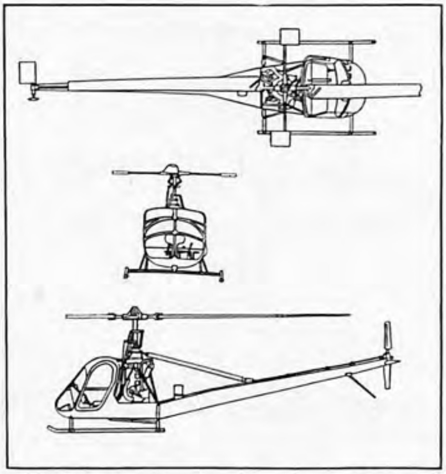
Total weight of the triphibian modification is 695 pounds. When conditions make it advisable, 435 pounds of this weight can be eliminated by quick removal of the main skid, shock strut and float skids. All other data are classified.



HILLER HELICOPTERS

Palo Alto, Calif.

Hiller Model HTE-2



TYPE: Helicopter. DESIGNATION: (Army) H-23B, (N) HTE-2.

DATA

POWERPLANT: Franklin 6V4-200-C33, 200 hp at 3,100 rpm. FUEL CAPACITY: 28 gal.

SPECS

MAIN ROTOR DIAMETER: 35 ft. LENGTH: 38.7 ft. HEIGHT: 9.8 ft. WEIGHTS: GROSS, 2,500 lb.; EMPTY, (HTE-2) 1,754 lb., (H-23B) 1,705 lb. USEFUL LOAD: (HTE-2) 795 lb., (H-23B) 746 lb.

PERFORMANCE

SPEEDS: MAXIMUM, 84 mph; CRUISING, 70 mph. RATE OF CLIMB: 770 ft. per min. HOVERING CEILING: 3,200 ft. SERVICE CEILING: 9,400 ft. RANGE: 135 mi.

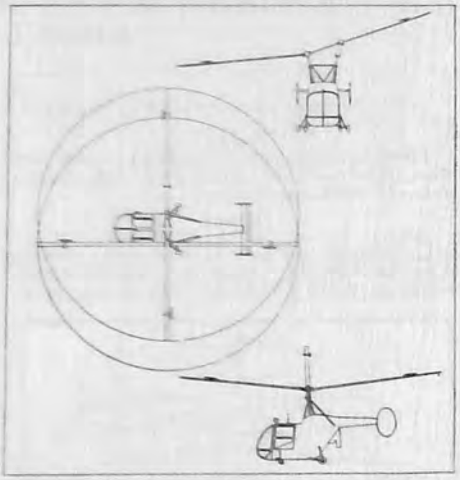
REMARKS

The Navy uses the HTE-2 as its standard helicopter trainer in Naval Reserve squadrons. A few have also been sent the British for their naval training program. Earlier commercial model 360's are still in service in this country, Alaska and Europe.

KAMAN AIRCRAFT CORP.

Windsor Locks, Conn.

Kaman HOK-1 for the Navy



TYPE: Helicopter. **DESIGNATION:** (N) HOK-1.

DATA

POWERPLANT: Continental R 975-40, 500 hp. **GEAR:** Tricycle fixed.

REMARKS

The HOK-1 is a twin intermeshing rotor machine and uses the Kaman system of aerodynamic controls which consists of small servo-flaps mounted on the ¾ radius of each rotor blade actuated by the pilot to control the blades. In addition to use as a general utility helicopter, the HOK-1 is convertible to an aerial ambulance. As such it carries two litter patients, one ambulatory patient or medical attendant and pilot. All other data are classified.

KAMAN HOK-1

Most early helicopters were dubbed "eggbeaters" by a dubious press and the word continues to crop up in newspaper stories. Literally, of course, the typical helicopter with its single main rotor, or in a tandem rotor configuration, bears no relationship to the familiar eggbeater. One helicopter that fits the description exactly, however, is the Kaman design, which features canted rotors which intermesh as they pass over the fuselage—precisely like an eggbeater. This design arrangement gives the craft the advantages of a laterally-disposed dual rotor configuration without the great lateral clearance penalty paid by designers using huge supporting arms. The intermeshing arrangement costs only an infinitesimal penalty in reduced rotor efficiency which is compensated for hundreds of times over in reduced weight, drag and complexity lateral booms would entail.

LOCKHEED AIRCRAFT CORP.

Burbank, Calif.

Lockheed T-33 jet trainer

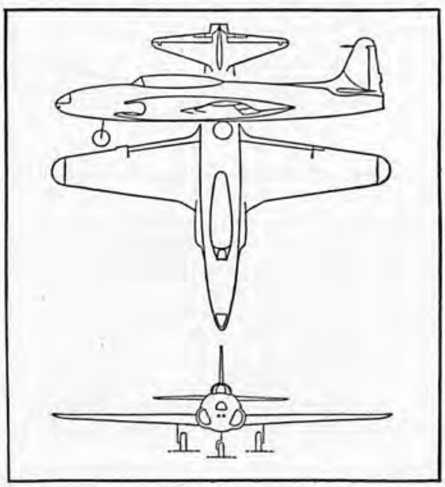
TYPE: Trainer. DESIGNATION: (AF) T-33A (N) TV-2.

DATA

POWERPLANT: Allison J-33-35, model 400 C-13, over 5,200 lb. thrust at takeoff. GEAR: Tricycle, fully retractable.

SPECS

SPAN: 37 ft. 6 in. LENGTH: 37 ft. 8 in. HEIGHT: 11 ft. 8 in. WEIGHTS: EMPTY, 8,400 lb.; GROSS, 15,000 lb.; USEFUL LOAD, 6,358 lb. WING LOADING: 60.8 lb. per sq. ft.



POWER LOADING: 3.3 lb. per lb. of thrust.

PERFORMANCE

SPEEDS: MAXIMUM, 600 mph class. RATE OF CLIMB: 5,525 ft. per min. SERVICE CEILING: over 44,000 ft. fully loaded. RANGE: Capable of carrying out range missions assigned to conventional long-range fighter planes. ARMAMENT: Two 50 cal. machine guns and two 1,000 lb. bombs on wings.

REMARKS

When single place, jet propelled aircraft became operational in the military services, the transition training of pilots became important because of the higher speeds and new techniques involved. Experiments were conducted using an F-80 aircraft arranged so that an instructor could ride behind the pilot. The necessity for providing a second standard cockpit soon became apparent, and an F-80 was modified by lengthening the fuselage to accommodate the second cockpit. This arrangement proved satisfactory, and with other improvements in the T-33A (TV-2) aircraft was put into production in March, 1948. 1953 production rates were increased to meet required schedules.

In addition to being the standard jet trainer for the U. S. Air Force, Navy and Marines, T-33s have been used to train pilots from nine NATO countries. Included in the list of countries whose jet pilots have received their flight training in T-33s are: Holland, France, Belgium, Turkey, Greece, Denmark, Norway, Italy and Portugal. Also, T-33s are now being manufactured in Canada by Canadair, Ltd., under license from Lockheed. Under provisions of the Mutual Defense Assistance Program, the Lockheed trainer has been delivered to the following nations: Turkey, France, Greece, Canada, Belgium, Holland, Yugoslavia and Italy.

Radar-equipped Lockheed P2V-6

TYPE: Patrol. DESIGNATION: (N) P2V-6.

DATA

POWERPLANT: Two Wright R-3350-30WA. 3,250 hp. PROPELLERS: Hamilton Standard four-bladed type. GEAR: Tricycle retractable.

The following specifications and performance are for the P2V-5. Similar data for the P2V-6 are classified.

SPECS

SPAN: 100 ft. LENGTH: 81 ft. 6.8 in. HEIGHT: 28 ft. 1 in. WEIGHTS: EMPTY, 41,754 lb.; GROSS, 76,152 lb.; USEFUL LOAD, 30,279 lb. WING LOADING: 76 lb. per sq. ft.

PERFORMANCE

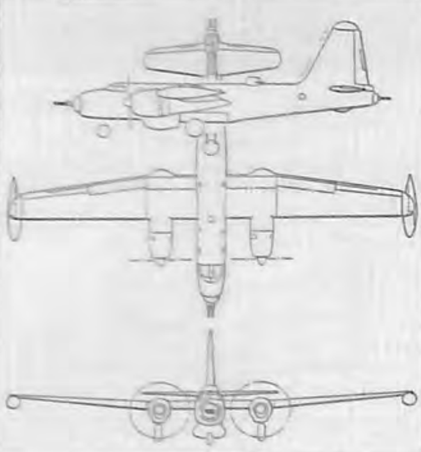
SPEEDS AT SEA LEVEL: MAXIMUM, 312 mph; STALLING, 109 mph (power off at full gross). RATE OF CLIMB: 1,640 ft. per min. at sea level and gross weight. SERVICE CEILING: 28,000 ft. fully loaded. RANGE: 4,750 mi.

REMARKS

The P2V-6 is the newest version of the U. S. Navy's Neptune. The Neptune series has been in service since 1945 with both P2V-5 and P2V-6 in production during the year.

The third Neptune built established a long distance flight record which still stands—11,236 miles nonstop without refueling from Perth, Australia, to Columbus, Ohio. Carrying specialized radar and electronics instruments, the P2V was developed to meet the snorkle submarine threat. Compound engines were first developed on the P2V. P2V-6s have been flown with experimental jet engine pods on each wing, the auxiliary jets each producing 3400 lbs. of thrust. P2Vs are designed to operate from carriers with JATO assist.

Both Great Britain and Australia have received P2Vs under the Mutual Defense Assistance Pact and release of certain key U. S. equipment to friendly nations. All other data are classified.



LOCKHEED P2V-6

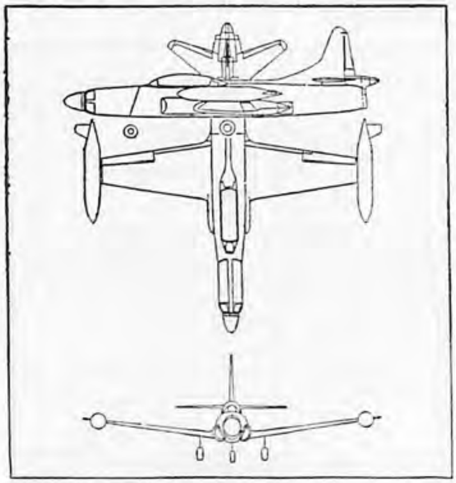
The search plane, heretofore, has been a "sitting duck" for pouncing fighters as it rises from sea level after dropping torpedoes, bombs or depth charges. Nearly every "VP" pilot, at one time or another, has prayed helplessly for a miraculous "boost"—if only for a few minutes. Lockheed has provided such a boost by installation of two Westinghouse J34 turbojet engines under the wing of the Neptune which doubles its power. Hopelessly uneconomic at the P2V's speed for continuous operation, the two jets provide a life-saving "boost" at critical moments when they may be used for the 10-15 min. it takes to climb out of a tight spot.

Lockheed F-94C two-place jet interceptor

TYPE: All-weather jet interceptor. **DESIGNATION:** (AF) F-94C.

DATA

POWERPLANT: Pratt & Whitney J-48-P-5, 6,250 lb. thrust at takeoff plus afterburner. **GEAR:** Tricycle retractable.



SPECS

SPAN: 37 ft. 3 in. **LENGTH:** 44 ft. 6 in. **HEIGHT:** 14 ft. 10 in. **USEFUL LOAD:** 24 2.75-in. internal rockets in nose and 12 rockets each in two wing pods.

PERFORMANCE

SPEEDS: more than 600 mph; **SERVICE CEILING:** over 45,000 ft. fully loaded.

REMARKS

F-94C Starfire has many changes over earlier F-94A and B models, including improved electronics. More than 1200 pounds of brain-like radar equipment make the F-94C a nearly-automatic interceptor. Placement of rockets as far forward as possible—24 in nose and a dozen in each wing pod—achieves maximum accuracy because of freedom from wind-stream turbulence. The F-94C is the first production fighter aircraft equipped with a deceleration parachute. Uses thin straight wing, swept-back tail. F-94C is latest development of original mass-produced jet, the F-80 Shooting Star, first jet to see combat in Korea. F-94Cs assigned vital job of round-the-clock defense of America's homeland. Has crew of two—pilot and radar operator. All other data are classified.

LOCKHEED F-94C

The machine-gun has been as much a part of the fighter as its wings for four decades—a fighter without guns became unthinkable. Lockheed broke the precedent and started a new era with its F-94C, a fighter without guns. Instead the two-man all-weather fighter carries only rockets—48 of them—in special nose and pod launchers. Replacing 1,800 machine-gun bullets with only 48 rocket rounds made good sense: any one of the rockets could destroy a bomber with a single hit, whereas all 1,800 bullets might not do the job for sure. Lockheed set another style with this fighter that has kept the engineers buzzing: a straight wing with a swept tail, the only airplane of such a combination of features now in the air.

THE GLENN L. MARTIN AIRCRAFT CO.

Baltimore, Md.

Martin P5M Marlin

TYPE. Anti-submarine seaplane. **DESIGNATION:** (N) P5M-1.

DATA

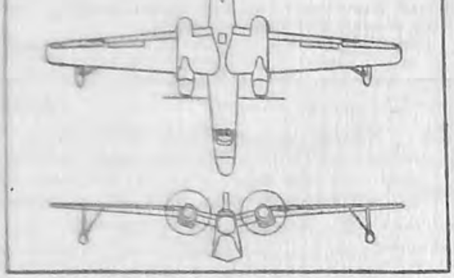
POWERPLANT: Two Wright Model 3350-30 engines. **PROPELLERS:** Hamilton Standard 4-bladed, Model 34E60, reversible.

SPECS

SPAN: 118 ft.; **AREA:** 1,406 sq. ft.; **LENGTH:** 94 ft. 6 in. **HEIGHT:** 37 ft. 3 in. **GROSS WEIGHT:** over 70,000 lbs.

REMARKS

The Martin Marlin is a medium range, twin-engine seaplane intended primarily for anti-submarine patrol duty. The P5M-1 is equipped with the latest Navy all-weather, day-and-night electronic devices for tracking suspected targets. Within its two nacelle bomb bays and on the wings, the Marlin carries a variety of torpedoes, rockets and/or mines. A gun turrent is located in the tail. An important feature of the aircraft is the long after-body hull designed for rough water operations. The hull makes take-offs and landings easier under adverse sea conditions—and has reduced aerodynamic drag by fairing of the main step. Another item of special interest is the hydroflap, or underwater rudder, installed for greater maneuverability in taxiing. All other data are classified.



Martin B-57 night intruder

TYPE: Night intruder bomber. DESIGNATION: (AF) B-57A.

DATA

POWERPLANT: Two Wright J-65 Sapphire turbojet engines, each producing 7,200 lb. of thrust. GEAR: Tricycle.

SPECS

SPAN: 64 ft.; WING AREA: 960 sq. ft.; LENGTH: 65 ft. 6 in.; HEIGHT: 15 ft. 7 in.

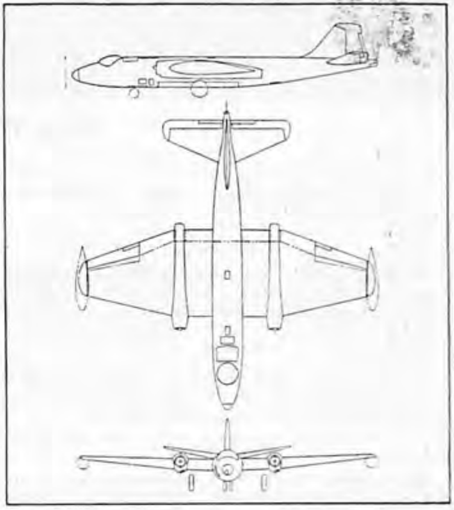
REMARKS

The first Martin B-57 Night Intruder was delivered to the USAF on August 20, 1953.

Included in its armament is a rotary bomb door developed by Martin. The door is removable from the airplane, and is preloaded before being hoisted into position. Bombs or rockets are carried internally until the airplane is ready to strike. Then the door is turned over, making the stores external. Bombs are released by air actuated pins which push them into the airstream, thus avoiding tumbling.

Visually the B-57 is characterized by its very broad, tapering wing, and operationally by its high maneuverability and speed.

The B-57 carries a crew of two—pilot and navigator-radar operator-bombardier. All other data are classified.



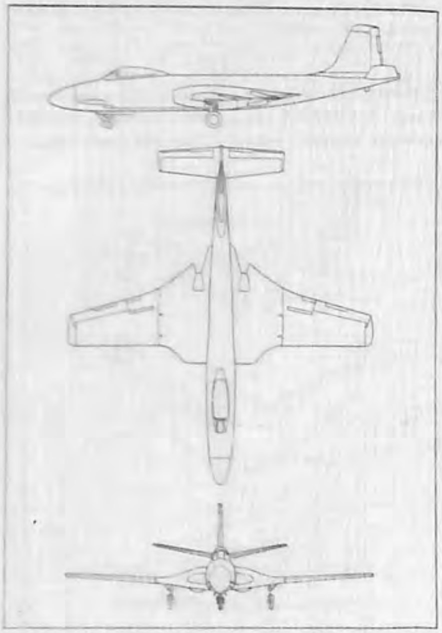
MARTIN B-57

Because they are "look alikes," it has been easy to suppose the new Martin B-57 is merely an English Electric Canberra built under license. Martin engineers now reveal that only the exterior of the airplanes are identical, that underneath the B-57 is an entirely new and different airplane. Its structure, its equipment, its engines, its armament, its interior arranegment—even its crew seats, are different than its English counterpart. And, significantly, so is its performance.

McDONNELL AIRCRAFT CORP.

St. Louis, Mo.

McDonnell twin-jet Banshee



TYPE: Fighter. **DESIGNATION:** (N) F2H-3.

DATA

POWERPLANT: Two Westinghouse J34-WE-34. **FUEL CAPACITY:** More than 1,000 gal. with tip tanks.

SPECS

SPAN: 44 ft. 11 in. **LENGTH:** 47 ft. 6 in. **HEIGHT:** 14 ft. 5½ in.

PERFORMANCE

SPEEDS: MAXIMUM, over 600 mph; CRUISING, more than 500 mph. **SERVICE CEILING:** Above 50,000 ft. **NORMAL RANGE:** Over 2,000 mi. with tip tanks.

REMARKS

The Banshee is one of the Navy's fastest and highest-flying service fighters now in carrier use throughout the fleet. It has been produced in a wide variety of models including the F2H-2N, night-fighter version, and the F2H-2P, photo-reconnaissance model. Latest model is the F2H-3, which features an extended fuselage, to house additional fuel, and search radar equipment in the nose. The F2H-2 saw combat in Korea for more than a year and established an enviable record as a rugged, effective ground-support fighter. All other data are classified.

NORTH AMERICAN AVIATION, INC.

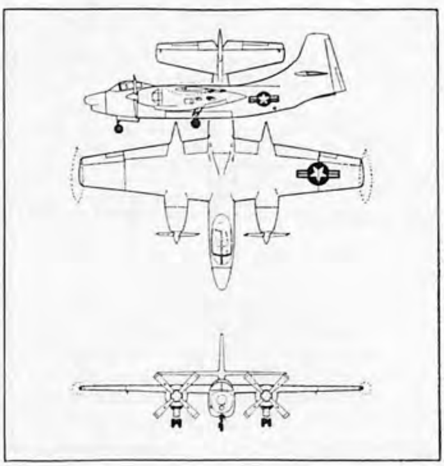
Los Angeles, Calif.

Carrier-based North American AJ-2P Savage

TYPE: Photo-reconnaissance. **DESIGNATION:** (N) AJ-2P.

DATA

POWERPLANT: Two Pratt & Whitney Double Wasp R-2800-48 and one Allison J33-A-10 turbojet engine. **GEAR:** Tricycle retractable.



SPECS

SPAN: 75 ft. **LENGTH:** 65 ft. **GROSS WEIGHT:** 50,000 lb.

PERFORMANCE

SPEED AT SEA LEVEL: Approx. 425 mph. **SERVICE CEILING:** 40,000 ft. **RANGE:** more than 3,000 miles.

REMARKS

The AJ-2P pictured above is a photo-reconnaissance version of the AJ-1.

The AJ-1 was designed as a carrier-based bomber to deliver the atom bomb. Its jet engine is located in the aft fuselage and is used only periodically for takeoff, speed over the target, escape from pursuing airplanes. The outer wing panels fold vertically, the fin folds to starboard for shipboard accommodation. Crew of three rides in pressurized cabin. First group of AJ-1's in service, Squadron VC-5 at N.A.S. Norfolk, completed carrier qualification tests in Oct., 1950. Second group of AJ's to go into carrier operation was Composite Squadron VC-6 of Heavy Attack Wing 1, aboard the Midway. All other data are classified.

North American F-86 Sabre

TYPE: All-weather fighter interceptor. DESIGNATION: (AF) F-86D.

DATA

POWERPLANT: General Electric J-47-GE-17. 5,800 lb. thrust plus afterburner. GEAR: Tricycle, retractable, steerable nosewheel.

SPECS

SPAN: 37 ft. LENGTH: 40 ft. HEIGHT: 15 ft. WEIGHT: 18,000 lb.

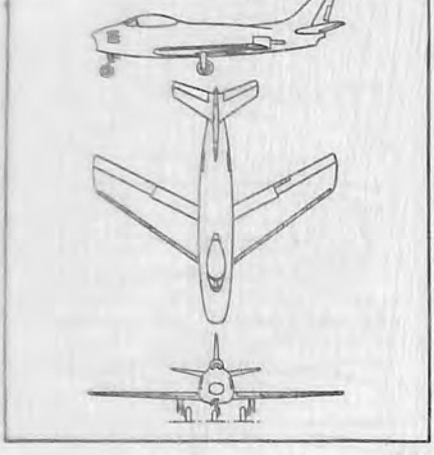
PERFORMANCE

SPEEDS: Set former official world's record of 715.697 mph, July 16, 1953. SERVICE CEILING: Over 45,000 ft. TACTICAL RADIUS: Over 500 mi.

REMARKS

F-86 production models during the year were the D, F and H. The E which set such a combat record in Korea went out of production in 1952. The F-86D was virtually a new design over previous models when it first appeared. It is equipped with an afterburner and search radar in the nose. A combat-equipped model once held the world's speed record averaging 699.92 mph late in 1952. The F-86F was designed for use as either a fighter or low-level fighter bomber. It has a more powerful engine, improved gun-sight with manual pip control for dive bombing and a new leading edge for improved maneuverability at altitude. Still another model, the F-86H, was put into production near the end of the year. It was designed for the dual role of fighter bomber and day fighter. The H is slightly larger than former models. It is powered by a GE J-47GE-3, has a stronger landing gear, improved suspension and release mechanisms for carrying droppable wing tip tanks.

The Navy's new version of this model, the FJ-2 Fury is an advanced design of the FJ-1 and is aerodynamically similar to the F-86 series. The FJ-2 is a carrier based fighter with folding wings assigned to the Marines. It is armed with four 20 mm cannons. A third model, the FJ-3, was ordered by the Navy during the year. This model was modified slightly for the J-65-W2 Sapphire engine. An improved gun hight and navigational equipment have also been added. All F-86 and FJ models have the all-flying tail in which the stabilizer and elevator are a single controllable surface. All other data are classified.

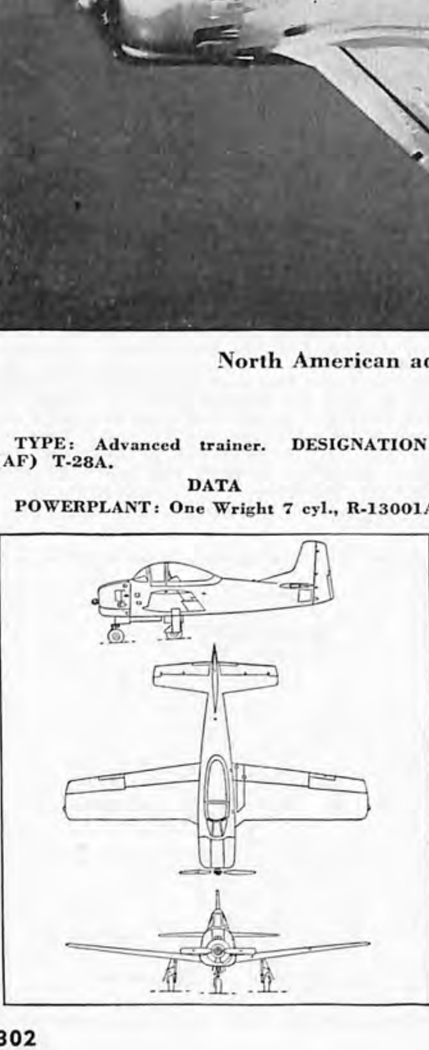


North American advanced trainer T-28A

TYPE: Advanced trainer. **DESIGNATION:** (AF) T-28A.

DATA

POWERPLANT: One Wright 7 cyl., R-13001A 800 hp. **FUEL CAPACITY:** 177 gal. **PROPELLER:** Aero Products, 2-bladed, constant speed. **GEAR:** Tricycle, hydraulically retractable.



SPECS

SPAN: 40.6 ft. **LENGTH:** 32 ft. **HEIGHT:** 12.7 ft. **WEIGHTS:** EMPTY, 5,780 lb.; GROSS, NORMAL 7,339 lb.; GROSS, MAXIMUM TAKE-OFF, 7,808 lb. **WING LOADING,** 27.1 lb. per sq. ft. **POWER LOADING,** 9.17 lb. per hp.

PERFORMANCE

SPEEDS: MAXIMUM (at 5,900 ft.) 288 mph; CRUISING, 190 mph; STALLING, 72 mph; RATE OF CLIMB, 2,060 ft. per. min. **SERVICE CEILING:** 25,600 ft. **RANGE:** 1,008 mi.

REMARKS

The T-28 is one of the first U. S. training planes to use a tricycle gear. Additional improvements include a 12½ degree visibility over the nose (11 degrees is required), lowered and more streamlined canopy, easier accessibility for maintenance (there is an access port directly back of the engine nacelle underneath the fuselage), and special lighting on the instrument panel for use of the "view-lighter" for simulated instrument flying.

The Navy has ordered into production the T-28B, which is powered by a Wright R-1820 engine rated at 1425 horsepower. Its speed will be 343 mph.

North American F-100 Super Sabre

TYPE: Fighter. **DESIGNATION:** (AF) F-100.

DATA

POWER PLANT: Pratt & Whitney J57-P7 with afterburner.

GEAR: Tricycle, retractable.

SPECS

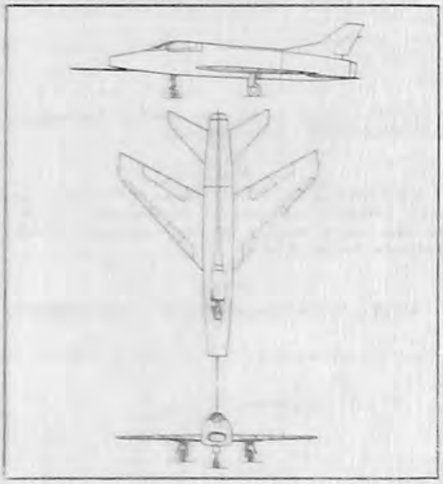
SPAN: 36 ft. **LENGTH:** 45 ft. **HEIGHT:** 14 ft. **WING AND TAIL SWEEPBACK:** 45 deg.

PERFORMANCE

SPEED: Supersonic in level flight. **MAXIMUM SERVICE CEILING:** over 50,000 ft. **COMBAT RADIUS:** over 500 nautical mi.

REMARKS

The F-100 confirmed its design specification by exceeding the speed of sound in its first test flight, May 25, 1953. Subsequent flights disclosed the plane was easy to handle and had excellent stability characteristics. The first production model came off North American's assembly line October 20 and was accepted by the Air Force plant representative, November 25. Production is currently concentrated at the Los Angeles plant of North American. All other data are classified.



NORTH AMERICAN

It is a well-known fact that North American has built more airplanes than anybody but it is not as well known that the company has produced every type of airplane known. Its reputation as a builder of fighters, bombers and trainers is secure and its postwar production of the well-known Navion four-place monoplane marked its entry into the personal aircraft field. This leaves the commercial transport missing—but North American built one of those, too: the Clark GA-43 monoplane back in the early 'thirties when the company was known as the General Aviation Corp.

NORTHROP AIRCRAFT, INC.

Hawthorne, Calif.

Northrop Scorpion F-89D Scorpion

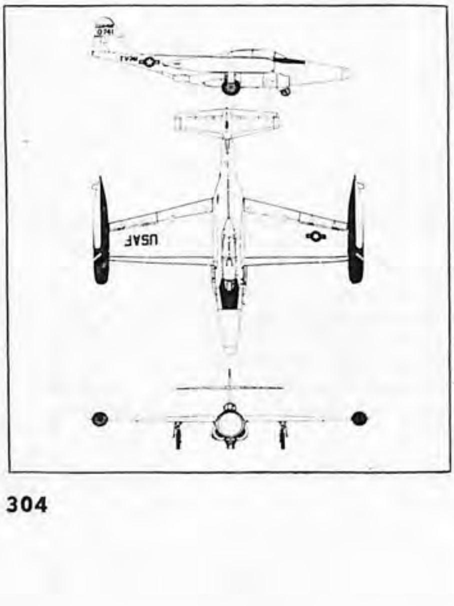
TYPE: Long range all-weather interceptor. **DESIGNATION:** (AF) F-89D.

DATA

POWERPLANT: Two Allison J35 turbo-jets with afterburners carried in separate nacelles on the lower section of the fuselage. **GEAR:** Tricycle retractable.

SPECS

SPAN: Approximately 56 ft. 2 in. **LENGTH:** Approximately 53 ft. 4 in. **HEIGHT:** Approximately 17 ft., 7 in. **GROSS WEIGHT:** Over 40,000 lb.



PERFORMANCE

MAXIMUM SPEED: 600 mph range. **OPERATIONAL CEILING:** Over 45,000 ft.

REMARKS

Newest in the F-89 series of all-weather interceptors is the all-rocket armed F-89D. A total of 104 2.75 inch folding fin aircraft rockets carried in wing tip launching pods make the new Scorpion the U. S. Air Force's most heavily armed fighter-type aircraft.

Use of the wing tip launchers provides improved dispersal of rockets, since two sources of firepower are used instead of a single concentrated source. Firing of rockets from wing tips does not interfere with the vision of its crew of pilot and radar observer at the critical moment of interception and engine air intakes are not exposed to smoke and debris produced by rocket firing.

The F-89D is equipped with advanced electronic aiming and automatic triggering devices coupled with the latest radar and electronic navigational equipment, enabling it to locate, intercept and destroy enemy aircraft in any type of weather or at night.

Standard Scorpion features retained on the F-89D include: upswept tail that gives the Scorpion its name; thin, straight wing; 'decelerons,' combination ailerons and dive brakes; pressurized air-conditioned cockpit equipped with ejection seats; and power-operated, jettisonable canopy. All other data are classified.

PIASECKI HELICOPTER CORP.

Morton, Pa.

Navy shipboard helicopter, Piasecki HUP Retriever

TYPE: Helicopter. **DESIGNATION:** (N) HUP-1 and 2, (Army) H-25.

DATA

POWERPLANT: Continental R-975—46, 525 hp at takeoff. **FUEL CAPACITY:** 100 gal. **GEAR:** Tricycle.

SPECS

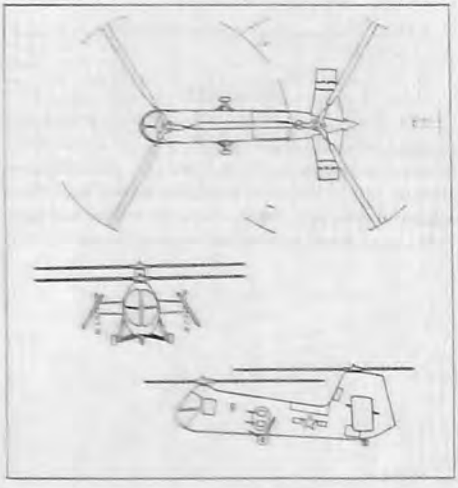
LENGTH: 31 ft. 7 in. **HEIGHT:** 12 ft. 6 in. **WEIGHTS:** EMPTY, 3,966 lb.; NORMAL GROSS, 5,355 lb.; OVERLOAD GROSS, 5,355 lb.

PERFORMANCE

SPEEDS AT SEA LEVEL: MAXIMUM, over 125 mph; CRUISING, over 100 mph. **RATE OF CLIMB:** Normal rated power (best climb speed 50-60 mph), 1,200 ft. per min. **SERVICE CEILING:** Over 10,000 ft. **RANGE:** Over 400 mi. cruising.

REMARKS

Three experimental models (XHJP-1) were constructed as prototypes for the present production model and won a Navy production contract. It was the first helicopter to use the overlapping tandem rotor arrangement. It is a 5-place, single engine, semi-monocoque, aluminum alloy fuselage land helicopter. Service type is passenger and cargo. Production continued during the year under Navy contract.



PIASECKI

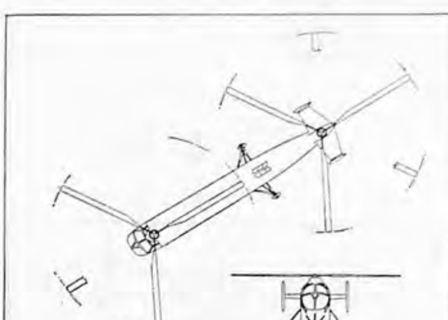
The early models of Piasecki helicopters were accurately, if irreverently, dubbed "Flying Bananas," an apt sobriquet describing their "bend-in-the-middle" fuselage. But this bend had a real and necessary purpose. With the flapping rotor system, the blades must be free to move up and down about their hinges, resulting in a pronounced "drooping" at rest. As the rotor clutch is engaged, these blades swing through their low arcs until they gain speed enough to produce the centrifugal force needed to hold them outright. For this reason ,the tandem rotor configuration must have a clearance in the fuselage. Later model Piasecki helicopters solved the problem by raising the rotors on pylons at the nose and tail.

Piasecki tandem rotor H-21 Work Horse

TYPE: Helicopter. DESIGNATION: (AF and Army) H-21.

REMARKS

The H-21A is an Air Force 14 to 20 place, tandem-rotored, single engine rescue and utility helicopter. Power is a Wright R-1820-103 engine with a take-off rating of 1,425 hp. The engine drives two 44 ft. diameter rotors through drive shafts and reduction transmissions.



The fuselage is all metal stressed skin, monocoque. The cockpit has side-by side seating with the pilot sitting on the right. There are dual controls and an autopilot.

Cabin dimensions are 20 ft. long x 5 ft. 6 in. wide x 5 ft. 6 in. high or 615 cu. ft. This area can accommodate 12 litters or 20 troop seats. There is a main entrance door on the left side at the aft end of the cabin and a rescue door and rescue facilities with a swinging boom type rescue hoist immediately behind the pilot at the forward end of the cabin.

The fixed wheel landing gear includes provisions for the installation of flotation gear for land, swamp and water landings. The model also can come equipped with complete winterization items.

Other H-21 models include the H-21B, the Air Force assault version, and the H-21C for Army troop transport. Both these models are 22 place with provisions for auxiliary, external, jettisonable fuel tanks.

The H-21 is the first tandem helicopter for the Air Force.

In September, 1953, the H-21 set two new world helicopter flight records. At Vandalia, Ohio, it was flown at 146.735 miles an hour and reached an altitude of 22,289 feet. Pilot was Capt. Russell M. Dobyns, USAF.

REPUBLIC AVIATION CORP.

Farmingdale, L. I., N. Y.

Republic sweptwing F-84F

TYPE: Fighter. DESIGNATION: (AF) F-84F.

DATA

POWERPLANT: Wright Sapphire J-65. 7,200 lb. thrust. GEAR: Tricycle retractable.

SPECS

SPAN: 33 ft. 6 in. LENGTH: 43 ft. 4 in. HEIGHT: 14 ft. 4 in. GROSS WEIGHT: 25,000 lbs.

PERFORMANCE

MAXIMUM SPEED: Over 600 mph. SERVICE CEILING: Over 45,000 ft. RANGE: Over 2,000 miles with external tanks.

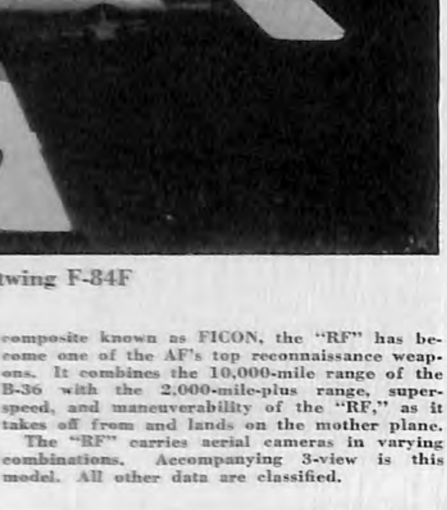
REMARKS

The F-84F Thunderstreak, the Air Force's first swept-wing fighter-bomber, far exceeds performance of previous F-84 models. Equipped for in-flight refueling, the F-84F has a primary mission as fighter-bomber, but its high performance and versatility make it a highly desirable plane for interception and escort missions.

The RF-84F, reconnaissance version of the F-84F Thunderstreak, has the same general specifications as the F-84F except for the fuselage which is 4 ft. 2½ in. longer. Units of this high speed, high or low altitude, day or night photo plane started coming off the production line in 1953. The plane exceeds in all performance categories earlier fighter reconnaissance models. The new plane is designed to meet requirements for a high speed photo plane capable of getting pictures of enemy installations and, if necessary, fighting its way safely back to base. The plane has four .50 cal. machine guns, two mounted in each wing.

Teamed with the B-36 carrier plane in the composite known as FICON, the "RF" has become one of the AF's top reconnaissance weapons. It combines the 10,000-mile range of the B-36 with the 2,000-mile-plus range, superspeed, and maneuverability of the "RF," as it takes off from and lands on the mother plane.

The "RF" carries aerial cameras in varying combinations. Accompanying 3-view is this model. All other data are classified.

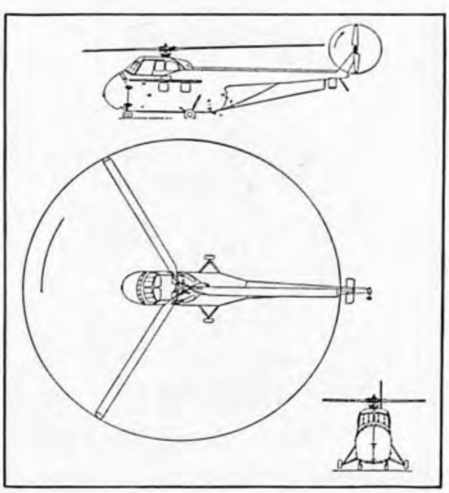


SIKORSKY AIRCRAFT

DIVISION OF UNITED AIRCRAFT CORP.

Bridgeport, Conn.

Sikorsky 10-place H-19



TYPE: Helicopter. DESIGNATION: (AF) H-19A-B-C-D, (N) HRS-1-2-3 and HO4S-1-2-3, (Commercial) S-55. CAA TYPE CERTIFICATE: 1H4. MANUFACTURER'S MODEL DESIGNATION: S-55.

DATA

POWERPLANT: Pratt & Whitney Wasp R-1300-57, 600 hp. FUEL CAPACITY AND CONSUMPTION: 185 gal., 37 gal. per hr. GEAR: Quadricycle.

SPECS

MAIN ROTOR DIAMETER: 53 ft. LENGTH: 42 ft. 2 in. HEIGHT: 13 ft. 4 in. WEIGHTS: EMPTY, 4,795 lb.; GROSS, 7,200 lb.; USEFUL LOAD, 2,405 lb. (S-55 only).

PERFORMANCE

SPEEDS: MAXIMUM, 101 mph; CRUISING, 85 mph. MAXIMUM RATE OF CLIMB: 780 ft. per min. SERVICE CEILING: 11,400 ft. RANGE: 405 mi.

REMARKS

This is a 12-place closed land model fitted for rescue, cargo and passenger transportation. The commercial model is the largest CAA approved helicopter in the world.

CHAPTER EIGHT

Engines in Production

The following list of aircraft engines includes only those in production during the year. Unless otherwise noted the specifications are the manufacturers'.

AEROJET-GENERAL CORP.

Azusa, Calif.

MODEL: 14AS-1000 (Jato Motor).

DATA

Type: Solid propellant rocket.

SPECS

DIAMETER: 10.25 in. LENGTH: 35.4 in. EMPTY WEIGHT: 120 lb. LOADED WEIGHT: 200 lb.

PERFORMANCE

RATING: 1,000 lb. thrust, or 330 hp, for a duration of 14 sec.

EQUIPMENT

Jato motor consists of a steel cylinder closed on fore end with exhaust nozzle, igniter and safety diaphragm located on aft end. Thrust is transmitted through three mounting lugs welded on the cylinder to the aircraft attachment fittings.

REMARKS

The 14AS-1000 Jato motor is CAA-certificated and its use on the Douglas DC-3 and Douglas DC-4 airplanes has been approved by CAA for commercial airline operation.

A hermetically sealed version of the 14AS-1000, the 14AS-1000 G-1, has been authorized by the CAA for a source of standby power for commercial aircraft.

MODEL: 15KS-1000 (Jato Motor).

DATA

TYPE: Solid-propellant rocket.

PERFORMANCE

RATING: 1,000 lb. thrust for 15 sec.

REMARKS

A new smokeless JATO developed for the Armed Services.

MODEL: Liquid rocket engine (Aerobee).

DATA

TYPE: Liquid bi-propellant rocket, gas or chemically pressurized.

SPECS

DIAMETER: 15 in. LENGTH: 130 in.

EQUIPMENT

Assembly consists of a cylindrical section which contains the oxidizer, fuel and pressurizing tanks. The pressure regulator and rocket motor are attached to the tank section.

REMARKS

This rocket powerplant is used to propel the Aerobee high-altitude sounding rocket.

AIRCOOLED MOTORS, INC.

Syracuse, N. Y.

MODEL: Franklin 6AG4-185B12.

DATA

TYPE: 6 cylinder, air-cooled, horizontally opposed. CAA TYPE CERTIFICATE: 238.

SPECS

LENGTH: 40 19/32 in. FUEL GRADE: 80 octane. BORE: 4.5 iln. STROKE: 3.5 in. DISPLACEMENT: 335 cu. in. COMPRESSION RATIO: 7:5:1. DRY WEIGHT: 360 lbs. with hub and accessories. WEIGHT PER HP: 1.86 lbs.

PERFORMANCE

TAKE-OFF POWER, 185 hp at 3,100 rpm. CRUISE: 135 hp. FUEL CONSUMPTION: .51 lbs. per hp hr. OIL CONSUMPTION: .002 lbs.

EQUIPMENT

CARBURETOR: Marvel-Schebler MA4-5 or Bendix PS5-C. IGNITION: Dual Scintilla. STARTER: Delco-Remy. GENERATOR: Delco-Remy. FUEL PUMP: A. C. Spark Plug Co.

MODEL: Franklin 6A4-165-B3.

DATA

TYPE: 6 cylinder, air-cooled, horizontally opposed. CAA TYPE CERTIFICATE: 238.

SPECS

LENGTH: 27 13/32 in. FUEL GRADE: 80 octane. BORE: 4.5 in. Stroke: 3.5 in. DISPLACEMENT: 335 cu. in. COMPRESSION RATIO: 7:1. DRY WEIGHT: 324 lb. with hub and accessories. WEIGHT PER HP: 1.97 lb.

PERFORMANCE

TAKE-OFF POWER: 165 hp at 2,800 rpm. CRUISE: 124 hp at 2,200 rpm. FUEL CONSUMPTION: .5 lb. per hp hr. OIL CONSUMPTION: .002 lb. per hp hr.

EQUIPMENT

CARBURETOR: Marvel-Schebler MA4-5 or Bendix PS5-6. IGNITION, Dual · Scintilla S6N21. STARTER: Delco-Remy. GENERATOR: Delco-Remy. FUEL PUMP: AC.

MODEL: Franklin 4A4-100-B3.

DATA

TYPE: 4 cylinder, air-cooled, horizontally opposed. CAA TYPE CERTIFICATE: 239.

SPECS

LENGTH: 27 15/16 in. FUEL GRADE: 80 octane. BORE: 4.5 in. STROKE: 3.5 in. DISPLACEMENT: 225 cu. in. COMPRESSION RATIO: 7:1. DRY WEIGHT: 230 lb. with hub and accessories. WEIGHT PER HP: 2.3 lb.

PERFORMANCE

TAKE-OFF POWER: 100 hp at 2,550 rpm. CRUISE: 75 hp at 2,300 rpm. FUEL CONSUMPTION: .5 lb. per hp hr. OIL CONSUMPTION: .002 lb. per hp hr.

EQUIPMENT

CARBURETOR: Marvel-Schebler MA3SPA. IGNITION: Dual Eisemann LA-4. STARTER: Auto Lite or Delco-Remy. GENERATOR: Auto Lite or Delco-Remy. FUEL PUMP: A. C. Spark Plug Co.

MODEL: Franklin 6V4-200-C32, C33.

DATA

TYPE: 6 cylinder, air-cooled, horizontally opposed. CAA TYPE CERTIFICATE: 244.

SPECS

LENGTH: 29 1/32 in. FUEL GRADE: 91 octane. BORE: 4.5 in. STROKE: 3.5 in. DISPLACEMENT: 335 cu. in. COMPRESSION RATIO: 8.5:1. DRY WEIGHT: 333 lb. with hub and accessories. WEIGHT PER HP: 1.66 lb.

PERFORMANCE

TAKE-OFF POWER: 200 hp. FUEL CONSUMPTION: .52 lb. per hp hr. OIL CONSUMPTION: .002 lb. per hp hr.

EQUIPMENT

CARBURETOR: Marvel-Schebler MA4-5 or Bendix PS5-C. IGNITION: Dual Scintilla S6-RN21. STARTER: Delco-Remy. GENERATOR: Delco-Remy. FUEL PUUMP: Weldon.

REMARKS

This model was designed for helicopter installations.

MODEL: Franklin 6V4-178-B32 and B-33.

DATA

TYPE: 6 cylinder, air-cooled, horizontally opposed; 178 hp; CAA TYPE CERTIFICATE: 244.

SPECS

LENGTH: 34¾ in. FUEL GRADE: 80 octane. BORE: 4.5 in. STROKE: 3.5 in. DISPLACEMENT: 335 cu. in. COMPRESSION RATIO: 7:1. DRY WEIGHT: 308 lb. with hub and accessories. WEIGHT PER HP: 1.73 lb.

PERFORMANCE

TAKE-OFF POWER: 178 hp. FUEL CONSUMPTION: .52 lb. per hp hr. OIL CONSUMPTION: .002 lb. per hp hr.

EQUIPMENT

CARBURETOR: Marvel-Schebler MA4-5 or Bendix PS5-6. IGNITION, Dual Scintilla S6RN21. STARTER: Delco-Remy. GENERATOR: Delco-Remy. FUEL PUMP: Weldon.

MODEL: Franklin 6A4-150-B3.

DATA

TYPE: 6 cylinder, air-cooled, horizontally opposed. CAA TYPE CERTIFICATE: 238.

SPECS

LENGTH: 37⅝ in. FUEL GRADE: 80 octane. BORE: 4.5 in. STROKE: 3.5 in. DISPLACEMENT: 335 cu. in. COMPRESSION RATIO: 7:1. DRY WEIGHT: 321 lb. with hub and accessories. WEIGHT PER HP: 2.14 lb.

PERFORMANCE

TAKE-OFF POWER: 150 hp at 2,600 rpm. CRUISE: 113 hp at 2,350 rpm. FUEL CONSUMPTION: .5 lb. per hp hr. OIL CONSUMPTION: .002 lb. per hp hr.

EQUIPMENT

CARBURETOR: Marvel-Schebler MA-3SPA. IGNITION: Dual Eisemann LA-6 or Scintilla S6RN21. STARTER: Delco-Remy. GENERATOR: Delco-Remy. FUEL PUMP: A. C. Spark Plug Co.

MODEL: Franklin 6V6-245-B16F.

DATA

TYPE: 6 cylinder, air-cooled, horizontally opposed. CAA TYPE CETIFICATE: 258.

SPECS

LENGTH: 39 7/32 in. FUEL GRADE: 80 octane. BORE: 4.75 in. STROKE: 4 in. DISPLACEMENT: 425 cu. in. COMPRESSION RATIO: 7.5:1. DRY WEIGHT: 353 lb. with hub and accessories. WEIGHT PER HP: 2.26 lb.

PERFORMANCE

TAKE-OFF POWER: 245 hp at 3,275 rpm. FUEL CONSUMPTION: .52 lb. per hp hr. OIL CONSUMPTION: .002 lb. per hp hr.

EQUIPMENT

CARBURETOR: Bendix PS-7BD. IGNITION: Dual Eisemann LA-6.

Allison J-71 turbojet

ALLISON DIVISION
GENERAL MOTORS CORP.
Indianapolis, Ind.

MODEL: J71.
TYPE: Axial-flow turbojet.

SPECS

DIAMETER: 37 in. LENGTH: 194 in. WEIGHT: 4,090 lb.

PERFORMANCE

All performance data are classified.

REMARKS

The new J71 series turbojet engines are the latest development of the axial flow multi-stage compressor engine made by Allison. This series of super jets is the most powerful turbojet currently in production. The new engine has 16 axial stages of compression with a 3 stage turbine. It is an all-weather engine, incorporating de-icing features and has substantially improved fuel economy. The engine features a cannular combustion section. There are 10 individual inner cans within the single outer can and compressed air flows from the outer section to the inner liners for combustion.

Entirely independent of external oil supply, the J71 has its own complete oil system. It also has its own hydraulic system to operate a variable-area jet nozzle and retractable air inlet screens.

MODEL J33-A-35.
TYPE: Centrifugal-flow turbojet.

SPECS

DIAMETER: 50.5 in. LENGTH: 107 in. WEIGHT: 1,820 lb. COMPRESSION RATIO: 4.4:1. AIR MASS FLOW: 87 lb. per sec. EXHAUST TEMP.: 1,265 deg. F. FUEL GRADE: J-P3. FUEL CONSUMPTION: 1.14 lbs. per hr. per lb.

PERFORMANCE

TAKE-OFF: 5,400 lb. at 11,750 rpm with water injection, 4,600 lb. at 11,750 rpm dry.

NORMAL: 3,900 lb. at 11,250 rpm. CRUISE: 3,510 lb. at 10,900 rpm.

REMARKS

Used in Lockheed T-33 and TV-2 two-seat jet trainers.

MODEL: J35-A-35.

TYPE: Axial-flow turbojet.

SPECS

DIAMETER: 37 in. LENGTH: 195.5 in. WEIGHT: 2,830 lb. COMPRESSION RATIO: 5.1:1. AIR MASS FLOW: 90 lb. per sec. EXHAUST TEMP.: 1,340 deg. F. FUEL GRADE: JP-4. FUEL CONSUMPTION: 1.10 lbs. per hr. per lb.

PERFORMANCE

TAKE-OFF: 7,400 lb. at 8,000 rpm. MILITARY: 5,600 lb. at 8,000 rpm. NORMAL: 4,990 lb. at 7,650 rpm. CRUISE: 4,491 lb. at 7,370 rpm.

REMARKS

Afterburner equipped. Used in Northrop F-89D all-weather Scorpion.

MODEL: J35-A-29.
TYPE: Axial-flow turbojet.

SPECS

DIAMETER: 37 in. LENGTH: 146 in. WEIGHT: 2,305 lb. COMPRESSION RATIO: 5.1:1. AIR-MASS FLOW: 90 lb. per sec. FUEL GRADE: JP-4. FUEL CONSUMPTION: 1.07 lbs. per hr. per lb.

PERFORMANCE

TAKE-OFF: 5,600 lb. at 8,000 rpm. NORMAL: 4,900 lb. at 7,650 rpm. CRUISE: 4,410 lb. at 7,400 rpm.

REMARKS

Used in Republic F-84G long-range Thunderjet fighter.

MODEL: J-33-A-16A.

TYPE: Centrifugal-flow turbojet.

SPECS

DIAMETER: 49.5 in. LENGTH: 99.25 in. WEIGHT: 1,920 lb. FUEL GRADE: AN-F-48A.

REMARKS

All other data restricted. Used in Grumman F9F-7 Cougar.

MODEL: T38-A-6.

SPECS

TYPE: Axial-flow turboprop.

HEIGHT: 26.8 in. WIDTH: 34.3 in. LENGTH: 147 in. WEIGHT: 1,385 lb. AIR MASS FLOW: 32.1 lb. per sec. COMPRESSOR: 19-stage axial. TURBINE: 4-stage axial. FUEL GRADE: AN-F-48A. FUEL CONSUMPTION: 0.620 lbs. per hr. per lb. OIL CONSUMPTION: 2.5 lb. per hp. hr. (max. allowable).

PERFORMANCE

TAKE-OFF: 2,925 ESHP at 14,300 rpm.

REMARKS

Used in Convair Turbo-Liner, first U. S. turboprop-powered transport.

MODEL: T40-A-6, -10.
TYPE: Axial-flow turboprop.

SPECS

LENGTH: 182 in. WIDTH: 39 in. HEIGHT: 36 in. WEIGHT: 2,864 lb. COMPRESSOR: 19-stage, axial-flow. TURBINE: 4-stage, axial-flow. AIR MASS FLOW: 62.2 lb. per sec. FUEL GRADE: AN-F-48A. FUEL CONSUMPTION: 0.620 lb. per hp. hr. OIL CONSUMPTION (max. allow.): 4 lb. per hr.

PERFORMANCE

TAKE-OFF: 5,850 ESHP at 14,300 rpm.

REMARKS

Model -6 is used in Douglas A2D Skyshark carrier bomber and North American A2J-1. The model -10 is similar, except for relocation of accessories, and is used in the Convair R3Y flying boat.

CONTINENTAL MOTORS CORPORATION

Muskegon, Mich.

MODEL: A65-8F.

DATA

TYPE: 4 cylinder, air-cooled, horizontally opposed. CAA TYPE CERTIFICATE: 205.

SPECS

LENGTH: 30.41 in. FUEL GRADE: 73 octane. BORE: 3.875 in. STROKE: 3.625 in. DISPLACEMENT: 171 cu. in. COMPRESSION RATIO: 6.3:1 DRY WEIGHT: 176 lb. with hub and accessories. WEIGHT PER HP: 2.7 lb.

PERFORMANCE

TAKE-OFF POWER: 65 hp at 2,350 rpm. CRUISE: 53 hp at 2,150 rpm. FUEL CONSUMPTION: .49 lb. per hp hr.

EQUIPMENT

CARBURETOR: Stromberg NA-S3B. IGNITION: Eisemann AMA or J. I. Case 4-CAM. FUEL PUMP: A. C. Spark Plug Co.

MODEL: C85-12F.

DATA

TYPE: 4 cylinder, air-cooled, horizontally opposed. CAA TYPE CERTIFICATE: 233.

SPECS

LENGTH: 32 in. FUEL GRADE: 73 octane. BORE: 4,062 in. STROKE: 3.625 in. DISPLACEMENT: 188 cu. in. COMPRESSION RATIO: 6.3:1. DRY WEIGHT: 182 lb. with hub and accessories. WEIGHT PER HP: 2.14 lb.

PERFORMANCE

TAKE-OFF POWER: 85 hp at 2,575 rpm. CRUISE: 63 hp at 2,400 rpm. FUEL CONSUMPTION: 5.4 gal. per hr.

EQUIPMENT

CARBURETOR: Bendix-Stromberg NA-S3A1. IGNITION: Scintilla S4LN-21. STARTER: Delco-Remy. GENERATOR: Delco-Remy. FUEL PUMP: A. C. Spark Plug Co.

MODEL: C90-12F.

DATA

TYPE: 4 cylinder, air-cooled, horizontally opposed. CAA TYPE CERTIFICATE: 252.

SPECS

LENGTH: 31¼ in. FUEL GRADE: 80 octane. BORE: 4,062 in. STROKE: 3.875 in. DISPLACEMENT: 200.91 cu. in. COMPRESSION RATIO: 7:1. DRY WEIGHT: 186 lb. with hub and accessories. WEIGHT PER HP: 2.07 lb.

PERFORMANCE

TAKE-OFF POWER: 90 hp at 2,475 rpm. CRUISE: 68 hp at 2,350 rpm. FUEL CONSUMPTION: .52 lb. per hp hr.

EQUIPMENT

CARBURETOR: Bendix-Stromberg NA-S3A1. IGNITION: Scintilla S4LN-21. STARTER: Delco-Remy. GENERATOR: Delco-Remy. FUEL PUMP: A. C. Spark Plug Co.

MODEL C125-2.

DATA

TYPE: 6 cylinder, air-cooled, horizontally opposed. CAA TYPE CERTIFICATE: 236.

SPECS

LENGTH: 41 in. FUEL GRADE: 73 octane. BORE: 4.062 in. STROKE: 3.625 in. DISPLACEMENT: 282 cu. in. COMPRESSION RATIO: 6.3:1. DRY WEIGHT: 257 lb. with hub and accessories. WEIGHT PER HP: 2.05 lb.

PERFORMANCE

TAKE-OFF POWER: 125 hp at 2,550 rpm. CRUISE: 98 hp at 2,400 rpm. FUEL CONSUMPTION: .5 lb. per hp hr.

EQUIPMENT

CARBURETOR: Marvel MA-3SPA. IGNITION: Scintilla C6LN-21. STARTER: Delco-Remy. GENERATOR: Delco-Remy. FUEL PUMP: A. C. Spark Plug Co.

MODEL: C145-2.

DATA

TYPE: 6 cylinder, air-cooled, horizontally opposed. CAA TYPE CERTIFICATE: 253.

SPECS

LENGTH: 41 in. FUEL GRADE: 80 octane. BORE: 4.062 in. STROKE: 3.875 in. DISPLACEMENT: 301.37 cu. in. COMPRESSION RATIO: 7:1. DRY WEIGHT: 265 lb. WEIGHT PER HP: 1.77 lb.

PERFORMANCE

TAKE-OFF POWER: 145 hp at 2,700 rpm: CRUISE: 108 hp at 2,450 rpm; FUEL CONSUMPTION: .5 lb. per hp hr.

EQUIPMENT

CARBURETOR: Marvel MA-3SPA. IGNITION: Scintilla S6LN-21. STARTER: Delco-Remy. GENERATOR: Delco-Remy. FUEL PUMP: A. C. Spark Plug Co.

MODEL: E185.

DATA

TYPE: 6 cylinder, air-cooled, horizontally opposed. CAA TYPE CERTIFICATE: 246.

SPECS

LENGTH: 46.66 in. FUEL GRADE: 80 octane. BORE: 5 in. STROKE: 4 in. DISPLACEMENT: 471 cu. in. COMPRESSION RATIO: 7:1. DRY WEIGHT: 350 lb. WEIGHT PER HP: 1.89 lb.

PERFORMANCE

TAKE-OFF POWER: 205 hp at 2,600 rpm. CRUISE: 130 hp at 2,050 rpm. FUEL CONSUMPTION: .5 lb. per hp hr.

EQUIPMENT

CARBURETOR: Bendix-Stromberg PS-5C. IGNITION: Scintilla S6LN-21. STARTER: Provisions for direct cranking starter. GENERATOR: Delco-Remy. FUEL PUMP: Thompson or Romec. This engine also available with full AN accessory section.

MODEL: E-225.

DATA

TYPE: 6 cylinder, air-cooled, horizontally opposed. CAA TYPE CERTIFICATE: 267.

SPECS

LENGTH: 48.4 in. FUEL GRADE: 80/86 octane. BORE: 5 in. STROKE: 4 in.

PERFORMANCE

TAKE-OFF POWER: 225 hp at 2,650 rpm. CRUISE: 170 hp at 2,400 rpm. FUEL CONSUMPTION: .5 lb. per hp hr.

EQUIPMENT

CARBURETOR: Bendix-Stromberg PS-5C. IGNITION: Scintilla S6LN-21. STARTER: Eclipse Type 397-13. GENERATOR: Delco-Remy. FUEL PUMP: Romec. This engine also available with full AN accessory section.

MODEL O-315-A. *

DATA

TYPE: 4 cylinder, air-cooled, horizontally opposed.

SPECS

FUEL GRADE: 80/86 octane. BORE: 5 in. STROKE: 4 in. DISPLACEMENT: 315 cu. in. COMPRESSION RATIO: 7:1. DRY WEIGHT: 287 lbs. WEIGHT PER HP: 1.91 lbs.

PERFORMANCE

NORMAL RATED POWER: 150 hp at 2,600 rpm. CRUISE: 115 hp at 2400 rpm. FUEL CONSUMPTION: .5 lb. per hp hr.

MODEL O-470-A.

DATA

TYPE: 6 cylinder, air cooled, horizontally opposed. CAA type certificate: 273.

SPECS

FUEL GRADE: 80/86 Octane. BORE: 5 in. STROKE: 4 in. DISPLACEMENT: 471 cu. in. COMPRESSION RATIO: 7.01 to 1. DRY WEIGHT: 357 lbs. WEIGHT PER HP: 1.59 lb.

PERFORMANCE

TAKE-OFF POWER: 225 hp at 2,600 rpm. CRUISE: 175 hp at 2,400 rpm. FUEL CONSUMPTION: .5 lb. per hp hour.

EQUIPMENT

CARBURETOR: Marvel MA-4-5. **IGNITION:** Bendix-Scintilla S6RN-25. **STARTER:** Delco-Remy. **GENERATOR:** Delco-Remy. **OIL COOLER:** Harrison. **FUEL PUMP:** Romec. Provisions included for prop. governor.

REMARKS

This model which powers both the new Cessna 180 and 310 is the first of Continental's new 0-470 series to reach production. Among the design improvements are a new oil cooler integrally attached to the crankcase which uses the down flow of air, as do the cylinder fins and a full flow type oil filter mounted within the crankcase at the former location of the screen which it supplants. Supercharging can be provided at minimum cost by the addition of a belt-driven external supercharger. Other models in the series are:

MODEL 0-470-B. Similar to 0-470-A, but with Bendix-Stromberg PS5C carburetor mounted at back of engine. Designed for wing-type installation. **PERFORMANCE:** 235 hp at 2,600 rpm with compression ratio of 8:7 and 91 Octane fuel. **MODEL SO-470.** Similar to O-470-B, but with supercharger. Rating: 265 hp at 2600 rpm at 10,000 ft. for take-off and normal rating. **MODEL GSO-470.** Similar to SO-470, but with geared prop. drive. Rating: 300 hp at 3000 rpm at 10,000 ft. take-off and normal rating.

MODEL: Continental Model 140.

DATA

TYPE: Gas Turbine Air Compressor.

SPECS

DIAMETER: 18.7 in. **LENGTH:** 41.6 in. **COMPRESSOR:** single-sided, centrifugal. **TURBINE:** two-stage, solid disc, axial flow. **COMBUSTOR:** Annular, straight-through flow. **AIR DELIVERY:** 2.3 lb sec. at 50 psi, std. day. **WEIGHT:** 190 lb.

PERFORMANCE

AIR HP: 205 at 34,000 rpm, std. day. **TOTAL AIR FLOW:** 6.8 lb. sec., std. day. **FUEL FLOW:** 280 lb. hr. at max. rpm, std. day. **TURBINE EXIT TEMP.:** 1025 deg. F. at 34,000 rpm, 205 air hp.

REMARKS

The air generator is presently being used for turbine starting. The unit is an American version of the French PALOUSTE series.

MODEL: Continental Series 300.

DATA

TYPE: Centrifugal-flow turbojet.

SPECS

DIAMETER: 22.3 in. **LENGTH:** 42.5 in. **COMPRESSOR:** single-sided, centrifugal flow. **TURBINE:** single-stage, solid disc, axial flow. **COMBUSTOR:** annular, straight through flow. **WEIGHT:** 310 lb.

PERFORMANCE

STATIC THRUST: 920 lb. **TAKE-OFF AIR FLOW:** 17 lb. sec. **SFC:** 1.10 at Take-Off Rating. **TURBINE EXIT TEMP.:** 1220 deg. F. at 23,000 rpm sea level.

REMARKS

The series 300 engines are available as target drone power plant and booster units.

GENERAL ELECTRIC CO.

Schenectady, N. Y.

General Electric J47-GE-17 with afterburner and standard J-47-GE-11 model below

MODEL: J47-GE-13.

DATA

TYPE: Axial-flow turbojet.

SPECS

WEIGHT: 2,500 lb. (approx.). **FRONTAL AREA:** 7.35 sq. ft. **LENGTH:** 144 in. **DIAMETER:** 36.75 in. **COMPRESSOR:** 12 stage axial flow. **COMPRESSION RATIO:** 5:1. **TURBINE:** single stage. **INLET AIR FLOW:** 90 lb. per sec. **FUEL GRADE:** AN-F-58 or 100/130 gasoline.

PERFORMANCE

TAKE-OFF THRUST: Over 5,200 lb. at 7,950 rpm at sea level. **NORMAL RATING:** 4,320 lb. at 7,370 rpm. **CRUISE RATING:** 3,700 lb. at 7,000 rpm.

MODEL: J47-GE-17, 23, 25, 27.

The -17 engine is the standard production model redesigned to reduce its use of strategic materials by using substitute materials wherever possible. This redesign resulted in a saving of about 20 percent in special metals used previously. In addition, the engine is equipped with a long afterburner assembly. This auxiliary unit provides a substantial increase in thrust for short periods by the injection of raw fuel into the hot tailpipe gases, resulting in additional fuel consumption. The -23, 25, and 27 engines feature special anti-icing equipment and a special ignition system making starts possible at altitudes of more than 50,000 ft. Thrust is over 5,800 lb.

MODEL: J73.

DATA

TYPE: Axial-flow turbojet.

SPECS

DIAMETER: 36.75 in. LENGTH: 146 in.

PERFORMANCE

STATIC THRUST: In excess of 5,800 lb. dry Afterburner thrust has been estimated at 14,000 lb. by some experts not in on the development or production of this model.

REMARKS

Formerly J47-GE-21, design is virtually new engine with cannular type combustion chamber arrangement, all-weather and self-contained electronic control equipment.

JACOBS AIRCRAFT ENGINE CO.

Pottstown, Pa.

MODEL: R-775A Series.

DATA

TYPE: 7 cylinder, air-cooled. CAA TYPE CERTIFICATE: 237.

SPECS

DIAMETER: 44 in. LENGTH: 39.5 in. FUEL GRADE: 80 octane. BORE: 5.25 in. STROKE: 5 in. DISPLACEMENT: 757 cu. in. COMPRESSION RATIO: 6:1. DRY WEIGHT: 505 lb. WEIGHT PER HP: 1.68 lb.

PERFORMANCE

TAKE-OFF POWER: 300 hp at 2,200 rpm. FUEL CONSUMPTION: .45 lb. per hp hr. OIL CONSUMPTION: .010 lb. per hp hr.

EQUIPMENT

CARBURETOR: Bendix-Stromberg NA-B7A. IGNITION: 1 Scintilla VMN-7DF5, 1 Scintilla W67A distributor with coil. STARTER: Eclipse. GENERATOR: Eclipse.

REMARKS

Used in Cessna 195 aircraft.

LYCOMING-SPENCER DIVISION
AVCO MFG. CORP.

Williamsport, Pa.

MODEL: 0-235-C1.

DATA

TYPE: 4 cylinder, air-cooled, horizontally opposed; 115 hp. CAA TYPE CERTIFICATE: 223.

SPECS

LENGTH: 29.56 in. FUEL GRADE: 80 octane. BORE: 4.375 in. STROKE: 3.875 in. DISPLACEMENT: 233.3 cu. in COMPRESSION RATIO: 6.75:1. DRY WEIGHT: 236 lb. with hub and accessories. WEIGHT PER HP: 2.05 lb.

PERFORMANCE

TAKE-OFF POWER: 115 hp 2,800 rpm. CRUISE: 86 hp at 2,350 rpm. FUEL CONSUMPTION: .52 lb. per hp hr. OIL CONSUMPTION: .012 lb. per hp hr.

EQUIPMENT

CARBURETOR: Marvel-Schebler MA-3A. IGNITION: Dual Scintilla S4LN-21. STARTER: Delco-Remy. GENERATOR: Delco-Remy.

MODEL: GO-435-C2

DATA

TYPE: 6-cylinder, horizontally-opposed, geared, air-cooled. APPROVED TYPE CERTIFICATE: 228.

SPECS

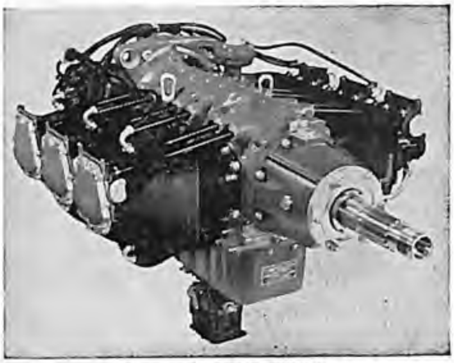
LENGTH: 39.57 in. HEIGHT: 29.59 in. WIDTH: 33.12 in. BORE: 4.875 in. STROKE: 3.875 in. DISPLACEMENT: 434 cu. in. COMPRESSION RATIO: 7.3:1. WEIGHT: 432 lb. FUEL GRADE: 91/98.

PERFORMANCE

TAKE-OFF POWER: 260 hp at 3,400 rpm. RATED POWER: 240 hp at 3,000 rpm. FUEL CONSUMPTION: 0.47 lb. per hp. hr.

EQUIPMENT

CARBURETOR: Marvel Schebler MA-4-5. MAGNETOS: Scintilla SF6LN-8. SPARK PLUGS: Autolite SH-2K.



Lycoming GO-435-C2

MODEL: 0-435-A.

DATA

TYPE: 6 cylinder, air-cooled, horizontally opposed. CAA TYPE CERTIFICATE: 228.

SPECS

LENGTH: 38.10 in. FUEL GRADE: 80 octane. BORE: 4.875 in. STROKE: 3.875 in. DISPLACEMENT: 434 cu. in. COMPRESSION RATIO: 6.5:1. DRY WEIGHT: 392 lb. with hub and accessories. WEIGHT PER HP: 2.06 lb.

PERFORMANCE

TAKE-OFF POWER: 190 hp at 2,550 rpm. CRUISE: 145 hp at 2,300 rpm. FUEL CONSUMPTION: .52 lb. per hp hr. OIL CONSUMPTION: .0012 lb. per hp hr.

EQUIPMENT

CARBURETOR: Marvel Schebler MA-4-5 IGNITION: Dual Scintilla SFGLN-8. STARTER: Delco-Remy. GENERATOR: Delco-Remy.

MODEL: 0-290-D-2.

DATA

TYPE: 4-cylinder, horizontally-opposed, direct-drive, air-cooled. APPROVED TYPE CERTIFICATE: 229.

SPECS

LENGTH: 29.56 in. HEIGHT 22.81 in. WIDTH: 32.32 in. BORE: 4.875 in. STROKE: 3.875 in. DISPLACEMENT: 289 cu. in. COMPRESSION RATIO: 6.50:1. WEIGHT: 255 lb. FUEL GRADE: 80 octane.

PERFORMANCE

TAKE-OFF POWER: 135 hp at 2,800 rpm. RATED POWER: 125 hp at 2,600 rpm. FUEL CONSUMPTION: 0.49 lb. per hp. hr.

EQUIPMENT

CARBURETOR: Marvel-Schebler MA-3SPA. MAGNETOS: Scintilla S4LN-20/21. STARTER: Delco-Remy. GENERATOR: Delco-Remy.

MODEL: GSO-580-D.

DATA

TYPE: 8 cylinder, air-cooled, horizontally opposed. CAA TYPE CERTIFICATE: 256.

SPECS

LENGTH: 57.08 in. FUEL GRADE, 100/130 octane. BORE: 4.875 in. STROKE: 3.875 in. DISPLACEMENT: 578 cu. in. COMPRESSION RATIO: 7.30:1. WEIGHT: 604 lb.

PERFORMANCE

TAKE-OFF POWER: 400 hp. FUEL CONSUMPTION: 16.7 gal. per hr.

EQUIPMENT

CARBURETOR: Bendix. IGNITION: Scintilla. FUEL PUMP: Pesco.

MODEL: 0-320.

DATA

TYPE: 4 cylinder air-cooled, horizontally opposed. CAA TYPE CERTIFICATE: 274.

SPECS

LENGTH: 29.40 in. FUEL GRADE: 80/87 octane. BORE: 5.125 in. STROKE: 3.875 in. DISPLACEMENT: 319.8 cu. in. COMPRESSION RATIO: 7.00:1. DRY WEIGHT: 272 lb.

PERFORMANCE

TAKE-OFF POWER: 150 hp. FUEL CONSUMPTION: 8.2 gal. per hr.

EQUIPMENT

CARBURETOR: Marvel-Schebler. IGNITION: Delco-Remy. FUEL PUMP: AC.

PRATT & WHITNEY AIRCRAFT

DIVISION OF UNITED AIRCRAFT CORP.

East Hartford, Conn.

MODEL: Twin Wasp D Series, (R-2000).

DATA

TYPE: 14 cylinder, air-cooled, radial. CAA TYPE CERTIFICATE: 230.

SPECS

DIAMETER: 49.1 in. LENGTH: 59.66 in. FUEL GRADE: 100/130. BORE: 5.75 in. STROKE: 5.5 in. DISPLACEMENT: 2,004 cu. in. COMPRESSION RATIO: 6.5:1. DRY WEIGHT: Single speed, 1,485 lb.; two speed, 1,605 lb.

PERFORMANCE

TAKE-OFF: 1,450 at 2,700 rpm and 2,800 ft. NORMAL RATED POWER: 1,200 hp at 2,550 rpm and 6,400 ft.

EQUIPMENT

CARBURETOR: Stromberg PD-12F13. IGNITION: two Scintilla SF-14LN-8.

REMARKS

Powers Douglas C-54 military transport, workhorse of World War II, the Berlin Airlift and the Trans-Pacific Airlift in support of the Korean campaign.

MODEL: Double Wasp CA and CB series, (R-2800)

DATA

TYPE: 18 cylinder, air-cooled, radial. CAA TYPE CERTIFICATES: 231 and 264.

SPECS

DIAMETER: 52.8 in. LENGTH: 81.40 in. FUEL GRADE: 100/130 or 108/135. BORE: 5.75 in. STROKE: 6 in. DISPLACEMENT: 2,804 cu. in. COMPRESSION RATIO: 6.75 to 1. DRY WEIGHT: Two speed, 2,390 lb.; single speed, 2,357 lb.

PERFORMANCE (CB3)

TAKE-OFF POWER: 2,400 hp at 2,800 rpm at 4,000 ft. with water injection; 2,050 hp at 2,700 rpm at 6,000 ft. dry. NORMAL RATED POWER: 1,800 hp at 2,600 rpm at 8,500 ft.

EQUIPMENT

CARBURETOR: Stromberg PR-58E5. IGNITION: Scintilla DLN-10 low tension. CB16, same in low, but has maximum continuous rating in high of 1,725 hp.

REMARKS

The CA series includes the -3, -15, and -18 models. The CB series includes the -3, -4, -16 and -17 models. Essential differences are in supercharger gear ratios and weights. Most other parts are interchangeable. Military versions of the Double Wasp power the following production aircraft: Beech T-36, Bell XHSL-1 helicopter, Chase C-123 transport, Convair T-29 trainer, Douglas C-118A cargo, Grumman AF-2S and -2W hunter-killer teams, North American AJ-1 carrier bomber and Vought F4U-5N and AU-1 fighter-bombers. Commercial versions power the Convair 240 and 340 transports, Douglas DC-6, -6A, and -6B transports and Martin 2-0-2A and 4-0-4 transports.

MODEL: Wasp Major CB Series, (R-4360).

DATA

TYPE: 28 cylinder, air-cooled, radial. CAA TYPE CERTIFICATE: 247.

SPECS

DIAMETER: 55 in. LENGTH: 96.5 in. FUEL GRADE: 108/135. BORE: 5.75 in. STROKE: 6 in. DISPLACEMENT: 4,363 cu. in. COMPRESSION RATIO: 6.7:1. DRY WEIGHT: 3,682 lb.

PERFORMANCE

TAKE-OFF POWER: 3,500 hp at 2,700 rpm and 500 ft. (with water); 3,250 hp at 2,700 rpm and 700 ft. (without water). NORMAL RATED POWER: 2,650 hp at 2,550 rpm at 5,500 ft. MAXIMUM CONTINUOUS RATING: 2,840 hp at 2,550 rpm.

EQUIPMENT

CARBURETOR: Stromberg PR-100B3. IGNITION: 4 Scintilla S14RN-15 low tension.

REMARKS

Wasp Major is used on Boeing B-50 bomber (4), Convair B-36 bomber (6), Boeing C-97 transport (4), Douglas C-124 transport (4), Convair C-99 transport (6), Fairchild C-119 Packet (2) and the Boeing Stratocruiser commercial transport (4). Development versions of the engine have already produced more than 4,000 hp.

Pratt & Whitney Wasp Major

MODEL: Turbo-Wasp PT-2 (T34).

DATA

TYPE: Axial-flow turboprop.

SPECS

DIAMETER: 34.06 in. **LENGTH:** 157.4 in. **COMPRESSOR:** 13-stage axial-flow. **TURBINE:** three-stage, axial-flow. **PROPELLER REDUCTION GEAR:** two-stage, 11:1 ratio. **WEIGHT:** 2,564 lb. **FUEL:** Kerosene, gasoline or special jet fuel.

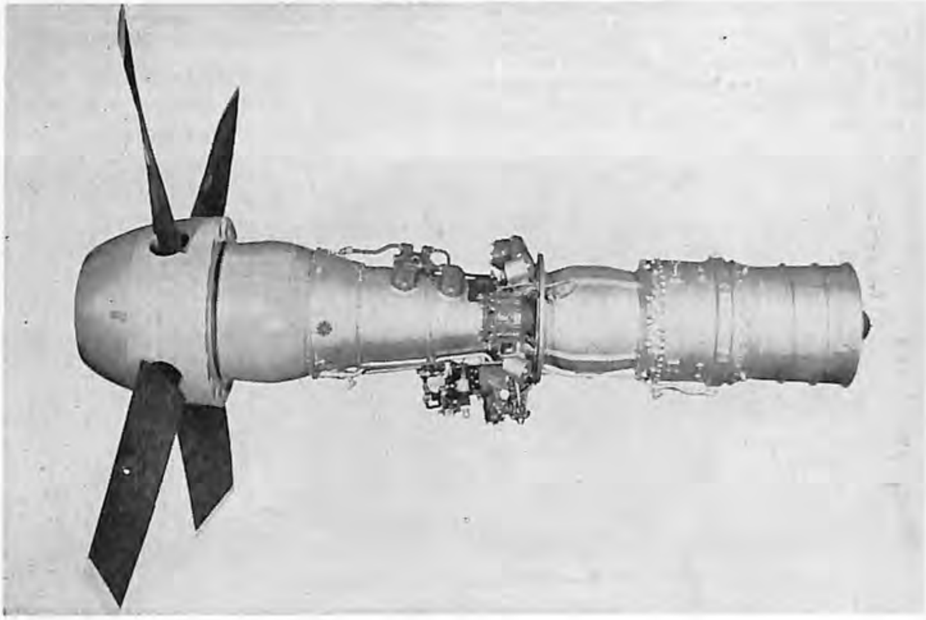
PERFORMANCE

TAKE-OFF POWER: 5,700 hp. **FUEL CONSUMPTION:** 0.62 lb. hp hr.

REMARKS

Engine thrust is divided 90 percent to propeller turbine and 10 percent to jet nozzle. Stainless steel is used almost exclusively throughout the engine structure. This model is no longer offered commercially.

Pratt & Whitney T34



MODEL: Turbo-Wasp JT-7 (J48).

DATA

TYPE: Centrifugal-flow turbojet.

SPECS

DIAMETER: 50.50 in. **LENGTH:** 109.75 in. **COMPRESSOR:** double-sized, single-stage, centerifugal-flow. **TURBINE:** axial-flow, single-stage. **WEIGHT:** 2,080 lb. **FUEL:** Kerosene, gasoline or special jet fuel.

PERFORMANCE

STATIC THRUST: 6,250 lb. dry. Thrust is greatly increased using water injection and afterburning but augmented ratings are still classified.

REMARKS

The J48 powers the Grumman F9F-5 Panther and the swept-wing F9F-6 Cougar now going into service with the Navy and the Lockheed F-94C all-weather interceptor for the Air Force.

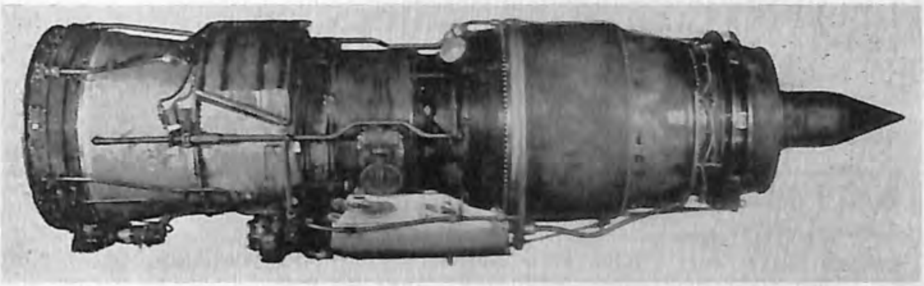
MODEL: Turbo-Wasp JT-3 (J57).

DATA

TYPE: Axial-flow turbojet.

REMARKS

Specifications and performance are still classified other than mention that engine is in the 10,000 lb. thrust class. It powers the Boeing B-52 long-range bomber and the Convair YB-60 swept-wing jet version of the familiar B-36, the North American F-100, McDonnell F-101 and the Convair F-102.



Pratt & Whitney J57

WESTINGHOUSE ELECTRIC CORP.
AVIATION GAS TURBINE DIVISION
Philadelphia, Pa.

MODEL: J34-WE-36

DATA

TYPE: Axial-flow turbojet.

SPECS

DIAMETER: 27 in. **LENGTH:** 111.4 in. **HEIGHT:** 34.7 in. **WEIGHT:** 1,207 lb. **COMPRESSION RATIO:** 4.35.

PERFORMANCE

TAKEOFF THRUST: 3,400 lb. at 12,500 rpm. **OPERATING ALTITUDE:** 45,000 ft.

REMARKS

Automatic control system functions from single cockpit lever. Air inlet is divided into two elliptic openings between the arms of the "Y" duct. All other data are classified.

MODEL: J40-WE-8

DATA

TYPE: Axial-flow turbojet.

SPECS

DIAMETER: Approx. 40 in. **LENGTH:** Approx. 25 ft. **WEIGHT:** Approx. 3,500 lb.

REMARKS

All other specification and performance data are classified.

MODEL: J46-WE-8

DATA

TYPE: Axial-flow turbojet

SPECS

DIAMETER: Approx. 36 in. **LENGTH:** Approx. 16½ ft. **WEIGHT:** Approx. 2,100 lb.

REMARKS

All other specification and performance data are classified.

Westinghouse J40 is used in McDonnell F3H fighter

WRIGHT AERONAUTICAL DIV.

Wood-Ridge, N. J.

MODEL: R-1300-1.

DATA

TYPE: 7 cylinder, air-cooled, radial.

SPECS

LENGTH: 48.12. FUEL GRADE: 91/98 octane. BORE: 6.125 in. STROKE: 6.312 in. DISPLACEMENT: 1,300 cu. in. COMPRESSION RATIO: 6.2:1. DRY WEIGHT: 1,045 lb. WEIGHT PER HP: 1.28 lb.

PERFORMANCE

TAKE-OFF POWER: 800 hp at 2,600 rpm. CRUISE: 420 hp. FUEL CONSUMPTION: .48 lb. per hp hr. OIL CONSUMPTION: .015 lb. per hp hr.

EQUIPMENT

CARBURETOR: Stromberg PD9F1. IGNITION: Dual Bosch SF-7LU-2.

MODEL R-1820-76A.

DATA

TYPE: 9 cylinder, air-cooled, radial. CAA TYPE CERTIFICATE: 243.

SPECS

LENGTH: 47.69 in. FUEL GRADE: 100/130. BORE: 6.125 in. STROKE: 6.875 in. DISPLACEMENT: 1,820 cu. in. COMPRESSION RATIO: 6.8:1. DRY WEIGHT: 1,365 lb. WEIGHT PER HP: .99 lb.

PERFORMANCE

TAKE-OFF POWER: 1,425 hp at 51.5 in. Hg. 2,700 rpm. CRUISE: 890 hp at 33 in. Hg., 2,300 rpm. FUEL CONSUMPTION: .46 lb. per hp hr. at 60 percent power. OIL CONSUMPTION: .020 lb. per hp hr. at 89 percent.

EQUIPMENT

CARBURETOR: Stromberg PD12K14. IGNITION: Dual Scintilla S9LU-5.

REMARKS

This engine is the latest in a long line of 1820 cu. in power-plants that were first introduced more than ten years ago. This model is also built with 2-speed spuercharger and optional reduction gear ratios.

MODEL: R-3350-30W-30WA, 85, 34.

DATA

TYPE: 18 cylinder air-cooled radial.

SPECS

LENGTH: 89.53 in. FUEL GRADE: 115/145 octane. BORE: 6.125 in. STROKE: 6.312 in. DISPLACEMENT: 3,350 cu. in. COMPRESSION RATIO: 6.7 to 1. DRY WEIGHT: 3,514 lb. WEIGHT PER HP: .92.

PERFORMANCE

TAKE-OFF POWER: 3,250 hp at 2,900 rpm. NORMAL RATED POWER: 2,600 hp at 6,500 ft.

REMARKS

The R-3350-30W is a compound version of the R-3350-26W using three small turbines driven by exhaust gas and connected by fluid couplings to the crankshaft. This increases the take-off power to 3,250 hp. Ignition system is Scintilla DLN-9; the carburetor, Stromberg PR58T1.

MODEL: R-3350-24W.

DATA

TYPE: 18 cylinder, air-cooled, radial. CAA TYPE CERTIFICATE: 218.

SPECS

LENGTH: 78.52 in. FUEL GRADE: 100/130. BORE: 6.125 in. STROKE: 6.3125 in. DISPLACEMENT: 3,350 cu. in. COMPRESSION RATIO: 6.5:1. DRY WEIGHT: 2,884 lb. WEIGHT PER HP: 1.1 lb.

PERFORMANCE

TAKE-OFF POWER: 2,500 hp at 2,800 rpm. CRUISE: 1,470 hp at 2,300 rpm. FUEL CONSUMPTION: .46 lb. per hp hr. OIL CONSUMPTION: .015 lb. per hp hr.

EQUIPMENT

IGNITION: Scintilla DLN-9. CARBURETOR: Bendix No. 135091 direct fuel injection.

MODEL: R-3350-26W.

DATA

TYPE: 18 cylinder, air-cooled, radial.

SPECS

LENGTH: 81.93 in. FUEL GRADE: 115/145. BORE: 6.125 in. STROKE: 6.312 in. DISPLACEMENT: 3,350 cu. in. COMPRESSION RATIO: 6.5:1. DRY WEIGHT: 2,848 lb. WEIGHT PER HP: 1.05 lb.

MODEL: J65

TYPE: Axial-flow turbojet.

SPECS

DIAMETER: 37.3 in. LENGTH: 133.85 in. WEIGHT: 2,500 lb. FRONTAL AREA: 6.78 sq. ft. FUEL CONSUMPTION: 0.915 lb. per lb. per hr.

PERFORMANCE

TAKE-OFF: 7,220 lb.

1953 DAY BY DAY CHRONOLOGY

(NOTE: The following chronology is condensed principally from *American Aviation Daily*, only daily in the aviation field; published by American Aviation Publications, Inc., Wayne W. Parrish, Editor.)

JANUARY

Jan. 2

Cessna Aircraft Co. was declared winner of a primary jet trainer competition among 14 entries. The winning Cessna entry was a twin-jet design featuring side-by-side seating. Powered by two Continental Marbore turbojet engines of 900 lb. thrust each, the new trainer will have a cruising speed of more than 350 knots.

Jan. 8

McDonnell Aircraft Corp. received an additional order for its Navy F3H-1 Demon jet carrier fighter, the second order placed to date. Dollar value was not announced.

Jan. 9

President Truman submitted the 1954 fiscal year budget to the Congress calling for $16,788-million for the Air Force, including more than $6-billion for aircraft procurement. Navy procurement request was for more than $2-billion while the Army asked $150-million for aircraft.

Jan. 15

Fairchild begins production of the C-119G, an advanced model of the Packet using four-blade Aeroproducts propellers and Wright R-3350-30W Turbo Compound engines.

Jan. 21

Transport Air Group formed in Washington, D. C., to represent independent air cargo lines. Manager of the new group is L. R. "Mike" Hackney, long-time Lockheed aircraft cargo specialist.

Jan. 22

Newly-inaugurated President Eisenhower announces he will use the Air Force Lockheed C-121 Constellation "Columbine" as his personal airplane, replacing the Douglas DC-6 "Independence" used by former President Truman.

Jan. 23

Aircraft Industries Association creates Guided Missile Committee to be made up of experts from member companies and to handle collective problems in research, design, construction and testing of missiles.

New York Airways announces plan to purchase four Sikorsky S-55 transport helicopters for its aerial taxi service between New York City's three major air terminals.

Jan. 26

Chance Vought Aircraft completes last F4U Corsair fighter to bring to a close the longest production record of any airplane ever built. The last Corsair was No. 12,571.

Jan. 31

Eastern Air Lines flies last schedule with Douglas DC-3 equipment. At one time Eastern operated 63 of the twin-engined airliners and during 17 years of service Eastern estimates its DC-3's have flown 83.5-million miles.

FEBRUARY

Feb. 2

First meeting held by newly-formed Helicopter Committee of the Air Transport Association. Function of the new committee is to plan long range integration of the helicopter into scheduled airline operation.

Feb. 3

Navy Bureau of Aeronautics signed its first "basic contract agreement" under which the manufacturer agrees to a long series of clauses now carried in each separate contract. After signing such basic agreements, future contracts are of short form and more quickly drawn and approved. First contractee is Lockheed Aircraft Corp.

Feb. 9

Grand Central Aircraft Co. establishes Rocket Division at Pacoima, Calif. The new division will develop and produce solid propellant rocket motors and complete missiles, including one under contract with the Army Ordnance Corps.

National Aeronautic Association announces correction to World Speed Record set by Capt. Slade Nash in North American F-86D. Correct figure is 698.5 mph. The correction of 1½ mph was made following microscopic study of photographs taken during the flight.

Feb. 16

The Aircraft Production Board is abolished in reorganization of Office of Defense Mobilization as first step in new Administration's program of removing economic controls. The APB had served since the start of the Korean war as a central directorate of aircraft production.

Feb. 17

Aircraft Industries Association announces plan to sponsor a continuing program of aviation education in the nation's schools in cooperation with the National Aviation Education Council. Chairman of the program is Mr. Ken Ellington, Republic Aviation Corp.

Feb. 18

First test flight of new Lockheed L-1049C Super Constellation is made at Burbank, Calif. The new model is powered by four Wright R-3350 Turbo Compound engines of 3,250 hp ea. Gross weight of the new model is 130,000 lb.

Feb. 20

Air Force announces order for "a large number" of Convair 340 Air Liners to be designated C-131C. The military version of the airliner will be equipped as a heavy cargo transport with a large loading door and floor stressed to accommodate loads of 200 lb./sq. ft.

Lockheed announces new C-130 turboprop-powered transport for the Air Force. First U. S. transport designed expressly for turboprop power, new C-130 will be powered by four Allison engines of 3,750 hp ea. Span is 132 ft., length 95 ft. and height 38 ft. Quantity production will begin at Lockheed plant at Marietta, Ga.

President Eisenhower nominated Fred B. Lee to be Administrator of Civil Aeronautics. Lee had been serving as Deputy Administrator.

Fairchild Engine Division revealed production of the J44 turbojet engine, a small unit producing 1,000 lb. of thrust. The new engine is especially designed for missile installation and is 72 in. long and only 22 in. in diameter.

Feb. 24

Northwest Airlines announced contract for 22 Lockheed Super Constellation transports costing about $30-million. Deliveries are to begin in 1954 and all will be in service by mid-1955.

Feb. 25

Douglas Aircraft Co. reveals that it has spent more than $1-million on its DC-8 jet airliner but that no decision has been made on placing the plane in production.

Fairchild Aircraft Division announced that its employment had passed its World War II peak. Production of Packet transports is now utilizing more than 9,000 workers, compared to 8,250 employed at the previous peak in 1943.

MARCH

Mar. 2

Hiller Helicopters announced resumption of commercial production for the first time since 1950, when the Korean war caused the company to turn its attention entirely to military production. The Hiller 12-B, a three-place, dual-control model, was offered for quick delivery at $36,000.

Mar. 4

Air Force announced award of a production contract for the Douglas B-66 swept-wing medium bomber. The Air Force had earlier ordered a special reconnaissance version of the machine, the RB-66. Both models were developed from the Navy A3D version of the jet bomber.

John K. Northrop, retired president and founder of the company bearing his name, was retained as a consultant to the Garret Corp., parent firm of AiResearch Manufacturing Co.

Mar. 5

Bell XHSL-1, anti-submarine warfare helicopter, made its first hovering flight at Fort Worth, Tex. The new machine is the first tandem rotor design to be produced by Bell. It has been ordered into Navy production.

Mar. 6

Boeing Airplane Co. delivered its last piston-engined bomber, a TB-50H, to the Air Force. The delivery marked the completion of more than 17,000 Boeing-designed four-engined bombers.

Mar. 12

First Lockheed R7V-1, Navy version of the Super Constellation, was delivered to the Navy at Burbank, Calif. The four-engined transport is equipped to handle 106 passengers in rearward facing seats. It is the first of a large production order for the Military Air Transport Service and the Navy Fleet Logistic Support Wings.

Mar. 16

Republic Aviation Corp. announces delivery of its 4,000th jet fighter. The F-84 Thunderjet has been in production since 1946 and those in service have now logged more than 750,000 flight hours.

Mar. 24

Air Force announced that the North American F-86F model is now in combat in Korea. The new "F" model is powered by a General Electric J47 engine of 5,800 lb. thrust and features an improved gunsight and increased performance.

Mar. 25

Lockheed reported that it had studied 300 different designs for a jet transport over the past eight years, an average of one new design every seven working days. It now has a definite design ready for fabrication whenever management deems the market acceptable.

Mar. 30

√General Dynamics Corp. completed arrangements to acquire control of Consolidated Vultee Aircraft Corp. through purchase of 400,000 shares of stock held by Atlas Corp. General Dynamics also owns Canadair, Ltd.

Navy disclosed first details on the Vought Regulus missile, designed for ship-to-surface bombardment of enemy coast lines. About 30 ft. long, the swept-wing missile is capable of supersonic speed on a conventional turbojet engine. It is in production at the Chance Vought plant near Dallas, Tex.

Convair C-99 established a new world's load-lifting record of 104,000 lb. A cargo version of the Convair B-36 bomber, the monster transport has completed 2,000 hours of service testing.

Mar. 31

Bell X-1A, an advanced version of the historic XS-1, began flight tests at Edwards Air Force Base, Calif., with Jean C. "Skip" Ziegler at the controls. The new model is expected to fly faster and higher than its predecessor, the first airplane to fly faster than sound.

APRIL

Apr. 7

Atomic Energy Commission reveals it is using Lockheed QF-80 remotely-controlled "drone" aircraft at the Nevada Proving Grounds. The pilotless jet fighters are flown directly through atomic clouds to collect samples of radioactive particles for subsequent examination. The USAF planes are flown from "mother" planes a safe distance away by special Sperry control equipment.

Apr. 10

Convair XF2Y-1 Sea Dart, radical new high-speed seaplane, made its first test flight at San Diego, Calif. Piloted by test pilot Sam Shannon, the hydro-ski delta-wing fighter rides on its fuselage until its speed forces it up onto the thin hydro-skis. The skis are retracted in flight and the twin jet engines drive the unique new fighter at transonic speed.

Lockheed announced that the first Boeing B-47 had been completed at its Marietta, Ga., factory. The swept-wing, six-jet bomber is being built under license from Boeing.

Apr. 13

The North American T-28B, Navy version of its T-28 Air Force advanced trainer, completed its first test flight at Downey, Calif. The T-28B features increased power to 1,425 hp from its Wright R-1820 engine and has a top speed of 346 mph. It has a service ceiling of 35,500 ft., unusual performance for a training plane.

Apr. 17

First step in the program of the new administration to cut back aeronautical production from non-aviation companies came with cancellation or reduction of contracts for jet engines at the Ford Motor Co., Lincoln-Mercury and Chrysler Motor Co. plants. Production program was also reduced at the General Electric Co. plant at Evendale, Ohio.

Apr. 20

First flight of the Chase C-123B assault transport was completed successfully at the West Trenton, N. J. plant. The twin-engine Avitruc has been ordered into quantity production by the Kaiser company facilities at Willow Run, Mich.

Apr. 23

Fred B. Lee was confirmed by the Senate as Administrator of Civil Aeronautics.

Eastern Air Lines purchased six more Lockheed Super Constellation transports, bringing to 22 the total of the type Eastern now has on order. Deliveries are scheduled for Fall, 1954.

Apr. 28

President Eisenhower named Oswald Ryan, Chairman of the Civil Aeronautics Board and appointed Harmar D. Denny as a Board member.

Apr. 29

American Airlines president C. R. Smith announced that the turboprop engine should be used in the next series of transport airplanes, rather than making the jump direct to turbojet airliners. He based his opinion on the fact that existing airplanes could be modified by installation of turboprop engines at a much cheaper cost than the production of jet transports.

The Navy announced an order for the Vought A2U, an attack version of the F7U-3 tailless carrier fighter.

Apr. 30

Eastern Air Lines celebrated its 25th Anniversary. Eastern is unique among U. S. airlines in having shown a profit during the past 18 years of its existence. The anniversary was celebrated by a traveling air show featuring one of President "Eddie" Rickenbacker's World War I Spad pursuit planes still in flying condition.

MAY

May 8

Charles F. Horne, former Administrator of Civil Aeronautics, named consultant to Bendix Radio Division, Bendix Aviation Corp.

C. C. Pearson, former vice president, Glenn L. Martin Co., elected vice president for manufacturing, Beech Aircraft Corp.

May 11

Walter Sternberg elected president, Resort Airlines. He had formerly been vice president-sales, National Airlines.

North American F-86H made first flight at Edwards Air Force Base, Calif. The new model Sabre is powered by a General Electric J73 engine and features heavier landing gear, modified wing fittings and clamshell canopy.

May 12

Secretary of Defense Charles E. Wilson revealed that the Air Force strength had been revised downward to 120 wings, instead of the 143 wings previously planned.

J. H. Sidebottom resigns as assistant director, Technical Service, Aircraft Industries Association, to accept post as engineering manager, Flight Refueling, Inc., Danbury, Conn.

May 13

Bell X-2 supersonic research airplane, exploded in air over Lake Ontario, costing life of test pilot Jean "Skip" Ziegler. Considered world's fastest airplane, the supersonic craft featured stainless steel construction and was five years a-building.

May 15

First Fairchild C-119 Packet assigned to the Italian Air Force departed Dover, Del., on a ferry flight to Rome. The assignment was made under the Mutual Defense Assistance Program.

May 18

Douglas DC-7 made first test flight at Santa Monica, Calif. The new transport is powered by four Wright Turbo Compound engines of 3,250 hp ea. It has a top speed of 410 mph and will cruise at 360 mph. Fifty-eight of the new airliners are already on order with the first deliveries scheduled for American Airlines.

John Jay Hopkins succeeds Floyd B. Odlum as chairman of the board of Consolidated Vultee Aircraft Corp. Hopkins is chairman of

General Dynamics Corp., which purchased Convair interest held by Odlum's Atlas Corp.

Glenn L. Martin, aviation pioneer, announces retirement after 44 years as designer, pilot and manufacturer. He will continue as director of the Glenn L. Martin Co., Baltimore, Md.

Jacqueline Cochran Odlum established new speed record of 652.337 mph over 100-km. course at Edwards Air Force Base, Calif. Mrs. Odlum flew a Canadair F-86 Sabre swept-wing fighter. Her record eclipsed the former mark of 635.868 mph set by Col. Ascani of the USAF and the women's mark of 534.375 mph previously held by Mme. Jacqueline Auriol.

May 20

First of a series of Lockheed P2V Neptune patrol bombers left Burbank on delivery flight to French Navy under MDAP.

Air Force reveals significant flights of Boeing B-47 Stratojet bombers: a 12,000-mile, 24-hour flight, using aerial refueling three times; a flight from Fairbanks, Alaska over the North Pole and return and a 3,120-mile non-refueling flight from Limestone, Me. to Fairford, England in 5 hrs. 38 min.

May 21

Air Force announced its new "weapons system concept" under which a prime contractor would exercise full authority for all aspects of the project, including ground equipment and training programs. Convair was revealed as first contractor to be selected for the new system with its XB-58 Hustler supersonic bomber.

Ralph Platt, reporter for the Cleveland News, was re-elected president of the Aviation Writers Association during convention at Fort Worth, Tex.

JUNE

June 4

Fifteen Boeing B-47 Stratojet bombers of the 306th Bombardment Wing made non-stop Atlantic crossing to England as part of routine rotation of USAF bomber units. Boeing KC-97 flying tankers accompanied the mission as precaution but none was used.

June 8

The U. S. Air Force awarded a $22,500,000 contract to the Fiat aircraft manufacturing company in Italy for production of the F-86D all-weather fighter. The first 50 airplanes will be assembled from parts shipped by North American Aviation, Inc., designers of the plane.

Pan American World Airways and Transocean Air Lines announced plans to test the use of flight refueling for commercial airliners. The companies will use Douglas DC-4 and DC-6 transports for the experiments, which are expected to furnish data for use in the future when short-range jet transports come into use.

June 10

The U. S. Air Force awards $50-million contract to Republic Aviation Corp.-International, Geneva, Switzerland for production of spare parts for the Republic F-84F swept-wing fighter. Republic-International, a subsidiary of the U. S. firm, will subcontract the work to European manufacturers.

June 15

Piasecki H-21C helicopter makes first test flight. Known as the "Work Horse," the new version of the helicopter is intended for assault and rescue duties with the Army Ground Forces.

Westinghouse Electric Corp. signed a 10-year cooperative agreement with Rolls-Royce, Ltd. in England for exchange of technical data on aircraft gas turbine development.

June 16

North American Aviation delivers its 1,000th T-28A training plane to the Air Force. The company reveals that production of the airplane has been on or ahead of schedule for 31 consecutive months.

June 18

Rear Admiral Apollo Soucek, pioneer Naval aviator, was nominated to be Chief of the Navy Bureau of Aeronautics. He succeeds Rear Adm. Thomas S. Combs, who will receive an assignment with the Fleet.

Douglas C-124 Globemaster transport crashed after takeoff from Tachikawa Air Base, Japan, killing 129 officers and enlisted men in history's worst air disaster.

June 19

Air Force revised its heavy press program downward and is now sponsoring construction of only 10 forging and extrusion presses, instead of the 17 programmed earlier. The program includes presses with a capacity of 50,000 tons.

June 24

The Air Force cancelled contracts with Kaiser Motors Corp. for production of the Fairchild C-119 and the Chase C-123 twin-engine transport planes. Kaiser has already delivered 57 airplanes of the 159 on the C-119 order but the C-123 had not yet gone into production.

JULY

July 3

Air Force revealed it is using the McDonnell XF-88B fighter as a flying test bed for supersonic propeller experiments. Powered by two Westinghouse J34 turbojet engines in the belly and an Allison T38 turboprop engine in the nose, the XF-88B will test three different gear ratios and 12 different types of supersonic propellers.

July 6

Col. Bernt Balchen, famed Arctic pilot, was named winner of the 1953 Harmon Trophy as outstanding aviator of the year. Named as outstanding aviatrix was Mme. Jacqueline Auriol of France. Winner of the award as outstanding lighter-than-air pilot was Walter Massie of the Goodyear Tire and Rubber Co.

July 7

Lufthansa, the revived German airline, announced it had selected the Lockheed Super Constellation and the Convair Liner 340 as flight equipment for its projected international air service.

First Republic F-84F Thunderstreak produced by the Buick-Oldsmobile-Pontiac Division of General Motors made its first test flight from the Kansas City, Kans. plant. The F-84F is also in production by Republic Aviation Corp. at Farmingdale, Long Island, N. Y.

North American Aviation announced that its F-100 Super Sabre had completed first test flights. The swept-wing fighter, powered by a Pratt & Whitney J57 engine, was flown by test pilot George Welch.

Dr. Edward P. Warner was re-elected president of the International Civil Aviation Organization, having served in that office since creation of the group in 1947.

July 9

Fairchild Aircraft Division was ordered by the Air Force to build the remaining 88 C-119 Packet transports from the cancelled contract with Kaiser Motors Corp. Fairchild is already in quantity production on the C-119.

July 13

Boeing Airplane Co. reveals new KC-97G flying tanker transport in which all equipment has been relocated under the main cabin floor, which is freed for cargo-carrying. Previous models had equipment located in the main cabin.

July 14

The Custer "Channel Wing" transport made its first test flight at Oxnard, Calif. Although previously tested in simplified form, the new Channel Wing aircraft is a development of the Baumann Brigadier executive transport.

Douglas-El Segundo chief engineer Ed Heinemann revealed that the AD-4 Skyraider is equipped to carry the atomic bomb. This is the first single-engine carrier airplane specifically mentioned as having this capability.

July 16

U. S. Air Force placed $600,000 order for universal cargo carriers with Transit Van Corp. of Redwood City, Calif. The standard containers are for use in a wide variety of aircraft as well as on railroads and trucks. The units measure 8 ft. x 8 ft. x 20 ft. and have a capacity of 12,000 lb. of cargo.

A new World's Speed Record of 715.697 mph was established by Lieut. Col. William F. Barns in a North American F-86D Sabre jet fighter at Salton Sea, Calif. The new mark eclipses the previous mark of 698.505 set last Nov. 19.

July 20

First flight test was made of Martin B-57 night intruder at Baltimore, Md. with test pilot O. E. "Pat" Tibbs at the controls. The B-57 is the U. S. Air Force version of the English Electric Canberra twin jet bomber.

July 22

Convair and the Navy held first public demonstration of the XF2Y-1 Sea Dart jet fighter seaplane equipped with hydro-ski gear. Piloted by test pilot Sam Shannon, the delta-wing fighter was taxied on the water and flown at low altitude for press and civic officials.

July 29

Douglas DC-7 began CAA certification tests, which will require about 200 hours of flight test time. The fast, new transport is scheduled to go into airline service in November.

U. S. Air Force revealed that Far East Air Force had shot down 839 MiG-15 jet fighters, probably destroyed 154 and damaged 919 others during the 37 months of the Korean War. United Nations air forces lost 110 airplanes in air combat, 677 due to enemy ground fire and 213 to "other causes."

Pratt & Whitney Aircarft Division was revealed as a contractor to the Atomic Energy Commission for nuclear power plant research.

AUGUST

Aug. 6

Kellett Aircraft Corp., Camden, N. J. receives Navy Bureau of Aeronautics contract for conversion of a pre-war Kellett autogiro by addition of two 275-hp Jacobs engines mounted on a short wing. Purpose of the conversion is to provide fligh test data on convertiplane configurations.

Capt. Edward V. Rickenbacker was named Chairman of the Board, Eastern Air Lines. Rickenbacker, who has headed the airline since 1938, continues as General Manager. Thomas F. Armstrong was elected President of the airline.

Aug. 13

The Mooney Model 20, a four-place executive aircraft, passed its first test flight successfully. The small plane is powered by a 145 hp Continental engine but has a cruising speed of 160 mph and a range of 500 miles.

Boeing Airplane Co. announced completion of the RB-47B, a photo-reconnaissance version of the six-jet bomber especially designed for highspeed, high altitude photography.

Aug. 14

Lockheed Aircraft Corp. revealed that the P2V-6 twin-engine anti-submarine patrol plane has been equipped with two pod-mounted Westinghouse J34 turbojet engines. The jet engines will provide high speed for the Neptune in its attacks on enemy submarines but will be used only intermittently with the craft's two Wright R-3350-30WA Turbo Compound engines supplying normal cruising power.

Aug. 18

Fairchild Aircraft Division announced completion of $9-million expansion program with opening of 328,000 sq. ft. addition to main production area. The new addition brings total company floor space to 1,405,383 sq. ft. Employment has passed the 9,000 mark, highest in company history.

Aug. 21

Air Force announced award of Exceptional Service Awards to Donald W. Douglas, for the DC-3; James H. Kindelberger, for the F-86, and Frederick B. Rentschler, for jet propulsion progress. The awards are for outstanding service to the Air Force by civilians not employed by the Air Force.

A mass flight of 28 Republic F-84G Thunderjet fighters across the Atlantic was completed successfully. The mass flight, first of single-engine jets across the Atlantic nonstop, used aerial refueling.

Aug. 24

Lockheed Aircraft Corp. revealed that it is in production on "flying radar stations" for both the Air Force and Navy. The new aircraft are versions of the Super Constellation and featuring bulging radomes both atop and below the fuselage. The planes will establish aerial radar picket lines for early warnings of approaching enemy aircraft.

Aug. 25

Cessna Aircraft Co. announced delivery of its XL-19B liaison airplane to the Air Force. The new model is the first light aircraft to be powered by a turboprop engine. It uses the Boeing 502-8 gas turbine unit.

Air Force announced successful mid-air contact and release of a Republic F-84F jet fighter from a special trapeze built into the belly of a Convair B-36 bomber. Purpose of the experiments is to investigate the practicality of the B-36 carrying its own fighter defense to the target area, where the fighters are launched to ward off enemy fighters and retrieved for the flight home.

Aug. 28

The Air Materiel Command announced that Boeing Airplane Co. would modify two C-97 Stratofreighter transports to take Pratt & Whitney T34 turboprop engines. The turboprop engines will provide 63 percent more power at 5,000 lb. less weight and give the big transports shorter takeoffs, higher cruising speeds and higher cruising altitude.

Admiral D. C. Ramsey (USN ret.), president of Aircraft Industries Association, revealed that the aircraft manufacturing industry had orders for 25,000 airplanes for delivery by 1956. The industry has delivered more than 22,000 military airplanes since 1950 but is only half-way to its programmed output.

SEPTEMBER

Air Force revealed that a Boeing B-47 Stratojet bomber had been specially equipped as a flying tanker plane and that tests of aerial refueling of another B-47 bomber had proved successful. The KB-47 uses the probe-and-drogue system developed by Flight Refueling, Ltd. Boeing earlier had developed a "flying boom" system of aerial refueling.

Sept. 3

Department of Defense, implementing its reduced budget for the Air Force, announced reduction of 965 aircraft from the current procurement program. The resulting saving of $750-million permits the Air Force to place additional orders for the North American F-100 supersonic fighter and the Boeing B-52 eight-jet bomber.

Sept. 8

Westinghouse announced that production deliveries of its J46 turbojet engine had begun with installations scheduled for the Vought F7U-3 Cutlass carrier fighter. The J46 is a lighter but more powerful version of the J34 turbojet engine used in earlier versions of the F7U as well as in Douglas and McDonnell carrier fighters.

The National Aircraft Show at Dayton, Ohio produced the following new records: 100-km speed of 690.118 mph by Brig. Gen. Stanley Holtoner in a North American F-86D; 15-km speed of 707.889 mph by Capt. Harold E. Collins in F-86D; helicopter altitude record of 22,289 ft. by Capt. Russell M. Dobyns in a Piasecki YH-21; 3-km helicopter speed record of 146.735 mph by Capt. Dobyns in the YH-21.

The first F-86H Sabre fighter was completed by North American Aviation Columbus (Ohio) Division. The new model features installation of the General Electric J73 turbojet engine.

Sept. 10

First of the new Douglas C-124C Globemaster transports was delivered to the Military Air Transport Service. The new model is powered by 3,800 hp Pratt & Whitney R-4360-63A engines and includes navigational radar in the nose.

Sept. 16

Douglas delivered the first production A3D-1 jet bomber to the Navy. The swept-wing carrier bomber carries a three-man crew and has a top speed of nearly 700 mph. A version of the airplane has been procured by the Air Force as the B-66.

The Air Force revealed award of an experimental contract for two Lockheed XF-104 jet fighters. Although further details were withheld it is understood the new fighters are special light-weight designs intended to answer criticism of growing fighter weight and complexity.

Jerome Lederer, director of the Flight Safety Foundation, was awarded the Arthur Williams Award, a major honor in the safety field.

Sept. 21

The Hughes Flying Boat, world's largest airplane, was virtually demolished when an earth dike burst allowing sea water to rush into the plane's graving dock. Damage was estimated at $5-million and repairs are expected to take at least a year. The accident occurred as the monster craft was undergoing final inspection preparatory to the start of flight tests in October.

First Helio Courier, four-place "safety" plane, was delivered to the Army Ground Forces at Fort Bragg, N. C., for evaluation as a military liaison type.

OCTOBER

Oct. 3

Lt. Cmdr. James B. Verdin establishes new World's Speed Record of 753.4 mph in Douglas XF4D-1 Skyray Navy carrier fighter. This marks first time a carrier plane has held world's speed mark and first time U. S. Navy has held the record since 1948. The XF4D was powered by a Westinghouse J40 engine equipped with afterburner.

Oct. 13

Air Force Assistant Secretary Roger Lewis announced that the aircraft manufacturing industry now employed over 500,000 people and is delivering aircraft and equipment at the rate of about $1-billion per month. "Generally speaking," he said, "we are at a peak and this figure will decline as our inventory of aircraft fills up and we shift to a production phase rather than a buildup."

Fairchild Aircraft Division was named recipient of the production contract for the Chase C-123 twin-engine assault transport. The Kaiser production order for this airplane had been cancelled last June. Fairchild will finish existing contracts for the C-119 Packet and the first C-123B is not expected to be completed until late 1954.

Convair revealed plans for conversion of a Model 340 transport to turboprop power by installation of two Allison YT56 engines of 3,750 hp ea. The added power will require larger tail surfaces. Two airplanes will be converted for use as demonstrators to airlines. Convair believes that all 340 Liners now in service can be converted to turboprop power if desired.

Oct. 14

Convair has confirmed a contract for four Model 340 transports from Lufthansa, the revived German national airline. The 40-passenger transports will be used on Lufthansa routes on the Continent with Lockheed Super Constellations handling the transoceanic routes.

Oct. 16

Air Force formally released performance data on the Bell XS-1, first supersonic airplane in history. The rocket-powered research airplane attained a speed of 967 mph in 1948 and an altitude of 70,140 ft. in 1949.

Oct. 19

Air Force Assistant Secretary Roger Lewis revealed that the Boeing B-52 Stratofortress jet bombers will cost about $3,600,000 each in production but that the first four will cost about $20-million each to amortize the design development and tooling costs. In comparison, the Convair B-36 bombers cost about $3,500,000 each.

Oct. 20

A Trans World Airlines Lockheed Super Constellation completed the first scheduled nonstop transcontinental passenger trip from Los Angeles to New York. The trip carried 56 passengers and covered the distance in 8 hr. 17 min. Due to crew restrictions, the Westbound trip makes a stop in Chicago.

Preparatory to inauguration of nonstop transcontinental service in both directions, an American Airlines Douglas DC-7 made a survey flight from Los Angeles to New York in 6 hr. 52 min.

Oct. 26

The Convair XF-102, delta-wing supersonic interceptor, made its first test flight at Edwards Air Force Base, Calif. Test pilot Richard L. Johnson was at the controls. The F-102 is powered by a Pratt & Whitney J57 turbojet engine.

Oct. 29

North American YF-100 Super Sabre established a new World's Speed Record of 754.98 mph at Salton Sea, Calif. The swept-wing fighter was piloted by Lieut. Col. F. K. "Pete" Everest. The new mark was established over a 15-km course and does not replace the Douglas XF4D mark of 753.4 mph for a 3-km course since it does not exceed the former mark by the required one percent.

NOVEMBER

Nov. 2

Air Force Secretary Talbott announced that the Air Force would supply Lockheed T-33 jet trainers to the Spanish Air Force.

Nov. 3

McDonnell Aircraft Corp. delivered the last F2H Banshee carrier jet fighter to the Navy. The plane, an F2H-4, is powered by two Westinghouse J34 turbojet engines. McDonnell has produced more than 800 F2H fighters during the past six years.

Nov. 6

North American Aviation has received an Air Force contract for the experimental modification of an F-86 Sabre fighter into a two-seat advanced trainer.

A Boeing B-47 Stratojet bomber flew from Limestone Air Force Base, Maine to Brize Norton, England in 4 hr. 43 min. to establish a new speed record for the trans-Atlantic flight.

Nov. 10

Air Force announced the new Pratt & Whitney J57 turbojet engine as being in the "10,000-lb. thrust class." The announcement also credits the new engine with the lowest specific fuel consumption of any turbojet engine presently in production for the Air Force.

Nov. 16

The Douglas F4D Skyray successfully passed carrier trials at sea aboard the U.S.S. Coral Sea off the Virginia Capes. The catapult takeoffs and arrested landings were performed by Lt. Cmdr. James B. Verdin, who flew the airplane on its record-breaking speed flights in California.

Representative Carl Hinshaw (R., Calif.) was named winner of the 1953 Wright Brothers Memorial Trophy for his services in sponsoring aviation legislation.

Nov. 17

Fairchild Aircraft Division revealed complete details on its jet transport design, the M-186B. The twin-jet design features a delta-wing with tail fin. Capable of carrying 44-64 passengers or 35,000 lb. of cargo, the jet liner could cruise at 563 mph at 40,000 ft. No plans for construction of a prototype were announced.

Nov. 20

Navy Assistant Secretary for Air James H. Smith revealed that the U. S. now has 39,936 military and 52,643 civil aircraft in service, a

RED THREAT

"What I now fear most is complacency in the midst of inexorably rising peril. There occurred the other day a happening that should give us all serious pause. I refer, of course, to the explosion of a hydrogen device in the depths of the Soviet Union. . . .

"I am not one of those who face the future with despair. The United States is no frail reed to be bent to the ground by a single blast.

"But if we doze, if in our complacency we forget the deadly earnestness of the enemy, his ever-increasing technical competence, and his undoubted ability to deliver his new weapons, then, I say, our strength will not avail us.

"You, my friends in the airpower community, understand this better than most. God speed you in your task of arousing our countrymen."

Gen. Hoyt S. Vandenberg
—Air Force, October, 1953

total of 92,579 airworthy U. S. aircraft. He stated that the U. S. has 908 airports in the continental U. S. and 135 airports abroad representing an investment of $11.5-billion.

Nov. 23

Westinghouse Electric Corp. announced plans to transfer its entire aircraft gas turbine activities to its Kansas City, Kans. plant, where it is now producing J40 jet engines. Main research, engineering and administrative staffs have been at the company's Lester (Philadelphia), Pa. facilities.

A National Airlines Douglas DC-7 established a new Los Angeles-Miami transport speed record of 5 hr. 50 min. The transport was on a delivery flight from the factory to National headquarters. The DC-7 averaged 401 mph for the trip with its speed reaching 436 mph at times.

Nov. 27

Air Force Secretary Harold E. Talbott revealed plans to increase production of titanium manyfold as soon as possible, following Congressional hearings which revealed that the aircraft manufacturing industry needs many times as much as is now scheduled. The small titanium industry is currently producing about 2,000 tons a year whereas aircraft industry spokesmen indicate a need for as much as 35,000 tons in 1956.

Nov. 29

American Airlines inaugurated first scheduled nonstop transcontinental air service in both directions using its new Douglas DC-7 transports. The eastbound flight is scheduled at 7 hr. 15 min., the westbound flight at 7 hr. 45 min. The DC-7 carries 60 passengers on the 2,600-mile trip at a cruising speed of 360 mph. The new transport is powered by 3,250-hp Wright Turbo Compound engines.

Nov. 30

North American Aviation delivered its 50,-001st airplane, an F-100 Super Sabre fighter and the company continues its record of having built more airplanes than any other company in the world.

DECEMBER

Dec. 1

Charles A. Lindbergh was named recipient of the Daniel Guggenheim Award for 1953 for "pioneering achievements in flight and air navigation." The award is sponsored jointly by the IAS, SAE and ASME professional societies.

Dec. 2

Navy revealed that it is conducting tests of three new primary training plane designs at Pensacola, Fla. Entered in the competition are the Temco Plebe, the Ryan model 72 and the Beech Mentor. Navy Bureau of Aeronautics plans to order "more than a hundred" trainers after the winning type has been selected.

Dec. 4

The Indian Air Force has placed an order for 28 Fairchild C-119 transports for use as paratroop and paradrop cargo carriers.

Dec. 12

Maj. Charles E. Yeager, USAF pilot, establishes new world speed record of more than 1600 mph in the Bell X-1A.

Dec. 17

Aircraft industry observes 50th anniversary of powered flight at Wright Memorial Day Dinner in Washington, D. C.

Dec. 18

AIRCRAFT YEAR BOOK GOES TO PRESS.

BIOGRAPHICAL BRIEFS

To include the names of all who are outstanding in current aviation activities in this section would expand it to a book. We have therefore been faced with the difficult problem of setting arbitrary limits, governed by space. If, as a result, we have omitted anyone who should have been included, we are extremely sorry—and hope that our readers will inform us of it for correction in future editions.

ADAMS, Alvin P., aviation executive born in Grand Junction, Colo.; vice president, Pan American World Airways. Address: 135 E. 42nd St., New York, N. Y.

ADAMS, C. G., aviation executive; secretary-treasurer, Braniff Airways, Inc. Address: Love Field, Dallas, Tex.

ADAMS, Joseph P., government executive born in Seattle, Wash., Nov. 15, 1907; member Civil Aeronautics Board; NACA; Washington State and D. C. Bar; Colonel, Marine Corps Reserve aviation. Address: 2367 King Place, N. W., Washington 7, D. C.

ADAMS, Russell Baird, economist and administrator born in Wheeling, W. Va., Dec. 28, 1910; Vice-President, Pan American-World Airways. Address: Silver Spring, Md.

ADLER, Ernest Jr., engineer born in Hardin, Mont., June 6, 1915; president, All American Aircraft, Inc. Address: Long Beach, Cal.

AHNSTROM, Doris N., editor and writer born in Muskegon, Mich., Aug. 4, 1915; managing editor, *Skyways*. Address: 444 Madison Ave., New York, N. Y.

AHRENS, R. F., aviation executive; vice president, personnel, United Air Lines. Address: Clearing Station, 5959 S. Cicero Ave., Chicago 38, Ill.

ALBERT, E. V., engineer born in Lynch, Ky., Apr. 20, 1920; product planning engineer, General Electric Co., Aircraft Gas Turbine Div. Address: 8624 Melody Lane, Cincinnati, Ohio.

ALEXANDER, Eben Roy, editor born in Omaha, Nebr., Feb. 15, 1899; managing editor, *Time*. Address: 9 Rockefeller Plaza, New York, N. Y.

ALEXANDER, John J., aeronautical service and maintenance executive born in Jersey City, N. J. Oct. 7, 1909; service manager, Curtiss-Wright Corp., Electronics Div. Address: 21 Bowers Rd., Caldwell, N. J.

ALISON, John R., aircraft executive born in Micanopy, Fla., Nov. 21, 1912; admin. vice president Northrop Aircraft. Address: Northrop Aircraft, Inc., Northrop Field, Hawthorne, Calif.

ALLEN, C. B., aviation executive; assistant to president, The Glenn L. Martin Co., Baltimore 3, Md. Address: Moorefield, W. Va.

ALLEN, William M., airplane manufacturer born in Lo Lo, Mont., Sept. 1, 1900; president, Boeing Airplane Co. Address: P. O. Box 3107, Seattle 14, Wash.

ALLIS, James Ashton, banker born in St. Paul, Minn., 1881; chairman of the board, Fairchild Engine and Airplane Corp. Address: 200 Inwood Ave., Upper Montclair, N. J.

ALTSCHUL, Selig, aviation consultant born in Chicago, Ill. Address: 25 Broad St., New York, N. Y.

AMIS, B. T., Jr., aviation executive born in Kansas City, Mo., June 13, 1912; president, Aero Design & Manufacturing Co. Address: 2620 N. W. 27th, Oklahoma City, Okla.

AMOS, David H., Jr., airline executive born in Bowling Green, Ky., Apr. 12, 1916; personnel director, National Airlines. Address: 3240 N. W. 27th Ave., Miami 37, Fla.

ANDERSON, Ben M., aircraft engineer born in Oklahoma City, Okla., Mar. 2, 1916; president, Anderson, Greenwood & Co. Address: 1400 N. Rice, Bellaire, Tex.

ANDERSON, F. C., aviation executive; president and treasurer, Iowa Airplane Co., Inc. Address: P. O. Box 59, Des Moines, Iowa.

ANDERSON, Jack, public relations counsel born in Los Angeles, Calif., March 31, 1910; manager of public relations and advertising, Marquardt Aircraft Co., Van Nuys, Calif.

ANDERSON, Leland D., pilot born in Ontario, Cal., Jan. 3, 1908; asst. chief pilot, Delta-C & S Airlines. Address: 1252 Farrow Rd., Whitehaven, Tenn.

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ANDERSON, Orvil A., Air Force officer born in Springfield, Utah, May 2, 1895; Major General (permanent). Address: Maxwell Air Force Base, Ala.

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ANGST, Walter, chief engineer, Kollsman Instrument Corp. Address: 80-08 45th Ave., Elmhurst, N. Y.

ANKENBRANDT, Francis L., Air Force officer born in Ill., Jan. 27, 1904; Major General Address: Chief Signal Officer, SHAPE, APO 55, c/o Postmaster, New York, N. Y.

ANSLEY, M. L., controller born in Bay St. Louis, Miss., Mar. 3, 1902; treasurer, Aeronautical Securities, Inc. Address: One Wall St., New York, N. Y.

ARCHER, Harold B., engineering test pilot born in Morris Twp., Washington County, Pa., Nov. 17, 1915; chief, experimental flight test, Pratt & Whitney Aircraft. Address: 95 West Middle Turnpike, Manchester, Conn.

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ASPINWALL, Robert A., aviation executive born in Brooklyn, N. Y., Apr. 13, 1915; assistant general manager, Sikorsky Aircraft. Address: No. Maple Ave., Westport, Conn.

ATKINSON, Joseph Hampton, Air Force officer born in Dublin, Tex., Feb. 5, 1900; Major General. Address: Headquarters, Alaskan Air Comd., APO 942, c/O PM, Seattle, Wash.

ATWOOD, John Leland, aviation executive born in Walton, Ky., Oct. 26, 1904; president, North American Aviation, Inc. Address: International Airport, Los Angeles 45, Cal.

AUSTIN, James W., aviation executive; vice-president, traffic and sales, Capital Airlines, Inc. Address: National Airport, Washington 1, D. C.

AVERITT, Robert A., engineer born in Terre Haute, Ind., May 10, 1915; manager, aviation engineering division, General Electric Co. Address: 1 River Rd., Schenectady, N. Y.

AVERY, John B., public relations counsel born in Fesno, Cal., May 3, 1906. Address: 5253 Electric St., La Jolla, Cal.

BACKMAN, Roy, aviation executive born in Salt Lake City, Utah, Nov. 23, 1914; vice pres.-sales, Pacific Airmotive Corp., Burbank, Cal.

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BAILEY, Joseph, chief pilot, National Airlines. Address: 3240 N. W. 27th Ave., Miami 37, Fla.

BAKER, Carl F., engineer born in Quincy, Mass., Dec. 4, 1908; chief engineer, Hamilton Standard Div., United Aircraft Corp. Address: Windsor Locks, Conn.

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BAKER, Keith, journalist born in Springfield, Mo., June 18, 1917; public relations manager, Chance Vought Div., United Aircraft Corp. Address: Box 5907, Dallas, Tex.

BAKER, Paul S., aeronautical engineer born in Quincy, Mass., Oct. 2, 1907; development engineer, Republic Aviation Corp. Address: Farmingdale, N. Y.

BALDINI, Angelo, accountant born in New Castle, Del., Dec. 11, 1921; treasurer, Bellanca Aircraft Corp. Address: 1423 Stapler Pl., Wilmington, Del.

BALFOUR, Maxwell W., aviation executive born in Traer, Iowa, June 22, 1895; vice-president, Spartan Aircraft Co., and vice president, Aeronautical Training Society. Address: Tulsa, Okla.

BANGS, Scholer, public relations executive born in Wamego, Kans., June 12, 1905; owner, Scholer Bangs Public Relations Consultant. Address: 123 N. Gladys Ave., Monterey Park, Cal.

BARCUS, Glenn O., Air Force officer born in Genoa, Ill., 1903; Lieutenant General (Commanding General), Fifth Air Force. Address: Hq. Fifth Air Force, APO 970, c/o Postmaster, San Francisco, Calif.

BARDWELL, Eugene S., aviation executive born in Falconer, N. Y., Nov. 19, 1895; director public and industrial relations, Schweizer Aircraft Corp. Address: 208 Overland St., Elmira, N. Y.

BARKER, John DeForest, Air Force officer born in St. Albans, Vt., Mar. 25, 1897; Major General. Address: Air Adjutant General's Office, Hq., U. S. Air Force, Washington 25, D. C.

BARNARD, Harvey P., Jr., airline executive born in Harrisburg, Pa., Sept. 19, 1913; personnel director, Frontier Airlines. Address: 4045 East 18th Ave., Denver, Colo.

BARNES, Earl Walter, Air Force officer born in Alliance, Nebr., Aug. 23, 1902; Major General (temporary). Address: U. S. Air Force, Washington 25, D. C.

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BARRINGTON, William D., transportation analyst born in Syracuse, N. Y., 1914; rates and tariffs officer, International Air Transport Association. Address: 1756 Seminole Ave., New York 61, N. Y.

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BARROW, Wilmer L., engineering executive born in Baton Rouge, La., Oct. 25, 1903; vice president and chief engineer, Sperry Gyroscope Co. Address: 504 Park Ave., Manhasset, N. Y.

BARRY, Philip, aviation executive born in Winthrop, Mass.; assistant executive director, Airlines Personnel Relations Conference. Address: National Airport, Washington 1, D. C.

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BEACH, Robert E., lawyer born in New Britain, Conn., Sept. 12, 1911; corporation counsel, United Aircraft Corp. Address: 143 Boulder Rd., Manchester, Conn.

BEALL, Wellwood E., airplane designer and engineering executive born in Canon City, Colo., Oct. 28, 1906; senior vice president, Boeing Airplane Co. Address: Box 3107, Seattle 14, Wash.

BEALS, H. W., engineer born in Rona, Ind., Mar. 18, 1897; director, engineering, west coast American Airlines, Inc. Address: 231 18th St., Santa Monica, Cal.

BEARD, Charles E., aviation executive; director, Air Cargo, Inc., and executive vice-president, Braniff Airways, Inc. Address: 910 17th St., N. W., Washington 6, D. C.

BEARDSLEE, John Murchison, civil engineer born in Washington, D. C., Nov. 27, 1907; director, Office of Federal Airways, Civil Aeronautics Administration. Address: c/o Civil Aeronautics Adm., Washington 25, D. C.

BEAU, Lucas Victor, Air Force officer born in New York City, Aug. 3, 1895; Major General. Address: Hq. Civil Air Patrol—USAF, Bolling AFB, Washington 25, D. C.

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TRIGG, Leslie John, aeronautical engineer born in Detroit, Mich., Aug. 21, 1917; design engineer, Aerojet General Co. Address: 714 E. Lima Ave., Monrovia, Cal.

TRIPPE, Juan Terry, airline executive born in Seabright, N. J., June 27, 1899; president, Pan American World Airways System. Address: 135 E. 42nd St., New York 17, N. Y.

TROMBOLD, George J., aviation executive born in Chanute, Kans., Nov. 5, 1908; industrial relations director, Boeing Airplane Co., Wichita Div. Address: 135 N. Pershing, Wichita, Kans.

TROTMAN, E. Russell, writer born in Springfield, Mass., July 17, 1915; public relations, Hamilton Standard Div., United Aircraft Corp. Address: Windsor Locks, Conn.

TROVILLO, J. A., director of personnel, Cessna Aircraft Co. Address: 5800 Pawnee Road, Wichita 1, Kans.

TSONEFF, Stephen chief engineer, U. S. Propellers, Inc. Address: 3270 E. Foothill Blvd., Pasadena 8, Cal.

TUCKER, Harrison R., aircraft engineer born in Fairmont, W. Va., 1891; president, Tucker Industries, Inc. Address: 1900 E. 24th St., Cleveland, O.

TUNNER, William H., Air Force officer born in Elizabeth, N. J., July 14. 1906; Major General (temporary); commanded Berlin and Korean Airlifts; Deputy Commander Air Materiel Command. Address: Wright-Patterson Air Force Base, Dayton, O.

TURNER, Howard McMath, Air Force officer born in Avoca, Ia., Feb. 21, 1902; Major General (temporary). Address: U. S. Air Force, Washington 25, D. C.

TURNER, John P., Jr., mechanical engineer born in Nashville, Tenn.; manager of marketing, Small Aircraft Engine Dept., Turbine Section, Aircraft Gas Turbine Div., General Electric Co. Address: 920 Western Ave., West Lynn 3, Mass.

TURNER, Roscoe, aviator and aviation executive born in Corinth, Miss., Sept. 29. 1895; president, Roscoe Turner Aeronautical Corp.; president, Turner Airlines, Inc. Address: Municipal Airport, Indianapolis, Ind.

TURNEY, Newton V., aviation executive born in Petros, Tenn., June 26. 1910: divisional controller, Chance Vought Aircraft Div., United Aircraft Corp. Address: P.O. Box 5907, Dallas, Tex.

TUTTLE, M. W., aviation executive born in Los Angeles, Calif., Aug. 23, 1913; vice president, Radioplane Co. Address: 6055 Jumilla Ave., Woodland Hills, Calif.

UHL, E. G., aeronautical engineer born in Elizabeth, N. J., Mar. 24, 1918; vice-president engineering, The Glenn L. Martin Co. Address: 901 Army Rd., Towson, Md.

UHL, Joseph A., airline executive born in Cincinnati, O., Aug. 1, 1906; vice president and treasurer, Continental Air Lines, Inc. Address: 20 Crestmoor Dr., Denver, Colo.

UHLIG, E. R., aviation executive born in Baltimore, Md., May 30, 1913; controller, The Glenn L. Martin Co. Address: 304 Northway, Baltimore, Md.

VALK, William E., patent attorney born in Washington, D. C., Aug. 29, 1889; patent consultant, Curtiss-Wright Corp.; president, Manufacturers Aircraft Association. Address: 220 W. Ridgewood Ave., Ridgewood, N. J.

VANAMAN, Arthur William, Air Force officer born in Millville, N. J., May 9, 1892; Major General (permanent). Address: U. S. Air Force, Washington 25, D. C.

VANDENBERG, Hoyt Sanford, USAF Gen. (Ret.) born in Milwaukee, Wis., Jan. 24, 1899. Address: Chief of Staff, U. S. Air Force, Washington 25, D. C.

VAN HOVEN, Woodrow J., aviation insurance underwriter born in Huntington, N. Y., Aug. 25, 1919; vice president, United States Aviation Underwriters, Inc. Address: 3 Harvard St., Huntington, N. Y.

VANIK, Milford F., aeronautical engineer born in Cleveland, O., July 29, 1906; chief, technical staff, Wichita Div., Boeing Airplane Co. Address: 333 N. Old Manor Rd., Wichita 8, Kans.

VAN NOSTRAND, George, assistant vice president, American Airlines. Address: Avenida del Ejido No. 7, Mexico D.F., Mexico.

VAN VUREN, John, pilot born in Chicago, Ill., Sept. 20, 1906; assistant chief pilot, Chicago base, Delta Air Lines. Address: 3929 Grand Ave., Western Springs, Ill.

VAN ZANDT, John Parker, aviation economist and author born in Chicago, Ill., Jan. 16, 1894; Deputy for Civil Aviation. Address: Office of the Assistant Secretary of the Air Force, Washington 25, D. C.

VEST, George W., retired government official born in Buckner, Mo., Aug. 26, 1894; aviation consultant. Address: 919 N. 3rd St., Burlington, Iowa.

VICKERS, Harry F., business executive, president The Sperry Corporation; president, Vickers, Inc. Address: 30 Rockefeller Plaza, New York 20, N. Y.

VICTORY, John Francis, business executive born in New York, N. Y., Jan. 23, 1892; executive secretary, National Advisory Committee for Aeronautics. Address: 1724 F St., N. W., Washington 25, D. C.

VINCENT, Roy F., personnel director, Continental Air Lines. Address: Stapleton Airfield, Denver 7, Colo.

WACKS, Peter J., aviation executive born in Binghamton, N. Y., June 30, 1907; personnel manager, Chance Vought Aircraft Div., United Aircraft Corp. Address: P.O. Box 5907, Dallas, Tex.

WAGENECK, Russell L., maintenance official born in Garrison, Ill., Dec. 4, 1910; director of maintenance, Slick Airways. Address: 6204 Goodland, Pl., N. Hollywood, Cal.

WAGNER, Frank DeChant, Naval officer born in Pottstown, Pa., Aug. 22, 1893; Rear Admiral. Address: c/o Navy Dept., Washington 25, D. C.

WAGNER, R. A., aeronautical engineer born in Frackville, Pa., Nov. 14, 1913; chief engineer, Hiller Helicopters, Inc. Address: 955 Woodland Ave., Menlo Park, Cal.

WAGNER, Robert, chief engineer, Aircraft Div., McCulloch Motors Corp. Address: 9775 Airport Blvd., Los Angeles 45, Cal.

WAGNER, William, public relations counsel born in Boise, Ida., July 28, 1909; public relations manager, Ryan Aeronautical Co. Address: 3544 Emerson St., San Diego, Cal.

WALES, Henry M., mechanical engineer born in Sewaren, N. Y., manager of marketing, Accessory Turbine, Aircraft Gas Turbine Div., General Electric Co. Address: 920 Western Ave., West Lynn 3, Mass.

WALKER, Franklin D., aviation journalist born in Forest City, Pa., Dec. 29, 1908; editorial director, Henry Publishing Co. (*Skyways*). Address: Little Falls, N. J.

WALKER, Randolph C., president and general manager, Audio Products Corp. Address: 2265 Westwood Blvd., Los Angeles 64, Cal.

WALLACE, Dwane L., corporation executive born in Belmont, Kans., Oct. 29, 1911; president, Cessna Aircraft Co. Address: 5800 Pawnee Rd., Wichita, Kans.

WALLACE, William J., Major General, born in Church Hill, Md., Aug. 6, 1895; Commanding General, Aircraft, Fleet Marine Force, Pacific, MCAS, El Toro, Santa Ana, Cal.

WALTER, Don L., engineer born in Pelican Lake, Wis., Nov. 28, 1918; director of engineering and manufacturing, member, board of directors, Marquardt Aircraft Co. Address: 15907 Victory Blvd., Van Nuys, Cal.

WARD, Carrol Kramer, aviation executive born in Kansas City, Mo., Oct. 30, 1905; director of personnel, Mid-Continent Airlines. Address: 5540 Norwood, Kansas City, Kans.

WARD, Henry DeC., treasurer, American Meteorological Society. Address: 3 Joy St., Boston 8, Mass.

WATERHOUSE, Helen, journalist born in Watertown, Mass., May 31, 1900; aviation editor and reporter, *Akron Beacon Journal*. Address: Westgate Manor, Akron, O.

WATSON, David, airline executive born in Glasgow, Scotland, Jan. 3, 1907; treasurer, Hawaiian Airlines, Ltd. Address: 2104 Hunnewell St., Honolulu 14, T. H.

WATTS, Robert B., lawyer born in Portland, Me., May 28, 1901; vice president and legal counsel, Consolidated Vultee Aircraft Corp. Address: 7949 Princess St., La Jolla, Cal.

WAUGH, John D., industrial publicist born in Herington, Kans., June 26, 1919; director of information, Nitrogen Division, Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y.

WEAD, Robert K., aeronautical engineer born in Arlington, Mass., Oct. 10, 1913; chief application engineer, Marquardt Aircraft Co. Address: 16901 Covello St., Van Nuys, Cal.

WEBB, Leland D., (Capt., USN, Retired) aeronautical engineer born in Chicago, Ill., Apr. 7, 1891; vice president, western region, Aircraft Industries Association. Address: 241 N. Bentley Ave., Los Angeles 49, Calif.

WEBB, Theodore J., engineer born in Chicago, Ill., Jan. 2, 1921; works manager, Continental Aircraft, Inc. Address: 3615 Aviation Blvd., Manhattan Beach, Calif.

WEBSTER, Donald D., Col., past president National Aeronautic Association and past commanding officer of the National Capital wing of the Civil Air Patrol; gen. mgr., NAA. Address: NAA, Washington, D. C.

WEBSTER, Robert M., Air Force officer born in Boston, Mass., Oct. 10, 1892; Major General (permanent). Address: U. S. Air Force, Washington 25, D. C.

WECKEL, A. R., general sales manager, Sperry Gyroscope Co. Div. of Sperry Corp. Address: Great Neck, L. I., N. Y.

WEDBERG, F. Albert, aeronautical engineer born in Bridgeport, Conn., Aug. 1, 1903; chief research engineer, North American Aviation, Inc., Columbus Div. Address: 921 Francis Ave., Columbus 9, O.

WEIKERT, John Maurice, Air Force officer born in McKnightstown, Pa., Sept. 29, 1898; Major General (temporary). Address: The National War College, Fort Lesley J. McNair, Washington 25, D. C.

WEILER, J. F., director of flying, Continental Air Lines. Address: Stapleton Airfield, Denver 7, Colo.

WELBORN, Max, aviation executive born in Pendleton, S. C., Oct. 14, 1899; vice president-sales, Bellanca Aircraft Corp. Address: 2910 Midvale Ave., Philadelphia 29, Pa.

WELLER, John L., transportation executive born in Whitefish, Mont.; vice president, Trans World Airlines. Address: 380 Madison Ave., New York 17, N. Y.

WELLS, Edward C., aeronautical engineer born in Boise, Ida., Aug. 26, 1910; vice-president, engineering, Boeing Airplane Co. Address: Box 3107, Seattle 14, Wash.

WELLS, Lester A., aviation executive born in Baltimore, Md., May 28, 1900; president, Engineering and Research Corp. Address: 10 E. Blackthorne St., Chevy Chase, Md.

WELLS, T. A., aircraft executive born in Corning, Ia., Mar. 12, 1907. Address: 5 Lynnwood Blvd., Wichita, Kans.

WELSH, William W., aviation executive born in Alma, Colo., Sept. 16, 1893; technical assistant to the president, Fairchild Engine & Airplane Corp. Address: 1015 Cafritz Bldg., Washington 6, D. C.

WENDT, Charles W., executive born in New York, N. Y., 1903; president, All American Engineering. Address: Wilmington, Del.

WENIGMANN, Ernest, aircraft executive born in New York, N. Y., April 22, 1897; factory superintendent, Republic Aviation Corp. Address: Kirk La., Media, Pa.

WENTZ, Daniel S., II, aviation writer born in Hanover, Pa., Dec. 15, 1919. Address: NACA, Ames Aeronautical Laboratory, Moffett Field, Calif.

WEST, C. C., Jr., airline executive born in Arcadia, Cal., May 9, 1906; vice president, Continental Air Lines, Inc. Address: 345 Jersey, Denver, Colo.

WEYLAND, Otto Paul, Air Force officer born in Riverside, Cal., Jan. 27, 1902; Lieutenant General, Commanding General, Far East Air Forces. Address: Hq. FEAF, APO 925, c/o P. M., San Francisco, Cal.

WHARTON, J. B., Jr., accountant born in Ellwood City, Pa., Mar. 21, 1914; vice president-finance, Glenn L. Martin Co. Address: 106 Thicket Rd., Baltimore 12, Md.

WHARTON, R. H., lawyer born in Birmingham, Ala., June 10, 1915; director of personnel, Delta Airlines. Address: Municipal Airport, Atlanta, Ga.

WHEELER, M. H., chief pilot, Northeast Airlines. Address: Logan International Airport, 239 Prescott St., E. Boston 28, Mass.

WHELAN, Bernard L., aviation executive born in Cincinnati, O., Nov. 19, 1890; general manager, Sikorsky Aircraft. Address: Bridgeport 1, Conn.

WHITAKER, Sidney F., pilot born in Phoenix, Miss., Oct. 25, 1895; assistant chief pilot, Delta-C&S Airlines. Address: Box 166, Airport Branch, Miami, Fla.

WHITE, John A., secretary, American Helicopter Co., Inc. Address: 4708 Crenshaw Blvd., Los Angeles, Cal.

WHITE, Thomas Dresser, Air Force officer born in Walker, Minn., Aug. 6, 1901; Major General (permanent). Address: U. S. Air Force, Washington 25, D. C.

WHITEHEAD, Ennis Clement, Air Force officer born in Westphalia, Kans., Sept. 3, 1895; Lieutenant General (retired). Address: Box 171, Newton, Kans.

WHITEHEAD, Richard Francis, Naval Officer born in Fall River, Mass., Jan. 1, 1894; Rear Admiral. Address: Navy Dept., Washington 25, D. C.

WHITEHEAD, William C., business executive born in Salt Lake City, Utah, May 8, 1894; manager, Airsupply Co., Div. Garrett Corp.; executive vice president, Garrett Corp. Address: 5959 W. 3rd St., Los Angeles 36, Cal.

WHITMAN, Ray P., aircraft executive born in Washington, D. C., Apr. 7, 1894; 1st vice-president, Bell Aircraft Corp. Address: P. O. Box One, Buffalo 5, N. Y.

WHITNEY, E. N., airline executive born in Syracuse, N. Y., Oct. 27, 1902; director, flight operations, Western Air Lines. Address: 6060 Avion Dr., Los Angeles 45, Cal.

WHITTEN, Lyman P., Air Force officer born in Malden, Mass., Mar. 25, 1897; Major General. Address: Commanding General, Middletown Air Materiel Area, Olmsted Air Force Base, Middletown, Pa.

WIEBEN, Herman C., aircraft executive born in New York City, Feb. 28, 1907; project engineer C-123, Chase Aircraft Co., Inc. Address: West Trenton, N. J.

WIEGMAN, Clarence H., engineer born in Detroit, Mich., Sept. 11, 1902; chief engineer, Lycoming-Spencer Div., AVCO Manufacturing Corp. Address: Williamsport 38, Pa.

WIEN, Sigurd, pilot born in Lake Nebagamon, Wis., Nov. 5, 1903; president-manager, Wien Alaska Airlines, Inc. Address: 900 Lathrop St., Fairbanks, Alaska.

WILD, Arthur W., business executive born in England, 1905; vice-president, Continental Motors Corp. Address: 1366 Whittier Rd., Grosse Pointe, Mich.

WILFORD, E. Burke, president and chief engineer, Pennsylvania Aircraft Syndicate Ltd. Address: 300 Linden Lane, Merion, Pa.

WILKIN, M. Cullen, airline executive born in Salt Lake City, Utah, Jan. 31, 1913; vice-president in charge of sales, Slick Airways. Address: Burbank, Calif.

WILKINSON, Paul Howard, engineer born in St. Paul, Minn., Feb. 2, 1895; editor and publisher, *Aircraft Engines of the World*. Address: 5900 Kingswood Rd., Bethesda, Md.

WILKINSON, William L., corporation executive born in Prattville, Ala., Nov. 12, 1899; director of contracts, Solar Aircraft Co. Address: 2200 Pacific Highway, San Diego 12, Cal.

WILLEY, G. T., aircraft executive born in Birmingham, England, Sept. 29, 1901; vice president manufacturing, The Glenn L. Martin Co. Address: Springwood Farm, Forest Hill, Md.

WILLIAMS, Betty Jane, commercial flight instructor born in Wilkes-Barre, Pa., Apr. 2, 1919; aeronautical technical writer, North American Aviation. Address: 605 S. Barrington, Los Angeles, Cal.

WILLIAMS, Lawrence E., aviation executive born in Jamestown, N. Y., Mar. 13, 1897; vice president, McDonnell Aircraft Corp. (726 Jackson Pl., N. W., Washington, D. C.) Address: Bywater Rd., Annapolis, Md.

WILLIAMS, Roger, newspaperman born in Oakland, Cal., Sept. 4, 1916; aviation editor, *San Francisco News*. Address: Oakland, Cal.

WILLIAMS, Thomas P., engineer born in Frostburg, Md., Jan. 29, 1914; assistant chief engineer, Aeroproducts Div., General Motors Corp.; vice-pres.-engineering, Alloy Engr. & Casting Co., Champaign, Ill. Address: 15 Skyview Dr., Vandalia, O.

WILLIAMSON, John H., pilot born in Dyson, S. C., Apr. 18, 1906; assistant chief pilot, Delta Air Lines. Address: 611 W. Lyle Ave., College Park, Ga.

WILSON, Alfred M., business executive born in Minneapolis, Minn., Dec. 31, 1903; vice-president, aeronautical div., Minneapolis Honeywell Regulator Co. Address: 2747 4th Ave., South, Minneapolis, Minn.

WILSON, Gill Robb, newspaperman born in Clarion County, Pa., Sept. 18, 1893; editor and publisher, *Flying Magazine*. Address: 366 Madison Ave., New York, N. Y.

WILSON, Ray M., aviation executive born in Newton, Ill., 1900; vice president in charge of operations, Frontier Airlines. Address: Stapleton Airfield, Denver, Colo.

WITHINGTON, S. B., corporation official born in Hillsdale, Mich., Feb. 27, 1895; vice-president and general manager, Lycoming-Spencer Div., AVCO Manufacturing Corp., vice-president and general manager, Bridgeport-Lycoming Div. Address: 550 S. Main St., Stratford, Conn.

WITZE, Claude O., public relations executive born in Gloversville, N. Y., Oct. 26, 1909; director, public relations and advertising, Piasecki Helicopter Corp. Address: 448 Conestoga Rd., Ithan, Pa.

WOHL, E. P., aviation executive born in Chicago, Ill., Dec. 7, 1917; executive assistant to the president, Consolidated Vultee Aircraft Corp. Address: 4186 Rochester Rd., San Diego, Calif.

WOLFE, Leon C., aeronautical engineer born in Sherwood, Mich., Sept. 8, 1915; chief engineer, Aeronca Mfg. Corp. Address: 3208 Grand Ave., Middletown, Ohio.

WOLFE, Thomas, aircraft executive born in David City, Neb., June 12, 1901; president and chairman of the board, Pacific Airmotive Corp., 2940 N. Hollywood Way, Burbank, Calif. Address: 873 Linda Vista, Pasadena, Calif.

WOOD, Charles R., Jr., executive born in Kokomo, Ind., June 8, 1908; president, Charles Wood Corp. Address: Box 354, Marion, Ill.

WOOD, Lysle Austin, aeronautical engineer born in Renville, Minn., Feb. 23, 1904; director, pilotless aircraft, Boeing Airplane Co. Address: Seattle, Wash.

WOOD, Robert H., journalist born in Pratt, Kans., Nov. 4, 1911; editor, *Aviation Week*. Address: 330 W. 42nd St., New York, N. Y.

WOODHEAD, Harry, aviation executive born in Bradford, Yorkshire, England, Jan. 29, 1889; vice president-general manager, Douglas Aircraft Co., Inc., Tulsa Division. Address: 4136 S. Trenton, Tulsa, Okla.

WOODWARD, Harper, attorney born in Rochester, N. Y., Nov. 26, 1909; counsel and aviation advisor to Laurance S. Rockefeller. Address: Rm. 5600, 30 Rockefeller Plaza, New York, N. Y.

WOOLMAN, C. E., president and general manager, Delta-C & S Air Lines. Address: Municipal Airport, Atlanta, Ga.

WRIGHT, Theodore Paul, aircraft engineer and executive born in Galesburg, Ill., May 25, 1895; vice-president for research, Cornell University, president, Cornell Aeronautical Laboratory, Inc., and chairman, Executive Committee, Guggenheim Aviation Safety Center at Cornell University. Address: Cornell University, Ithaca, N. Y.

YEAGER, Charles; Major, USAF. Address: Edwards AFB, Calif.

YEASTING, John O., aircraft executive born in Helena, Ohio, Dec. 1, 1905; vice president, comptroller, Boeing Airplane Co. Address: Box 3107, Seattle 14, Wash.

YOUNG, John W., mechanical engineer born in Philadelphia, Pa., May 25, 1906. Director, quality control, North American Aviation, Inc. Address: 15050 Altata Dr., Pacific Palisades, Cal.

YOUNG, Ora W., government official born in Greenville, O., Mar. 25, 1893; regional administrator, region one, Civil Aeronautics Administration. Address: Federal Bldg., International Airport, Jamaica, L. I., N. Y.

YOUNG, Raymond W., mechanical engineer born in St. Joseph, Mo., April 9, 1899; president and general mgr., Reaction Motors, Inc. Address: Box 85, Hohokus, N. J.

ZACHAROFF, Lucien, editor and publisher. *Payload and The Air Shipper*. Address: Box 246, Madison Sq. Sta., New York 10, N. Y.

ZIMMER, V. C., aviation executive born in Great Bend, Kans., Oct. 29, 1905; director of industrial security, Consolidated Vultee Aircraft Corp. Address: 1201 Virginia Way, La Jolla, Cal.

ZIPP, Harold W., aircraft engineer born in Lincoln, Neb., Sept. 10, 1906; staff engineer, office vice president engineering, Boeing Airplane Co. Address: 8710 Overlake Dr., Bellevue, Wash.

ZISCH, W. E., vice president and general manager, Aerojet-General Corp. Address: Azusa, Cal.

ZOOK, Jack, aviation executive born in Wellston, O., Oct. 5, 1918; assistant sales manager, administrative, Cessna Aircraft Co. Address: 5800 Pawnee Rd., Wichita 15, Kan.

ZWICKY, Fritz, Dr., born in Varna, Bulgaria, Feb. 14, 1898; chief research consultant, Aerojet-General Corp. Address: Azusa, Calif.

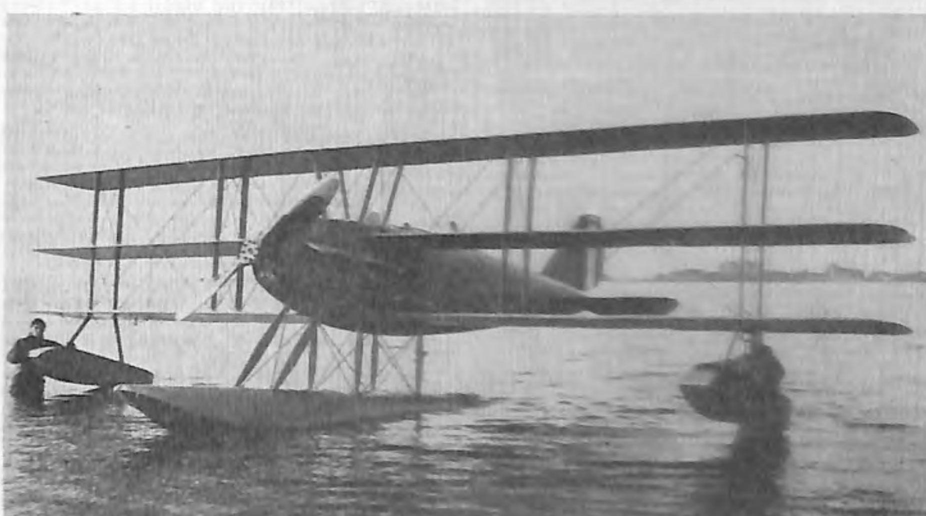
A CHRONOLOGY of U. S. AVIATION

The following chronology has been compiled and edited by Ernest L. Jones, (Lt. Col., ret.), secretary of The Early Birds, now residing in Clifton, Virginia.

Although this chronology has been expanded considerably over previous editions, it still represents only brief excerpts from Colonel Jones' vast store of air data. Space has forced us to deal only with the highlights.

We are deeply indebted—as is aeronautics in the United States—to Colonel Jones for his thorough knowledge of aeronautics in this country and the generosity with which he shares it.

First U. S. seaplane fighter was this Curtiss Triplane of 1918



United States Chronology

1784, Jan. 16—Airborne troops proposed by Benjamin Franklin in reporting on the first balloon ascents.

1784, July 17—First U. S. balloon flight in Peter Carnes' captive balloon, Baltimore, Md.

1784, Nov. 30—First ascent by an American abroad, by Dr. John Jefferies, physician, with French aeronaut Blanchard, at London. On Jan. 7, 1785, they make the first Channel crossing by air.

1793, Jan. 9—Balloon flight by Jean Pierre Blanchard from Philadelphia, Pa., to Woodbury, N. J. (Letter from George Washington carried on this flight.)

1837, Sept. 18—First parachute demonstration in America when John Wise drops animals from a balloon at Philadelphia.

1838, Aug. 11—John Wise safely lands with his parachuted balloon at Easton, Pa.

1840, Sept. 8—Col. John H. Sherburne urges Secretary of War to use night balloons to locate Seminoles.

1842, Oct. 22—John Wise proposes to capture Vera Cruz by air.

1844, Oct. 16—America's first air patent to Muzio Muzzi on direction of balloons.

1845, Sept. 18—Rufus Porter proposes steam airship line, New York-California, to carry gold-seekers at $100 a trip. Stock sales unsatisfactory. His 1849 booklet illustrates a jet-propeller passenger rocket.

1859, July 1—World record balloon trip, 809 miles, St. Louis to Henderson, N. Y., by John Wise and three companions.

1859, Aug. 16—Airmail carried by John Wise in balloon flight from Lafayette to Crawfordsville, Ind.

1860, Aug. 21—Capt. E. B. Hunt, Corps of Engineers, U.S.A., advocates balloon telegraphy.

1860, Oct. 13—Successful aerial photos taken by William Black from a balloon, Boston, Mass.

1861, June 10—Military flight by James Allen, First Rhode Island State Militia, in balloon over Washington, D. C.

1861, June 18—Balloon telegraph demonstrated by T. S. C. Lowe. (Message to Abraham Lincoln.)

1861, June 22-24—Military reconnaissance by T. S. C. Lowe and Army officers from balloon using telegraph, over Arlington and Falls Church, Va. Military air observation continues into 1863.

1861, Aug 3—Civilian aeronaut La Mountain inaugurates aircraft carrier operations with his war balloon. Lowe follows.

1861, Sept. 24—Air artillery adjustment from Lowe's Army ballon near Washington.

1861, Nov. 7—Helicopter proposed for Union Army. After experiments, a machine is partly built before Appomattox ends the project.

1862, Mar. 9—War helicopter bomber designed and urged by William C. Powers of Mobile, Ala.

1866, May 25—Solomon Andrews' airship maneuvers over New York with 4 passengers.

1873, Oct. 7—Unsuccessful trans-Atlantic flight by W. H. Donaldson, Alfred Ford and George A. Lunt in balloon, *Graphic*, from Brooklyn, N. Y., to New Canaan, Conn.

1877—Prof. William H. Pickering, Harvard University, begins experiments with model helicopters. In 1903 a rabbit is sent aloft.

1880—Thomas A. Edison conducts helicopter experiments for James Gordon Bennett.

1883, Mar. 17—First of a series of glider flights by John Joseph Montgomery, Otay, Cal.

1885, Jan. 7—Russell Thayer, C. E., a graduate of West Point, urges on Secretary of War Robert T. Lincoln a compressed-air airship of his design. No action.

1887, Jan. 30—Thomas E. Baldwin makes his first parachute jump at San Francisco.

1886, July—W. E. Irish, publisher of *Aeronautical World*, proposes balloon radio.

1887—American altitude record made by aeronaut Moore and Prof. H. A. Hazen of U. S. Signal Service, at St. Louis; 15,400 feet, in balloon of St. Louis *Post Dispatch*.

1890, July 31—During the month, L. Gathmann, of Chicago, explodes a shell at high altitude in attempt to produce rain.

1890, Oct. 1—President Harrison approves legislation creating the Weather Bureau and re-establishing the Signal Corps which is charged with collection and transmission of information, among other duties. Military aeronautics is then considered as among such means, and Army aeronautics is revived.

1892, Oct. 10—Balloon section is being organized with each telegraph train by Chief Signal Officer, General A. W. Greely, who anticipates military airships and airplanes.

1892, Nov. 5—Wingless aerial torpedo suggested by Prof. A. F. Zahm.

1893, Aug. 1-4—International Conference on Aerial Navigation held at Chicago; Octave Chanute, Chairman; Dr. A. F. Zahm, Secretary.

1893, Oct. 9—The Chief Signal Officer, General Greely reports the purchase of a Lachambre balloon for the Signal Corps balloon section. First ascents since the war are made at the Chicago exposition from Oct. 31, 1893.

1896, Apr. 29—First American wind tunnel begins operation at M.I.T.

1896, May 6—Steam-powered airplane model flown by Samuel Langley, Washington, D. C.

1898, Apr. 29—War and Navy Departments examine Langley's work, approve, and Board of Ordnance and Fortification makes two allotments of $25,000 each to build his airplane.

1898, Dec. 22—The Secretary of War approves a Fort Myer site for barracks, officer quarters, administration building and a balloon house to concentrate Signal Corps schools at one point.

1901, Sept. 1—Simon Newcomb, Ph.D., LL.D., writes in *McClures* for September: "The first successful flyer will be the handiwork of a watchmaker and will carry nothing heavier than an insect."

In December, Rear Admiral Melville, USN says in the *North American Review:* "A calm survey . . . leads the engineer to pronounce all confident prophecies at this time for future success as wholly unwarranted, if not absurd."

1902, Sept. 15—A. Leo Stevens sails his airship *Pegasus* over Manhattan Beach in a race with Edward C. Boyce in the latter's Santos Dumont airship.

1903, Mar. 23—Orville and Wilbur Wright

apply for patent on their flying machine. (Patent issued May 22, 1906.)

1903, Dec. 8—Samuel Langley's flying machine, piloted by Charles Manly, plunges in the Potomac and is wrecked on its second test, Washington, D. C.

1903, Dec. 17—First sustained controllable flight of powered heavier-than-air machine by Orville and Wilbur Wright, Kitty Hawk, N. C.

1904, Aug. 3—Circuit flight in airship (Curtiss motor) by Capt. Thomas S. Baldwin at Oakland, Cal.

1904, Wright brothers make 104 flights, covering 20 miles. British representative visits the Wrights in November.

1905, Jan. 18—Wright brothers open negotiations with U. S. War Department for disposition of their invention. Correspondence to had through 1907.

1905, Apr. 29—Daniel Maloney begins series of glides with Montgomery glider, taking off from captive balloon. Later killed.

1905, Aug. 5—Charles K. Hamilton begins series of kite flights, towed by cars and boats.

1905, Sept. 26-Oct. 5—Wright brothers make 55 flights, the longest being 24 miles in 38 min. 3 sec. Frank S. Lahm, in France, obtains report on Wrights' flying from Ohio relative. French remain skeptical. In October the French government is negotiating along with British.

1905—Lt. Frank P. Lahm becomes first Army balloon pilot.

1906, Jan. 13-20—First indoor aero exposition, New York.

1906, Mar.—French and British visit Wright brothers at Dayton.

1906, Sept. 30—First Bennett international balloon race won by Lt. F. P. Lahm—Paris to England.

1906, Dec. 1-8—Second indoor air exhibition of Aero Club of America.

1907, June 8—Building devoted exclusively to aeronautics dedicated at Jamestown (Va.) Exposition.

1907, Aug. 1—Aeronautical Division established, Army Office of Chief Signal Officer.

1907, Sept. 2—Walter Wellman airship *America* fails in polar attempt.

1907, Sept. 30—Ornithopter of H. C. Gammeter, multigraph inventor, lifts temporarily.

1907, Oct. 1—Aerial Experiment Association formed by Dr. A. Graham Bell, F. W. Baldwin, J. A. D. McCurdy, Glenn H. Curtiss and Thomas E. Selfridge.

1907, Oct. 3—Record altitude of 23,110 feet by U. S.- Weather Bureau meterological kite.

1907, Oct. 18—Air bombing prohibition signed at second Hague conference.

1907, Oct. 21—Second Bennett international balloon race, St. Louis, won by Oscar Erbsloh of Germany. Airship races are held Oct. 22-23.

1907, Oct. 28-29—International Aeronautic Congress held in New York.

1907, Oct. 28—Admiral C. M. Chester urges anti-submarine airships and shipboard airplanes at International Aeronautic Congress.

1907, Dec. 6—Seven-minute towed flight from motor boat tug in Dr. Bell's kite, flown by Lt. T. E. Selfridge.

1907, Dec. 16—Chief Signal Officer advertises for airship bids, resulting in purchase of Baldwin airship.

1907, Dec. 23—Chief Signal Officer advertises for airplane bids, after visit of Wrights.

1908, Feb. 10—First Army plane contract signed by Signal Corps with Wright Brothers. (Other contracts signed with A. M. Herring and J. F. Scott.)

1908, Mar. 12—First Aerial Experiment Association's plane, *Red Wing*, flown by F. W. Baldwin. Later, three other machines fly.

1908, May 6-18—Wright brothers renew flying preliminary to delivery of Army airplane. Charles Furnas is first airplane passenger.

1908, May 13—Balloon radio reception demonstrated by Signal Corps.

1908, May 31—G. H. Curtiss Manufacturing Company announces planes for sale.

1908, June 10—Aeronautical Society formed in New York and Morris Park Airfield shortly obtained—first of kind in U.S.

1908, June 20—Anthony radio-controlled airship model demonstrated.

1908, July 4—*Scientific American* Trophy awarded Glenn H. Curtiss for first public flight of one kilometer circuit in his biplane, *June Bug*, Hammondsport, N. Y.

1908, July 17—First air ordinance passed by Kissimmee, Fla., with registration and regulation.

1908, Aug. 8—Demonstration flights under French syndicate control begin near LeMans, France, by Wilbur Wright, continuing through December, making a number of astounding records. Training of students follows.

1908, July 31-Aug. 8—Henri Farman of France makes first exhibition airplane flights in U.S.

1908, Aug. 22—First Army Baldwin airship accepted.

1908, Sept. 17—First plane fatality, killing Signal Corps Lt. Thomas E. Selfridge and severely injuring Orville Wright, in delivery of first Army airplane, Fort Myer, Va.

1908, Dec. 28—Matthew B. Sellers makes several flights with 7 hp quadroplane.

1909, Jan. 22—Commercial airplane, built by Glenn Curtiss, sold to Aeronautic Society of New York.

1909, April 16-28—Wilbur Wright delivers an airplane in Italy and teaches pupils.

1909, June 10—President Taft presents Aero Club of America medal to Wright brothers. Congressional medal presented at a celebration at Dayton, June 17-18.

1909, June 26—Glenn H. Curtiss demonstrates at the Aeronautical Society's meet, Morris Park, New York, the machine ordered Jan. 22. Further flights are made at the Society's meet July 5, before removal of the machine to Mineola and the instruction of member Charles F. Willard.

1909, July 17—Curtiss flies 52 mins. in longest U.S. flight except Wrights and wins *Scientific American* trophy for second time. On this success in the Mineola flights the Aero Club of America names him as America's entry in the Bennett international race.

1909, Aug. 22-29—Glenn H. Curtiss wins first Bennett international airplane race and other events of first International Flying meet, Rheims, France. Speed: 45.7 mph.

1909, Aug. 25—First Army airfield leased at College Park, Md.

1909, Aug. 28—After instruction by Glenn H. Curtiss and subsequent practice in the machine contracted by the Aeronautical Society, Charles F. Willard gives his first exhibition at

Scarsborough Beach, Toronto—America's first exhibition pilot. His exhibitions continue over several years.

1909, Sept. 7-Oct. 15—At Berlin, Orville Wright makes flights under German contract, with more records.

1909, Sept. 30—Inception of Wright-Curtiss patent litigation.

1909, Sept. 30—Emile Berliner describes a proposed guided missile.

1909, Oct. 3—At Zurich, Switzerland, E. W. Mix wins the Bennett International balloon race the second time for America.

1909, Oct. 4—Wilbur Wright makes sensational flight, Governors Island to Grant's Tomb and return. Glenn H. Curtiss makes a short flight Sept. 29 and Oct. 3.

1909, Oct. 7—Glenn H. Curtiss flies his first exhibition at St. Louis. Chicago is next. The same month, Charles K. Hamilton and Otto Brodie learn to fly, followed by others. An exhibition company is formed and Curtiss returns to his development work.

1909, Oct. 8-Nov. 5—First Army aviators taught to fly by Wilbur Wright, College Park, Md.: Lt. Frank P. Lahm, Lt. Frederic E. Humphreys, and Lt. B. D. Foulois.

1909, Nov. 27—Anti-aircraft firings begin at Sandy Hook by Ordnance Department.

1909, Nov. 22—The Wright Co. formed with $1,000,000 capital. In 1914, Orville Wright buys the company back. On Oct. 13, 1915, a syndicate buys the company and adds the Simplex Co. In 1916 it becomes the Wright-Martin Co.

1910, Jan. 10-20—First flying meet held at Los Angeles; Louis Paulhan, of France, the star performer.

1910, May 29—Record flight from Albany to New York by Glenn Curtiss, 142.50 mi. in 2 hr., 50 min.

1910, Mar. 25—Wright patent condemnation urged by William M. Page, attorney for C. F. Bishop, president, Aero Club of America.

1910, June 13—Charles K. Hamilton flies New York-Philadelphia and return for N. Y. *Times* and Philadelphia *Public Ledger* and $10,000 prize—149.5 miles in flying time 3 hr. 27 min.; elapsed time, 6 hr. 57 min.

1910, June 13-18—First show of Wright exhibition team, Indianapolis, Ind. where Walter Brookins is star and makes new records. Exhibitions by single pilots or groups continue about the country until the Wright exhibition business is discontinued in Nov. 1911.

1910, June 30—Dummy bomb demonstration made by Glenn H. Curtiss to Army and Navy officers.

1910, Aug. 4—Plane-ground radio demonstrated by E. N. Pickerill.

1910, Aug. 8—Tricycle landing gear installed by Lt. B. D. Foulois on Army Wright at San Antonio.

1910, Aug. 27—Air-land plane radio used by J. A. D. McCurdy, Sheepshead Bay, N. Y.

1910, Sept. 2—First American woman pilot solos: Blanche Stuart Scott. First exhibition at Fort Wayne, Oct. 22.

1910, Oct. 8-10—Former President Theodore Roosevelt is flown at St. Louis exhibition by Arch Hoxsey.

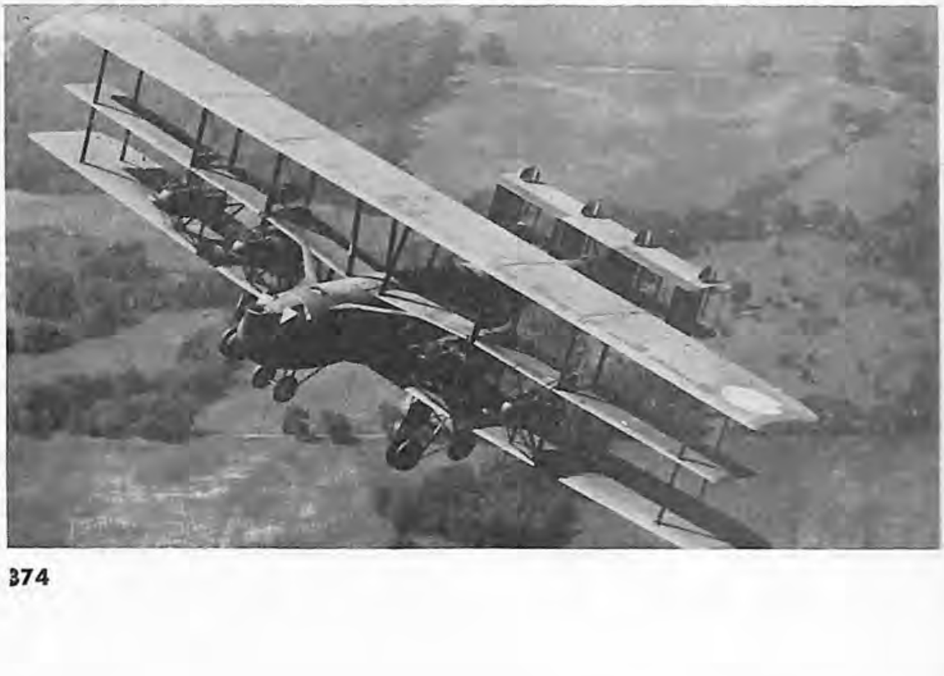
1910, Oct.14-16—Wellman airship, *America*, abandons trans-Atlantic trip after some 800 miles.

1910, Oct. 22-31—Second Bennett international airplane race won by C. G. White (Bleriot) at 61 mph during Belmont Park meet where numerous records are made.

1910, Nov. 14—First battleship takeoff by Eugene Ely from U.S.S. *Birmingham* in Hampton Roads, Va.

1910—Night flights by Walter R. Brookins

First of the super bombers was this Witteman-Barling of 1923



(Montgomery, Ala., Apr. 18) and Charles Hamilton (Camp Dickenson, Nashville, Tenn., June 21-26).

1911, Jan. 7—Didier Masson flies Los Angeles-San Bernardino to deliver *Times* newspapers. Mail and papers delivered Feb. 17 by Fred J. Wiseman.

1911, Jan. 7-25—Dive bombing, aerial photography, airplane radio demonstrated by Army officers in San Francisco meet.

1911, Jan. 27-28—Lieut. T. G. Ellyson, U.S.N., is first U.S. naval aviator when he takes his Curtiss off at San Diego during Curtiss exhibitions.

1911, Jan. 30—J. A. D. McCurdy attempts Key West-Havana flight but lands in water ten miles short and is rescued by Navy destroyer. In 1913 Domingo Rosillo makes the entire distance.

1911, Feb. 17—Curtiss flies tractor seaplane from North Island to cruiser *Pennsylvania*. Plane hoisted on board and return flight later made.

1911, Mar. 3—Lt. B. D. Foulois and P. O. Parmalee fly record cross-country Laredo-Eagle Pass, Tex., 106 mi. in 2 hr. 10 min. in Wright plane loaned Army by R. J. Collier. Messages dropped en route, radio received and sent.

1911, Mar. 13—Capt. W. Irving Chambers, U.S.N., is assigned the Bureau of Navigation to devote exclusive efforts to naval aeronautics.

1911, Mar. 31—About this date Missouri National Guard Signal Corps establishes air section and members taught flight and ballooning.

1911, May 8—First Navy airplane ordered, Curtiss Triad, amphibian. By July the three 1911 planes of the Navy are delivered—Curtiss A-1, A-2; Wright B-1.

1911, May 13—Lieuts. H. H. (Hap) Arnold and Thomas DeWitt (Tommy) Milling complete flying training at Wright School: 7th and 8th Army pilots.

1911, June 7—Lieut. John P. Kelley, Med. Res. Corps, assigned Army School at College Park—first U. S. air medical officer.

1911, June 8—Connecticut state air regulation is first state air law.

1911, June 21—Short-lived Aeronautical Manufacturers Assn'n. incorporated; Ernest L. Jones, president.

1911, June 30-July 11—Boston-Washington flown by Harry N. Atwood. Charles K. Hamilton flies with him most of way—longest continuous air journey to this date.

1911, July 1—Third Bennett plane race won for U. S. by Charles T. Weyman (Nieuport-Gnome 100) at 78 mph.

1911, July 31—During the month, Frank E. Boland begins flying his tailless, allegedly non-infringing airplane.

1911, Aug. 5—Lincoln Beachy wins over Eugene Ely and Hugh Robinson in New York-Philadelphia race for Gimbel $5000 purse. Elapsed time: 1 hr. 50 min. 18 sec.; one stop for fuel.

1911, Aug. 14-25—Harry N. Atwood flies St. Louis-New York, 1155 miles by route; longest cross-country flight to this date.

1911, Aug. 20—World altitude record set at 11,642 ft. by Lincoln Beachy in Curtiss biplane.

1911, Sept. 4—Earle L. Ovington (Bleriot-Gnome 70) wins over Lieut. T. D. Milling (Burgess-Wright-Wright 30) in 160-mile tri-state race during Boston meet, in 3 hr. 6 min. 22 sec.

1911, Sept. 7—Lt. T. G. Ellyson, U.S.N., demonstrates shipboard launching by taking off from aerial cable at Hammondsport, N. Y.

1911, Sept. 17-Nov. 5 — Transcontinental flight by Calbraith P. Rodgers from New York to Pasadena, Calif.—3,390 mi., 49 days.

1911, Sept. 23-30—Earle L. Ovington appointed Airmail Pilot No. 1, flying mail from Nassau Boulevard to Mineola, L. I., N. Y.

1911, Sept. 30—Lt. H. H. Arnold is "stunt man" for the lead in pioneer air movies at Nassau Boulevard meet where Army pilots compete.

1911, Oct. 9—Demonstration of Tarbox automatic pilot made before officers at College Park. Other similar inventions follow.

1911, Oct. 10—Bombsighting and dropping device demonstrated by Riley Scott, College Park, Md.

1911, Oct. 19-Feb. 12, 1912—Eastbound transcontinental flight of Robert G. Fowler (Wright B), Los Angeles-Pablo Beach, Fla., 2520 mi. in 116 days.

1911, Oct. 24—Orville Wright makes soaring record of 9 min. 45 sec. at Kitty Hawk.

1912, Feb. 12—Frank T. Coffyn takes automatic movie aerials over New York harbor.

1912, Feb. 17—First pilot physical exam published by U. S. Army.

1912, Mar. 1—Attached type parachute jump by Bert Berry from Benoist pusher plane, St. Louis.

1912, Apr. 16—First U. S. licensed woman pilot, Harriet Quimby, flies English Channel. (Killed at Boston Aviation Meet, July 1.)

1912, May 24—Paul Peck makes American duration record of 4 hr. 23 min. 5 sec. in biplane with Berliner Gyro engine.

1912, May 30—Death of Wilbur Wright by typhoid.

1912, June 7-8—Machine gun fired from Wright biplane by Capt. Charles DeForest Chandler, College Park, Md.

1912, July 2—Vaniman airship *Akron* crashes off Atlantic City in renewed trans-Atlantic attempt.

1912, July 31—Plane launched from sea wall by catapult. Navy Lt. T. G. Ellyson in Curtiss AH-3.

1912, Aug. 12—First Army tractor plane, Burgess, received; flown by Lts. H. H. Arnold and Roy C. Kirtland from Marblehead, Mass.

1912, Oct. 6—In night flight, Lt. J. H. Towers, U.S.N. (Curtiss A-2) makes world seaplane duration record, 6 hr. 10 min. 35 sec. at Annapolis; American record for any plane.

1912, Oct. 8—First Navy physical exam for pilots published by Bureau of Medicine and Surgery.

1912, Oct. 9—First competition for Mackay Trophy won by Lt. H. H. Arnold.

1912, Nov. 5-13—First U. S. airplane artillery adjustment, Ft. Riley, Kans., Lt. H. H. Arnold and observer Lt. Follett Bradley.

1912, Nov. 6-Dec. 15—Antony Jannus (Benoist seaplane Roberts 2-cycle 100 hp) flies Omaha-New Orleans, with mail and merchandise, carrying passengers at stops en route—1833 mi., flying time: 31 hr. 43 min.

1913, Jan. 13-Mar. 31—Air parcel post flight, Boston-New York, by Harry M. Jones (Wright B).

1913, Feb. 11—James Hay bill in Congress

inaugurates the project of a separate air service.

1913, Feb. 13—Langley Field Aerodynamical Laboratory project inaugurated.

1913, Apr. 27—First cross-Isthmus flight by Robert G. Fowler and cameraman R. A. Duhem. Panama-Cristobal. Publication of story and pictures results in arrest.

1913, May 10—Didier Masson and bomber Dean attack Mexican federal gunboats in Guayamas Bay. A number of other Americans fly for Villa in this and subsequent years.

1913, May 28—Lt. T. D. Milling and Lt. W. C. Sherman make 2-man duration and distance record of 4 hr. 22 min. and 220 miles (Burgess tractor-Renault 70), Texas City-San Antonio.

1913, May 30—About this date is instituted M.I.T.'s aerodynamics course under Asst. Naval Constructor Jerome C. Hunsaker.

1913, June 20—First Naval aviator killed when Ensign W. D. Billingsley is thrown from seaplane.

1913, July 19—Sky writing initiated by Milton J. Bryant over Seattle.

1913, Oct. 12—Eighth Bennett international balloon race won for U. S. for fourth time at Paris by R. H. Upson and R. A. D. Preston, landing in England.

1913, Nov. 27—First exhibition loop by Lincoln Beachy in Curtiss biplane, Coronado, Cal.

1913, Dec. 4—Tactical Air Unit, First Aero Squadron, set up as provisional organization, San Diego, Cal.

1913, Dec. 12—Wright pilot Oscar Brindley reports at San Diego as Army's first civilian instructor. Scores of others subsequently employed through 1918.

1913, Dec. 31—Orville Wright demonstrates automatic pilot; awarded Collier Trophy.

1914, Jan. 1—First scheduled airline begins operations with Benoist flying boat between St. Petersburg and Tampa, Fla.; Tony Jannus, pilot.

1914, Jan. 31—During the month first U. S. Navy air station established at Pensacola, following temporary camps at San Diego and Annapolis, 1911-1912.

1914, Feb. 17—Seaplanes and flying boats classed as "vessels" by the Department of Commerce and the license No. 1 is issued to Antony Jannus.

1914, Feb. 24—Army Board condemns all pusher type airplanes.

1914, Apr. 15—Electric self starter fitted to Anzani 200-hp engine of Collier flying boat.

1914, June 23—Curtiss' Wanamaker trans-Atlantic flying boat tested. With outbreak of World War I the project is abandoned.

1914, July 2—Lawrence Sperry wins French War Dept. prize for "stable airplane" flown by early automatic pilot over Seine River in Paris.

1914, July 18—Aviation Section of Signal Corps created by Congress, authorizing 60 officers and students and 260 enlisted men.

1914, Dec. 1-16 — Two-way plane-ground radio demonstrated by Lt. H. A. Dargue and Lt. J. O. Mauborgne, Manila, P. I.

1915, Mar. 3—National Advisory Committee for Aeronautics established by Congress.

1915, May 14—Contract let for first Navy airship D-1 to Connecticut Aircraft Co. In July is contracted a floating airship shed.

1915, June 22—Wisconsin State Forester,

1927 Boeing Fighter was first of the post World War I breed exceeding wartime types

E. M. Griffith, flown by Jack Vilas, in first air forest patrol.

1915, Sept. 17—Joseph Dolgos of Philadelphia demonstrates air incendiary bombs.

1916, Feb. 9—Cpl. A. D. Smith (Martin S-Hall Scott 125) makes world seaplane duration record of 8 hr. 42 min.

1916, Feb. 12—Invitation for bids on airmail issued by Post Office in Massachusetts and Alaska.

1916, Mar. 15—First Aero Squadron, under command of Capt. B. D. Foulois, begins operations at Columbus, N. M., with Gen. Pershing's Punitive Expedition.

1916, Apr. 5—The Governors Island Training Corps organized by Philip A. Caroll.

1916, Apr. 14—A power-driven turret is proposed without result by Col. F. P. Cobham.

1916, June 3—National Defense Act increases strength of Aviation S. C. from 60 to 148 officers over 5-year period. President may fix increase of enlisted men from old figure of 260.

1916, June 18—U. S. aviator H. Clyde Balsley shot down. (Member of Lafayette Escadrille, flying for France.)

1916, Aug. 29—First U. S. Coast Guard Aviation Division organized.

1916, Oct. 2—Allocation airship development to Army or Navy raised by Chief Signal Officer. Rigids later assigned Navy.

1916, Nov. 2—Chicago-New York commercial airmail line asked by Glenn Muffly. Sponsored by New York *Times*, Victor Carlstrom flies mail demonstration, Nov. 2-3.

1916, Nov. 14—More than 60 civilians are to Curtiss contract school at Newport News, Va. beginning this date and before Apr. 6, 1917. Others are sent to Curtiss school at Miami. Gen. Mitchell learns to fly here at this period.

1916, Nov. 18-20—Group National Guard cross-county flight under Capt. R. C. Bolling from New York to Princeton, N. J. and return. On Dec. 30, another is made to Philadelphia.

1916, Nov. 19-20—Ruth Law flies her 1914 Curtiss pusher Chicago-New York, with 2 stops en route, for new cross-country record.

1916, Dec. 17—To this date the Aero Club of America has certified 636 airplane pilots. In addition are many other pilots who have never flown for the Aero Club certificate. On Dec. 31, the Army has graduated 122 pilots since 1909.

1916, Dec. 18—Non-exclusive licenses are offered by Wright-Martin Aircraft Corp. on royalty basis. Terms are considered prohibitory and in 1917 Congress appropriates $1,000,000 to acquire basic patents. Solution is the cross-license agreement of the Aircraft Manufacturers Association.

1917, Feb. 13—Capt. Francis T. Evans, U.S.-M.C., loops and spins a seaplane at Pensacola.

1917, Feb. 15—Aircraft Manufacturers Association completes organization.

1917, Apr. 6—U. S. declares war on Germany.

1917, Apr. 6—Official strength of the Aviation Section, S. C., is 131, including regular and reserve. Of these, 112 are airplane pilots or student pilots. Enlisted strength is given variously from 1087-1800. At armistice the figures are: total officers, 20,708 (pilots and student pilots, 12,449); enlisted, 174,315.

Airplane strength, "less than 300." Produced in U. S., Apr. 6, 1917—Nov. 1, 1919: 13,894; received from Allies, 5,229; total: 19,123.

1917, May 10—Arrangements made for eight ground schools for theoretical training Reserve officer candidates.

1917, May 16—Aircraft Production Board created. Superseded by the Aircraft Board Oct. 1. Dissolved May 19, 1919.

1917, May 23—French Premier Ribot asks U.S. to furnish 5,000 pilots, 50,000 mechanics, 4,500 planes for active service by spring 1918.

1917, May 29—Liberty engine project inaugurated. An 8-cylinder Liberty is flown in an L.W.F., July 25. The 12-cylinder production Liberty follows in December.

1917, June 1—Barlow robot bomber urged. Armistice ends project.

1917, July 13—Fiske torpedo plane tested with dummy missile. Experiments continue.

1917, July 24—First great U. S. air appropriation, $640,000,000. Act also provides for increase in organization of Aviation Section, S. C.

1917, July 27—Secretary of Navy authorizes a Naval Aircraft Factory at Philadelphia.

1917, July 27—First British DH-4 arrives to be the first American service plane put into production, with Liberty engine. First American DH-4 completed is flown Oct. 29 by civilian test pilot H. M. Rinehart.

1917, Aug. 5—Original First Aero Squadron leaves Columbus, N.M. for overseas under Maj. Ralph Royce.

1917, Aug. 13—First AEF squadron program calls for 89 wings and 508 squadrons. One wing equals six squadrons (5 airplanes, 2 balloons). A brigade comprises two or more wings.

1917, Sept. 5—Bristol fighter project started. Condemned July 20, 1918, after 27 planes are built.

1917, Sept. 22—Montgomery heirs sue Wright-Martin Aircraft Corp. for infringement. Suit withdrawn June 6, 1921. Suit of same date against U. S. is dismissed May 28, 1928.

1917, Oct. 16—Airplane to airplane radio-phone conversation is demonstrated.

1917, Oct. 18—McCook Field established as Signal Corps Experimental Laboratory.

1917, Oct. 18—Aviation Medical Research Board established by Signal Corps.

1917, Nov. 15—J. Newton Williams' helicopter proposal results in recommendation of N.A.C.A. for Government prize of $20,000, not accomplished.

1917, Nov. 21, Robot bomber demonstrated to Army and Navy officers.

1917, Nov. 27—Brig. Gen. B. D. Foulois made Chief of Air Service, AEF.

1917—Gen. William Mitchell claimed as first officer to fly over enemy lines.

1918, Jan. 19—U. S. School of Aviation Medicine begins operations under Signal Corps Maj. William H. Wilmer, Hazelhurst Field, Mineola, L. I., N. Y.

1918, Feb. 28—Under President Wilson's proclamation, licenses are required for civilian pilots or owners; more than 800 are issued.

1918, Mar. 8—Maj. Edward C. Schneider and Maj. James L. Whitney, in simulated altitude flight, reach artificial altitude of 34,000 ft. in 24 min. at Signal Corps, Mineola, N. Y. laboratory.

1918, Mar. 11—First D.S.C. awarded Army air service personnel goes to Lt. Paul Baer of 103rd Squadron for his performance this date.

1918, Mar. 14—Two pilots of First Pursuit Group (95th Squadron) go on patrol.

1918, May 9—Flight Surgeons are organized at flying fields.

1918, May 11—U. S.-built DH-4 Liberty planes received by AEF.

1918, May 15—Congress establishes Air Mail Flyer's Medal of Honor. First award is to M. F. Freeburg, 1932.

1918, May 15—Regular airmail service flown by Army between New York and Washington, D. C.

1918, May 20—Army aeronautics severed from Signal Corps; two departments created: Bureau of Military Aeronautics and Bureau of Aircraft Production.

1918, June 26—A trans-Atlantic flight is urged by Gen. William L. Kenly, Director Military Aeronautics as "most necessary." On Aug. 8, Roy N. Francis is assigned to study project. Experiments continue to 1919 when Navy's NC4 makes the flight.

1918, July 4—Plan to distribute tons of propaganda by balloon over Germany this day fails attainment. Previously extended experiments had been conducted and contracts let.

1918, Aug. 2—First DH Liberty patrol by 135th Aero Squadron.

1918, Aug. 17—First Martin bomber flown at Cleveland by Thomas Eric Springer.

1918, Sept. 7—First U. S. demonstration of troop transport by air.

1918, Sept. 12-13—Greatest air concentration of history at St. Mihiel under Gen. William Mitchell—1481 planes.

1918, Sept. 16—German attached type parachutes being in use at least as early as May 1, 1918, the AEF cables need and suggests Floyd Smith, test pilot, prosecute development. Smith develops free type 'chute. Leslie L. Irving makes first free jump Apr. 28, 1919.

1918, Sept. 18—Altitude of 28,899 ft. reached by Maj. R. W. Schroeder.

1918, Sept. 25—First Congressional Medal of Honor awarded for air activity voted 1st Lt. Edward V. Rickenbacker of 94th Aero Squadron.

1918, Sept. 26—First phase of Meuse-Argonne attack.

Ford Tri-Motor established the airlines as a mode of travel

1918, Sept. 28—Pilotless airplane maneuvered from another airplane by radio, after some months of experiment. Various automatic pilots and radio controllers tried over the years.

1918, Oct. 2—First successful flights of Army's guided missile. Its prototype had been flown by H. M. Rinehart in July, substituting for the explosive load and the automatic controls.

1918, Oct. 3—Flight refueling demonstrated by Lt. Godfrey L. Cabot, U.S.N.R., continuing into 1920.

1918, Oct. 12—Use of oxygen tanks ordered all pilots over German lines.

1918, Oct. 25—Charles E. Hughes reports on his investigation of dishonesty in aircraft production.

1918, Nov. 11—Armistice signed.

1918, Dec. 4—First Army trans-continental flight made by Major Albert D. Smith's group of JN4 planes, San Diego-Jacksonville-New York-San Diego. Major Smith's plane alone completes the full round trip.

1919, Jan. 2—Maj. Gen. Charles T. Menoher becomes Director of Air Service.

1919, Jan. 21-30—Army second transcontinental flight; Major T. C. Macauley (DH-4 Liberty), Ft. Worth-San Diego-Miami-Ft. Worth. Repeated in April.

1919, Jan. 24—At Issoudun, France, 1st Lt. Temple M. Joyce (Morane) makes 300 consecutive loops.

1919, Mar. 3—U. S.-Canada airmail flown by Edward Hubbard in Boeing seaplane, Type C.

1919, Apr. 26—Lt. Comdr. H. B. Grow, U.S. N. in F5L flying boat makes non-stop endurance record: 20 hr. 10 min.

1919, Apr. 28—Leslie L. Irving makes first free type manually operated airplane parachute jump over McCook Field. (See 9/16/18).

1919, May 8-31—Trans-Atlantic crossing by Lt. Albert C. Read and crew from Rockaway Beach, N. Y., to Plymouth, England, in NC-4, 53 hr. 58 min.

1919, May 14—Navy airship C-5 makes American non-stop record of 25 hr. 50 min., Montauk Pt., L. I. to St. Johns, N.F.

1919, May 18—In first trans-Atlantic takeoff, H. C. Hawker and McKenzie Grieve alight in ocean 1200 miles and 14½ hours out with engine trouble. Rescued.

1919, May 19—First award of DFC made to M/Sgt. Ralph W. Bottriell for first jump by Army personnel with free-type 'chute.

1919, June 1—First organized and sustained forest fire patrol inaugurated at Rockwell.

1919, June 14—First non-stop Atlantic crossing by Capt. John Alcock and Lt. A. W. Brown (Vickers-2 Rolls 375) St. Johns to Clifden, Ireland: 1890 mi. in 16 hr. 12 min.

1919, June 28—Treaty of peace with Germany signed at Versailles.

1919, July 1—Aerial fish patrols inaugurated at San Diego by Comdr. E. W. Spencer, Jr., U.S.N.

1919, July 2-6—First airship ocean crossing, British R-34, E. Fortune, Scotland, to Mitchel Field, N. Y., 3270 mi. in 108 hr. 12 min.; Lt. Comdr. L. Lansdowne, U.S.N. on board. Return made July 9-12, Col. William M. Hensley, representing Air Service.

1919, Aug. 14—Airmail from Aeromarine flying boat to White Star liner, *Adriatic*.

1919, Aug. 27-29—New York-Toronto race of military and civilian pilots.

1919, Aug. 28-Sept. 19—Lawson "air liner," 26-passenger, twin Liberty biplane, makes demonstration trip Milwaukee-Washington via Chicago, New York and other cities. It returns Sept. 25-Nov. 6.

1919, Sept. 1—Dive bombing demonstrated about this date at Aberdeen Proving Ground.

1919, Sept. 16—Flood relief provided by four JN4D's from Corpus Christi to stranded inhabitants.

1919, Sept. 18—Roland Rohlfs (Curtiss triplane-K12 Curtiss 400) makes world altitude record of 31,420 ft.

1919, Oct. 8-31—Army transcontinental reliability and endurance test New York-San Francisco and return. Forty-four compete westbound; 15 eastbound. Ten planes make round trip.

1919, Oct. 30—Reversible pitch propeller tested at McCook Field, Dayton, Ohio.

1919, Nov. 12-June, 1920—Six Navy F-5L's cruise New York to West Indies and return, covering 12,731 nautical miles.

1920—Moon eclipse observed by Lts. J. H. Tilton and W. H. Cushing of Rockaway Naval air station from height of some three miles.

1920, Feb. 27—World altitude record of 33,113 feet set by Maj. R. W. Schroeder (Le Pere-Liberty).

1920, Mar. 29-Apr. 22—Marine Corps group flight Washington-San Domingo and return, 4842 miles.

1920, June 7—Lt. John H. Wilson makes unofficial world parachute jump record of 19,800 ft.

1920, June 4—Army Reorganization Bill approved, creating Air Service in Army.

1920, July 7—F-5L Navy seaplane flown by radio compass from Hampton Roads, Va., to *U.S.S. Ohio*, at sea.

1920, July 15-Oct. 20—New York-Alaska flight; Capt. St. Clair Street, 1st Lt. Clifford Nutt, 2nd Lts. Ross C. Kirkpatrick, Eric H. Nelson and C. E. Crumrine, Sgts. James Long and Joseph E. English, Capt. Howard Douglas, advance officer; Mitchel Field, N. Y., to Nome and return.

1920, Sept. 8—Transcontinental mail route, combination plane-train, New York-Chicago-San Francisco, completed.

1920, Nov. 1—U. S. international passenger service started by Aeromarine West Indies Airways between Key West, Fla., and Havana, Cuba.

1920, Nov. 25—1st Lt. C. C. Moseley (Verville-Packard 600) wins first Pulitzer race at 156.54 mph; 24 contestants finish, 13 others start but do not finish.

1920, Dec. 13-14—Navy balloon of Lts. L. A. Kleer, Walter Hinton and S. A. Farrell land beyond Moose Factory, Ont., after 25 hours, 852 miles from start at Rockaway, N. Y.

1921, Feb. 18—First U. S. airplane parachute escape by C. C. Eversole, airmail pilot.

1921, Feb 22-23—Night airmail flown by Jack Knight from North Platte, Neb., to Chicago, Ill.

1921, Feb. 24—Lt. W. D. Coney completes transcontinental flight, San Diego-Jacksonville, 2180 mi. in 22 hr. 27 min.; 57 hr. 24 min. elapsed time.

1921, Mar. 23—Lt. A. G. Hamilton drops 23,700 ft. by parachute, Chanute Field.

1921, June 21—Navy F5L planes sink German sub U-117 in demonstration.

1921, July 18-21—Sinking of captured German cruiser, *Frankfurt*, and battleship, *Ostfriesland*, by U. S. bombs proves vulnerability of naval craft to aerial attack.

1921, Aug. 10—Navy Bureau of Aeronautics formed with Rear Admiral W. A. Moffett as Chief.

1921, Sept. 28—New world altitude record of 34,508 ft. set by Lt. J. A. Macready.

1921, Nov. 5—Bert Acosta (Curtiss Navy-C12 Curtiss 400) wins Pulitzer race at 176.7 mph.

1921, Nov. 12—Refueling in air: Earl S. Daugherty transfers *Wesley May* with can of gasoline from wing of another plane.

1921, Nov. 15—Italian airship *Roma* makes initial ascent in U. S. at Langley Field.

1921, Dec. 1—Helium airship, Navy dirigible C-7, flown from Hampton Roads, Va. to Washington, D. C.

1921, Dec. 29—World endurance record of 26 hr. 18 min. 35 sec. made at Roosevelt Field by Edw. Stinson and Lloyd Bertaud (CJL6 BMW 185).

1922, Jan. 1—Underwriters Laboratories starts registration of aircraft for benefit of insurance companies.

1922, Jan. 1—Aeronautical Chamber of Commerce organized, New York, with I. M. Uppercu, president.

1922, Feb. 21—Airship *Roma* destroyed.

1922, Mar. 20—Airplane carrier *U.S.S. Langley*, commissioned at Norfolk, Va.

1922, June 16—Helicopter demonstrated by Henry Berliner, Washington, D. C.

1922, July 14—Aeromarine Airways starts Detroit-Cleveland flying boat service.

1922, Aug. 5-7—Lt. Clayton Bissell completes first model airway flight, Washington-Dayton-Washington.

1922, Aug. 16—Sperry airway light beacon demonstration, McCook Field.

1922, Sept. 4-5 — Transcontinental speed flight by Lt. James H. Doolittle, Pablo Beach, Fla.-San Francisco, Cal., in 22 hr. 35 min. elapsed time.

1922, Sept. 14-23—Transcontinental Army airship flight with Maj. H. A. Straus commanding crew of Capt. G. W. McEntire and others, from Langley Field, Va. to Arcadia, Cal.

1922, Oct. 5-6—World endurance record, 35 hr. 18 min. 30 sec., Rockwell Field, by Lts. J. A. Macready and O. G. Kelly (Fokker T2 Liberty 375).

1922, Oct. 14—Lt. R. L. Maughan wins Pulitzer race at 206 mph (Army Curtiss-D12 Curtiss 375).

1922, Oct. 18—World speed record of 222.97 mph set by Brig. Gen. William Mitchell in Curtiss racer.

1922, Oct. 23—American Propeller Co. demonstrates reversible propeller at Bolling Field.

1922, Dec. 18—Army's De Bothezat helicopter makes first successful flight, 1 min. 42 sec., Dayton, Ohio.

1923, Mar. 29—Lt. R. L. Maughan makes world speed record 236.58 mph (Curtiss R6-Curtiss 465), Dayton, Ohio.

1923, Apr. 16-17—World duration—distance records by Lts. J. A. Macready and O. G. Kelly (Fokker T2 Liberty 375), 36 hr. 4 min. 34 sec., 2516.55 miles.

1923, May 2-3—Cross-country non-stop flight by Lts. J. A. Macready and Oakley G. Kelly in Fokker T-2, from New York to San Diego, 2,520 miles in 26 hr. 50 min. 3 sec.

1923, Aug. 27-28—Lts. L. H. Smith and J. P. Richter (DH-4E Liberty 400) made world duration-distance refueled records: 3293.26 miles, 37 hr. 15 min. 14.8 sec.; Rockwell Field.

1923, Sept. 5—Smoke screen demonstrated by Thomas Buck Hine during naval bombing maneuvers, Cape Hatteras, N. C.

1923, Sept. 5—Langley Field bombers sink naval vessels *New Jersey* and *Virginia*.

1923, Oct. 6—Lt. A. S. Williams, U.S.N. wins Pulitzer race (Curtiss R2C1-D12 Curtiss 460) at 243.68 mph.

1923, Oct. 25-27—Barling bomber makes series weight-carrying records with greatest weight 8000 kg.; duration, altitude records, 1 hr. 19 min. 11.8 sec., 5,344 ft.

1923, Nov. 4—Lt. A. J. Williams, U.S.N. (Curtiss R2C1-D12A Curtiss 500) makes world speed record 266.59 mph.

1923, Dec. 18—For $100,000 the Christmas Aeroplane Co. assigns its aileron patent to U. S. Government.

1924, Jan. 16—Navy airship *Shenandoah* tears loose from mast in storm and rides it out during the night.

1924, Feb. 21—Alaskan airmail flown by Carl B. Eielson from Fairbanks to McGrath.

1924, Feb. 22—Lt. J. A. Macready (Lepere-supercharged Liberty 400) reaches 41,000 ft. indicated altitude.

1924, Apr. 6-Sept. 28—Round-the-world flight by Lts. Smith, Nelson, Arnold, and Harding, Seattle to Seattle, 26,445 miles, 175 days (368 hours flying time).

1924, June 2—Lt. James T. Neely and storm-riding meteorologist Dr. C. L. Meisinger, Weather Bureau, killed by lightning in balloon near Monticello, Ill.

1924, July 1—Through transcontinental airmail service begun by U. S. Post Office.

1924, Oct. 4—Lt. H. H. Mills wins Pulitzer trophy (Verville Sperry-Curtiss HC D12A) at 216.55 mph.

1924, Oct. 7-25—Navy airship *Shenandoah* makes record cross-country cruise over 7080 miles in 235 hr. 01 min. Air hours total of 422 hr. 23 min. includes time moored.

1924, Oct. 12-15—U. S. Navy's German airship *ZR3 (Los Angeles)* makes fourth aircraft Atlantic crossing, Friedrichshafen - Lakehurst, in delivery under reparations.

1924, Oct. 29—Fog dispersal by electrified silica and sand demonstrated at Bolling Field.

1925, Jan. 29—Eclipse pictures and astronomic data secured at high altitudes by Air Service pilots.

1925, Feb. 2—Kelly Bill signed by President Coolidge authorizing private contract air transport of mail.

1925, Apr. 7—Navy carrier *Saratoga* launched.

1925, May 21-July 6—Amundsen-Ellsworth polar flight.

1925, July 15—Dr. A. Hamilton Rice Expedition, first to employ planes in exploration, returns from Amazon; Lt. Walter Hinton, pilot, in Curtiss Seagull.

1925, Aug. 4-22—MacMillan polar expedition, with Navy assistance.

1925, Aug. 5—Seven American pilots leave Paris to fly for the French in the Riff campaign in Africa. Others follow to a total of 17 pilots, 5 observers.

1925, Aug. 31-Sept. 8—In Navy's attempted San Francisco-Honolulu flight, Commander John Rodgers and crew (PN9-2 Packard 500 flying boat) alight short of mark, making non-stop cross-country seaplane record of 1,841 miles.

1925, Sept. 3—Navy dirigible, *Shenandoah*, collapsed in storm over Ava, O., killing 14 of 43 on board.

1925, Sept. 12—Morrow Board appointed by President Coolidge. (Laid down U. S. air policy.)

1925, Oct. 12—Lt. Cyrus Bettis wins 6th Pulitzer race (Curtis R3C1-V1400 Curtiss 619) at 248.97 mph.

1925, Oct. 26—Lt. J. H. Doolittle wins 8th international Schneider Seaplane Trophy race in first contest in America (Curtiss R3C2—V1400 Curtiss 619) at 232.57 mph.

1925, Dec. 17—Gen. William Mitchell found guilty of violating 96th Article of War; had risked insubordination by demanding unrestricted use of air power. Sentenced five years suspension of rank, pay and command. Resigned.

1926, Jan. 18—A $2,500,000 air promotion fund established by Daniel Guggenheim.

1926, Jan. 29—Lt. J. A. Macready (XCO5A-Liberty 400) makes American altitude record: 38,704 ft.

1926, Feb. 11—Strip bombing tests made at Kelly Field.

1926, Apr. 16—First cotton dusting plane purchased by Department of Agriculture.

1926, Apr. 30—Capt. G. H. Wilkins and Lt. Carl B. Eielson complete third round trip Fairbanks-Pt. Barrow-Fairbanks.

1926, May 8-9—Flight over North Pole by

Curtiss Condor of 1930 was passenger version of famed bomber

Richard Byrd, navigator, and Floyd Bennett, pilot, in Fokker monoplane.

1925, May 21-July 6—Amundsen-Ellsworth bile airship *Norge* crosses Pole in voyage Spitsbergen-Teller, Alaska in 71 hours.

1926, May 20—Air Commerce Act (Bingham-Parker Bill) signed by President Coolidge; Aeronautics Branch, Department of Commerce, established.

1926, May 30—Bennett international balloon race, Brussels, brought to America by the win of W. T. Van Orman and W. W. Morton in Goodyear III balloon. Capt. H. C. Gray, Air Service, second.

1926, July 2—Army Air Service renamed Army Air Corps.

1926, July 2—First reforesting by airplane, Hawaii.

1926, July 14—Armstrong seadrome model demonstrated at Wilmington, Del. to Air Service.

1926, Aug. 18—Metal-clad airship contract let at not over $300,000.

1926, Aug. 25—JN training plane dropped by parachute, San Diego Naval Air Station.

1926, Dec. 7—Airway beacon erected by Aeronautics Branch, Department of Commerce, on Chicago-Dallas route.

1926, Dec. 21-May 2 ('27)—Mass amphibian good will flight from San Antonio, Tex. through Mexico, Central and South America and West Indies, under Maj. H. A. Dargue.

1927, Mar. 9—American balloon altitude record of 28,508 ft. made by Capt. H. C. Gray.

1927, Apr. 12—New American duration record of Clarence D. Chamberlin and B. B. Acosta (Bellanca-15 Wright 200) 51 hr. 11 min. 25 sec.

1927, May 4—Record balloon altitude attempt by Capt. H. C. Gray, 42,470 ft.

1927, May 15-19 — Greatest concentration since World War I (109 planes) in maneuvers under Brig. Gen. J. E. Fechet.

1927, May 20-21—Non-stop trans-Atlantic solo flight by Charles A. Lindbergh, New York-Paris, 3,610 miles, 33 hr. 30 min. (13th aircraft to make completed crossing.)

1927, May 25—Outside loop demonstrated by Lt. James H. Doolittle.

1927, June 4—First nonstop flight to Germany, Clarence D. Chamberlin and passenger (Bellanca-15 Wright 200), 3,911 miles, 43 hr. 49 min. 33 sec.

1927, July 25—World airplane altitude record by Lt. C. C. Champion, U. S. N. (Wright-P & W 425 supercharged) 38,484 ft.

1927, Aug. 16-17—A. C. Goebel and Lt. W. V. Davis, U. S. N. (Travelair-15 Wright 200) win Dole Oakland-Honolulu race One team finishes. Two teams lost.

1927, Sept. 1—Air express operations began by American Railway Express and major airlines.

1927, Sept. 10—Bennett international balloon race, Dearborn, Mich., won by E. J. Hillard and A. G. Schlosser with 745 miles; 15 contestants.

1927, Oct. 12—Wright Field dedicated.

1928, Feb. 3-Dec. 28—Lt. H. A. Sutton conducts a series of spin tests; awarded Mackay Trophy.

1928, Mar. 1-9—Transcontinental amphibian flight by Army Lt. Burnie R. Dallas and civilian Beckwith Havens in Loening.

1928, Mar. 28-30—Edw. A. Stinson and George Holderman (Stinson-Wright 200) make endurance record of 53 hr. 36 min. 30 sec.

1928, Apr. 12-13—First non-stop westbound North Atlantic airplane crossing made by Baron G. von Huenefeld, Capt. Hermann Koehl and Maj. James Fitzmaurice (Junker-Junker 280/310 metal cabin land monoplane) from Baldonnel, Ireland to Greenly Island, N.F., 2,070 miles in 37 hours.

1928, Apr. 15-21 — First eastbound Arctic crossing made by Capt. G. H. Wilkins and Lt. C. B. Eielson (Lockheed-Wright 225) Pt. Barrow-Green Harbor, Spitzbergen, 2,200 miles, 20 hr. 20 min.

1928, May 24—Gen. Umberto's airship is over the Pole in trip from Spitzbergen. It is wrecked May 25, with loss of lives of crew and rescuers.

1928, May 31-June 8—First U. S.-Australian flight by Capt. C. Kingsford-Smith, Capt. C. T. P. Ulm, H. W. Lyon and James Warner (F7 Fokker-3 Wright 200) Oakland-Brisbane, 7,410 miles; 83 hr. 19 min.

1928, June 11-12—Mexico-Washington flight by Capt. Emilio Carranza (Bryan-Wright 200).

1928, June 17-18—First woman to fly Atlantic, Amelia Earhart with Wilmer Stultz, pilot, from Trepassey Bay, N.F., to Burryport, England, in trimotored Fokker, 2,140 miles, 20 hr., 40 min.

1928, July 30-31—Twenty-second Bennett international balloon race, Detroit, won by Capt. W. E. Kepner and Lt. W. O. Fareckson; 460 miles, 43 hr.

1928, Sept. 19—First Diesel engine to power heavier-than-air craft; designed by L. M. Woolson, manufactured by Packard Motor Car Co.; flight-tested at Utica, Mich.

1928, Oct. 19—Parachute troop demonstration at Brooks Field.

1928, Nov. 11—First Antarctic flight made by Lt. C. B. Eielson and Sir Hubert Wilkins (Lockheed-Wright 22). Other flights subsequently.

1928, Nov. 23-Dec. 30—New York-Girardot, Colombia, flight by Capt. Benjamin Mendez, 4,600 miles.

1928, Dec. 19—Autogiro flight by Harold F. Pitcairn, Pitcairn Field, Willow Grove, Pa.

1929, Jan. 1-7—Refueling endurance record set by Maj. Carl Spaatz and Capt. Ira C. Eaker, Lt. Elwood R. Quesada, Lt. Harry A. Halverson, S/Sgt. Roy W. Hooe in 150 hr., 40 min., 51 sec.

1929, Apr. 3—Floyd Smith trap-door parachute demonstrated.

1929, Apr. 30—Jack Barstow makes duration glider record of 15 hr. 13 min. at Point Loma, Cali.

1929, June 28-29—Round transcontinental flight by Capt. Frank M. Hawks (Lockheed-P & W) in 40 hr. 4 min. 32 sec. Capt. E. G. Harper repeats the performance July 11-26.

1929, July 13-30—World endurance record of 420 hr. 17 min. by Forrest O'Brien and Dale Jackson (Curtiss Robin-Curtiss 70).

1929, July 18-20 — N. Y.-Alaska flight by Capt. Russ G. Hoyt. Return flight ends at Edmonton, after covering 6,000 miles out of 8,469 itinerary.

1929, Aug. 5-6—Group transcontinental flight of 9 Keystone bombers under Major Hugh J. Knerr.

1929, Sept. 24—Demonstration by Lt. James H. Doolittle results in Guggenheim report blind flying solution.

1929, Oct. 21—Air Ambulance Service organized by Colonial Flying Service and Scully Walton Ambulance Co., New York.

1929 — Bennett international balloon race won by W. T. Van Orman and aide, 341 miles, 9 contestants.

1930, Mar. 15—Glider, piloted by Capt. Frank Hawks, released from seaplane, Port Washington, N. Y.

1930, Apr. 6—Transcontinental glider in tow, piloted by Capt. Frank Hawks; San Diego to New York; 2,860 miles in 36 hr., 47 min.

1930, May 20—Dirigible-launched Vought observation plane, flown by Lt. Comdr. Charles A. Nicholson from *U.S.S. Los Angeles* to *U.S.S. Saratoga*, Lakehurst, N. J.

1930, June 4—New world altitude record of 38,560 ft. set by Navy Lt. Apollo Soucek, Anacostia, Md.

1930, June 11-July 4—World endurance record of 553 hr. 41 min. 30 sec. established by John and Kenneth Hunter (Stinson-Wright 200).

1930, July 21-Aug. 17—Refueling endurance record raised to 647 hr., 28 min. by Forrest O'Brien and Dale Jackson in a Curtiss Robin, St. Louis, Mo.

1930, July 22—German air mail plane catapulted 250 miles out en route to New York; 198 such ship-shore flights 1929-1938.

1930, Sept. 1 — Bennett international balloon race again won for U. S. by W. T. Van Orman and aide, 542 miles.

1931, Feb. 14-19—Lts. W. W. Lite, Clement McMullen fly New York-Buenos Aires, 6,870 miles, 5 days, 5 hours elapsed time; 52:15:00 flying.

1931, Mar. 30—Airplane-airship mail transfer at Scott Field.

1931, Apr. 10—Airship sub-cloud observation car demonstration by Lt. W. J. Paul.

1931, May 25-28—World endurance record, non-refueled, set by Walter E. Lees and F. A. Brossi, Bellanca, Packard Diesel 225 hp; 85 hr., 32 min., 38 sec., Jacksonville, Fla.

1931, May 14-28—Transcontinental autogiro flight by John M. Miller, from Philadelphia to San Diego.

1931, June 4—Rocket glider flown by William G. Swan; remained aloft for 30 min. with 10 rockets, Atlantic City, N. J.

1931, June 23-July 1—World flight by Wiley Post and Harold Gatty (Lockheed-PW 550), New York-Harbor Grace-Berlin-Moscow-Irkutsk-Khabarovsk-Solomon Beach-Fairbanks-Edmonton-Cleveland-New York, in 14 hours. 8 days 16 hours, 16,500 miles.

1931, July 25-26—Glider duration record of 16 hr. 38 min. by 2nd Lt. John C. Crain, Honolulu.

1931, Oct. 3-5—Trans-Pacific non-stop airplane flight by Clyde Pangborn and Hugh Herndon, Samushiro Beach, Japan, to Wenatchee, Wash.

1931, Oct 3-5—Herndon and Pangborn (Bellanca-PW 420) left New York July 28 on world trip and had reached Japan Aug. 6, abandoning attempt to better Post-Gatty record.

1931, Oct. 6-9—Navy bomber tests on *U.S.S. Pittsburgh* in Chesapeake Bay.

1931, Nov. 3—Dirigible, *Akron*, carried record number of 207 persons in flight over New York and Philadelphia.

1931, Dec. 17-18—Glider duration record of 21 hr. 34 min. by Lt. Wm. A. Cocke, Honolulu.

1932, May 9—First solo blind flight, by Capt. Albert F. Hegenberger, Wright Field, Dayton, O.

1932, May 20-21—Amelia Earhart soloes across Atlantic, St. Johns, New Brunswick to Londonderry, Ireland, in Wasp-powered Lockheed Vega.

1932, Aug. 25—First woman to complete non-stop transcontinental flight, Amelia Earhart, Los Angeles to Newark.

1932, Dec. 1—Teletypewriter weather map service inaugurated by Department of Commerce.

1933, Jan. 19 — Rocket guided by sound waves from enemy aircraft proposed.

1933, Jan. 23 — Steam airplane project launched by Great Lakes Aircraft and General Electric Co. Later Besley brothers fly their steam airplane.

1933, Apr. 4—Navy dirigible, *Akron*, crashes into sea, killing 73; Comdr. Herbert V. Wiley, commanding.

1933, May 3-26 — Airborne troop logistics part of West Coast maneuvers, with 283 aircraft.

1933, July 15-22—Solo round-the-world flight by Wiley Post in Lockheed Vega monoplane, *Winnie Mae*, in 7 days, 18 hr., 49 min.

1933, Sept. 4—World speed record for land planes set at 304.98 mph by James R. Wedell in Wasp-powered Wedell-Williams racer.

1933, Nov. 20-21—World balloon altitude record set at 61,237 ft. by Lt. Comdr. T. G. W. Settle and Maj. C. L. Fordney over Akron, O.

1934, Jan. 10-11—Longest non-stop overwater mass flight completed by six P2Y-1 Navy flying boats under command of Lt. Comdr. Knefler McGinnis, San Francisco to Honolulu.

1934, Feb. 9 — Postmaster General Farley cancels certain mail contracts. Air Corps flies the mail Feb. 19-Mar 10; Mar. 19-May 5.

1934, June 12—Howell commission to study airmail act and report on all phases of aviation by Feb. 1, 1935.

1934, Dec. 31—War Department announces instruction governing GHQ Air Force organization and operation.

1935, Jan. 3—Antarctic flight by Ellsworth and Kenyon (Northrop-PW 600).

1935, Feb. 12—Navy dirigible, *Macon*, crashes into sea, killing 2.

1935, June 12-Aug. 14—Washington-Alaska-Washington flight (Douglas Amphibian-2 Wasps) in test of practicability of such flight with standard equipment and as any ordinary flight. Capt. Hez McClellan and crew of two.

1935, Aug. 15—Will Rogers and Wiley Post killed in take-off crash near Point Barrow, Alaska.

1935, Nov. 11—Balloon altitude record of 72,394 ft. by Capt. O. A. Anderson and Capt. Albert Stevens.

1935, Nov. 21-Dec. 5—Antarctic flights renewed by Ellsworth and Kenyon (Northrop-PW 600).

1935, Nov. 22-29—Trans-Pacific airmail flight by Capt. Edwin C. Musick, Pan American Airways, from San Francisco to Honolulu, Midway Island, Wake Island, Guam and Manila, in Martin *China Clipper*.

1936, June 7—All-instrument transcontinental flight by Maj. Ira C. Eaker, between New York and Los Angeles.

1936, Sept. 10-Oct. 20—Regular trans-Atlantic flying boat service by Deutsche Lufthansa. (Dornier twin Diesel engine 600.) Continued in 1937 and 1938.

1936, Sept. — Trans-Atlantic round-trip flight by Henry (Dick) Merrill and Harry Richman, New York to London and return.

1937, May 6—German dirigible, *Hindenburg*, burned on mooring, killing 36, Lakehurst, N. J.

1937, May 20-July 3—Amelia Earhart Putnam and Fred Noonan lost in Pacific in round-the-world attempt.

1937, June 25—Non-stop transcontinental amphibian flight by Richard Archbold in PBY-1, Catalina, from San Diego to New York.

1937, July 3-Sept. 3—Regular trans-Atlantic service test by Pan American Airways. Imperial Airways also similarly operate July 5-Aug. 2 and continue in 1938.

1937, Aug. 12—In joint coast defense exercise, Navy patrol planes locate target ship *Utah* 300 miles off San Francisco; Air Corps planes attack.

1937, Aug. 23—Wholly automatic landings made, "first in history," at Wright Field by Capt. Carl J. Crane with 2 passengers; awarded DFC.

1938, Feb. 15-27—Miami-Buenos Aires-Miami flight of 6 bombers under Lt. Col. Robert Olds, for inauguration President Ortiz.

1938, Feb. 26—Government acquires monopoly on helium by purchasing production facilities at Dexter, Kan.

1938, Apr. 22—Capt. E. V. Rickenbacker purchases Eastern Air Lines from North American Aviation, Inc., for $3,500,000.

1938, June 23—Civil Aeronautics Authority with five members, an administrator, and a three-man Safety Board, created under Civil Aeronautics Act signed by President. This supersedes Aeronautics Branch, Department of Commerce.

1938, July 10-14—Howard Hughes and crew of four fly short northern course around world in 3 days, 19 hr., 8 min.

1938, July 17-18—Douglas (Wrong-Way) Corrigan flies from New York to Ireland in nine-year-old Curtiss Robin.

1938, Aug. 3-12—Miami-Bogota-Miami goodwill flight of 3 bombers under Major Vincent J. Meloy.

1938, Aug. 10-11 — First Berlin-New York nonstop flight by Capt. Alfred Henke and crew (Focke-Wulf Condor 200), 4,577 miles, 24 hr. 54 min.

1938, Aug. 22—Civil Aeronautics Act becomes effective.

1939, Feb. 4-6—Langley Field-Santiago Red Cross flight by Major C. V. Haynes in XB bomber with medicinal supplies.

1939, Mar. 5—Non-stop airmail system by pick-up demonstrated by Norman Rintoul and Victor Yesulantes in Stinson Reliant planes, Coatesville, Pa.

1939, Apr. 3—The National Defense Act, providing for aerial rearmament, signed by President Roosevelt.

1939, Apr. 17—Inclined runways for assisted takeoff studied by Air Corps Board.

1939, May 20—North Atlantic airmail service begun by PAA between Port Washington, L. I., the Azores, Portugal and Marseille, France.

1939, June 27—Bill authorizing Civilian Pilot Training Program signed by President.

1939, Sept. 1-3—Germany invades Poland. England and France declare war on Germany.

1940, Mar. 26—U. S. commercial airlines complete a full year of flying without a fatal accident or serious injury to a passenger or crew member.

1940, July 1—Air Safety Board abolished with its functions delegated to the Civil Aeronautics Board. Civil Aeronautics Administration transferred to Department of Commerce.

1940, Sept. 23—House committee asks $80 million for airport development, in $500 million program; $40 million voted.

1941, Mar. 17—Milwaukee renames its airport as General Mitchell Field.

1941, Apr. 15—First officially-recorded rotor helicopter flight in western hemisphere, Vought-Sikorsky VS-300A, piloted by Igor I. Sikorsky; flight time, 1 hr., 5 min., 14.5 sec., Stratford, Conn.

1941, May—Barrage balloon defense transferred from Air Corps to Coast Artillery.

1941, June 5—Ferry Command, for delivery of planes to Britain, organized by Army Air Corps.

1941, June 20—Army Air Force, comprising office of Chief of Air Corps and Air Force Combat Command, created.

1941, June—First woman to ferry bomber across Atlantic, Jacqueline Cochran, Canada to British Isles.

1941, Sept. 5—Mass trans-Pacific flight of heavy bombers completed by nine Army B-17 Flying Fortresses.

1941, Dec. 7—Pearl Harbor.

1942, Apr. 8—First flight of Ferry Command over Himalayan "Hump" made by Lt. Col. William D. Old, between Assam, India and Kunming, China.

1942, Apr. 18—First bombing attack on Japanese mainland by 16 B-25 Mitchell bombers from Navy carrier, *Hornet*; Lt. Col. James H. Doolittle commanding.

1942, May 4-9—Battle of Coral Sea.

1942, June 20—Ferry Command redesignated Air Transport Command under Maj. Gen. Harold L. George.

1942, June 3-7—Battle of Midway.

1942, June 17—AAF tow planes successfully pick up gliders in tests at Wright Field.

1942, Aug. 17—First official bombing raid of Eighth Air Force, 12 Flying Fortresses, Brig. Gen. Ira C. Eaker commanding, Rouen, France.

1942, Sept.—Fifty American Eagle squadron pilots, RAF, all Americans, transferred to Eighth Air Force. (Fourth Fighter Group.)

1942, Oct. 1—Jet plane built and flown by Robert M. Stanley; Bell Airacomet (XP-59A), Muroc Dry Lake, Cal.

1943, Mar. 1-3—Battle of Bismarck Sea.

1943, Mar. 19—Lt. Gen. Henry H. Arnold, commanding general of the AAF, advanced to full four-star general, the first in air history.

1943, June 24—World's longest parachute drop, 40,200 ft., made by Lt. Col. W. R. Lovelace at Ephrata, Wash.

1943, June 11—First ground victory by air power when Pantelleria, Italy, surrenders unconditionally to Lt. Gen. Carl Spaatz. First case in history of a well-fortified citadel being defeated without aid of ground forces.

1943, Oct.—World's longest freight line opened by Capt. J. L. Okenfus and crew of five in 28,000-mile round-trip flight, Ohio to India.

1944, June—Army Air Force reaches peak with 78,757 aircraft.

1945, May 8—War in Europe ends.

1945, Aug. 6—Atomic bomb dropped on Hiroshima from B-29, *Enola Gay*, under command of Col. Paul W. Tibbets, Jr.

1945, Aug. 14—Japan's surrender ends World War II.

1945, Sept. 28-Oct. 4—Round-the-world air service begun by Air Transport Command, Douglas C-54E, Globester, 9 passengers, 23,147 miles in 149 hr., 49 min.

1946, Jan. 26—Jet-propelled P-80, flown by Col. William H. Councill, sets non-stop transcontinental record of 4 hr., 13 min., 26 sec., between Long Beach, Cal., and New York.

1946, Mar. 12—First commercial helicopter license granted by Civil Aeronautics Administration for Bell 2-place Model 47.

1946, Mar. 22—First American-built rocket to escape earth's atmosphere, reaches 50-mile height. Constructed by Douglas.

1946, July 21—The McDonnell XFH-1 Phantom is first U.S. jet to operate from carrier, *U.S.S. Franklin D. Roosevelt*.

1946, Aug. 6—Two B-17 radio-controlled bombers with stand-by crews, fly non-stop, Hilo, Hawaii, to Muroc Lake, Cal.

1947, Feb. 28—Lt. Col. Robt. E. Thacker and Lt. John M. Ard, in a North American F-82 (Rolls Royce V-1650) fly longest known flight by fighter aircraft, Honolulu to N. Y., 4,968 miles in 14 hr. 31 min. 50 sec.

1947, July 18—Air Policy Commission established by President.

1947, July 26—Army-Navy Merger Bill signed by President, making Department of Air Forces co-equal with Army and Navy, and creating Department of Defense.

1947, Oct. 17—First faster-than-sound flight by Capt. Charles E. Yeager in rocket-powered Air Force research plane, Bell XS-1, betters 760 mph. (Not announced officially until June 10, 1948.)

1948, June 18—Air parcel post system established by Congress; to begin Sept. 1.

1948, June 26—Berlin Airlift begins "Operation Vittles" with Douglas C-47's carrying 80 tons of supplies the first day. During first five months, Airlift tops cargo volume of all U.S. airlines by flying 93,000,000 ton-miles.

1948, July 1—Air Transport Command and Naval Air Transport Service consolidated as Military Air Transport Service (MATS) under command of Air Force Chief of Staff.

1948, Sept. 15—U. S. Air Force recaptures world speed record with North American F-86 jet fighter traveling 670.981 mph, flown by Maj. Richard L. Johnson.

1948—Northrop's YB-49 Flying Wing, first eight-jet bomber in the U.S. Air Force, makes longest jet-propelled flight on record of approximately 3,400 miles at average speed of 382 mph.

1949, Jan. 7—Air Force announces a new unofficial climbing speed record set by the Bell X-1 at Muroc Air Force Base with Capt. Charles E. Yeager at the controls, climbing more than 13,000 ft. per min., compared with 8-10,000 ft. per min. for jet planes.

1949, Jan. 14—Capt. William Odom, flying a specially modified Beechcraft Bonanza, sets a new lightplane distance record, crossing from Honolulu to Oakland, Cal.

1949, Feb. 7—Eastern Air Lines reports new transcontinental speed record for transport aircraft set Feb. 5 by new-type Lockheed Constellation on delivery flight from Los Angeles to La Guardia Field in 6 hr. 17 min. 39-2/5 sec.

1949, Feb. 8—Boeing XB-47 jet bomber sets cross-country speed record to Andrews Field, Washington, D. C. from Moses Lake, Wash. in 3 hr. 46 min.

1949, Mar. 2—Air Force completes the first nonstop round-the-world flight in history, as a Boeing B-50 bomber, *Lucky Lady II*, lands at Carswell AFB, Ft. Worth, Tex. at 9:30 CST, after a 94-hour trip; piloted by Capt. James Gallagher, assisted by a crew of 13, the B-50 flew a total of 23,452 miles at an average speed of 249 mph. Four refueling contacts were made with B-29 tankers.

1949, Mar. 8—New world distance record for light planes set by Capt. William Odom in a Beechcraft *Bonanza*, flying 5,273 miles from Honolulu to Teterboro, N. J., in 36 hr. 2 min.

1949, May 3—The Martin *Viking*, 45-ft. research rocket, is fired successfully at White Sands Proving Ground, Las Cruces, N. M., reaching an altitude of 51½ miles and a speed of 2,250 mph.

1949, May 6—Sikorsky S-52-1 helicopter sets new international speed record of 122.75 mph.

1949, Oct. 3—Navy jet-rocket special research plane, the Douglas D-558-II Skyrocket, reaches a top speed of slightly over 700 mph at an altitude of 25,000 ft. in test flight at Muroc, Cal.

1950, Jan. 3—Jacqueline Cochran sets new official F.A.I. 500 kilometer closed course record flying a North American F-51 (Packard-built Merlin V1650) at 444 mph.

1950, Jan. 22—Paul Mantz sets new transcontinental record flying a North American P-51 Mustang (Allison) from Burbank, Calif. to La Guardia Field, N. Y. in 4 hr. 52 min. 58 sec.

1950, Feb. 9—Navy Lockheed P2V Neptune (Wright 3350) patrol bomber completes 5,156-mile flight in 25 hr. 57 min.

1950, Mar. 31—Ana Louisa Branger, flying a Piper Cub Special powered by a Continental C-90-8F engine, sets official new lightplane international altitude record of 24,504 feet.

1950, Sept. 5—North American Aviation announces successful completion of tests at Edwards AFB in which heavy bombs were dropped for first time at speeds over 500 mph with a B-45 Tornado (GE-J47).

1950, Sept. 22—Col. David C. Schilling and Lt. Col. William D. Ritchie fly London-New York nonstop with three in-flight refuellings in two Republic F-84E (Allison J-35A-17) jet fighters. (Schilling completed flight; Ritchie bailed out over Newfoundland and was later rescued by helicopter.)

1950, Nov. 10 — A Lockheed F-80 shoots down a Russian-built MIG-15 in first jet aerial combat, Korea.

1951, Jan. 17—Convair RB-36D reconnaissance bomber makes 51 hr. 20 min. non-stop flight without refueling.

1951, Feb. 2—First successful air-to-air refueling of a U.S. jet bomber is carried out by a North American RB-45C Tornado and a Boeing KB-29P tanker at Edwards AFB, Calif.

1951, Apr. 24—Piper Super Cub, piloted by Mrs. Ana Louisa Branger, sets an international altitude record of 26,820 feet in the minus 1,103-pound category.

1951, May 15—Max Conrad sets non-stop lightplane record in Piper Pacer (125 hp Lycoming), crossing the country in 23 hr. 4 min. 31 sec.

1951, Aug. 8—Navy's Martin Viking VII sets new altitude record for single stage missiles, flying 135 miles up from White Sands Proving Ground, N. M., reaching a top speed of 4,100 mph.

1951, Aug. 18—North American F-86A Sabre jet, piloted by Col. Keith K. Compton, flies from Edwards AFB, Calif., to Detroit, Mich., in 3 hr. 27 min. 56 sec. at an average speed of 553.761 mph.

1952, Jan. 2—A Sikorsky H-19 helicopter completes 1,800-mile flight from Great Falls, Mont., to Ladd AFB, Fairbanks, Alaska, in five days—probably the longest flight ever made by rotary wing craft.

1952, Mar. 18—Two Republic F-84 Thunderjets land in Neubiberg, Germany, after a 2,800 mile flight without refueling—believed to be the longest sustained jet fighter flight in history. The jets crossed seven countries, averaged 585 mph, and were in the air 4 hr. 48 min.

1952, Apr. 30—For the first time in aviation history, air passenger-miles (10,679,281,000) in 1951 exceeded the total passenger-miles traveled in Pullman cars (10,224,714,000).

1952, May 10—Transcontinental lightplane record is set by Max Conrad in a Piper Pacer, traveling from Los Angeles to New York (2,461 mi.) non-stop in 24 hr. 54 min.

1952, Aug. 1—Two Sikorsky H-19 helicopters complete first trans-Atlantic helicopter crossing and break non-stop distance record for rotary wing aircraft.

1952, Nov. 19—New record set by North American F-86D (GE J-47 GE-17) Sabre jet, piloted by Capt. J. Slade Nash, flying at 699.92 mph. (Previous world speed record—670.981 mph.)

1953, Jan. 26—Chance Vought Aircraft completes final F4U Corsair, bringing to an end the longest production record of any airplane ever built.

1953, May 18—Jacqueline Cochran Odlum flies at record speed of 652.337 mph over a 100 km. course, in a Canadair F-86 swept-wing Sabre.

1953, Oct. 3—LCdr. James B. Verdin establishes new world speed record of 753.4 mph in Douglas XF4D-1 Skyray, Navy carrier fighter.

1953, Oct. 20—TWA Lockheed Super Constellation completes first scheduled nonstop transcontinental passenger trip from Los Angeles to New York in 8 hr. 17 min.

1953, Oct. 29—North American YF-100 Super Sabre establishes new world's speed record of 754.98 mph, piloted by Lt. Col. F. K. Everest.

1953, Dec. 12—Maj. Charles E. Yeager, USAF pilot, establishes new world speed record of more than 1600 mph in the Bell X-1A.

OFFICIAL RECORDS

The Federation Aeronautique Internationale, Paris, France, better known as the FAI, currently composed of the national aero clubs of forty-nine nations, is the governing body of the world for official aircraft records and sporting aviation contests. The FAI was organized in Paris in October, 1905, by representatives from Belgium, France, Germany, Great Britain, Italy, Spain, Switzerland, and the United States. Representing the FAI in the United States is the National Aeronautic Association, organized in 1922.

The rules for all official world and international aircraft records are proposed initially by the various national aero clubs who are members of FAI. Later they are evaluated by the International Sporting Aviation Commission of FAI and then submitted, for final approval, to the delegates of the many national aero clubs who attend each annual FAI conference. Developed over a period of forty-four years, the rules are markedly complete. All attempts to establish official aircraft records must meet identical FAI standards.

NAA also rules on the best national performances and on many records of strictly national interest, such as inter-city speed times of transport aircraft.

FAI-NAA rules have these goals: (1) an equal opportunity to every competitor, (2) competent, unbiased judging, and (3) scientifically accurate records.

The NAA Contest Board enforces FAI-NAA regulations in the United States.

OFFICIAL F.A.I. WORLD AIR RECORDS

Note: International Records are now designated World Class Records by F.A.I.

MAXIMUM SPEED OVER A STRAIGHTAWAY COURSE .... 754.98 mph.
Lt. Col. F. K. Everest, USAF, Oct. 29, 1953. (Subject to FAI confirmation as we went to press.)

MAXIMUM SPEED IN A CLOSED CIRCUIT .... 728.11 mph.
Robert O. Rahn, Oct. 16, 1953. (Subject to FAI confirmation as we went to press.)

DISTANCE IN A STRAIGHT LINE .... 11,235.600 mi.
Comdr. Thomas D. Davies, USN.; Comdr. Eugene P. Rankin, USN.; Comdr. Walter S. Reid, USN.; Lt. Comdr. Ray A. Tabeling, USN.; United States, Sept. 29 - Oct. 1, 1946.

DISTANCE IN CLOSED CIRCUIT .... 8,854.308 mi.
Lt. Col O. F. Lassiter, pilot; Capt. W. J. Valentine, co-pilot and USAF crew, Tampa Fla., Aug. 1-3, 1947.

ALTITUDE .... 72,395 ft.
Capt. Orvil Anderson and Capt. Albert Stevens, United States, Nov. 11, 1935.

◀ *Flight line work being done on B-52 tail. Tip is 48 feet above ground.*

More eight-jet giants are on the way

The Boeing B-52 Stratofortress is a global jet bomber of remarkable, but as yet undisclosed, speed, capacity and performance.

More of these eight-jet giants of defense are on the way. Production models are now taking shape in Boeing's huge Seattle plant, where wings are being joined to fuselages. In addition, the airplane has been ordered into production at Boeing's Wichita Division to provide a second source of B-52s. This action on the part of the Air Force is a result of the highly successful flight test program of the Stratofortress. It has proved that the aircraft is "ready for expanded production."

Boeing has invested much time and engineering skill in tooling up and getting the B-52 Stratofortress into production—for every hour spent in careful preparation saves hundreds of man hours, and substantial sums of money, in turning out finished airplanes. Boeing's unequaled experience with large multi-jet aircraft is an important factor in its ability to produce the new plane.

The global B-52 bombers are guardians of world peace. The very fact of their existence is a powerful deterrent to attack.

Boeing integrity in research, design and engineering created the Stratofortress. You can count on Boeing to produce these great bombers economically and efficiently.

Boeing is now building a prototype jet transport, designed to be adaptable for either military or commercial use. It will fly in 1954.

BOEING

OFFICIAL F.A.I. INTERNATIONAL AND NATIONAL "CLASS" RECORDS

AIRPLANES—(Class C) Group II

RECIPROCATING ENGINES

DISTANCE, CLOSED CIRCUIT

World Class Record — 8,854.308 mi.
Lt. Col. O. F. Lassiter, pilot; Capt. W. J. Valentine, co-pilot; Capt. William D. Bailey, Capt. F. O. Hinckley, 1st Lt. A. J. Orillon, 1st Lt. R. L. Lewis, M/Sgt. J. J. Blancio, T/Sgt. J. R. Sanders, S/Sgt. J. Gauthier, and M/Sgt. R. B. Corey, crew: USAAF, United States, Boeing B-29 monoplane, 44-84061, 4 Wright 3350-57A engines of 2,200 hp each, MacDill Field, Tampa, Fla., Aug. 1 - 3, 1947.

National (U.S.) Record — Same as above.

DISTANCE IN A STRAIGHT LINE

World Class Record — 11,235.600 mi.
Comdr. Thomas D. Davies, USN.; Comdr. Eugene P. Rankin, USN.; Comdr. Walter S. Reid, USN.; and Lt. Comdr. Ray A. Tabeling, USN; United States, Lockheed P2V-1 monoplane, 2 Wright R-3500 engines of 2,300 hp each, from Pearce Field, Perth, Australia, to Port Columbus, Columbus, O., Sept. 29 - Oct. 1, 1946.

National (U.S.) Record — Same as above.

ALTITUDE

World Class Record — 56,046 ft.
Mario Pezi, Italy, Caproni 161 biplane, Piaggio XI R.C. engine, Montecelio, Oct. 22, 1938.

National (U.S.) Record — 47,910 ft.
Maj. F. F. Ross, pilot; Lt. D. M. Davis, co-pilot; Lt. C. B. Webster, Lt. L. B. Barrier, F/O Pamphille Morrissette, Sgt. W. S. George, crew; USAAF, Boeing B-29 monoplane, 4 Wright R-3350-23 A 2,000 hp engines, Harmon Field, Guam, M. I., May 15, 1946.

MAXIMUM SPEED OVER A 1.86 MI. MEASURED COURSE

World Class Record — 469.220 mph.
Fritz Wendel, Germany, Messerschmitt B. F. 109R, Daimler Benz 601 1,000 hp engine, Augsburg, Apr. 26, 1939.

National (U.S.) Record — 412.002 mph.
Jacqueline Cochran, North American F-51 monoplane, Packard built Rolls Royce Merlin 1,450 hp engine, Thermal, Cal., Dec. 17, 1947.

MAXIMUM SPEED AT HIGH ALTITUDE

World Class Record — 464.374 mph.
Jacqueline Cochran, United States, North American F-51 low wing monoplane, Packard built Rolls Royce Merlin 1,450 hp engine, near Indio, Cal., Apr. 9, 1951.

National (U.S.) Record — Same as above.

SPEED FOR 62.137 MI. WITHOUT PAYLOAD

World Class Record — 469.549 mph.
Jacqueline Cochran, United States, North American F-51, Rolls Royce Merlin 1,450 hp engine. Coachella Valley, Calif., Dec. 10, 1947.

National (U.S.) Record — Same as above.

SPEED FOR 310.685 MI. WITHOUT PAYLOAD

World Class Record — 436.995 mph.
Jacqueline Cochran, United States, North American F-51, Packard Rolls Royce Merlin 1,450 hp engine, Desert Center—Mt. Wilson Course, Dec. 29, 1949.

National (U.S.) Record — Same as above

SPEED FOR 621.369 MI. WITHOUT PAYLOAD

World Class Record — 431.094 mph
Jacqueline Cochran, United States, North American F-51, Packard Rolls Royce Merlin 1,450 hp engine. Start and finish near Palm Springs, Cal., May 24, 1948.

National (U.S.) Record — Same as above.


American Aviation
Official
Airline
Guide

SPEED FOR 1,242.739 MI. WITHOUT PAYLOAD

World Class Record — 447.470 mph
Jacqueline Cochran, United States, North American P-51 monoplane, Packard built Rolls Royce Merlin Engine of 1,450 hp near Palm Springs, Cal., May 22, 1948.
National (U.S.) Record — Same as above

SPEED FOR 3,106.849 MI. WITHOUT PAYLOAD

World Class Record — 338.392 mph
Capt. J. E. Bauer, pilot; Capt. J. E. Cotton, co-pilot; M/Sgt. Angelo Queses, T/Sgt. Richard McDonald and Cpl. Raymon Koss, crew; USAAF, United States, Boeing B-29 monoplane, 4 Wright R-3350-23A engines of 2,200 hp each, Dayton, O., June 28, 1946.
National (U.S.) Record — Same as above

SPEED FOR 6,213.698 MI. WITHOUT PAYLOAD

World Class Record — 273.195 mph
Lt. Col. O. F. Lassiter, pilot; Capt. W. J. Valentine, co-pilot; Capt. William D. Bailey; Capt. F. O. Hinckley, 1st Lt. A. J. Orillon, 1st Lt. R. L. Lewis, M/Sgt. J. J. Blancio, T/Sgt. J. R. Sanders, S/Sgt. J. Gauthier, S/Sgt. R. B. Corey, crew; USAAF, United States, Boeing B-29 monoplane, 4 Wright R-3350-57A engines, 2,200 hp each, Wright Field, Dayton, O., July 29 - 30, 1947.
National (U.S.) Record — Same as above

WITH PAYLOAD OF 2,204.622 LB.

ALTITUDE

World Class Record — 47,910 ft
Maj. F. F. Ross, pilot; Lt. D. M. Davis, co-pilot; Lt. L. B. Barrier, Lt. C. B. Webster, F/O Pamphille Morrissette and Sgt. W. S. George, crew; USAAF, United States, Boeing B-29 monoplane, 4 Wright 2,000 hp engines, Harmon Field, Guam, M.I., May 15, 1946.
National (U.S.) Record — Same as above.

SPEED FOR 621.369 MI.

World Class Record — 325.713 mph.
Furio Niclot, Italy, Breda 88, 2 Piaggio XI R. C. 40B, 1,000 hp engines, Dec. 9, 1937.
National (U.S.) Record — 259.398 mph.
Capt. C. S. Irvine and Capt. P. H. Robey, USAAC pilots; Capt. C. J. Crane and Lt. P. G. Miller, USAAC, Boeing YB-17A monoplane, 4 Wright 840 hp engines, Dayton, O., Aug. 1, 1939.

SPEED FOR 1,242.739 MI.

World Class Record — 365.649 mph.
Lt. E. M. Grabowski, pilot; Lt. J. J. Liset, co-pilot; M/Sgt. D. P. Kelly, Cpl. F. M. Polmotier, and Cpl. O. W. Lambert, crew; USAAF, United States, Boeing B-29 monoplane, 4 Wright 2,200 hp engines, Dayton, O., May 17, 1946.
National (U.S.) Record — Same as above.

SPEED FOR 3,106.849 MI.

World Class Record — 338.392 mph.
Capt. J. E. Bauer, pilot; Capt. J. E. Cotton, co-pilot; M/Sgt. Angelo Queses, T/Sgt. Richard McDonald and Cpl. Raymon Koss, crew; USAAF, United States, Boeing B-29 monoplane, 4 Wright R-3350-23A engines of 2,200 hp each, Dayton, O., June 28, 1946.
National (U.S.) Record — Same as above.

WITH PAYLOAD OF 4,409.244 LB.

ALTITUDE

World Class Record — 46,522 ft.
Col. E. D. Reynolds, pilot; Capt. B. P. Robson, co-pilot; Lt. J. G. Barnes, Lt. Theodore Madden, Lt. K. H. Morehouse, S/Sgt. W. C. Flynn and Cpl. A. L. Lentowski, crew; USAAF, United States, Boeing B-29 monoplane, 4 Wright 2,000 hp engines, Harmon Field, Guam, M.I., May 13, 1946.
National (U.S.) Record — Same as above.

Aeroproducts reports...

AEROPROPS KEEP GOING DESPITE SEVERE FLAK DAMAGE

OFFICIAL U. S. NAVY PHOTO

Lieutenant (jg) Robert C. Notz, USN, inspects the Aeroprop blade that brought him safely back from a North Korean target. Flying from fast carrier Task Force 77, Lt. Notz' AD fighter-bomber was hit by Red flak during a low level attack. A bite approximately 18 inches long was taken out of the trailing edge of the blade deep into the rib section. The blade remained intact and enabled him to reach a repair base. A new Aeroprop blade was installed without removing the propeller and the ship returned immediately to combat.

OFFICIAL U. S. NAVY PHOTO

Now Lieutenant Commander Lynn Du Temple knows why his AD Skymaster raised such a howl when he brought it aboard the USS Princeton off Korea. A 37mm enemy anti-aircraft shell had torn a gaping hole completely through one blade of his Aeroprop. LCdr Du Temple had just completed his fourth bombing run on Hamhung railroad bridge when the flak ripped through his prop blade and shattered his canopy. The pierced Aeroprop blade did not falter; damage was not apparent until the plane reached its carrier base.

THESE INSTANCES OF COMBAT DAMAGE EXEMPLIFY THE DURABILITY OF AEROPROPS . . . THE METICULOUS ENGINEERING AND CAREFUL FABRICATION OF ALL AEROPRODUCTS PROPELLER EQUIPMENT. AEROPRODUCTS SERVICE—INCLUDING THE ABILITY TO ENVISION THE AIRCRAFT OF THE FUTURE—IS AVAILABLE TO ASSIST YOU WITH ANY PROPELLER PROBLEM IN THE SUBSONIC, TRANSONIC OR SUPERSONIC RANGES.

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ALLISON DIVISION • GENERAL MOTORS CORPORATION • DAYTON, OHIO

SPEED FOR 621.369 MI.

World Class Record .... 369.692 mph.

Lt. E. M. Grabowski, pilot; Lt. J. J. Liset, co-pilot; M/Sgt. D. P. Kelly, Cpl. F. M. Polmotier, and Cpl. O. W. Lambert, crew; USAAF, United States, Boeing B-29 monoplane, 4 Wright 2,200 hp engines, Dayton, O., May 17, 1946.

National (U.S.) Record .... Same as above.

SPEED FOR 1,242.739 MI.

World Class Record .... 365.649 mph.

Lt. E. M. Grabowski, pilot; Lt. J. J. Liset, co-pilot; M/Sgt. D. P. Kelly, Cpl. F. M. Polmotier, and Cpl. O. W. Lambert, crew; USAAF, United States, Boeing B-29 monoplane, 4 Wright 2,200 hp engines, Dayton, O., May 17, 1946.

National (U.S.) Record .... Same as above.

SPEED FOR 3,106.849 MI.

World Class Record .... 338.392 mph.

Capt. J. E. Bauer, pilot; Capt. J. F. Cotton, co-pilot; M/Sgt. Angelo Queses, T/Sgt. Richard McDonald and Cpl. Raymon Koss, crew; USAAF, United States, Boeing B-29 monoplane, 4 Wright 2,200 hp engines, Dayton, O., June 28, 1946.

National (U.S.) Record .... Same as above.

WITH PAYLOAD OF 11,023 LB.

ALTITUDE

World Class Record .... 45,253 ft.

Lt. J. P. Tobinson, pilot; Lt. Lloyd A. Lee, co-pilot; Lt. D. B. Gleicher, Lt. A. W. Armistead, Lt. R. M. Beattie, Lt. F. J. Royce, F/O R. F. Johnson and Mario R. Genta, crew; USAAF, United States, Boeing B-29 monoplane, 4 Wright 2,000 hp engines, Harmon Field, Guam, M.I., May 14, 1946.

National (U.S.) Record .... Same as above.

SPEED FOR 621.369 MI.

World Class Record .... 369.692 mph.

Lt. E. M. Grabowski, pilot; Lt. J. J. Liset, co-pilot; M/Sgt. D. P. Kelly, Cpl. F. M. Polmotier, and Cpl. O. W. Lambert, crew; USAAF, United States, Boeing B-29 monoplane, 4 Wright 2,200 hp engines, Dayton, O., May 17, 1946.

National (U.S.) Record .... Same as above.

SPEED FOR 1,242.739 MI.

World Class Record .... 365.649 mph.

Lt. E. M. Grabowski, pilot; Lt. J. J. Liset, co-pilot; M/Sgt. D. P. Kelly, Cpl. F. M. Polmotier, and Cpl. O. W. Lambert, crew; USAAF, United States, Boeing B-29 monoplane, 4 Wright 2,200 hp engines, Dayton, O., May 17, 1946.

National (U.S.) Record .... Same as above.

SPEED FOR 3,106.849 MI.

World Class Record .... 266.023 mph.

Lt. Col. R. G. Ruegg, pilot; Lt. Col. Carl P. Walter, co-pilot; 2nd Lt. J. E. Wetzel, M/Sgt. William Cunningham and M/Sgt. R. L. Hilton, crew; USAAF, United States, Boeing B-29 monoplane, 4 Wright 2,200 hp engines, Dayton, O., June 21, 1946.

National (U.S.) Record .... Same as above.

WITH PAYLOAD OF 22,046 LB.

ALTITUDE

World Class Record .... 41,562 ft.

Capt. A. A. Pearson, pilot; Lt. V. L. Dalbey, co-pilot; Lt. R. S. Strasburg, Lt. I. E. Bork, Cpl. J. T. Collins and Cpl. Joseph Friedberg, crew; USAAF, United States, Boeing B-29 monoplane, 4 Wright 2,200 hp engines, Harmon Field, Guam, M.I., May 8, 1946.

National (U.S.) Record .... Same as above.

SPEED FOR 621.369 MI.

World Class Record .... 357.731 mph.

Capt. J. D. Bartlett, pilot; Lt. William Murray, co-pilot; M/Sgt. C. M. Youngblood, Cpl. D. J. Shrader and Cpl. R. F. Wilden, crew; USAAF, United States, Boeing B-29 monoplane, 4 Wright 2,200 hp engines, Dayton, O., May 19, 1946.

National (U.S.) Record .... Same as above.

SPEED FOR 1,242.739 MI.
World Class Record .... 357.035 mph.
Capt. J. D. Bartlett, pilot; Lt. William Murray, co-pilot; M/Sgt. C. M. Youngblood, Cpl. D. J. Shrader and Cpl. R. F. Wilden, crew; USAAF, United States, Boeing B-29 monoplane, 4 Wright 2,200 hp engines, Dayton, O., May 19, 1946.
National (U.S.) Record .... Same as above.

SPEED FOR 3,106.849 MI.
World Class Record .... 266.023 mph.
Lt. Col. R. G. Ruegg, pilot; Lt. Col. Carl P. Walter, co-pilot; 2nd Lt. J. E. Wetzel, M/Sgt. William Cunningham and M/Sgt. R. L. Hilton, crew; USAAF, United States, Boeing B-29 monoplane, 4 Wright 2,200 hp engines, Dayton, O., June 21, 1946.
National (U.S.) Record .... Same as above.

WITH PAYLOAD OF 33,069 LB.

ALTITUDE
World Class Record .... 39,521 ft.
Col. B. H. Warren, pilot; Maj. J. R. Dale, Jr., co-pilot; Lt. W. D. Collier, M/Sgt. Gordon S. Fish, S/Sgt. V. H. Worden and Sgt. Thomas H. Hall, crew; USAAF, United States, Boeing B-29 monoplane, 4 Wright 2,200 hp engines, Harmon Field, Guam, M.I., May 11, 1946.
National (U.S.) Record .... Same as above

SPEED FOR 621.369 MI. .... No official record.
SPEED FOR 1,242.739 MI. .... No official record
SPEED FOR 3,106.849 MI. .... No official record

GREATEST PAYLOAD CARRIED TO AN ALTITUDE OF 6,561,666 FT.
World Class Record .... 33,435 lb.
Col. B. H. Warren, pilot; Maj. J. R. Dale, Jr., co-pilot; Lt. W. D. Collier, M/Sgt. Gordon S. Fish, S/Sgt. V. H. Worden and Sgt. Thomas H. Hall, crew; USAAF, United States, Boeing B-29 monoplane, 4 Wright 2,200 hp engines, Harmon Field, Guam, M.I., May 11, 1946.
National (U.S.) Record .... Same as above.

CIRCUIT OF THE WORLD .... No official record.

AIRPLANES—(Class C) Group I

JET ENGINES

DISTANCE, CLOSED CIRCUIT .... No official record.
DISTANCE IN A STRAIGHT LINE .... No official record.

ALTITUDE
World Class Record .... 63,668 ft.
Walter F. Gibb, Great Britain, English Electra Canberra B. Mark II, two Bristol "Olympus" 9,750 pounds static thrust jet engines, Bristol, May 4, 1953.
National (U.S.) Record .... 47,169 ft.
Miss Jacqueline Cochran, Canadian-built F-86E swept-wing monoplane, Orenda jet engine, Edwards, Cal., May 24, 1953.

MAXIMUM SPEED OVER A 1.8 MI. STRAIGHTAWAY COURSE
World Class Record .... 753.4 mph.
Lt. Comdr. James B. Verdin, USN, United States, Douglas XF4D delta wing aircraft, Westinghouse J-40-WE-8 jet engine, Salton Sea, Cal., Oct. 3, 1953. (Pending confirmation by FAI as we went to press.)
National (U.S.) Record .... Same as above.

MAXIMUM SPEED OVER A 9.3 MI. STRAIGHTAWAY COURSE
World Class Record .... 755.149 mph.
Lt. Col. F. K. Everest, USAF, United States, North American YF-100A swept wing monoplane, Pratt Whitney J-57 jet engine, Salton Sea, Cal., Oct. 29, 1953. (Pending confirmation by FAI as we went to press.)
National (U.S.) Record .... Same as above.

SPEED FOR 62.137 MI. WITHOUT PAYLOAD
World Class Record .... 728.114 mph.
Robert O. Rahn, United States, Douglas XF4D delta wing aircraft, Westinghouse J-40-WE-8 jet engine, Edwards, Cal., Oct. 16, 1953. (Pending confirmation by FAI as we went to press.)
National (U.S.) Record .... Same as above.

SPEED FOR 310.685 MI. WITHOUT PAYLOAD

World Class Record .... 590.321 mph.
Miss Jacqueline Cochran, United States, Canadair-built F-86E sweptwing monoplane, Orenda jet engine, Edwards, Cal., May 23, 1953.

National (U.S.) Record .... Same as above.

SPEED FOR 621.369 MI. WITHOUT PAYLOAD

World Class Record .... 510.925 mph.
J. Reginald Cooksey, Great Britain, Gloster Meteor F. 8, VZ 496, 2 Rolls Royce Derwent 3,500 lb. thrust jet engines, Moreton Valence, Campo Ness Course, May 12, 1950.

National (U.S.) Record .... 462.970 mph.
Lt. John J. Hancock, USAAF, Lockheed P-80 monoplane, Allison J.33 jet engine, Dayton, O., May 19, 1946.

SPEED FOR 1,242.739 MI. WITHOUT PAYLOAD

World Class Record .... 440.298 mph.
Lt. John Hancock, USAAF, United States, Lockheed P-80 monoplane, Allison J-33 jet engine, Dayton, O., May 19, 1946.

National (U.S.) Record .... Same as above.

SPEED FOR 3,106.849 MI. WITHOUT PAYLOAD .... No official record.

SPEED FOR 6,213.698 MI. WITHOUT PAYLOAD .... No official record.

WITH PAYLOAD OF 2,204.622 LB.

ALTITUDE .... No official record.

SPEED FOR 621.369 MI.

World Class Record .... 410.431 mph.
Lt. Col. T. P. Gerrity, pilot; Capt. Wm. Rickert, co-pilot, USAAF, United States, Douglas XA-26F monoplane, 2 Pratt and Whitney R-2800, 2,000 hp and 1 General Electric I-16 jet engine, Dayton, O., June 20, 1946.

National (U.S.) Record .... Same as above.

SPEED FOR 1,242.739 MI. .... No official record.

SPEED FOR 3,106.849 MI. .... No official record

CLIMB TO 9,842.5 FT.

World Class Record .... 1 min., 15.5 sec
Richard Bellingham, Great Britain, Gloster Meteor Mark 8 W.A. 820, two Armstrong Siddeley Sapphire Mark 2 jet engines, Moreton Valence airport, Gloucestershire, Aug. 31, 1951.

National (U.S.) Record .... No official record

CLIMB TO 19,685 FT.

World Class Record .... 1 min., 50.0 sec
Richard Bellingham, Great Britain, Gloster Meteor Mark 8 W.A. 820, two Armstrong Siddeley Sapphire Mark 2 jet engines, Moreton Valence airport, Gloucestershire, Aug. 31, 1951.

National (U.S.) Record .... No official record

CLIMB TO 29,527.5 FT.

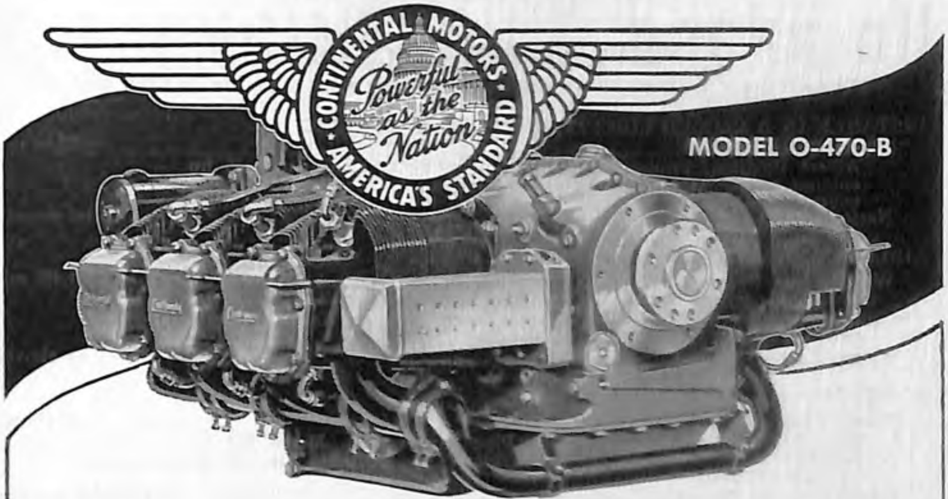
World Class Record .... 2 min., 27.0 sec.
Richard Bellingham, Great Britain, Gloster Meteor Mark 8 W.A. 820, two Armstrong Siddeley Sapphire Mark 2 jet engines, Moreton Valence airport, Gloucestershire, Aug. 31, 1951.

National (U.S.) Record .... No official record.

CLIMB TO 39,370 FT.

World Class Record .... 3 min., 09.5 sec.
Richard Bellingham, Great Britain, Gloster Meteor Mark 8 W.A. 820, two Armstrong Siddeley Sapphire Mark 2 jet engines, Moreton Valence airport, Gloucestershire, Aug. 31, 1951.

National (U.S.) Record .... No official record.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LIGHT AIRPLANES—(Class C-1.a)

FIRST CATEGORY (AIRCRAFT WEIGHING LESS THAN 1,102.3 LB., IN FLYING ORDER)

DISTANCE IN A CLOSED CIRCUIT, WITHOUT REFUELING

World Class Record ____ 1,242.74 mi.
Albert Revillon, France, Minicab, Type G-Y 20, Continental 65 hp engine; gross weight 499.5 kilograms, Toussus-le-Noble-Tour-Bourges course, May 10, 1952.
National (U.S.) Record ____ No official record.

AIRLINE DISTANCE

World Class Record ____ 1,361.485 mi.
Robert C. Faris, United States, Mooney M-18-L, Lycoming 65 hp engine; gross weight 476.73 kilograms, from Wichita, Kan. to Montpelier, Vt., Aug. 9, 1952.
National (U.S.) Record ____ Same as above.

ALTITUDE

World Class Record ____ 27,152 ft.
Mrs. Ana L. Branger, Venezuela, Piper Super Cub, Model PA-18, Lycoming 0-290-D 125 hp engine, Hybla Valley Airport, Alexandria, Va., Apr. 10, 1951.
National (U.S.) Record ____ No official record.

SPEED FOR 62.137 MI. IN A CLOSED CIRCUIT

World Class Record ____ 155.256 mph.
Iginio Guagnellini, Italy, Ambrosini G.F.4 Rondone, Continental 90 hp engine, gross weight 498.8 Kilograms, Cameri, Italy, Dec. 21, 1952.
National (U.S.) Record ____ No official record.

SPEED FOR 310.685 MI. IN A CLOSED CIRCUIT

World Class Record ____ 115.611 mph.
Albert Revillon, France, Minicab, Type G-Y 20, Continental 65 hp engine; gross weight 499.5 kilograms, Toussus-le-Noble-Tour-Bourges course, May 10, 1952.
National (U.S.) Record ____ No official record.

SPEED FOR 621.369 MI. IN A CLOSED CIRCUIT

World Class Record ____ 115.442 mph.
Albert Revillon, France, Minicab, Type G-Y 20, Continental 65 hp engine; gross weight 499.5 kilograms, Toussus-le-Noble-Tour-Bourges course, May 10, 1952.
National (U.S.) Record ____ No official record.

SPEED FOR 1,242.74 MI. IN A CLOSED CIRCUIT

World Class Record ____ 113.979 mph.
Albert Revillon, France, Minicab, Type G-Y 20, Continental 65 hp engine; gross weight 499.5 kilograms, Toussus-le-Noble-Tour-Bourges course, May 10, 1952.
National (U.S.) Record ____ No official record.

LIGHT AIRPLANES—(Class C-1.b)

SECOND CATEGORY (ALL AIRCRAFT WITH A TOTAL WEIGHT, IN FLYING ORDER, BETWEEN 1,102.3 AND 2,204.6 LB.)

DISTANCE IN A CLOSED CIRCUIT WITHOUT REFUELING

World Class Record ____ 1,553.425 mi.
Robert E. A. Goemas, Belgium, Piper Pacer aircraft, Lycoming 125 hp engine, Toussus-le-Noble, France, Aug. 12, 1952.
National (U.S.) Record ____ No official record.

AIRLINE DISTANCE

World Class Record ____ 2,462.330 mi.
Maximillian A. Conrad, United States, Piper Pacer, Lycoming 0-290-D 125 hp engine; gross weight 998.4 kilograms, Los Angeles, Cal. to New York, N. Y., Apr. 30-May 1, 1952.
National (U.S.) Record ____ Same as above.

ALTITUDE

World Class Record .... 37,063 ft.

William D. Thompson, Jr., United States, Cessna Turbo Prop XL-19B monoplane, Boeing 502-8 XT-50-BO-1 engine, Wichita, Kan., July 16, 1953.

National (U.S.) Record .... Same as above.

SPEED FOR 62.137 MI. IN A CLOSED CIRCUIT

World Class Record .... 192.839 mph.

R. R. Paine, Great Britain, Miles Hawk Speed Six, de Havilland Gipsy Major 205 hp engine; gross weight 1,843 lb., at Wolverhampton, June 17, 1950.

National (U.S.) Record .... No official record.

SPEED FOR 310.685 MI. IN A CLOSED CIRCUIT

World Class Record .... 164.231 mph.

Miss Marie Nicolas, France, Norecrin, Regnier engine; gross weight 2,082 lb., Montpellier-Frejorgues course, Dec. 5, 1951.

National (U.S.) Record .... No official record.

SPEED FOR 621.369 MI. IN A CLOSED CIRCUIT

World Class Record .... 163.287 mph.

Miss Marie Nicolas, France, Norecrin, Regnier engine; gross weight 2,082 lb., Montpelier-Frejorgues course, Dec. 5, 1951.

National (U.S.) Record .... No official record.

SPEED FOR 1,242.74 MI. IN A CLOSED CIRCUIT

World Class Record .... 142.058 mph.

Joseph G. Garnier, France, Nord 1203, Regnier 135 hp engine; gross weight 999.05 kilograms, Lyon-Bron—Corbas-Montelimar-Ancone course, Apr. 23, 1952.

National (U.S.) Record .... No official record.

LIGHT AIRPLANES—(Class C-1.c)

THIRD CATEGORY (ALL AIRCRAFT WITH A TOTAL WEIGHT, IN FLYING ORDER, BETWEEN 2,204.6 AND 3,858 LB.)

AIRLINE DISTANCE

World Class Record .... 4,957.240 mi.

William P. Odom, United States, Beech Bonanza Model 35 airplane, take-off weight 3,858 lb., Continental E-185-1 engine, from Honolulu, Hawaii to Teterboro, N. J., Mar. 7 - 8 (G.M.T.), 1949.

National (U.S.) Record .... Same as above.

ALTITUDE .... No official record.

SPEED FOR 62.137 MI. IN A CLOSED CIRCUIT

World Class Record .... 222.846 mph.

Leonardo Bonzi, Italy, SAI.7 Ambrosini, deHavilland Gipsy Queen 240 hp engine, gross weight 3,197 lb., Point X-Fiumicino-Vaianica-Anzio Course, Dec. 21, 1951.

National (U.S.) Record .... No official record.

SPEED FOR 310.685 MI. IN A CLOSED CIRCUIT

World Class Record .... 156.475 mph.

Nikolai Kouznetzov, U.S.S.R. YAK-18, M.11 FR-1 160 hp engine, gross weight 2,491 lb., Touchino-Skhodnia course, Oct. 11, 1951.

National (U.S.) Record .... No official record.

SPEED FOR 621.369 MI. IN A CLOSED CIRCUIT

World Class Record .... 216.114 mph.

Leonardo Bonzi, Italy, SAI.7 Ambrosini, deHavilland Gipsy Queen 240 hp engine, gross weight, 3,197 lb., Fiumicino-Chiesa Antignano-Tauerna Pagliavone Course, Dec. 21, 1951.

National (U.S.) Record .... No official record.

SPEED FOR 1,242.739 MI. IN A CLOSED CIRCUIT

World Class Record .... 158.932 mph.

Paul Burniat, Belgium, Beechcraft Bonanza, Continental 185 hp engine, gross weight 3,586 lb., Keerbergen-Ostende-Gosselies-Bierset Course, June 8, 1952.

National (U.S.) Record .... No official record.


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LIGHT AIRPLANES—(Class C-1.d)

FOURTH CATEGORY (ALL AIRCRAFT WITH A TOTAL WEIGHT, IN FLYING ORDER, BETWEEN 3,858.1 AND 6,613.9 LB.)

AIRLINE DISTANCE .... No official record.

ALTITUDE .... No official record.

SPEED FOR 62.137 MI. IN A CLOSED CIRCUIT

World Class Record .... 322.789 mph.

Miss R. M. Sharpe, Great Britain, Vickers Supermarine Spitfire 5B, gross weight 5,626 lb., Rolls Royce Merlin 55 M 1,280 hp engine, Wolverhampton, June 17, 1950.

National (U.S.) Record .... No official record.

SPEED FOR 310.685 MI. IN A CLOSED CIRCUIT

World Class Record .... 292.881 mph.

Y. D. Forostenco, U.S.S.R., YAK II, A.C.H. 650 hp engine, gross weight 4,916 lb., Touchino-Skhodnia course, July 12, 1951.

National (U.S.) Record .... No official record.

SPEED FOR 621.369 MI. IN A CLOSED CIRCUIT

World Class Record .... 274.825 mph.

Nicolay Golovanov, U.S.S.R., YAK II, ACH-21 engine, gross weight 5,251 lb., Skhodnia-Kourgane-Orel-Skhodnia course, Aug. 26, 1951.

National (U.S.) Record .... No official record.

SPEED FOR 1,242.739 MI. .... No official record.

LIGHT AIRPLANES—(Class C-1.e)

FIFTH CATEGORY (ALL AIRCRAFT WITH A TOTAL WEIGHT, IN FLYING ORDER, BETWEEN 6,613.9 AND 9,920.8 LB.)

AIRLINE DISTANCE .... No official record.

ALTITUDE .... No official record.

SPEED FOR 62.137 MI. IN A CLOSED CIRCUIT

World Class Record .... 328.447 mph.

P. G. Robarts, Great Britain, Vickers Supermarine Spitfire 8 trainer, gross weight 7,474 lb., Rolls Royce Merlin 66 168 hp engine, Wolverhampton, June 17, 1950.

National (U.S.) Record .... No official record.

SPEED FOR 310.685 MI. IN A CLOSED CIRCUIT .... No official record.

SPEED FOR 621.369 MI. .... No official record.

SPEED FOR 1,242.739 MI. .... No official record.

SEAPLANES—(Class C-2)

DISTANCE, CLOSED CIRCUIT

World Class Record .... 3,231.123 mi.

Mario Stoppani and Carlo Tonini, Italy, Cant Z I-LERO seaplane, 3 Alfa Romeo 126 RC.34 750 hp engines, May 27-28, 1937.

National (U.S.) Record .... 1,569 mi.

Lts. B. J. Connell and H. C. Rodd, Pn-10, 2 Packard 600 hp each, San Diego, Cal., Aug. 15 - 16, 1927.

AIRLINE DISTANCE

World Class Record .... 5,997.462 mi.

Capt. D. C. T. Bennett and First Officer L. Harvey, pilots; Great Britain, Short-Mayo Mercury seaplane, 4 Napier Rapiers J.I. 370 hp engines, from Dundee, Scotland to near Fort-Nolloth, S. Africa, Oct. 6-8, 1938.

National (U.S.) Record .... 3,281.402 mi.

Lt. Comdr. Knefler McGinnis, USN, Lt. J. K. Averill, USN, NAP T. P. Wilkinson, USN, Pilots; C. S. Bolka, A. E. J. Dionne and E. V. Sizer, crew; Navy XP3Y-1 seaplane, 2 Pratt and Whitney 825 hp engines, from Cristobal Harbor, C. Z. to San Francisco Bay, Alameda, Cal., Oct. 14-15, 1935.

ALTITUDE

World Class Record ____________ 44,429 ft.
Col. Nicola Di Mauro, Italy, Caproni 161 seaplane, (biplane), Piaggio XI RC 100 engine, at Vigna di Valle, Sept. 25, 1939.

National (U.S.) Record ____________ 38,559.594 ft.
Lt. Appollo Soucek, USN, Apache, Pratt and Whitney 425 hp engine, supercharged, at Washington, D. C., June 4, 1929.

MAXIMUM SPEED

World Class Record ____________ 440.681 mph.
Francesco Agello, Italy, M.C. 72 seaplane, Fiat A.S. 6 engine at Lake Garda, Italy, Oct. 23, 1934.

National (U.S.) Record ____________ 245.713 mph.
Lt. James H. Doolittle, USAF, Curtiss R3C-2, Curtiss V-1400, 600 hp engine, Bay Shore, Baltimore, Md., Oct. 27, 1925.

SPEED FOR 62.137 MI. WITHOUT PAYLOAD

World Class Record ____________ 391.072 mph.
Guglielmo Cassinelli, Italy, Macchi C. 72 seaplane, 2,400 hp Fiat AS 6 engine, Falconara-Pesaro permanent course, Oct. 8, 1933.

National (U.S.) Record ____________ 241.679 mph.
Lt. G. T. Cuddihy, USN, Curtiss R3C-2, Curtiss V-1500, 700 hp at Norfolk, Va., Nov. 13, 1926.

SPEED FOR 310.685 MI. WITHOUT PAYLOAD ____________ No official record.

SPEED FOR 621.369 MI. WITHOUT PAYLOAD

World Class Record ____________ 250.676 mph.
M. Stoppani and G. Gorini, pilots; Ing. Luzzatto and E. Accomolli, passengers; Italy, Cant Z 509 seaplane, 3 Fiat A80 RC 41 1,000 hp engines, Mar. 30, 1938.

National (U.S.) Record ____________ 165.040 mph.
Maj. Gen. Frank M. Andrews, pilot; J. G. Moran and H. O. Johnson, crew; Martin BO12-A seaplane, 2 Pratt and Whitney 700 hp Hornet engines, Aug. 24, 1935.

SPEED FOR 1,242.739 MI. WITHOUT PAYLOAD

World Class Record ____________ 246.351 mph.
M. Stoppani and G. Gorini, pilots; Ing. Luzzatto and E. Accomolli, passengers; Italy, Cant Z 509 seaplane, 3 Fiat A80 RC 41 1,000 hp engines, Mar. 30, 1938.

National (U.S.) Record ____________ 157.319 mph.
Edwin Musick, Boris Sergievsky and Charles A. Lindbergh, Sikorsky S-42 Seaplane, 4 Pratt and Whitney 670 hp Hornet enines, Aug. 1, 1934.

SPEED FOR 3,106.849 MI. WITHOUT PAYLOAD

World Class Record ____________ 191.534 mph.
Mario Stoppani and Carlo Tonini, Italy, Cant Z I-LERO seaplane, 3 Alfa Romeo 126 RC.34 750 hp engines, May 27-28, 1937.

National (U.S.) Record ____________ No official record.

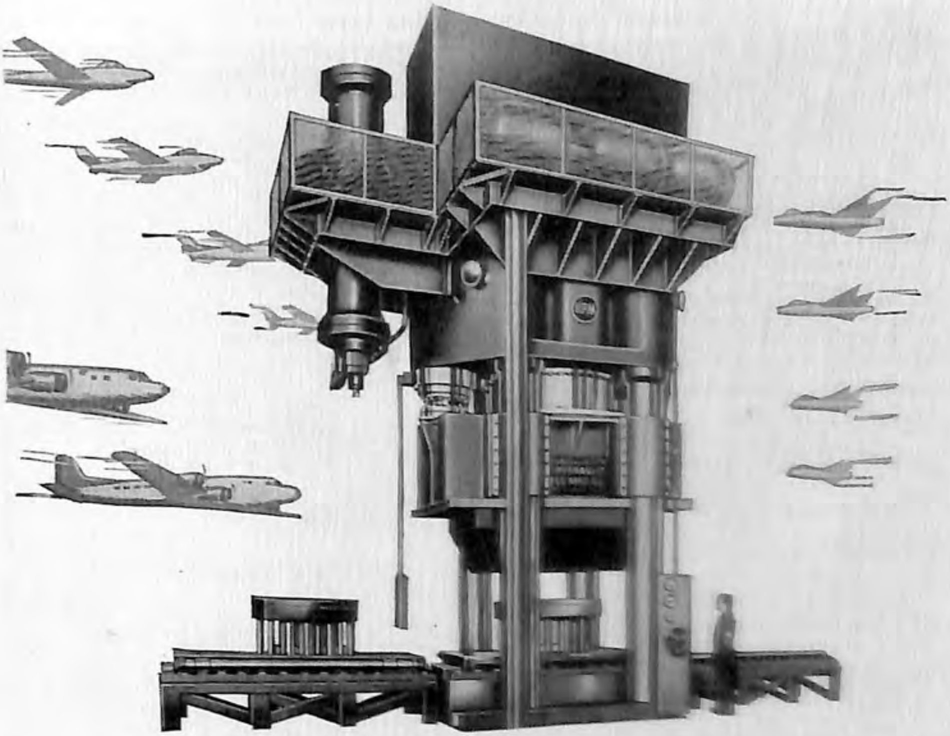
SPEED FOR 6,213.698 MI. WITHOUT PAYLOAD ____________ No official record.

WITH PAYLOAD OF 2,204.622 LB.

ALTITUDE

World Class Record ____________ 34,085 ft.
Nicola di Mauro and Mario Stoppani, Italy, Cant Z. 506 B. seaplane, 3 Alfa Romeo RC.55 700 hp engines, at Monfalcone, Nov. 12, 1937.

National (U.S.) Record ____________ 26,929 ft.
Boris Sergievsky, Sikorsky S-48 seaplane, 2 Pratt and Whitney Hornet, 575 hp each, at Bridgeport, Conn., July 21, 1930.



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SPEED FOR 621.369 MI.

World Class Record — 250.676 mph.

M. Stoppani, and G. Gorini, pilots; Ing. Luzzatto and E. Accomolli, passengers; Italy, Cant Z 509 seaplane, 3 Fiat A80 RC 41 1,000 hp engines, Mar. 30, 1938.

National (U.S.) Record — 165.040 mph.

Maj. Gen. F. M. Andrews, pilot; J. G. Moran and H. C. Johnson, crew; Martin B-12-A seaplane, 2 Pratt and Whitney 700 hp Hornet, engines, Aug. 24, 1935.

SPEED FOR 1,242.739 MI.

World Class Record — 246.351 mph.

M. Stoppani and G. Gorini, pilots; Ing. Luzzatto and E. Accomolli, passengers; Italy Cant Z 509 seaplane, 3 Fiat A80 RC 41; 1,000 hp engines, Mar. 30, 1938.

National (U.S.) Record — 157.319 mph.

Edwin Musick, Boris Sergievsky and Charles A. Lindbergh, Sikorsky S-42 seaplane, 4 Pratt and Whitney 670 hp Hornet engines, Aug. 1, 1934.

SPEED FOR 3,106.849 MI.

World Class Record — 191.534 mph.

Mario Stoppani and Niccola di Mauro, Italy, Cant Z 506-B seaplane, 3 Alfa Romeo 126 RC.34 750 hp engines, May 27-28, 1937.

National (U.S.) Record — No official record.

WITH PAYLOAD OF 4,409.244 LB.

ALTITUDE

World Class Record — 29,367 ft.

Mario Stoppani and Nicola di Mauro, Italy, Cant Z 506-B seaplane, 3 Alfa Romeo 700 hp engines, at Monfalcone, Nov. 3, 1937.

National (U.S.) Record — 19,709 ft.

Boris Sergievsky, S-38 seaplane, 2 Pratt and Whitney 424 hp Wasp, engines, at Stratford, Conn., Aug. 11, 1930.

SPEED FOR 621.369 MI.

World Class Record — 250.676 mph.

M. Stoppani and G. Gorini, pilots; Ing. Luzzatto and E. Accomolli, passengers; Italy, Cant Z 509 seaplane, 3 Fiat A80 RC 41 1,000 hp engines, Mar. 30, 1938.

National (U.S.) Record — 157.580 mph.

Edwin Musick, Boris Sergievsky and Charles A. Lindbergh, Sikorsky S-42 seaplane, 4 Pratt and Whitney 670 hp Hornet engines, Aug. 1, 1934.

SPEED FOR 1,242.739 MI.

World Class Record — 246.351 mph.

M. Stoppani and G. Gorini, pilots; Ing. Luzzatto and E. Accomolli, passengers; Italy, Cant Z 509 seaplane, 3 Fiat A80 RC 41 1,000 hp engines, Mar. 30, 1938.

National (U.S.) Record — 157.319 mph.

Edwin Musick, Boris Sergievsky and Charles A. Lindbergh, Sikorsky S-42 seaplane, 4 Pratt and Whitney 670 hp Hornet engines, Aug. 1, 1934.

SPEED FOR 3,106.849 MI. — No official record.

WITH PAYLOAD OF 11,023.11 LB.

ALTITUDE

World Class Record — 24,311 ft.

Mario Stoppani and Nicola di Mauro, pilots; Forlivesi, mechanic; Italy, Cant Z 506-B seaplane, 3 Alfa Romeo 700 hp engines, at Monfalcone, Nov. 7, 1947.

National (U.S.) Record — 20,406 ft.

Boris Sergievsky and Raymond B. Quick, Sikorsky S-42 seaplane, 4 Pratt and Whitney 670 hp Hornet engines, Bridgeport, Conn., May 17, 1934.

SPEED FOR 621.369 MI.

World Class Record — 156.516 mph.

Mario Stoppani and Ing. Antonio Maiorana, pilots; A. Spinelli, S. Forlivesi and R. T. Suriano, crew; Italy, Cant Z, 508 seaplane, 3 Isotta-Fraschini Asso 11 R.C. 836 hp engines, Grado-Faro Ancona-Faro di Rimini temporary course, May 1, 1937.

National (U.S.) Record — No official record.

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SPEED FOR 1,242.739 MI.

World Class Record .... 154.356 mph.

Mario Stoppani and Ing. Antonio Maiorana, pilots; A. Spinelli, S. Forlivesi and R. T. Suriano, crew; Italy, Cant Z, 508 seaplane, 3 Isotta-Fraschini Asso 11 RC 836 hp engines, Grado-Faro Ancona-Faro di Rimini temporary course, May 1, 1937.

National (U.S.) Record .... No official record.

SPEED FOR 3,106.849 MI. .... No official record.

WITH PAYLOAD OF 22,046.22 LB.

ALTITUDE

World Class Record .... 15,955 ft.

Mario Stoppani, pilot; G. Divari and A. Spinetti, passengers; Italy, Cant Z 508 seaplane, 3 Isotta Fraschini Asso 11 R.C. 836 hp engines, Monfalcone, Apr. 13, 1937.

National (U.S.) Record .... No official record.

SPEED FOR 621.369 MI.

World Class Record .... 131.110 mph.

Guillaumet, Leclaire, Comet, Le Duff, Le Morvan and Chapaton, France, Latecoere 521 seaplane, *Lt. de Vaisseau Paris*, 6 Hispano-Suiza 650 hp engines, Lucon-Aureilhan base, Dec. 27, 1937.

National (U.S.) Record .... No official record.

SPEED FOR 1,242.739 MI. .... No official record.

SPEED FOR 3,106.849 MI. .... No official record.

WITH PAYLOAD OF 33,069.33 LB.

ALTITUDE

World Class Record .... 13,509 ft.

Guillaumet, Leclaire, Comet, Le Duff, Le Morvan and Chapaton, France, Latecoere 521 seaplane, *Lt. de Vaisseau Paris*, 6 Hispano-Suiza 650 hp engines, at Biscarosse, Dec. 30, 1927.

National (U.S.) Record .... No official record.

SPEED FOR 621.369 MI.

World Class Record .... 117.899 mph.

Guillaumet, Leclaire, Comet, Le Duff, Le Morvan and Chapaton, France, Latecoere 521 seaplane, *Lt. de Vaisseau Paris*, 6 Hispano-Suiza 650 hp engines, Lucon-Aureilhan course, Dec. 29, 1937.

National (U.S.) Record .... No official record.

SPEED FOR 1,242.739 MI. .... No official record.

SPEED FOR 3,106.849 MI. .... No official record.

GREATEST PAYLOAD CARRIED TO AN ALTITUDE OF 6,561.660 FT.

World Class Record .... 39,771 lb.

Guillaumet, Leclaire, Comet, Le Duff, Le Morvan and Chapaton, France, Latecoere 521 seaplane, *Lt. de Vaisseau Paris*, 6 Hispano-Suiza 650 hp engines, at Biscarosse, Dec. 30, 1937.

National (U.S.) Record .... 16,608 lb.

Boris Sergievsky, Sikorsky S-42 seaplane, 4 Pratt and Whitney Hornet 650 hp engines, Bridgeport, Conn., Apr. 26, 1934.

LIGHT SEAPLANES—(Class C-2.a)

FIRST CATEGORY (LIGHT SEAPLANES WEIGHING LESS THAN 1,322.8 LBS.)

ALTITUDE

World Class Record .... 24,498 ft.

Charles L. Davis, United States, Piper Super Cub PA-18, Lycoming 125 hp engine, gross weight 1,295 lb., Detroit, Mich., June 18, 1952.

National (U.S.) Record .... Same as above.

DISTANCE IN A STRAIGHT LINE .... No official record.

SPEED FOR 62.137 MI. IN A CLOSED CIRCUIT

World Class Record .... 108.806 mph.

Charles L. Davis, United States, Piper Super Cub PA-18, Lycoming 125 hp engine, gross weight 1,321 lb., Grosse Point, Mich. Yacht Club, Aug. 29, 1952.

National (U.S.) Record .... Same as above.

SPEED FOR 310.137 MI. IN A CLOSED CIRCUIT
World Class Record .... 105.354 mph.
Charles L. Davis, United States, Piper Super Cub PA-18, Lycoming 125 hp engine, gross weight 1,321 lb., Grosse Point, Mich. Yacht Club, Aug. 29, 1952.
National (U.S.) Record .... Same as above.

SPEED FOR 621.359 MI. IN A CLOSED CIRCUIT .... No official record.
SPEED FOR 1,242.739 MI. IN A CLOSED CIRCUIT .... No official record.

LIGHT SEAPLANES—(Class C-2.b)

SECOND CATEGORY (LIGHT SEAPLANES WITH A TOTAL WEIGHT, IN FLYING ORDER, BETWEEN 1,322.8 AND 2,645.6 LB.)

ALTITUDE
World Class Record .... 26,266 ft.
Charles L. Davis, United States, Piper Super Cub Seaplane, N1997A, Lycoming 125 hp engine, Detroit Seaplane Base, Mich., Oct. 18, 1952.
National (U.S.) Record .... Same as above.

AIRLINE DISTANCE
World Class Record .... 946.732 mi.
Harold E. Mistele, United States, Cessna 170, Continental 145 hp engine, gross weight 1,117 kilograms, from near Brownsville, Tex. to near Rosiclair, Ill., June 12, 1952.
National (U.S.) Record .... Same as above.

SPEED FOR 62.137 MI. IN A CLOSED CIRCUIT
World Class Record .... 109.081 mph.
Harold E. Mistele, United States, Cessna 170, Continental 145 hp engine, gross weight 1,986.5 lb., Grosse Pointe, Mich., Yacht Club, Aug. 25, 1952.
National (U.S.) Record .... Same as above.

SPEED FOR 310.685 MI. IN A CLOSED CIRCUIT
World Class Record .... 102.274 mph.
Harold E. Mistele, United States, Cessna 170, Continental 145 hp engine, gross weight 1,986.5 lb., Grosse Pointe, Mich., Yacht Club, Aug. 25, 1952.
National (U.S.) Record .... Same as above.

SPEED FOR 621.369 MI. IN A CLOSED CIRCUIT .... No official reocrd.
SPEED FOR 1,242.739 MI. IN A CLOSED CIRCUIT .... No official record.

LIGHT SEAPLANES—(Class C-2.c)

THIRD CATEGORY (LIGHT SEAPLANES WITH A TOTAL WEIGHT, IN FLYING ORDER, BETWEEN 2,645.6 AND 4,629.7 LB.)

AIRLINE DISTANCE .... No official record.
ALTITUDE .... No official record.
SPEED FOR 62.137 MI. .... No official record.
SPEED FOR 310.685 MI. IN A CLOSED CIRCUIT .... No official record.
SPEED FOR 621.369 MI. .... No official record.
SPEED FOR 1,242.739 MI. .... No official record.

LIGHT SEAPLANES—(Class C-2.d)

FOURTH CATEGORY (LIGHT SEAPLANES WITH A TOTAL WEIGHT, IN FLYING ORDER, BETWEEN 4,629.7 AND 7,495.7 LB.)

AIRLINE DISTANCE .... No official record.
ALTITUDE .... No official record.
SPEED FOR 62.137 MI. .... No official record.
SPEED FOR 310.685 MI. IN A CLOSED CIRCUIT .... No official record.
SPEED FOR 621.369 MI. .... No official record.
SPEED FOR 1,242.739 MI. .... No official record.

LIGHT SEAPLANES—(Class C-2.e)

FIFTH CATEGORY (LIGHT SEAPLANES WITH A TOTAL WEIGHT, IN FLYING ORDER, BETWEEN 7,495.7 AND 11,023 LB.)

AIRLINE DISTANCE .... No official record.
ALTITUDE .... No official record.
SPEED FOR 62.137 MI. .... No official record.
SPEED FOR 310.685 MI. IN A CLOSED CIRCUIT .... No official record.
SPEED FOR 621.369 MI. .... No official record.
SPEED FOR 1,242.739 MI. .... No official record

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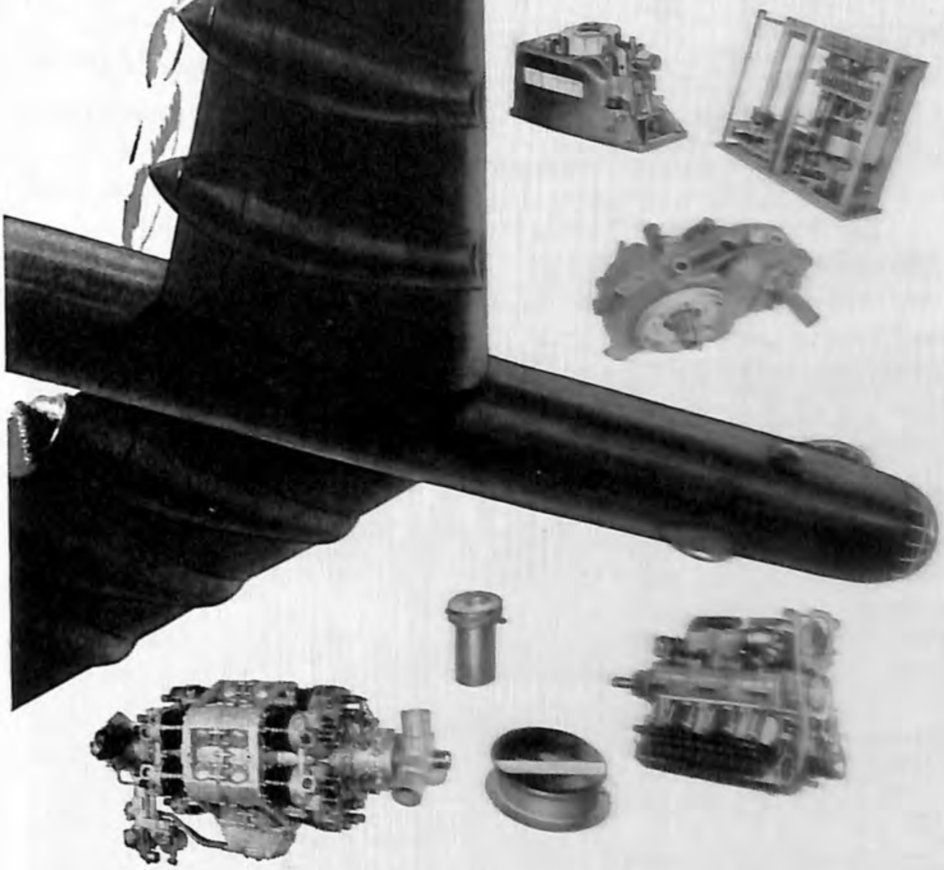
"PRECISION!"



THE STEEL PRODUCTS ENGINEERING CO.

ENGINEERS AND MANUFACTURERS • SPRINGFIELD, OHIO

AMPHIBIANS—(CLASS C3)

AIRLINE DISTANCE

World Class Record .... 1,429,685 mi.
Maj. Gen. F. M. Andrews, pilot; Maj. John Whiteley, co-pilot; and crew, United States, Douglas YOA-5 amphibian, 2 Wright Cyclone 800 hp engines, from San Juan, Puerto Rico, to Langley Field, Va., June 29, 1936.

National (U.S.) Record .... Same as above.

ALTITUDE

World Class Record .... 24,951 ft.
Boris Sergievsky, United States, Sikorsky S-43 amphibian, 2 Pratt and Whitney 750 hp Hornet engines, Stratford, Conn., Apr. 14, 1936.

National (U.S.) Record .... Same as above.

MAXIMUM SPEED

World Class Record .... 230.413 mph.
Maj. Alexander P. de Seversky, United States, Seversky Amphibian, Wright Cyclone 710 hp engine, Detroit, Mich., Sept. 15, 1935.

National (U.S.) Record .... Same as above.

SPEED FOR 62.137 MI. WITHOUT PAYLOAD

World Class Record .... 241.883 mph.
R. R. Colquhoun, Great Britain, Vicker's Supermarine Seagull I, Rolls Royce Griffin Mark 29 1380 hp engine, Marston Moor, July 22, 1950.

National (U.S.) Record .... 209.451 mph.
Major A. P. deSeversky, United States, Seversky Amphibian, Wright "Cyclone" 1,000 hp engine, Miami, Fla., Dec. 19, 1936.

SPEED FOR 621.369 MI. WITHOUT PAYLOAD

World Class Record .... 180.076 mph.
Capt. W. P. Sloan and Capt. B. L. Boatner, USA AC, pilots; United States, Grumman YOA-9 amphibian, 2 Pratt and Whitney engines, 400 hp each, Dayton, O., July 31, 1939.

National (U.S.) Record .... Same as above.

SPEED FOR 1,242.739 MI. WITHOUT PAYLOAD

World Class Record .... 154,701 mph.
Giuseppe Burei and Enrico Rossaldi, pilots; Gino Velati, passenger; Italy, Macchi C-94 I.-NEP I amphibian, 2 Wright Cyclone 750 hp engines, Rovine Ansedonia-Faro Fiumicino Antignano temporary course, May 6, 1937.

National (U.S.) Record .... No official record.

SPEED FOR 3,106.849 MI. WITHOUT PAYLOAD .... No official record.

SPEED FOR 6,213.689 MI. WITHOUT PAYLOAD .... No official record.

WITH PAYLOAD OF 2,204.622 LB.

ALTITUDE

World Class Record .... 23,405 ft.
Ivan Soukhomline, USSR, Tsagui 44 D Amphibian, 4 M-87 840 hp engines, Katcha, near Sebastopol, June 17, 1940.

National (U.S.) Record .... 19,626 ft.
Boris Sergievsky, Sikorsky S-43, 2 Pratt and Whitney 750 hp Hornet engines, Stratford, Conn., Apr. 25, 1936.

SPEED FOR 621.369 MI.

World Class Record .... 172.409 mph.
Ivan Soukhomline, USSR, Tsagui 44 D Amphibian, 4 M-85, 750 hp engines, Katcha-Kersoness-Taganrog course, Sept. 28, 1940.

National (U.S.) Record .... No official record.

SPEED FOR 1,242.739 MI. .... No official record.

SPEED FOR 3,106.849 MI. .... No official record.

WITH PAYLOAD OF 4,409.244 LB.

ALTITUDE

World Class Record .... 20,617 ft.
Ivan Soukhomline, USSR, Tsagui 44 D Amphibian, 4 M-87 840 hp engines, Katcha, near Sebastopol, June 19, 1940.

National (U.S.) Record .... 19,625 ft.
Boris Sergievsky, United States, Sikorsky S-43 Amphibian, 2 Pratt and Whitney, 750 hp engines, Stratford, Conn., Apr 25, 1936.

SPEED FOR 621.369 MI.

World Class Record .... 149.694 mph.
Ivan Soukhomline, USSR, Tsagui 44 D Amphibian 4 M-85 750 hp engines, Katcha-Kersoness-Taganrog course, Oct. 7, 1940.

National (U.S.) Record .... No official record.

SPEED FOR 1,242.739 MI. .... No official record.
SPEED FOR 3,106.849 MI. .... No official record.

WITH PAYLOAD OF 11,023.11 LB.

ALTITUDE

World Class Record .... 17,123 ft.
Ivan Soukhomline, USSR, Tsagui 44 D Amphibian, 4 M-87 840 hp engines, Katcha, near Sebastopol, June 19, 1940.

National (U.S.) Record .... No official record.

SPEED FOR 621.369 MI. .... No official record.
SPEED FOR 1,242.739 MI. .... No official record
SPEED FOR 3,106.849 MI. .... No official record.

WITH PAYLOAD OF 22,046.22 LB.

ALTITUDE .... No official record.
SPEED FOR 621.369 MI. .... No official record.
SPEED FOR 1,242.739 MI. .... No official record.
SPEED FOR 3,106.849 MI. .... No official record.
GREATEST PAYLOAD CARRIED TO AN ALTITUDE OF 6,561.660 FT.

World Class Record .... 11,023 lb.
Ivan Soukhomline, USSR, Tsagui 44 D Amphibian, 4 M-87 840 hp engines, at Katcha, near Sebastopol, June 19, 1940.

National (U.S.) Record .... No official record.

LIGHT AMPHIBIANS

FIRST CATEGORY, CLASS C-3.a (less than 1,322.7 lb.)
SECOND CATEGORY, CLASS C-3.b (1,322.8 to 2,645.4 lb.)
THIRD CATEGORY, CLASS C-3.c (2,645.6 to 4,629.7 lb.)
FOURTH CATEGORY, CLASS C-3.d (4,629.7 to 7,495.7 lb.)
FIFTH CATEGORY, CLASS C-3.e (7,495.7 to 11,023 lb.)

AIRLINE DISTANCE .... No official record.
ALTITUDE .... No official record.
SPEED FOR 62.137 MI. IN A CLOSED CIRCUIT .... No official record.
SPEED FOR 310.685 MI. IN A CLOSED CIRCUIT .... No official record.
SPEED FOR 621.369 MI. IN A CLOSED CIRCUIT .... No official record
SPEED FOR 1,242.739 MI. IN A CLOSED CIRCUIT .... No official record.

ROTORPLANES—(Class E)

DISTANCE IN A STRAIGHT LINE WITHOUT PAYLOAD

World Class Record .... 1,217.137 mi.
Elton J. Smith, United States, Bell 47D1 Helicopter, Franklin 200 hp engine, from Hurst, Ft. Worth, Tex., to Niagara Falls, N. Y. Sept. 17, 1952.

National (U.S.) Record .... Same as above.

DISTANCE CLOSED CIRCUIT WITHOUT PAYLOAD

World Class Record .... 778.311 mi.
Jean Boulet, France, S.E.3 120 Helicopter, Salmson 9 NH 200 hp engine, Buc-Etampes-Rambouillet Course, July 2, 1953.

National (U.S. Record) .... 621.369 mi.
Maj. D. H. Jenson and Maj. W. C. Dodds; USAAF; U.S.; Sikorsky R-5A Helicopter, Pratt and Whitney 450 hp engine, Dayton, O., Nov. 14, 1946.

ALTITUDE, WITHOUT PAYLOAD
World Class Record .... 22,110 ft.
Capt. Russell M. Dobyns, USAF, United States, Piasecki YH-21 Helicopter, Wright R-1820-103 1425 hp engine, Dayton, O., Sept. 2, 1953. (Pending homologation).
National (U.S.) Record .... Same as above.

MAXIMUM SPEED WITHOUT PAYLOAD
World Class Record .... 146.763 mph.
Capt. Russell M. Dobyns, USAF, United States Piasecki YH-21 Helicopter, Wright R-1820-103 1425 hp engine, Vandalia, O., Sept. 4, 1953.
National (U.S.) Record .... Same as above.

SPEED FOR 62.137 MI. IN A CLOSED CIRCUIT, WITHOUT PAYLOAD
World Class Record .... 122.749 mph.
Harold E. Thompson, United States, Sikorsky S-52-1 Helicopter, Franklin 0-425-1 engine, 245 hp, Milford, Conn., May 6, 1949.
National (U.S.) Record .... Same as above.

SPEED FOR 310.685 MI. IN A CLOSED CIRCUIT WITHOUT PAYLOAD .... No official record.

SPEED FOR 621.369 MI. IN A CLOSED CIRCUIT, WITHOUT PAYLOAD
World Record Class .... 66.642 mph.
Maj. D. H. Jenson & Maj. W. C. Dodds, USAAF, Sikorsky R-5A Helicopter, Pratt and Whitney 450 hp engine, Dayton, O., Nov. 14, 1946.
National (U.S.) Record .... Same as above.

SPEED FOR 1,242.739 MI. IN A CLOSED CIRCUIT, WITHOUT PAYLOAD—No official record.
SPEED FOR 3,106.849 MI. IN A CLOSED CIRCUIT, WITHOUT PAYLOAD—No official record.

AIRSHIPS—(CLASS B)

AIRLINE DISTANCE
World Class Record .... 3,967.137 mi.
Dr. Hugo Eckener, Germany, L. Z. 127, *Graf Zeppelin* 5 Maybach 450-550 hp engines, from Lakehurst, N. J., to Friedrichshafen, Germany, Oct. 29, 30, 31, and Nov. 1, 1928.
National (U.S.) Record .... No official record.

GLIDERS—(CLASS D)

(Single-Place)

DISTANCE IN A STRAIGHT LINE
World Class Record .... 535.159 mi.
Richard H. Johnson, U.S. Ross-Johnson sailplane, N-3722C, from Odessa, Tex. to Salina, Kan., Aug. 5, 1951.
National (U.S.) Record .... Same as above.

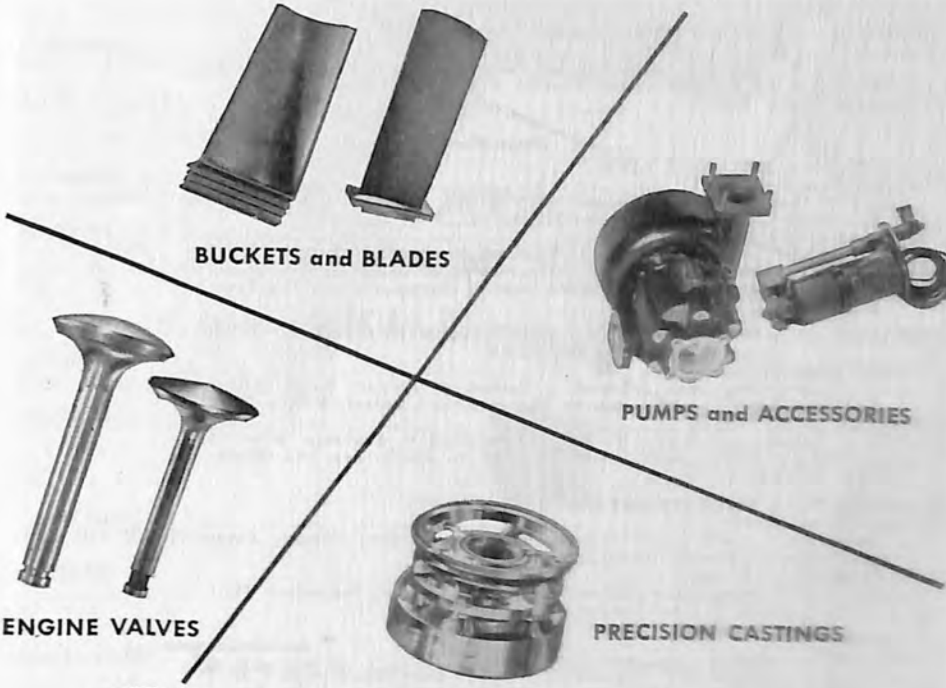
DISTANCE TO A PREDETERMINED POINT WITH RETURN TO POINT OF DEPARTURE
World Class Record .... 260.34 mi.
William H. Coverdale, Jr., United States, Schweizer 1-23 Sailplane, N 91875, from Grand Prairie, Tex. to Brownwood, Tex. and Return, Aug. 22, 1952.
National (U.S.) Record .... Same as above.

DISTANCE TO A PREDETERMINED DESTINATION
World Class Record .... 395.736 mi.
Viatcheslav I. Efimenko, U.S.S.R., A-9 Sailplane, from Grabtsevo (Kalouga) to Melovoe (Vorochilovograd), June 6, 1952.
National (U.S.) Record .... 332.903 mi.
Wallace R. Wiberg, Laister-Kaufmann 10A Sailplane, N 57826, from Odessa, Tex. to Guymon, Okla., Aug. 5, 1951.

DURATION WITH RETURN TO POINT OF DEPARTURE
World Class Record .... 56 hr., 15 min.
Charles Atger, France, Arsenal Air 100 glider, at Romanin les Alpilles (St. Remy de Provence), Apr. 2-4, 1952.
National (U.S.) Record .... 21 hr., 34 min.
Lt. William Cocke, Jr., Cocke "Nighthawk" glider, Honolulu, T. H., Dec. 17-18, 1931.

ALTITUDE GAINED
World Class Record .... 30,100 ft.
William S. Ivans, Jr., U.S., Schweizer SGS 1-23 sailplane, N-91876, Bishop, Cal., Dec. 30, 1950.
National (U.S.) Record .... Same as above.

ALTITUDE ABOVE SEA LEVEL
World Class Record .... 42,100 ft.
William S. Ivans, Jr., U.S., Schweizer SGS 1-23 sailplane, N-91876, Bishop, Cal., Dec. 30, 1950.
National (U.S.) Record .... 309.678 mi.


BUCKETS and BLADES
PUMPS and ACCESSORIES
ENGINE VALVES
PRECISION CASTINGS

SPEED FOR 62.137 MI. OVER A TRIANGULAR COURSE
World Class Record .... 52.766 mph.
Richard H. Johnson, United States, Ross-Johnson 5 Sailplane, N3722C, Grand Prairie-Russell-Don's Air Park-Grand Prairie, Tex. Course, Aug. 28, 1952.
National (U.S.) Record .... Same as above.

(Multi-Place)

DISTANCE IN A STRAIGHT LINE
World Class Record .... 515.626 mi.
Victor Iltchenko, pilot; Grigory Petchnikov, passenger; USSR; A-10 Sailplane, from Kountsevo (Moscow) to Ilovlia (Stalingrad), May 26, 1933.
National (U.S.) Record .... 309.678 mi.
Richard H. Johnson, pilot; R. A. Sparling, passenger; Schweizer TG-2 glider, NC-479903, from Prescott, Ariz. municipal Airport to the Ackerman Ranch approximately 11 miles west of Governador, N. M., Sept. 8, 1946.

DISTANCE TO A PREDETERMINED POINT WITH RETURN TO POINT OF DEPARTURE
World Class Record .... 270.917 mi.
Evert Dommisse, pilot; Samuel J. Barker, passenger; South Africa, Kranich II ZS-G Sailplane, from Keetmanshoop to Mariental and return, Feb. 9, 1952.
National (U.S.) Record .... 153.930 mi.
Ted Nelson and Harry N. Perl, Hummingbird auxiliary powered sailplane, N 68959, from Grand Prairie, Tex. to Bowie, Tex. and return, Aug. 20, 1952.

DISTANCE TO A PREDETERMINED DESTINATION
World Class Record .... 336.348 mi.
Jerzy Popiel, pilot; Adolf Siemaszkiewicz, passenger; Poland; Zuraw II S.P.-1211 Sailplane, from Lublin to Hrubieszow, July 20, 1953.
National (U.S.) Record .... 223.138 mi.
David C. Johnson, pilot; Robert Fronius, passenger; Schweizer TG-2 from Adelanto, Cal. to Overton, Nev. July 3, 1950.

DURATION
World Class Record .... 53 hr., 4 min.
Albert Carraz and Jean Branswick, France, Castel-Mauboussin C.M. 7 glider, Glider site at Romanin les Alphilles, Province of St. Remy, Feb. 4-6, 1952.
National (U.S.) Record .... 12 hr., 3 min.
Leslie R. Arnold, pilot; Harry N. Perl, passenger, Schweizer TG3-A Glider, Warm Springs, Cal., Apr. 29, 1951.

ALTITUDE GAINED
World Class Record .... 34,426 ft.
Laurence E. Edgar, pilot; Harold E. Klieforth, passenger, United States, Pratt-Read PR-G1 Sailplane, Bishop, Cal., Mar. 19, 1952.
National (U.S.) Record .... Same as above.

ALTITUDE ABOVE SEA LEVEL
World Class Record .... 44,255 ft.
Laurence E. Edgar, pilot; Harold E. Klieforth, passenger, United States, Pratt-Read PR-G1 Sailplane, Bishop, Cal., Mar. 19, 1952.
National (U.S.) Record .... Same as above.

SPEED FOR 62.137 MI. OVER A TRIANGULAR COURSE
World Class Record .... 49,920 mph.
Ernst-Günter Haase, pilot; Reinaldo Picchio, passenger, Germany; Condor IV Sailplane, at Klippeneck, Aug. 13, 1952.
National (U.S.) Record .... 27.873 mph.
William G. Briegleb, pilot; Jack LaMare, passenger; Briegleb BG-8 glider, N-33636, Adelanto, Cal., Aug. 12, 1949.

BALLOONS (CLASS A)

THIRD CATEGORY—(21,189 CU. FT. OR LESS)

DURATION
World Class Record .... 46 hr. 10 min.
Serge Sinoveev, USSR, VR 80 Balloon, 21,082.458 cu. ft., take-off near Dolgoproudnaia, Mar. 30, 1941.
National (U.S.) Record .... No official record.

DISTANCE
World Class Record .... 499.69 mi.
Georges Cormier, France, July 1, 1922.
National (U.S.) Record .... No official record

ALTITUDE
World Class Record .... 23,286 ft.
Boris Nevernov, USSR, VR-80 Balloon, 13,984.344 cu. ft., at Dolgoproudnaia, Aug. 31, 1940.
National (U.S.) Record .... No official record.

FOURTH CATEGORY—(21,224 - 31,783 CU. FT.)

DURATION
World Class Record .... 61 hr. 30 min.
F. Bourlouzki and A. Aliochine, USSR, from Moscow to Charaboulski, Apr. 3-6, 1939.
National (U.S.) Record .... 19 hr. 00 min.
W. C. Naylor and K. W. Warren, *Skylark*, Little Rock, Ark., to Crawford, Tenn., Apr. 29-30, 1926.

DISTANCE
World Class Record .... 1,056.950 mi.
F. Bourlouzki and A. Aliochine, USSR, from Moscow to Charaboulski, region of Koustanai, Apr. 3-6, 1939.
National (U.S.) Record .... 410.104 mi.
W. C. Naylor and K. W. Warren, *Skylark*, Little Rock, Ark., to Crawford, Tenn., Apr. 29-30, 1926.

ALTITUDE
World Class Record .... 27,718 ft.
Alexei Rostine, USSR, VR-70 Balloon of 29,451.876 cu. ft. at Dolgoproudnaia, Oct. 4, 1940.
National (U.S.) Record .... No official record.

FIFTH CATEGORY—(31,818 - 42,376.8 CU. FT.)

DURATION
World Class Record .... 61 hr. 30 min.
F. Bourlouzki and A. Aliochine, USSR, from Moscow to Charaboulski, Apr. 3-6, 1939.
National (U.S.) Record .... 26 hr. 48 min.
E. J. Hill and A. G. Schlosser, Ford Airport to Montale, Va., July 4-5, 1927.

DISTANCE
World Class Record .... 1,056.950 mi.
F. Bourlouzki and A. Aliochine, USSR, from Moscow to Charaboulski, region of Koustanai, Apr. 3-6, 1939.
National (U.S.) Record .... 571.877 mi.
S. A. U. Rasmussen, Ford Airport to Hookerton, N. C., July 4-5, 1927.

ALTITUDE
World Class Record .... 27,718 ft.
Alexei Rostine, USSR, VR-70 Balloon, 29,451.876 cu. ft., at Dolgoproudnaia, Oct. 4, 1940.
National (U.S.) Record .... No official record

SIXTH CATEGORY—(42,411.8 - 56,502.4 CU. FT.)

DURATION
World Class Record .... 69 hr. 20 min.
Boris Nevernov and Semion Gaiguerov, USSR, VR-73 Balloon, 50,357.764 cu. ft., from Dolgoproudnaia to Novosibirsk, Mar. 13-16, 1941.
National (U.S.) Record .... 26 hr. 46 min.
E. J. Hill and A. G. Schlosser, Ford Airport to Montvale, Va., July 4-5, 1927.

DISTANCE
World Class Record .... 1,719.215 mi.
Boris Nevernov and Semion Gaiguerov, USSR, VR-73 Balloon, 50,357.764 cu. ft., from Dolgoproudnaia to Novosibirsk, Mar. 13-16, 1941.
National (U.S.) Record .... 571.877 mi.
S. A. U. Rasmussen, Ford Airport to Hookerton, N. C., July 4-5, 1927.

ALTITUDE
World Class Record .... 27,718 ft.
Alexei Rostine, USSR, VR-70 Balloon, 29,451.876 cu. ft., at Dolgoproudnaia, Oct. 4, 1940.
National (U.S.) Record .... No official record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THE INSULATOR

SEVENTH CATEGORY—(56,537.7 - 77,690.8 CU. FT.)

DURATION

World Class Record .... 69 hr. 20 min.
Boris Nevernov and Semion Gaiguerov, USSR, VR-73 Balloon, 50,357.764 cu. ft., from Dolgoproudnaia to Novosibirsk, Mar. 13-16, 1941.

National (U.S.) Record .... 51 hr. 00 min.
T. G. W. Settle and C. H. Kendall, Gordon-Bennett Balloon Race, Chicago, Ill., Sept. 2-4, 1933.

DISTANCE

World Class Record .... 1,719.215 mi.
Boris Nevernov and Semion Gaiguerov, USSR, VR-73 Balloon, 50,357.764 cu. ft., from Dolgoproudnaia to Novosibirsk, Mar. 13-16, 1941.

National (U.S.) Record .... 963.123 mi.
T. G. W. Settle and Wilfred Bushnell, from Basle, Switzerland to Daugieliski, Poland, Sept. 25-27, 1932.

ALTITUDE

World Class Record .... 30,755 ft.
Josef Emmer, Austria, *OE-Marek Emmer II* Balloon, Vienna-Lac de Nuesiedl, Sept. 25-27, 1937.

National (U.S.) Record .... No official record

EIGHTH CATEGORY—(77,706 - 150,942 CU. FT.)

DURATION

World Class Record .... 69 hr. 20 min.
Boris Nevernov and Semion Gaiguerov, USSR, VR-73 Balloon, 50,357.764 cu. ft., from Dolgoproudnaia to Novosibirsk. Mar. 13-16, 1941.

National (U.S.) Record .... 51 hr. 00 min.
T. G. W. Settle and C. H. Kendall, Gordon-Bennett Balloon Race, Chicago, Ill., Sept. 2-4, 1933.

DISTANCE

World Class Record .... 1,719.215 mi.
Boris Nevernov and Semion Gaiguerov, USSR, VR-73 Balloon, 50,357.764 cu. ft., from Dolgoproudnaia to Novosibirsk, Mar. 13-16, 1941.

National (U.S.) Record .... 963.123 mi.
T. G. W. Settle and Wilfred Bushnell, from Basle, Switzerland to Daugieliski, Poland, Sept. 25-27, 1932.

ALTITUDE

World Class Record .... 30,755 ft.
Josef Emmer, Austria, *OE-Marek Emmer II* Balloon, Vienna-Lac de Neusiedl, Sept. 25-27, 1937.

National (U.S.) Record .... 28,508 ft.
Capt. Hawthorne C. Gray, Scott Field, Belleville, Ill., Mar. 9, 1927.

NINTH CATEGORY—(105,977 - 141,256 CU. FT.)

DURATION

World Class Record .... 69 hr. 20 min.
Boris Nevernov and Semion Gaiguerov, USSR, VR-73 Balloon, 50,357.764 cu. ft., from Dolgoproudnaia to Novosibirsk, Mar. 13-16, 1941.

National (U.S.) Record .... 51 hr. 00 min.
T. G. W. Settle and C. H. Kendall, Gordon-Bennett Balloon Race, Chicago, Ill., Sept. 2-4, 1933.

DISTANCE

World Class Record .... 1,719.215 mi.
Boris Nevernov and Semion Gaiguerov, USSR, VR-73 Balloon, 50,357.764 cu. ft., from Dolgoproudnaia to Novosibirsk, Mar. 13-16, 1941.

National (U.S.) Record .... 963.123 mi.
T. G. W. Settle and Wilfred Bushnell, from Basle, Switzerland to Daugieliski, Poland, Sept. 25-27, 1932.

ALTITUDE

World Class Record .... 38,811 ft.
Z. J. Burzynski, Poland, at Legjonowo, Mar. 29, 1936.

National (U.S.) Record .... 28,508 ft.
Capt. Hawthorne C. Gray, at Scott Field, Belleville, Ill., Sept. 2-4, 1933.

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TENTH CATEGORY—(141,291.3 CU. FT. OR OVER)

DURATION
World Class Record .... 87 hr. 00 min.
H. Kaulen, Germany, Dec. 13-17, 1913.
National (U.S.) Record .... 51 hr. 00 min.
Lt. Comdr. T. G. W. Settle and Lt. Charles H. Kendall, Gordon-Bennett Balloon Race, Chicago, Ill., Sept. 2-4, 1933.

DISTANCE
World Class Record .... 1,896.856 mi.
Berliner, Germany, Feb. 8-10, 1914.
National (U.S.) Record .... 1,172.898 mi.
A. R. Hawley, St. Louis, Mo. to Lake Tschotogama, Canada, Oct. 17-19, 1910.

ALTITUDE
World Class Record .... 72,395 ft.
Capt. Orvil Anderson and Capt. Albert Stevens, United States, *Explorer II*, take-off approximately 11 miles southwest of Rapid City, S. D., landing on school reserve land approximately 12 miles south of White Lake, S. D., Nov. 11, 1935.
National (U.S.) Record .... Same as above.

FEMININE RECORDS

AIRPLANES—(CLASS C) GROUP II

DISTANCE IN A CLOSED CIRCUIT .... No official record.

AIRLINE DISTANCE
World Class Record .... 3,671.432 mi.
V. Grisodoubova and P. Ossipenko, pilots; M. Raskova, Navigatrix; USSR; Soukhoi Rodina airplane, 2 M-96 800 hp engines, Sept. 24-25, 1938.
National (U.S.) Record .... 2,447.728 mi.
Amelia Earhart, Lockheed Vega monoplane, Pratt and Whitney Wasp 450 hp engine, from Los Angeles, Cal., to Newark, N. J., Aug. 24-25, 1932.

ALTITUDE
World Class Record .... 46,948.725 ft.
Mrs. Maryse Hilsz, France, Potez 506 biplane, Gnome and Rhone 900 hp engine, at Villacoublay, June 23, 1936.
National (U.S.) Record .... 30,052 ft.
Jacqueline Cochran, Beechcraft biplane, NX-18562, Pratt and Whitney 600 hp engine, Palm Springs, Cal., Mar. 24, 1939.

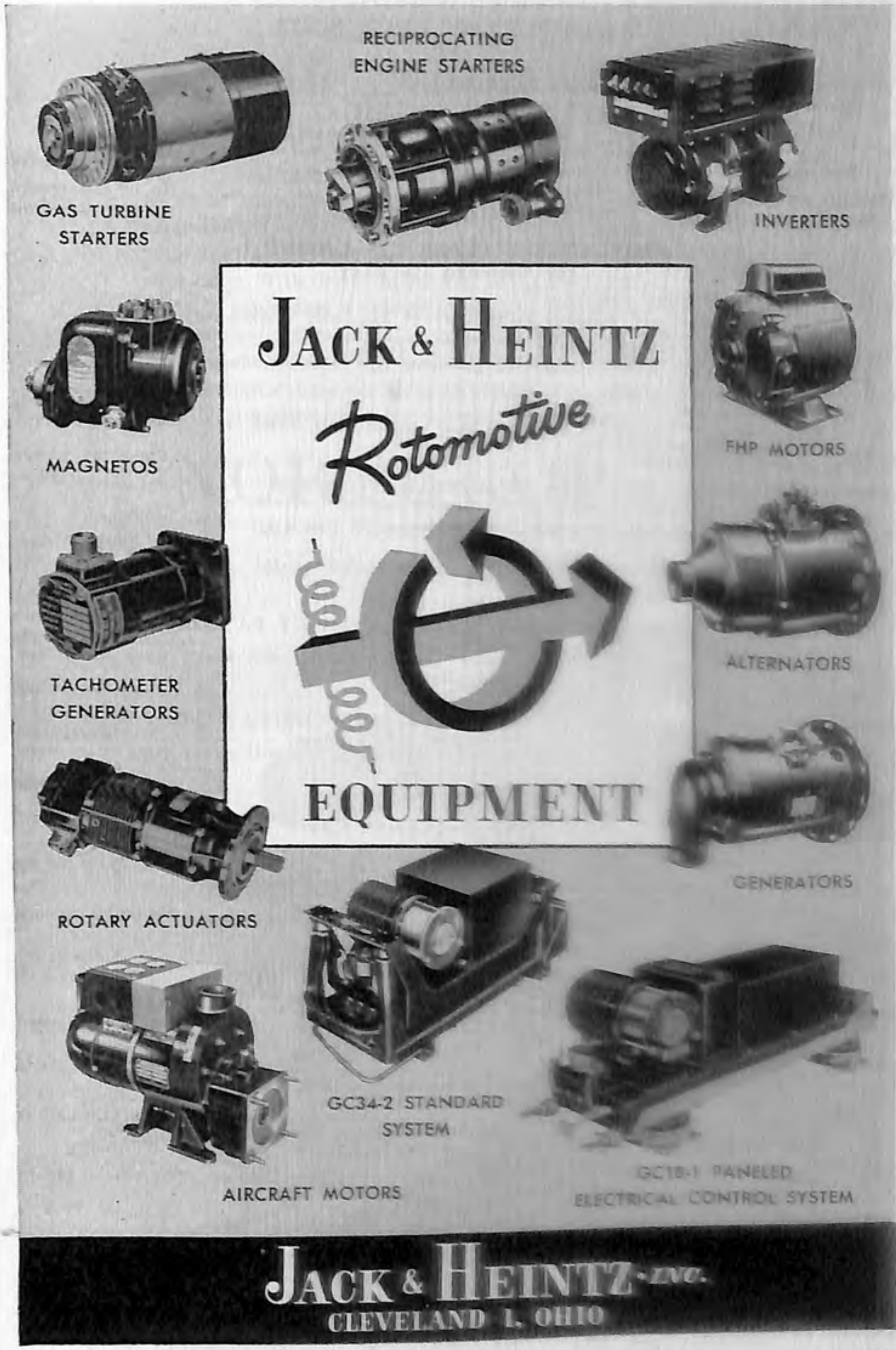
SPEED, MAXIMUM—1.8 MI. (3 KM.) COURSE
World Class Record .... 412.002 mph.
Jacqueline Cochran, United States, North American P-51 monoplane, Packard built Rolls Royce Merlin 1,450 hp engine; Thermal, Cal., Dec. 17, 1947.
National (U.S.) Record .... Same as above.

SPEED, MAXIMUM—9.3 MI. (15 KM.) COURSE
World Class Record .... 464.374 mph.
Jacqueline Cochran, United States, North American F-51 low wing monoplane, Packard built Rolls Royce Merlin 1450 hp engine, near Indio, Cal., Apr. 9, 1951.
National (U.S.) Record .... Same as above.

SPEED FOR 62.137 MI. WITHOUT PAYLOAD
World Class Record .... 469.549 mph.
Jacqueline Cochran, United States, North American P-51 monoplane, Packard Rolls Royce Merlin Engine 1,450 hp, Coachella Valley, Col., Dec. 10, 1947.
National (U.S.) Record .... Same as above.

SPEED FOR 310.685 MI. WITHOUT PAYLOAD
World Class Record .... 436.995 mph.
Jacqueline Cochran, United States, North American F-51 monoplane, Rolls Royce Merlin 1,450 hp engine; Desert Center-Mt. Wilson Course, Dec. 29, 1949.
National (U.S.) Record .... Same as above.

SPEED FOR 621.369 MI. WITHOUT PAYLOAD
World Class Record .... 431.094 mph.
Jacqueline Cochran, United States, North American F-51 monoplane, Packard built Rolls Royce Merlin 1,450 hp engine; start and finish near Palm Springs, Cal., May 24, 1948.
National (U.S.) Record .... Same as above.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GC18-1 PANELED
ELECTRICAL CONTROL SYSTEM
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CLEVELAND 1, OHIO

SPEED FOR 1,242.739 MI. WITHOUT PAYLOAD
World Class Record .... 447.470 mph.
Jacqueline Cochran, United States, North American P-51 monoplane, Packard built Rolls Royce Merlin 1,450 hp engine; start and finish near Palm Springs, Cal., May 22, 1946.
National (U.S.) Record .... Same as above.

SPEED FOR 3,106.847 MI. WITHOUT PAYLOAD .... No official record.
SPEED FOR 6,213.695 MI. WITHOUT PAYLOAD .... No official record.

AIRPLANES—(CLASS C)—GROUP I

JET POWERED AIRCRAFT

DISTANCE IN A CLOSED CIRCUIT
Neither World Class nor National (U.S.) Record has been established.

DISTANCE IN A STRAIGHT LINE
Neither World Class nor National (U.S.) Record has been established.

ALTITUDE WITHOUT LOAD
World Class Record .... 47,169 ft.
Miss Jacqueline Cochran, United States, Canadair-built F-86E swept wing monoplane, Orenda jet engine, Edwards, Cal., May 24, 1953.
National (U.S.) Record .... Same as above.

SPEED, MAXIMUM—1.8 MI. (3 KM.) STRAIGHTAWAY COURSE
Neither World Class nor National (U.S.) Record has been established.

SPEED, MAXIMUM—9.3 MI. (15 KM.) STRAIGHTAWAY COURSE
World Class Record .... 675.471 mph.
Miss Jacqueline Cochran, United States, Canadair-built F-86E swept wing monoplane, Orenda jet engine, Edwards, Cal., June 3, 1953.
National (U.S.) Record .... Same as above.

SPEED FOR 62.137 MILES IN A CLOSED CIRCUIT WITHOUT PAYLOAD
World Class Record .... 652.552 mph.
Miss Jacqueline Cochran, United States, Canadair-built F-86E swept wing monoplane, Orenda jet engine, Edwards, Cal., May 18, 1953.
National (U.S.) Record .... Same as above.

SPEED FOR 310.69 MILES IN A CLOSED CIRCUIT WITHOUT PAYLOAD
World Class Record .... 590.321 mph.
Miss Jacqueline Cochran, United States, Canadair-built F-86E swept wing monoplane, Orenda jet engine, Edwards, Cal., May 23, 1953.
National (U.S.) Record .... Same as above.

SEAPLANES—(CLASS C2)

DISTANCE IN A CLOSED CIRCUIT
World Class Record .... 1,086.908 mi.
Lt. P. Ossipenko and Lt. V. Lomako, USSR, MP-1 monoplane seaplane, AM-34 750 hp engine, May 24, 1938.
National (U.S.) Record .... No official record.

DISTANCE, AIRLINE
World Class Record .... 1,392.801 mi.
Poline Ossipenko and Vera Lomako, pilots; Marina M. Raskova, navigatrix; USSR, MP-1 seaplane, AM-34 750 hp engine, from Sebastopol to Lake Kholmskoie, July 2, 1938.
National (U.S.) Record .... No official record.

ALTITUDE
World Class Record .... 29,081.304 ft.
Poline Ossopenko, USSR Canot Volant monoplane seaplane, AM-34 750 hp engine, at Sebastopol, May 25, 1937.
National (U.S.) Record .... 13,461.259 ft
Mrs. Marion Eddy Conrad, Savoia-Marchetti seaplane, Kinner 125 hp engine, Port Washington, L. I., New York, Oct. 20, 1930.

MAXIMUM SPEED .... No official record
SPEED FOR 62.137 MI. WITHOUT PAYLOAD
World Class Record .... 79.138 mph.
Miss Crystal Mowry and Miss Edith McCann, United States, Kitty Hawk seaplane, Kinner 125 hp engine, Miami, Fla., Dec. 9, 1936.
National (U.S.) Record .... Same as above
SPEED FOR 310.685 MI. WITHOUT PAYLOAD .... No official record.
SPEED FOR 621.369 MI. WITHOUT PAYLOAD .... No official record.
SPEED FOR 1,242.739 MI. WITHOUT PAYLOAD .... No official record.
SPEED FOR 3,106.847 MI. WITHOUT PAYLOAD .... No official record
SPEED FOR 6,213.695 MI. WITHOUT PAYLOAD .... No official record


USAF

GLIDERS—(CLASS D)

(Single-Place)

DURATION WITH RETURN TO POINT OF DEPARTURE

World Class Record .... 35 hr. 3 min.
Miss Marcelle Choisnet, France, Arsenal Air-100 glider, No. 5 Romanin les Alpilles, Nov. 17-19, 1948.

National (U.S.) Record .... 7 hr. 28 min.
Helen M. Montgomery, Stevens-Franklin glider, Crystal Downs Beach, 5 miles North of Frankfort, Mich., Sept. 4, 1938.

DISTANCE IN A STRAIGHT LINE

World Class Record .... 465.532 mi.
O. Klepikova, USSR, Rot-Front 7 glider from Moscow to Otradnoie, region of Stalingrad, July 6, 1939.

National (U.S.) Record .... 201.450 mi.
Miss Betsy Woodward, Briegleb BG-7 Sailplane, from Grand Prairie, Tex. to Sweetwater, Tex., Aug. 22, 1952.

ALTITUDE GAINED

World Class Record .... 25,414 ft.
Mrs. Yvonne Gaudry, France, N-2000 glider No. 12, St. Auban sur Durance, Jan. 20, 1951.

National (U.S.) Record .... 14,496 ft.
Mrs. Betty Loufek, Laister-Kaufmann 10-A, NC 44781 glider, at Bishop, Cal., Apr. 15, 1948.

ALTITUDE ABOVE SEA LEVEL

World Class Record .... 27,342 ft.
Mrs. Vvonne Gaudry, France, N-2000 glider No. 12, St. Auban sur Durance, Jan. 20, 1951.

National (U.S.) Record .... No official record.

DISTANCE TO A PREDETERMINED DESTINATION

World Class Record .... 248.758 mi.
Miss Jacqueline Leroy, France, Air 100 Glider, from Chavenay-Villepreux to Angouleme, May 9, 1953.

National (U.S.) Record .... 76.752 mi.
Miss Betsy Woodward, Briegleb BG-7 Sailplane, from Grand Prairie, Tex. to Stephenville, Tex., Aug. 29, 1952.

DISTANCE TO A PREDETERMINED POINT WITH RETURN TO POINT OF DEPARTURE

World Class Record .... 180.320 mi.
Mrs. Choisnet-Gohard, France, Air 100 Gondolo Glider, Beynes-Romilly-Beynes course, May 12, 1953.

National (U.S.) Record .... 120.452 mi.
Miss Betsy Woodward, Briegleb BG-7 Sailplane, from Grand Prairie, Tex. to Mineral Wells, Tex. and return, Aug. 21, 1952.

SPEED FOR 62.137 MI. OVER A TRIANGULAR COURSE

World Class Record .... 36.766 mph.
Mrs. Ewa Nechay, Poland, Mucha S.P.-1132 Sailplane, Leszno-Rawicz-Gostyn-Leszno course, June 21, 1953.

National (U.S.) Record .... 28.635 mph.
Miss Betsy Woodward, Briegleb BG-7 Sailplane, Grand Prairie-Russell-Don's Air Park-Grand Prairie, Tex. Course, Aug. 28, 1952.

GLIDERS—(CLASS D)

(Multi-Place)

DURATION

World Class Record .... 28 hr. 41 min.
Miss Choisnet-Gohard, pilot; Miss Yvette Mazellier, passenger, France, Castel Mauboussin C.M.7 glider, Romanin les Alphilles, Nov. 22, 1951.

National (U.S.) Record .... 4 hr. 15 min.
Miss Betsy Woodward, pilot; Anna Saudek, passenger, Pratt Read Sailplane, from Adelanto, Cal. to Las Vegas, Nev., July 11, 1952.

DISTANCE IN A STRAIGHT LINE

World Class Record .... 275.711 mi.
O. Klepikova and V. Bardina, USSR, Stakanovetz glider, from Toula to Konotop, June 19, 1940.

National (U.S.) Record .... 170.316 mi.
Miss Betsy Woodward, pilot; Anna Saudek, passenger, Pratt Read Sailplane, from Adelanto, Cal. to Las Vegas, Nev., July 11, 1952.

ALTITUDE ABOVE SEA LEVEL

World Class Record .... 23,104 ft

Mrs. M. Choisnet-Gohard, pilot; Miss J. Queyrel, passenger; France, Castel Mauboussin CM glider No. 02, St. Auban sur Durance, Jan. 18, 1951.

National (U.S.) Record .... No official record.

ALTITUDE GAINED

World Class Record .... 19,921 ft.

Mrs. M. Choisnet-Gohard, pilot; Miss J. Queyrel, passenger; France, Castel Mauboussin CM glider No. 02, St. Auban sur Durance, Jan. 18, 1951.

National (U.S.) Record .... 10,797 ft.

Betsy Woodward, pilot; Vera Gere, passenger; Schweizer TG-3 glider, N-67871, El Mirage Field, Adelanto, Cal., Apr. 7, 1950.

DISTANCE TO A PREDETERMINED DESTINATION

World Class Record .... 219.716 mi.

Mrs. Wanda Ademak, pilot; Mrs. Marta Sitarska, passenger; Poland, Zuraw biplane glider, from Lisie Katy to Lublin, May 29, 1953.

National (U.S.) Record .... 170.316 mi.

Miss Betsy Woodward, pilot; Anna Saudek, passenger; United States, Pratt-Read Sailplane, from Adelanto, Cal. to Las Vegas, Nev., July 11, 1952.

DISTANCE TO A PREDETERMINED POINT WITH RETURN TO POINT OF DEPARTURE

World Class Record .... 102.28 mi.

Wanda Szemplinska, pilot; Ryszarda Rozum, passenger; Poland, Zuraw S.P. 1276 glider, Varsovie-Tluszcz-Kolbiel, June 8, 1952.

National (U.S.) Record .... No official record.

SPEED FOR 62.137 MI. OVER A TRIANGULAR COURSE

World Class Record .... 39.945 mph.

Anna Samocadova, pilot; A. V. Neventchannaya, passenger; U.S.S.R., A-10 glider No. 1, Grabtsevo Makarova-Peremychl course, July 30, 1952.

National (U.S.) Record .... No official record.

BALLOONS—(CLASS A)

THIRD CATEGORY (21,188.4 CU. FT. OR LESS)

DURATION

World Class Record .... 22 hr. 40 min.

A. Kondratyeva, USSR, SSSR BP-31 Balloon, Moscow to Loukino Polie, May 14-15, 1939.

National (U.S.) Record .... No official record.

DISTANCE

World Class Record .... 298.954 mi.

A. Kondratyeva, USSR, SSSR BP-31 balloon, from Moscow to Loukino Polie, May 14-15, 1939.

National (U.S.) Record .... No official record.

ALTITUDE .... No official record.

SIXTH CATEGORY (10,629.514 - 56,502.4 CU. FT.)

DURATION

World Class Record .... 34 hr. 21 min. 36 sec.

Miss L. Ivanova and Miss S. Tonkova, USSR, take-off near the Central Aerology Observatory at Dolgoproudnaia, landing at Barachevo, Apr. 22-24, 1948.

National (U.S.) Record .... No official record.

DISTANCE .... No official record.

ALTITUDE .... No official record.

SEVENTH CATEGORY (56,537.714 - 77,690.8 CU. FT.)

DURATION

World Class Record .... 34 hr. 21 min. 36 sec.

Miss L. Ivanova and Miss S. Tonkova, USSR, take-off near the Central Aerology Observatory at Dolgoproudnaia, landing at Barachevo, Apr. 22-24, 1948.

National (U.S.) Record .... No official record.

DISTANCE .... No official record.

ALTITUDE .... No official record.

EIGHTH CATEGORY (77,726.114 - 105,942 CU. FT.)

DURATION

World Class Record .... 34 hr. 21 min. 36 sec.

Miss L. Ivanova and Miss S. Tonkova, USSR, take-off near the Central Aerology Observatory at Dolgoproudnaia, landing at Barachevo, Apr. 22-24, 1948.

National (U.S.) Record .... No official record.

DISTANCE .... No official record.

ALTITUDE .... No official record.

NINTH CATEGORY (105,977.314 - 141,256 CU. FT.)

DURATION

World Class Record .... 34 hr. 21 min. 36 sec.

Miss L. Ivanova and Miss S. Tonkova, USSR, take-off near the Central Aerology Observatory at Dolgoproudnaia, landing at Barachevo, Apr. 22-24, 1948.

National (U.S.) Record .... No official record.

DISTANCE .... No official record.

ALTITUDE .... No official record.

TENTH CATEGORY (141,291.314 CU. FT. OR OVER)

DURATION

World Class Record .... 34 hr. 21 min. 36 sec.

Miss L. Ivanova and Miss S. Tonkova, USSR, take-off near the Central Aerology Observatory at Dolgoproudnaia, landing at Barachevo, Apr. 22-24, 1948.

National (U.S.) Record .... No official record.

DISTANCE .... No official record.

ALTITUDE .... No official record.

ROTORPLANES—(Class E)

DISTANCE AIRLINE

World Class Record .... 67.713 mi.

Miss Hanna Reitsch, Germany, FW. 61. V2, D-EKRA helicopter, from Stendal airport to Tempelhof airport, Oct. 25, 1937.

National (U.S.) Record .... No official record.

DISTANCE, CLOSED CIRCUIT .... No official record.

ALTITUDE .... No official record.

SPEED FOR 12.43 MI. .... No official record.

F.A.I. COURSE RECORDS

LOS ANGELES TO NEW YORK

World Class Record .... 580.935 mph.

Col. W. H. Councill, USAAF, United States, Lockheed P-80 jet propelled monoplane, Allison J-33 engine, from Long Island Beach Municipal Airport to La Guardia Airport, Jan. 26, 1946. Distance: 2,453.807 mi. Elapsed Time: 4 hr. 13 min. 26 sec.

National (U.S.) Record .... Same as above.

WASHINGTON, D. C. TO HAVANA, CUBA

World Class Record .... 314.070 mph.

Woodrow W. Edmondson, United States, North American P-51 monoplane, Packard Rolls Royce 1,450 hp engine, from Washington National Airport to Rancho Boyeros Airport, Nov. 25, 1947. Elapsed Time; 3 hr. 37 min. 28.6 sec.

National (U.S.) Record .... Same as above

HAVANA, CUBA TO WASHINGTON, D. C.

World Class Record .... 350.328 mph.

Woodrow W. Edmondson, United States, North American P-51 monoplane, Packard Rolls Royce 1,450 hp engine, from Rancho Boyeros Airport to Washington National Airport, Nov. 27, 1947. Elapsed Time: 3 hr. 15 min. 13 sec.

National (U.S.) Record .... Same as above

CAPETOWN, AFRICA TO LONDON, ENGLAND

World Class Record .... 151.456 mph.

A. Henshaw, Great Britain, Percival Mew Gull airplane, D. H. Gipsy VI-2 motor, 205 hp. Feb. 7-9, 1939. Elapsed Time: 39 hr. 36 min.

National (U.S.) Record .... No official record

LONDON, ENGLAND TO ROME, ITALY

World Class Record .... 447.219 mph.

John Cunningham and P. O. Bugge, Great Britain, de Havilland Comet DH-106 Mark I, 4 de Havilland Ghost Mark I jet engines, Mar. 16, 1950. Elapsed Time: 1 hr. 58 min. 37 sec.

National (U.S.) Record .... No official record

ROME, ITALY TO LONDON, ENGLAND

World Class Record .... 453.308 mph.

John Cunningham and P. O. Bugge, Great Britain, de Havilland Comet DH-106 Mark I, 4 de Havilland Ghost Mark I jet engines, Mar. 16, 1950. Elapsed Time: 1 hr. 58 min. 04 sec.

National (U.S.) Record .... No official record

PARIS, FRANCE TO SAIGON, FRENCH INDO-CHINA

World Class Record .... 67.926 mph.

Miss Maryse Hilsz, France, Caudron Simoun C. 635 airplane, Renault engine, from Le Bourget Airport to Tan Son Nhut Airport, Dec. 19-23, 1937. Elapsed Time: 96 hr. 36 min. 15 sec.

National (U.S.) Record .... No official record.

PARIS, FRANCE TO HANOI, FRENCH INDO-CHINA

World Class Record .... 111.976 mph.

Andre Japy, France, Caudron Simoun airplane, Renault 6Q01, number 71 motor, from Le Bourget, Paris to Gia Lam Airport, Hanoi, Nov. 15-18, 1936. Elapsed Time: 50 hr. 59 min. 49 sec.

National (U.S.) Record .... No official record.

NEW YORK, N. Y. TO LOS ANGELES, CAL.

World Class Record .... 328.598 mph.

Capt. Boyd L. Grubaugh, pilot; Capt. J. L. England, co-pilot; M/Sgt. R. R. Pierron, M/Sgt. D. H. Atkins, M/Sgt. T. L. Wolfe, T/Sgt. D. B. Smith, crew; USAAF, United States, Boeing B-29 monoplane, 4 Wright R-3350-23A engines, from La Guardia Airport to Burbank, Cal., Aug. 1, 1946. Distance: 2,453.805 mi. Elapsed Time: 7 hr. 28 min. 03 sec.

National (U.S.) Record .... Same as above

NEW YORK CITY, U.S.A. TO LONDON, ENGLAND

World Class Record .... 169.227 mph.

Henry T. Merrill and John S. Lambe, pilots, United States, Lockheed Electra monoplane, Pratt and Whitney SHI engine, May 9-10, 1937. Elapsed Time: 20 hr. 29 min. 45 sec.

National (U.S.) Record .... Same as above

LONDON, ENGLAND TO MELBOURNE, AUSTRALIA

World Class Record .... 159.038 mph.

C. W. A. Scott and T. Campbell Black, Great Britain, de Havilland Comet monoplane, 2 D H. Gipsy VI engines, Oct. 20-23, 1934. Elapsed Time: 71 hr. 00 min. 18 sec.

National (U.S.) Record .... 121.267 mph.

Roscoe Turner and Clyde Pangborn, Boeing 247-D monoplane, 2 Pratt and Whitney supercharged 550 hp engines, Oct. 20-24, 1934.

LONDON, ENGLAND TO SYDNEY, AUSTRALIA

World Class Record .... 130.309 mph.

F/O A. E. Clouston and Victor Ricketts, Great Britain, de Havilland Comet monoplane, 2 D H Gipsy VI engines, Mar. 21-26, 1938. Elapsed Time: 80 hr. 56 min.

National (U.S.) Record .... No official record.

SYDNEY, AUSTRALIA TO LONDON, ENGLAND

World Class Record .... 81.261 mph.

F/O A. E. Clouston and Victor Ricketts, Great Britain, de Havilland *Comet* monoplane, 2 D. H. Gipsy VI engines, Mar. 21-26, 1938. Elapsed Time: 130 hr. 3 min.

National (U.S.) Record .... No official record.

LONDON, ENGLAND TO WELLINGTON, NEW ZEALAND

World Class Record .... 194.657 mph.

Air Commodore N. H. d'Aeth, Squadron Leader J. S. Aldridge, Flight Lt. D. D. Hurditch, and crew, Great Britain, Modified Avro Lancaster Aries, 4 Rolls Royce Merlin engines of 1,200 hp each, Aug. 21-24, 1946. Elapsed Time: 59 hr. 50 min.

National (U.S.) Record .... No official record.

WELLINGTON, NEW ZEALAND TO LONDON, ENGLAND

World Class Record .... 83.454 mph.

A. F. Clouston and Victor Ricketts, Great Britain; D. H. Comet airplane, 2 D. H. Gypsy VI engines, Mar. 20-26, 1938. Elapsed Time: 140 hr. 12 min.

National (U.S.) Record .... No official record.

LONDON, ENGLAND TO CAPETOWN, AFRICA

World Class Record .... 279.244 mph.

Sq. Ldr. H. E. Martin, pilot, Sq. Ldr. E. B. Simone, navigator, Great Britain, de Havilland Mosquito R. G. 238, type PR 34, 2 Rolls Royce Merlin 114 A engines, Apr. 30-May 1, 1947. Elapsed Time: 21 hr. 31 min. 30 sec.

National (U.S.) Record .... No official record.

LONDON, ENGLAND TO KARACHI, INDIA

World Class Record .... 256.110 mph.

S/Ldr. Neville Duke, Great Britain, Hawker Fury K.857, Bristol Centaurus XVIII 2,500 hp engine, May 12, 1949. Elapsed time: 15 hr., 18 min., 36 sec.

National (U.S.) Record .... No official record.

LONDON, ENGLAND TO DARWIN, AUSTRALIA
World Class Record .... 189.523 mph.
Air Commodore N. H. d'Aeth, Squadron Leader J. S. Aldridge, Flight Lt. D. D. Hurditch, and crew, Great Britain, Modified Avro Lancaster *Aries*, 4 Rolls Royce Merlin engines, 1,200 hp each, Aug. 21-22, 1946. Elapsed Time: 45 hr. 35 min.
National (U.S.) Record .... No official record.

PARIS, FRANCE TO TANANARIVO, MADAGASCAR
World Class Record .... 94.391 mph.
Genin and Robert, France, Caudron Simoun airplane, Renault 180 hp engine, from Le Bourget airport to Ivato airport, Dec. 18-21, 1935. Elapsed Time: 57 hr. 35 min. 21 sec.
National (U.S.) Record .... No official record.

TOKYO, JAPAN TO LONDON, ENGLAND
World Class Record .... 101.193 mph.
Masaaki Linuma and Kenji Tsukaloshi, Japan, Kamikase monoplane, type *Karigane*, Mitsubishi *Nakajima* 550 hp engine, Apr. 6-9, 1937. Elapsed Time: 94 hr. 17 min. 56 sec.
National (U.S.) Record .... No official record.

ROME, ITALY TO RIO DE JANEIRO, BRAZIL
World Class Record .... 137.923 mph.
Attileo Biseo, Magg. Amedeo Paradisi, S. Ten. Giovanni Vitalini Sacconi, pilots; Ubaldo Ardu, mechanic; Giovanni Cubeddu, radio operator; Italy, S.79 I-Bise airplane, 3 Alfa Romeo 126 RC.34 750 hp engines, Jan. 24-25, 1938. Elapsed Time: 41 hr. 32 min.
National (U.S.) Record .... No official record.

ROME, ITALY TO ADDIS ABABA, ETHIOPA
World Class Record .... 242.938 mph.
M. Lualdi, G. Mazzotti and E. Valente, pilots; S. Pinna, radio telegrapher and G. Guerrini, mechanic; Italy; Fiat BR. 20 L airplane, 2 Fiat Asso 80 1,000 hp motors, Mar. 6-7, 1939. Elapsed Time: 11 hr. 25 min.
National (U.S.) Record .... No official record.

BERLIN, GERMANY TO NEW YORK CITY, N. Y., U.S.A.
World Class Record .... 158.759 mph.
Alfred Henke and Rudolf Freiherr von Moreau, pilots; Paul Dierberg, radiomecanicien and Walter Kober, radiotelegraphiste; Germany, Focke-Wulf FW 200 Condor airplane, 4 BMW 132 L motors, 750 hp each, Aug. 10-11, 1938. Elapsed Time: 24 hr. 56 min. 12 sec.
National (U.S.) Record .... No official record.

NEW YORK, N. Y., U.S.A., TO BERLIN, GERMANY
World Class Record .... 199.409 mph.
Alfred Henke and Rudolf Freiherr von Moreau, pilots; Paul Dierberg, radiomecanicien, and Walter Kober, radiotelegraphiste; Germany; Focke-Wulf FW 200 Condor airplane, 4 BMW 132 L motors, 750 hp each, Aug. 13-14, 1938. Elapsed Time: 19 hr. 55 min. 1 sec.
National (U.S.) Record .... No official record.

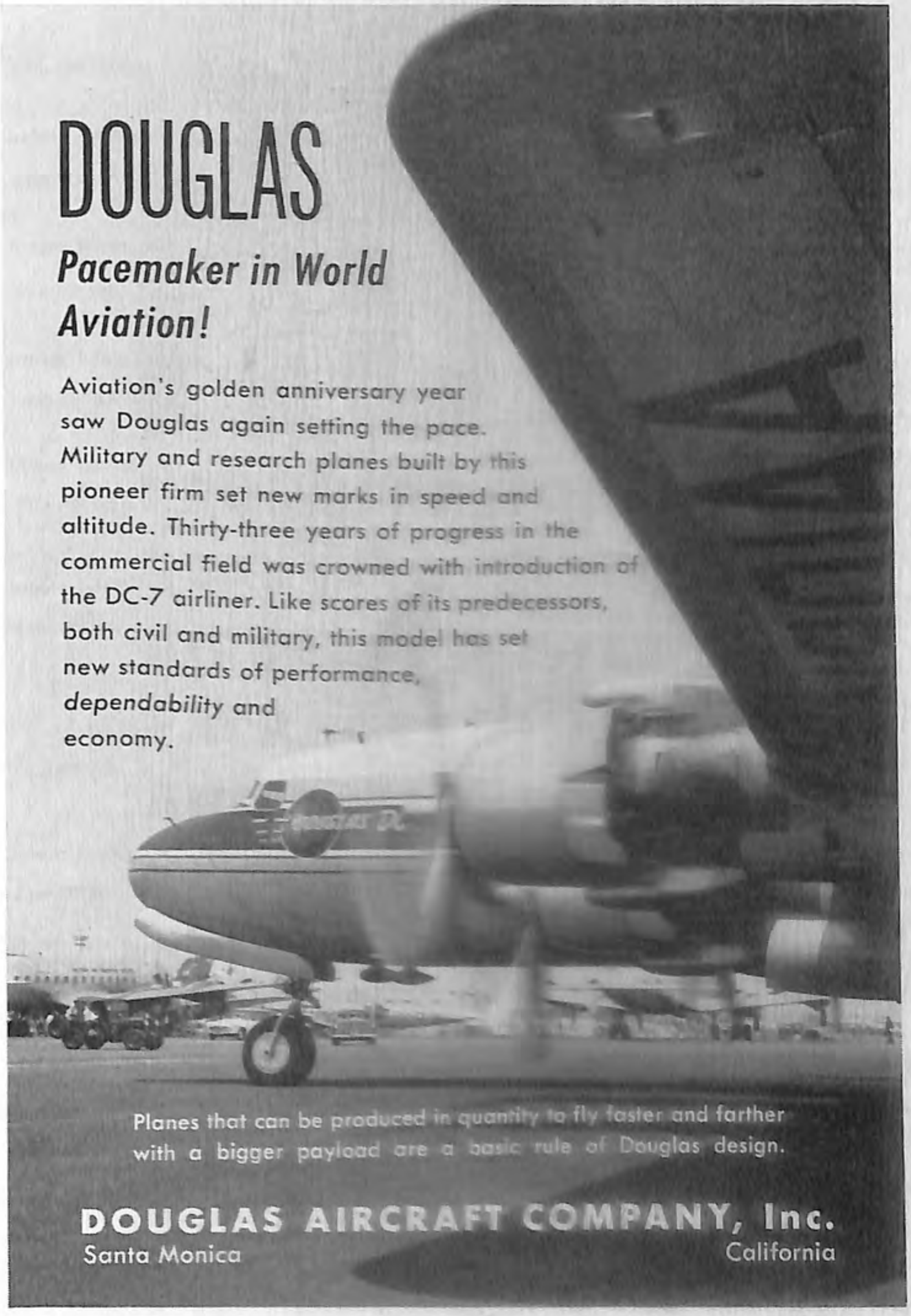
BERLIN, GERMANY TO TOKYO, JAPAN
World Class Record .... 119.494 mph.
Alfred Henke and H. R. Freiherr von Moreau, pilots; P. Dierberg, radiomecanicien; W. Kober, radiotelegraphiste, and G. Kohne, mechanic; Germany, Focke-Wulf FW 200 Condor airplane; 4 BMW 132 L motors, 750 hp each, from Tempelhof to Tachikawa, Nov. 28-30, 1938. Elapsed Time: 46 hr. 18 min. 19 sec.
National (U.S.) Record .... No official record

BERLIN, GERMANY TO HANOI, FRENCH INDO-CHINA
World Class Record .... 151 mph.
Alfred Henke and H. R. Freiherr von Moreau, pilots; P. Dierberg, radiomecanicien; W. Kober, radiotelegraphiste, and G. Kohne, mechanic; Germany, Focke-Wulf FW 200 Condor airplane; 4 BMW 132 L motors, 750 hp each, from Tempelhof to Gia Lam, Nov. 28-30, 1938. Elapsed Time: 34 hr. 17 min. 27 sec.
National (U.S.) Record .... No official record.

LONDON, ENGLAND TO PARIS, FRANCE
World Class Record .... 669.475 mph.
Lt. Comdr. M. J. Lithgow, Great Britain; Vickers-Armstrong Supermarine Swift Mark IV, WK.198 aircraft, Rolls Royce Avon RA.7 jet engine, July 5, 1953.
National (U.S.) Record .... No official record

PARIS, FRANCE TO LONDON, ENGLAND
World Class Record .... 664.425mph.
Lt. Comdr. M. J. Lithgow, Great Britain, Vickers-Armstrong Supermarine Swift Mark IV, WK.198 aircraft, Rolls Royce RA.7 jet engine, July 5, 1953.
National (U.S.) Record .... No official record.

LONDON, ENGLAND TO CAIRO, EGYPT
World Class Record .... 426.607 mph.
John Cunningham, D.S.O., D.F.C., Great Britain, de Havilland DH-106 Mark I Comet, 4 Ghost D. Gt. 3 jet engines, Apr. 24, 1950. Elapsed Time: 5 hr. 6 min. 58.3 sec.
National (U.S.) Record .... No official record


DOUGLAS
Pacemaker in World Aviation!
Aviation's golden anniversary year saw Douglas again setting the pace. Military and research planes built by this pioneer firm set new marks in speed and altitude. Thirty-three years of progress in the commercial field was crowned with introduction of the DC-7 airliner. Like scores of its predecessors, both civil and military, this model has set new standards of performance, dependability and economy.
Planes that can be produced in quantity to fly faster and farther with a bigger payload are a basic rule of Douglas design.
DOUGLAS AIRCRAFT COMPANY, Inc.
Santa Monica
California

CAIRO, EGYPT TO LONDON, ENGLAND

World Class Record .... 385.887 mhp.

John Cunningham, D.S.O., D.F.C., Great Britain, de Havilland DH 106 Mark I Comet, 4 Ghost D. Gt. 3 jet engines, May 11, 1950. Elapsed Time: 5 hr. 39 min. 21.7 sec.

National (U.S.) Record .... No official record.

LONDON, ENGLAND TO COPENHAGEN, DENMARK

World Class Record .... 541.417 mph.

Janusz Zurakowski, Great Britain, Gloster Meteor Mk. F8 V2468, 2 Rolls Royce Derwent V jet engines, Apr. 4, 1950. Elapsed Time: 1 hr. 5 min. 5 sec.

National (U.S.) Record .... No official record

COPENHAGEN, DENMARK TO LONDON, ENGLAND

World Class Record .... 500.670 mph.

Janusz Zurakowski, Great Britain, Gloster Meteor Mk. F8, 2 Rolls Royce Derwent V jet engines, Apr. 4, 1950. Elapsed Time; 1 hr. 11 min. 17 sec.

National (U.S.) Record .... No official record.

GIBRALTAR TO LONDON, ENGLAND

World Class Record .... 435.886 mph.

Group Capt. A. C. P. Carner, Great Britain, de Havilland Hornet F Mark III, 2 Rolls Royce Merlin 130, 2,030 hp engines, Sept. 19, 1949. Elapsed Time: 2 hr. 30 min. 21 sec.

National (U.S.) Record .... No official record.

LONDON, ENGLAND TO LA VALETTE, FRANCE

World Class Record .... 387.896 mph.

Lt. Commander W. R. MacWhirter, Lt. P. C. S. Chilton, Lt. D. A. Hook and Lt. D. W. Morgan, Great Britain, Hawker XI Sear Fury, Bristol Centaurus XVIII 2,560 hp engine, July 19, 1949. Elapsed time: 3 hr. 20 min. 49 sec.

National (U.S.) Record .... No official record.

LONDON, ENGLAND TO KHARTOUM, EGYPT

World Class Record .... 212.994 mph.

Squadron Leader J. C. T. Downey, chief pilot; Squadron Leader A. D. Frank, Squadron Leader, J. McKay, and Lt. Comdr. D. B. Law, pilots; and crew of 7; Avro Lincoln II "Aries", 4 Rolls Royce Merlin 68 A engines, 1,760 hp each; Oct. 20-21, 1950. Elapsed time: 14 hr., 23 min., 10 sec.

National (U.S.) Record .... No official record.

BELFAST, IRELAND TO GANDER, NEWFOUNDLAND

World Class Record .... 481.099 mph.

Roland P. Beamont, pilot; D. A. Watson, navigator; R. Rylands, radio operator, Great Britain, English Electric Canberra B. Mark 2, WD 940 aircraft, two Rolls Royce Avon RA 3 jet engines, Aug. 31, 1951. Distance: 2,071.7 mi.; Duration: 4 hr. 18 min. 24.4 sec.

National (U.S.) Record .... No official record.

LONDON, ENGLAND TO STOCKHOLM, SWEDEN

World Class Record .... 109.190 mph.

Capt. Jan H. Christie, Norway, Klemm airplane, Hirth 105 hp engine, Sept. 23, 1951. Elapsed time: 8 hr., 9 min., 48.5 sec. (Class C.1.b)

National (U.S.) Record .... No official record.

LONDON, ENGLAND TO BRUSSELS, BELGIUM

World Class Record .... 665.890 mph.

David W. Morgan, Great Britain, Vickers Armstrong Supermarine Swift, Rolls Royce Avon R.A.7 jet engine, July 10, 1952. Elapsed time: 18 min., 3.3 sec.

National (U.S.) Record .... No official record.

LONDON, ENGLAND TO TRIPOLI, LYBIA

World Class Record .... 538.119 mph.

Squad. Ldr. L. C. E. De Vigne, pilot; Flt. Lt. P. A. Hunt, navigator; Great Britain, English Electric Canberra, BMK2, 2 Rolls Royce Avon MK.1 jet engines, from London Airport to Castel Benito Airport, Feb. 18, 1952. Elapsed time: 2 hr., 41 min., 49.5 sec.

GANDER, NEWFOUNDLAND TO BELFAST, IRELAND

World Class Record .... 605.527 mph.

Wing Comm. R. P. Beamont, pilot; P. Hillwood, co-pilot; D. A. Watson, navigator, Great Britain, English Electric Canberra VX 185, two Rolls Royce Avon engines, Aug. 26, 1952.

BELFAST-GANDER-BELFAST

World Class Record .... 411.992 mph.

Wing Comm. R. P. Beamont, pilot; P. Hillwood, co-pilot; D. A. Watson, navigator, Great Britain, English Electric Canberra VX 185, two Rolls Royce Avon engines, Aug. 26, 1952.

OFFICIAL NATIONAL TRANSCONTINENTAL AND INTER-CITY RECORDS

WEST TO EAST TRANSCONTINENTAL (JET PROPELLED)
Col. W. H. Councill, USAAF, Lockheed P-80 jet-propelled monoplane, Allison J-33 engine, from Municipal Airport, Long Beach, Cal. to La Guardia Airport, L. I., N. Y., Jan. 26, 1946. Distance: 2,453.807 mi. Elapsed Time: 4 hr. 13 min. 26 sec. Average Speed: 580.935 mi.

WEST TO EAST TRANSCONTINENTAL (MULTI-ENGINE MILITARY AIRCRAFT)
Col. C. S. Irvine, pilot; Lt. Col. G. R. Stanley, co-pilot; Lt. Col. F. J. Shannon, Maj. K. L. Royer, Capt. W. J. Bennett, Capt. R. A. Saltzman, M/Sgt. D. E. West, T/Sgt. J. F. Broughton, crew; USAAF; Boeing B-29 monoplane, 4 Wright R-3350-23A engines; from Burbank, Cal. to Floyd Bennett Field, Brooklyn, Dec. 11, 1945. Distance: 2,457 mi. Elapsed Time: 5 hr. 27 min. 19.2 sec. Average Speed: 450.385 mph.

LOS ANGELES, CAL. TO MEXICO CITY, D. F.
A. Paul Mantz, North American F-51 monoplane, NX-1204, Packard built Rolls Royce Merlin 1,450 hp engine, from Lockheed Air Terminal, Burbank to Mexico City Airport, Mar. 8, 1950. Distance: 1,560.767 mi. Elapsed Time: 3 hr. 34 min. 45 sec. Average Speed: 436.070 mph.

WEST TO EAST TRANSCONTINENTAL (SINGLE RECIPROCATING ENGINE-SOLO)
A. Paul Mantz, North American F-51 monoplane NX-1204, Packard Merlin 1,650 hp engine, from Lockheed Air Terminal to La Guardia Airport, L. I., N. Y., Jan. 22, 1950. Distance: 2,453.805 mi. Elapsed Time: 4 hr. 52 min. 58 sec. Average Speed: 502.543 mph.

WEST TO EAST TRANSCONTINENTAL (COMMERCIAL TRANSPORT AIRCRAFT)
Capt. Fred E. Davis, pilot; Capt. H. Lloyd Jordan, co-pilot; and Flight Engineer, E. L. Graham; Eastern Air Lines' Lockheed Constellation, 4 Wright R-3350 2,500 hp engines, from Lockheed Air Terminal, Burbank, Cal. to La Guardia Airport, Jackson Heights, L. I., N. Y., Feb. 5, 1949. Elapsed Time: 6 hr. 17 min. 39.4 sec. Distance: 2,453.805 statute mi. Average Speed: 389.847 mph.

EAST TO WEST TRANSCONTINENTAL (SINGLE RECIPROCATING ENGINE-SOLO)
A. Paul Mantz, North American P-51 monoplane, NX-1202, Packard Merlin 1,650 engine, 1,450 hp, from La Guardia Airport, Jackson Heights, L. I., N. Y., to Lockheed Air Terminal, Burbank, Cal., Sept. 3, 1947. Distance: 2,453.805 mi. Elapsed Time: 7 hr. 00 min. 4 sec. Average Speed: 350.488 mph.

EAST TO WEST TRANSCONTINENTAL (MULTI-ENGINE MILITARY AIRCRAFT)
Capt. Boyd L. Grabaugh, pilot; Capt. J. L. England, co-pilot; and M/Sgt. R. R. Pierron, M/Sgt. D. H. Atkins, M/Sgt. T. L. Wolfe, T/Sgt. D. B. Smith, crew; USAAF, Boeing B-29 monoplane, 4 Wright R-3350-23A engines, from La Guardia Airport, L. I., N. Y., to Lockheed Air Terminal, Burbank, Cal., Aug. 1, 1946. Distance: 2,453.805 mi. Elapsed Time: 7 hr. 28 min. 3 sec. Average Speed: 328.598 mph.

LOS ANGELES, CAL. TO WASHINGTON, D. C.
Lt. Col. H. F. Warden, pilot; Capt. G. W. Edwards, co-pilot; Douglas XB-42 monoplane, 2 Allison V-1710-129 engines, 1,820 hp each, from Long Beach Municipal Airport to Bolling Field, Anacostia, D. C., Dec. 8, 1945. Elapsed Time: 5 hr. 17 min. 34 sec. Distance: 2,295 mi. Average Speed: 433.610 mph.

LOS ANGELES, CAL. TO MIAMI, FLA. (TRANSPORT AIRCRAFT)
Frank J. Bennett, pilot; John D. Scott, co-pilot; J. Jerram, flight engineer; and six passengers; Eastern Airlines' Lockheed Constellation, NC-104A, 4 Wright 2,100 hp engines, from Lockheed Air Terminal, Burbank, Cal. to 36th Street Airport, May 28-29, 1947. Elapsed Time; 6 hr. 24 min. 8 sec. Distance: 2,337.590 statute mi. Average Speed: 365.236 mph.

LOS ANGELES, CAL. TO JACKSONVILLE, FLA. (TRANSPORT AIRCRAFT)
Charles H. Dolson and Frank O. Boyer, pilots, thirty-seven passengers, including two stewardesses, Delta Airlines' Douglas DC-6, 4 Pratt and Whitney R-2800-CA-15 1,800 hp engines, from Clover Field, Santa Monica to Thomas Cole Imeson Airport, Oct. 4, 1948. Elapsed Time: 6 hr. 43 min. 10 sec. Distance: 2,154.448 statute mi. Average Speed: 320.600 mph

LOS ANGELES, CAL. TO TAMPA, FLA. (TRANSPORT AIRCRAFT)
G. T. Baker, pilot; J. Bailey, co-pilot; and 17 passengers; Northwest Airlines' Douglas DC-6, NC-90891, 4 Pratt and Whitney 2,100 hp engines, from Clover Field, Santa Monica to Drew Field, June 3, 1947. Elapsed Time: 6 hr. 5 min. 10 sec. Distance: 2,157 mi. Average Speed: 354.413 mph.

LOS ANGELES, CAL. TO ATLANTA, GA.
Capt. Charles Dolson and William H. Davis, Jr., Delta Airlines Douglas DC-6, 4 Pratt and Whitney R-2800-CA-15 1,800 hp engines, from Clover Field, Santa Monica to Atlanta Municipal Airport. Oct. 23, 1948. Elapsed Time: 6 hr. 11 min. 42 sec. Distance: 1,944.01 mi. Average Speed; 313.803 mph.

LOS ANGELES, CAL. TO CHARLESTON, S. C. (TRANSPORT AIRCRAFT)
Capt. T. P. Ball and Capt. John Van Buren, pilots, six passengers; Delta Airlines' Douglas DC-6, 4 Pratt and Whitney R-2800-CA-15 1,800 hp engines, from Clover Field, Santa Monica to Charleston Municipal Airport, Nov. 6, 1948. Elapsed Time: 6 hr. 24 min. 32 sec. Distance: 2,203 mi. Average Speed: 344.192 mph.

LOS ANGELES, CAL. TO MEXICO CITY, D. F. (TRANSPORT AIRCRAFT)

Capt. Roberto Pini, pilot; Guillermo S. Prieto, co-pilot; Cia. Mexicono de Aviacion Douglas DC-6 low wing monoplane, 4 Pratt and Whitney R-2800 engines, from Los Angeles International Airport to Mexico City Airport, Dec. 3, 1950. Elapsed time: 4 hr., 11 min., 50 sec. Distance: 1,551.941 statute miles. Average speed: 369.754 mph.

MEXICO CITY, D. F. TO LOS ANGELES, CAL.

A. L. Rodriques, North American P-51 monoplane, NX-33699, Rolls Royce Merlin, 68 engine from Mexico City (Balbuena) Airport to Clover Field, Santa Monica, Dec. 17, 1946. Elapsed Time: 4 hr. 24 min. 30 sec. Distance: 1,557.5 mi. Average Speed; 353.308 mph.

LOS ANGELES, CAL. TO DENVER, COLO.

Miss Dianna C. Cyrus, Douglas A-26, 2 Pratt and Whitney R-2800 engines of 2,000 hp each, from Lockheed Air Terminal, Burbank to Stapleton Airport, June 20, 1947. Elapsed Time: 2 hr. 18 min. 58 sec. Distance: 836 mi. Average Speed: 360.949 mph.

SAN FRANCISCO, CAL. TO LOS ANGELES, CAL.

Capt. R. D. Creighton, USAF, North American F-86A monoplane, General Electric J-47-A jet engine from San Francisco International Airport to Los Angeles International Airport, May 20, 1950. Elapsed Time: 32 min. 56 sec. Distance: 339.121 mi. Average Speed: 617.932 mph.

SAN FRANCISCO, CAL. TO SALT LAKE CITY, UTAH

Frank W. Fuller, Jr., Seversky monoplane, NX-70Y, Pratt and Whitney Twin Row Wasp 1,200 hp engine, from San Francisco Airport to Salt Lake Municipal Airport, Apr. 20, 1939. Elapsed Time: 2 hr. 9 min. 44 sec. Distance: 598.5 mi. Average Speed: 276.799 mph.

SAN FRANCISCO, CAL. TO SEATTLE, WASH.

Frank W. Fuller, Jr., Seversky monoplane, NR-70Y, Pratt and Whitney Twin Row Wasp 1,100 hp engine, from San Francisco Airport to Boeing Field, May 25, 1938. Elapsed Time: 2 hr. 31 min. 41 sec. Distance: 684.5 mi. Average Speed: 270.261 mph.

SAN FRANCISCO, CAL. TO SAN DIEGO, CAL.

Earl Ortman, Marcoux-Bramberg Special, Pratt and Whitney Wasp Jr., 1,195 hp engine, from Oakland Airport to Lindbergh Field, June 1, 1938. Elapsed Time: 1 hr. 48 min. 1 sec. Distance: 447 mi. Average Speed 248.295 mph.

SAN FRANCISCO, CAL. TO PORTLAND, ORE.

Frank W. Fuller, Jr., Seversky monoplane, NX-70Y, Pratt and Whitney Twin Row Wasp engine, from San Francisco Airport to Pearson Field, Jan. 16, 1938. Elapsed Time: 2 hr. 13 min. 53 sec. Distance: 553 mi. Average Speed: 247.828 mph.

SAN FRANCISCO, CAL. TO PHOENIX, ARIZ.

Frank W. Fuller, Jr., Seversky monoplane, NR-70Y, Pratt and Whitney Twin Row Wasp engine, from San Francisco Airport to Sky Harbor Airport, Jan. 16, 1939. Elapsed Time: 2 hr. 11 min. 58 sec. Distance; 650.5 mi. Average Speed: 295.757 mph.

SAN FRANCISCO, CAL. TO BOISE, IDAHO

Frank W. Fuller, Jr., Seversky monoplane, NR-70Y, Pratt and Whitney Twin Row Wasp 1,200 hp engine, from San Francisco Airport to Boise Municipal Airport, May 4, 1939. Elapsed Time: 1 hr. 47 min. 26 sec. Distance: 525.5 mi. Average Speed: 293.484 mph.

SAN FRANCISCO, CAL. TO DENVER, COLO.

Frank W. Fuller, Jr., Seversky monoplane, NX-70Y, Pratt and Whitney Twin Row Wasp 1,200 hp engine, from San Francisco Airport to Denver Municipal Airport, June 7, 1939 Elapsed Time: 3 hr. 22 min. 26.8 sec. Distance: 954 mi. Average Speed: 282.741 mph.

SAN FRANCISCO, CAL. TO WASHINGTON, D. C. (TRANSPORT AIRCRAFT)

Capt. Scott Flower, pilot; 1st officer R. E. McDonald, co-pilot; crew of seven and nine passengers; Pan American Airways Boeing B-377 Stratocruiser, 4 Pratt and Whitney Wasp Major R-4360 engines, from San Francisco Airport to Washington National Airpoft, Mar. 3, 1949. Elapsed Time: 6 hr. 22 min. 25.4 sec. Distance: 2,436.917 statute mi. Average Speed: 382.338 mph.

NEW YORK, N. Y. TO ATLANTA, GA. (TRANSPORT AIRCRAFT)

H. T. Merrill and Clifford Zieger, pilots; Eastern Airlines' Lockheed Constellation, NC-108A, 4 Wright 3350 engines, 2,500 hp each, from La Guardia Airport to Atlanta Municipal Airport, Aug. 5, 1947. Elapsed Time: 2 hr. 36 min. 20 sec. Distance: 759.707 mi. Average Speed: 330.068 mph.

ATLANTA, GA., TO NEW YORK, N. Y. (TRANSPORT AIRCRAFT)
H. T. Merrill and Clifford Zieger, pilots; Eastern Airlines' Lockheed Constellation, NC-108A, 4 Wright 3350 engines, 2,500 hp each, from Atlanta Municipal Airport to La Guardia Airport, Aug. 5, 1947. Elapsed Time: 2 hr. 36 min. 20 sec. Distance: 759.707 mi. Average Speed: 291.572 mph.

NEW YORK, N. Y. TO HAVANA, CUBA
Col. A. P. de Seversky, Modified Seversky P-35 monoplane, powered with a Pratt and Whitney 1830-9 850 hp engine, from Floyd Bennett Field to Camp Columbia, Havana, Dec. 3, 1937. Elapsed Time: 5 hr. 3 min. 5.4 sec. Distance: 1,307 mi. Average Speed: 258.735 mph.

NEW YORK, N. Y., TO HOUSTON, TEX.
Henry T. Merrill, pilot, J. D. Scott, co-pilot; Eastern Airlines' Lockheed Constellation, NC-102A, 4 Wright 2,100 hp engines from La Guardia Airport, Jackson Heights, L. I. to Houston Municipal, June 6, 1947. Elapsed Time: 4 hr. 39 min. 3 sec. Distance: 1,425.5 mi. Average Speed: 306.504 mph.

HOUSTON, TEX. TO NEW YORK, N. Y. (TRANSPORT AIRCRAFT)
Henry T. Merrill, pilot, J. D. Scott, co-pilot; Eastern Airlines' Lockheed Constellation, NC-102A, 4 Wright 2,100 hp engines, from Houston Municipal to La Guardia Airport, June 6, 1947. Elapsed Time: 4 hr. 41 min. 35 sec. Distance: 1,425.5 mi. Average Speed: 303.746 mph.

NEW YORK, N. Y. TO MIAMI, FLA. (TRANSPORT AIRCRAFT)
E. R. Brown, pilot; E. H. Parker, co-pilot; Eastern Airlines' Lockheed Constellation, 4 Wright engines, 2,100 hp each, from La Guardia Airport to 36th Street Airport, May 28, 1947. Elapsed Time: 3 hr. 58 min. 41.2 sec. Distance: 1,096.427 mi. Average Speed: 275.615 mph.

MIAMI, FLA. TO NEW YORK, N Y. (TRANSPORT AIRCRAFT)
E. R. Brown, pilot; E. H. Parker, co-pilot; Eastern Airlines' Lockheed Constellation, NC-102A, 4 Wright engines, 1,200 hp each, from 36th Street Airport to La Guardia Airport, May 28, 1947. Elapsed Time: 3 hr. 29 min. 11.4 sec. Distance: 1,096.427 mil. Average Speed: 314.477 mph.

NEW YORK, N. Y. TO NEW ORLEANS, LA. (TRANSPORT AIRCRAFT)
H. T. Merrill and E. R. Brown, pilots; Eastern Airlines' Lockheed Constellation, NC-108A, 4 Wright 3350 engines, 2,500 hp each, from La Guardia Airport, L. I., to Moisant International Airport, July 23, 1947. Elapsed Time: 3 hr. 52 min. 29.8 sec. Distance: 1,182.466 mi. Average Speed: 305.157 mph.

NEW ORLEANS, LA. TO NEW YORK, N. Y. (TRANSPORT AIRCRAFT)
H. T. Merrill and E. R. Brown, pilots; Eastern Airlines' Lockheed Constellation, NC-108A, 4 Wright 3350 engines, 2,500 hp each, from Moisant International Airport to La Guardia Airport, L. I., July 23, 1947. Elapsed Time: 3 hr. 35 min. 10.8 sec. Distance: 1,182.466 mi. Average Speed: 329.714 mph.

NEW YORK, N. Y. TO WASHINGTON, D. C.
Capt. Martin L. Smith, USAF, Lockheed P-80 jet-propelled monoplane, Allison J-33-11 engine, from La Guardia Airport, Jackson Heights, L. I. to Washington National Airport, Apr. 21, 1946. Elapsed Time: 29 min. 15 sec. Distance: 214 mi. Average Speed: 438.974 mph.

MEXICO CITY, D. F. TO NEW YORK, N. Y.
Francisco Sarabia, Gee Bee monoplane, X-BAKE, Pratt and Whitney Hornet 980 hp engine, from the Military Airport, Mexico City to Floyd Bennett Field, May 24, 1939. Elapsed Time: 10 hr. 47 min. 46.8 sec. Distance: 2,087.5 mi. Average Speed: 193.353 mph.

HONOLULU, HAWAII TO NEW YORK, N. Y.
Lt. Col. Robert E. Thacker, pilot; 1st Lt. John M. Ard, co-pilot; North American P-82 monoplane, 2 Rolls Royce V-1650 engines, 2,250 hp each, from Hickam Field, Honolulu to La Guardia Airport, Jackson Heights, L. I., Feb. 28, 1947. Elapsed Time: 14 hr. 31 min. 50 sec. Distance: 4,968.852 mi. Average Speed; 341.959 mph.

CHICAGO, ILL. TO ATLANTA, GA. (TRANSPORT AIRCRAFT)
H. T. Merrill and S. A. Bell, pilots; Eastern Airlines' Lockheed Constellation, NC-108A, 4 Wright 3350 engines, 2,500 hp each, from Chicago Municipal Airport, to Atlanta Municipal Airport, Aug. 5, 1947. Elapsed Time: 1 hr. 48 min. 20 sec. Distance: 590.281 mi. Average Speed: 326.925 mph.

ATLANTA, GA. TO CHICAGO, ILL. (TRANSPORT AIRCRAFT)
H. T. Merrill and S. A. Bell, pilots; Eastern Airlines' Lockheed Constellation, NC-108A, 4 Wright 3350 engines, 2,500 hp each, from Atlanta Municipal Airport to Chicago Municipal Airport, Aug. 5, 1947. Elapsed Time: 2 hr. 1 min. 55 sec. Distance: 590.281 mi. Average Speed: 290.501 mph.

CHICAGO, ILL. TO LOS ANGELES, CAL.
Howard R. Hughes, Northrop Gamma monoplane, NR-13761, Wright Cyclone engine, from Chicago Municipal Airport to Grand Central Air Terminal, Glendale, Cal., May 14, 1936. Elapsed Time: 8 hr. 10 min. 29.8 sec. Distance: 1,734.5 mi. Average Speed: 212.172 mph.

CHICAGO, ILL. TO MIAMI, FLA. (COMMERCIAL TRANSPORT)
Capt. Jack Roth, pilot; First Officer, A. C. Bonner, co-pilot, 2 stewardesses and 37 passengers, Delta Air Lines, Douglas DC-6, N-1905M, 4 Pratt and Whitney R-2800 engines, from Midway Airport to Miami International Airport, Mar. 2, 1950. Elapsed time: 3 hr. 8 min. 48 sec. Distance; 1,183.422 mi. Average Speed: 376.087 mph.

CHICAGO, ILL. TO WASHINGTON, D. C. (TRANSPORT AIRCRAFT)
Jack Frye, TWA, Northrop Gamma 2-D monoplane, NR-13758, Wright Cyclone 710 hp engine, from Chicago Municipal Airport to Washington-Hoover Airport, S. Washington, Feb. 18, 1936. Elapsed Time: 2 hr. 22 min. Distance: 599 mi. Average Speed: 253.098 mph.

VANCOUVER, B. C., CANADA TO AGUA CALIENTE, MEXICO
Frank W. Fuller, Jr., Seversky monoplane, NX-70Y, Pratt and Whitney Twin Row Wasp 1,100 hp engine, from Vancouver Airport to Agua Caliente Airport, Nov. 4, 1937. Elapsed Time: 4 hr. 54 min. Average Speed: 244 mph.

MIAMI, FLA. TO CHICAGO, ILL. (TRANSPORT AIRCRAFT)
Henry T. Merrill and P. L. Foster, pilots; Eastern Airlines' Lockheed Constellation, NC-105A, 4 Wright 3350 engines, 2,500 hp each, from 36th Street Airport to Chicago Municipal Airport, July 16, 1947. Elapsed Time: 3 hr. 56 min. 22 sec. Distance: 1,183.368 mi. Average Speed: 300.390 mph.

VANCOUVER, B. C., CANADA TO OAKLAND, CAL.
Frank W. Fuller, Jr., Seversky monoplane, NX-70Y, Pratt and Whitney Twin Row Wasp 1,100 engine, from Vancouver Airport to Oakland Airport, May 28, 1938. Elapsed Time: 3 hr. 8 min. 43 sec. Distance: 792.5 mi. Average Speed: 251.965 mph.

MARCH FIELD, CAL. TO MITCHEL FIELD, N. Y.
Lt. Ben S. Kelsey, USAF, Lockheed XP-38 airplane, 2 Allison liquid cooled 1,000 hp engines, Feb. 11, 1939. Elapsed Time: 7 hr. 45 min. 36 sec. Distance: 2,425 mi. Average Speed: 312.5 mph.

WICHITA, KAN. TO LOS ANGELES, CAL.
Paul Mantz, Lockheed Orion NR-12222, from Wichita Airport to Union Air Terminal, July 4, 1938. Elapsed Time: 7 hr. 11 min. 5 sec. Distance: 1,201 mi. Average Speed: 167.160 mph.

DETROIT, MICH. TO AKRON, O.
Louise Thaden, Beechcraft biplane, NC-15835, from Detroit City Airport to Akron Municipal Airport, Jan. 21, 1937. Elapsed Time: 40 min. 43 sec. Distance: 123.5 mi. Average Speed: 181.989 mph.

DETROIT, MICH. TO MIAMI, FLA. (TRANSPORT AIRCRAFT)
H. T. Merrill and F. Bennett, pilots; Eastern Airlines' Lockheed Constellation, NC-113A, 4 Wright 3350 engines, 2,500 hp each, from Willow Run Airport to 36th Street Airport, Aug. 7, 1947. Elapsed Time: 3 hr. 36 min. 29 sec. Distance: 1,150.455 mi. Average Speed: 318.857 mph.

TAMPA, FLA. TO MIAMI, FLA. (TRANSPORT AIRCRAFT)
G. T. Baker, pilot; J. Bailey, co-pilot; and passengers; National Airlines' Douglas DC-6, NC-90891, 4 Pratt and Whitney 2,100 hp engines, from Drew Field to 36th Street Airport, June 3, 1947. Elapsed Time: 39 min. 13 sec. Distance: 204.429 mi. Average Speed: 312.769 mph.

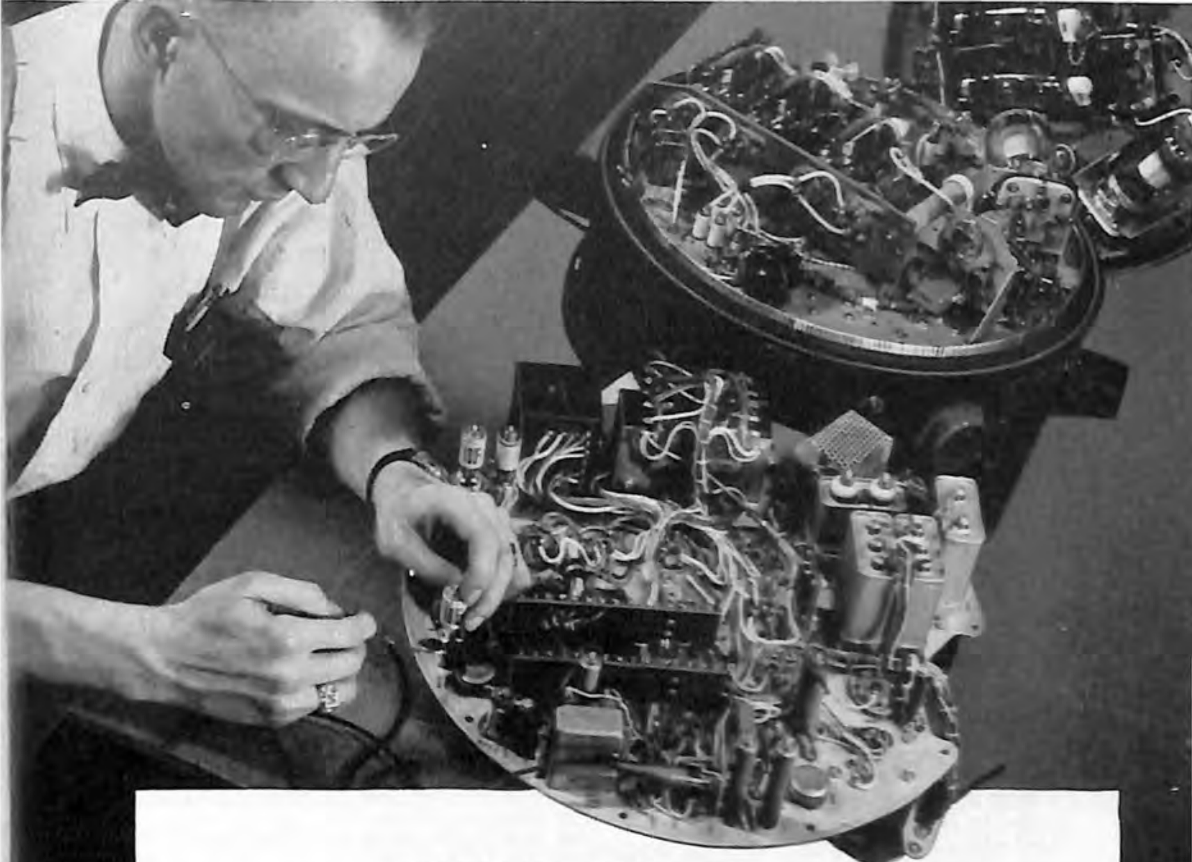
OFFICIAL FEMININE NATIONAL TRANSCONTINENTAL AND INTER-CITY RECORDS

WEST TO EAST TRANSCONTINENTAL RECORD
Jacqueline Cochran, modified Seversky pursuit monoplane, Pratt and Whitney Twin Row Wasp engine, from Burbank, Cal. to Brooklyn, N. Y., Sept. 3, 1938. Elapsed Time: 10 hr. 27 min. 55 sec. Average Speed: 234.776 mph.

EAST TO WEST TRANSCONTINENTAL RECORD
Louise Thaden and Blanche Noyes, Beechcraft, Wright 420 hp engine, from Floyd Bennett Field, Brooklyn, N. Y. to Los Angeles Municipal Airport, Cal., Apr. 19-20, 1935. Elapsed Time: 13 hr. 33 min.

MEXICO CITY TO WASHINGTON, D. C.
Amelia Earhart, Lockheed Vega monoplane, Pratt and Whitney Wasp 550 hp engine from Central Airport, Mexico City to Washington-Hoover Airport, S. Washington, Virginia, May 8, 1935. Elapsed Time: 13 hr. 1 min. 51 sec.

MEXICO CITY TO NEW YORK, N. Y.
Amelia Earhart, Lockheed Vega monoplane, Pratt and Whitney Wasp 550 hp engine from Central Airport, Mexico City to Newark Airport, Newark, N. J., May 8, 1935. Elapsed Time: 14 hr. 19 min.



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