The
AIRCRAFT YEAR BOOK
For 1954

TERRESA SMITH

The

AIRCRAFT YEAR BOOK

1954

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THE

AIRCRAFT YEAR BOOK

1954

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THE AIRCRAFT INDUSTRIES ASSOCIATION OF AMERICA, INC.

Thirty-sixth Annual Edition

Editors

FRED HAMLIN

LYNN BLACK

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The 1954 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

During 1954, aviation in the United States reached new high levels of achievement and importance, both in the civil and military fields.

Significant progress was made in improving the quality of the Air Force, Army, Navy and Marine air arms and the United States Air Force's expansion program continued on schedule. New models were introduced in squadron service.

Aircraft production emphasis moved from the build-up phase of the national rearmament effort to a program in which improvements in quality of the product were accorded increased priority and attention. During the year employment in aircraft manufacture passed the 800,000 mark and as the year came to a close, was gradually declining, although the aircraft industry at year's end remained the nation's largest manufacturing employer.

So rapidly have technological developments in aviation been introduced in military aircraft since the end of World War II that production of seven different models of supersonic military fighters and one supersonic bomber have been ordered.

The nation's airlines, carrying more passengers and more cargo than ever before in their history, set a new record for revenue miles flown. And both scheduled and non-scheduled airlines set new standards of safety and reliability by operating with the lowest fatality rate in airline history.

The use of the utility plane as a valuable and profitable tool of business and agriculture continued to increase, with the fleet of non-airline multi-engine aircraft outnumbering that of the scheduled airline fleet by 2½ times. Commercial helicotper operations continued to expand.

This 1954 edition of the Aircraft Year Book, official publication of the Aircraft Industries Association, records in detail the achievements and problems of every major element of American aviation during the past year. Because of this broad coverage of the American aviation scene, the Aircraft Industries Association believes that this new Year Book again will serve as a valuable reference work on American air power.

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

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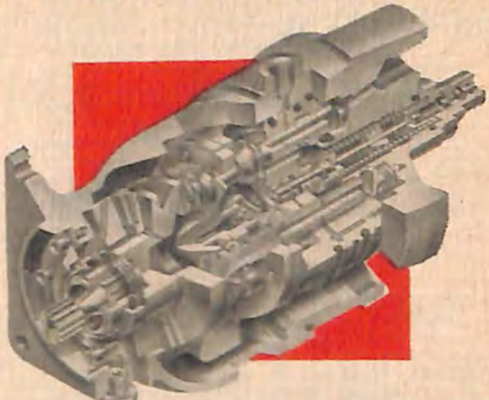

SERIES 66
**FIXED
DISPLACEMENT**

For use at higher service altitudes without reservoir pressurization. Inlet pressures to 80 psia. Nominal deliveries of 0.5, 1 and 2 gpm.

SERIES 67V
**VARIABLE DELIVERY
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The most direct known method of integral maximum pressure regulation. Capacities range from 0.85 to 3 gpm, over two dozen different models.

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Selective operation in either of two pressure ranges. Hydraulic or electrical pilot control. Adaptable to 66W or 67W Series Pumps.

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Fluid delivery instantly varied in response to system demands. Five sizes from 2 to 10 gpm, forty different models.

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**ELECTRIC
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For use in boost, utility or emergency circuits. AC or DC electric motors for both continuous and intermittent duty operation. Any combination of electric motor and STRATOPOWER Pump.

**CAPACITIES: Rated at 1500 rpm.
MAXIMUM CONTINUOUS SPEEDS: 3750 rpm.
MAXIMUM INTERMITTENT SPEEDS: 4500 rpm.
OPERATING PRESSURES: Continuous duty to 3000 psi.**

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U. S. AIR FORCE. Elementary Electricity for Airplane Mechanics. (Downgraded June 30, 1951). Washington, U. S. Govt. Print. Off. 1v. (AF Manual 52-7) $1.25

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ZWENG, CHARLES A. and ALLAN C. ZWENG. Airline Transport Pilot Rating. 7th rev. ed. North Hollywood, Calif., Pan American Navigation Service. 427p. $5.00

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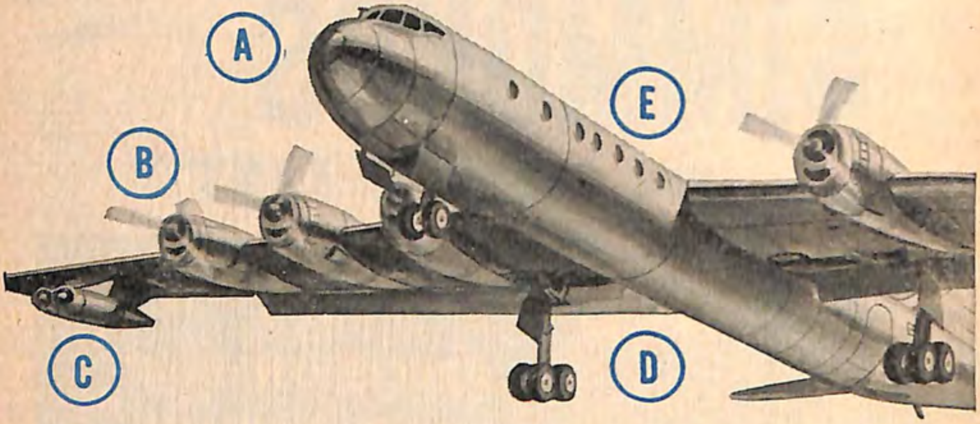
This is Bendix



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.

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Gyro Flux Gate* Compasses
Gyro Horizon Indicators
Magnetic Compasses
Rate of Climb Indicators
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ODR Components
Sextants
Control Panels

in Aviation

B

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Magnetos
Ignition Harnesses
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Vent—Line Type Filters
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Voltage Regulators
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Automatic Engine Boost Controls
Propeller Governor Controls
Supercharger Regulator Controls
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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

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Small Electric Actuators
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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.

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U. S. CIVIL AERONAUTICS ADMINISTRATION. Contractions. 6th ed. Washington, U. S. Govt. Print. Off. 67p. $.45

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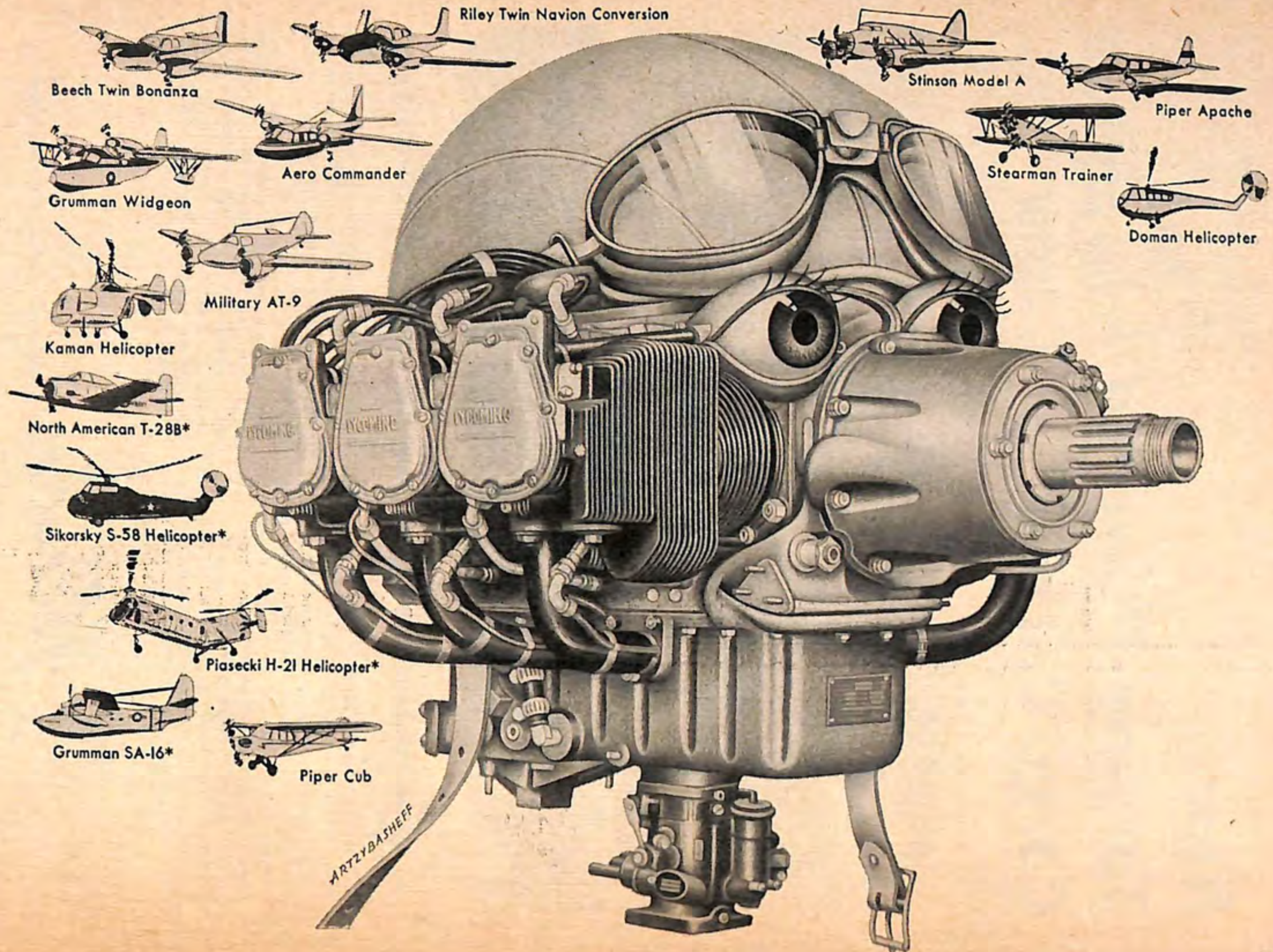
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Piper Apache
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Aero Commander
Stearman Trainer
Doman Helicopter
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SUMMARY STATISTICS

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, 1954 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: Aircraft Industries Association)

Year and Month	Aircraft and Parts	Aircraft	Aircraft Engines and Parts	Aircraft Propellers and Parts	Other Aircraft Parts and Equipment
1952	43.0	42.6	43.9	45.0	43.2
1953	41.9	41.3	43.0	41.9	42.8
1954					
January	40.6	40.1	41.3	38.0	41.7
February	41.2	41.3	41.0	40.6	41.4
March	41.0	41.1	40.5	40.6	41.2
April	40.5	40.4	40.5	39.6	40.9
May	40.7	40.7	42.0	38.4	41.3
June	40.8	40.8	40.5	38.4	41.2
July	40.7	40.8	41.0	38.4	40.5
August	40.8[a]	40.9[a]	41.0[a]	39.3	40.6[a]
September	40.9	41.0	40.4	39.0	41.1
AVERAGE WEEKLY EARNINGS					
1952	81.70	89.66	86.92	92.15	81.22
1953	83.80	82.19	87.29	85.90	85.17
1954					
January	83.23	82.21	84.67	78.28	85.07
February	85.28	85.49	85.28	84.04	84.04
March	84.46	84.67	84.24	85.67	84.05
April	83.43	83.22	83.84	82.76	83.85
May	83.84	83.84	83.42	79.87	85.08
June	84.86	84.86	84.65	80.26	84.87
July	84.66	84.86	86.51	79.87	83.84
August	85.27[a]	85.07[a]	86.10[a]	82.53	84.85[a]
September	85.89	86.10	84.84	81.12	86.12
AVERAGE HOURLY EARNINGS					
1952	1.90	1.87	1.98	2.05	1.88
1953	2.00	1.99	2.03	2.05	1.99
1954					
January	2.05	2.05	2.05	2.06	2.04
February	2.07	2.07	2.08	2.07	2.03
March	2.06	2.06	2.08	2.11	2.04
April	2.06	2.06	2.07	2.09	2.05
May	2.06	2.06	2.07	2.08	2.06
June	2.08	2.08	2.09	2.09	2.06
July	2.08	2.08	2.11	2.08	2.07
August	2.09	2.08	2.10	2.10	2.09
September	2.10	2.10	2.10	2.08	2.11

[a] Revised

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Efficient production design of the J44 Turbojet requires only standard tooling—means economical production.

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Other Divisions:
Aircraft Division, Hagerstown, Md.
American Helicopter Division, Manhattan Beach, Calif.
Guided Missiles Division, Wyandanch, N. Y.
Kinetics Division, New York, N. Y.
Speed Control Division, St. Augustine, Fla.
Stratos Division, Bay Shore, N. Y.

TOTAL EMPLOYMENT IN AIRCRAFT AND PARTS INDUSTRY[1]

(In thousands)

Source: Aircraft Industries Association

Years and Months	Total	Aircraft	Aircraft Engines & Parts	Aircraft Propellers & Parts	Other Aircraft Parts & Equipment
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	740.9	447.6	167.9	16.3	109.1
August	749.7	453.1	168.2	16.3	112.1
September	758.2	457.7	170.4	16.7	113.4
October	755.6	455.9	171.3	16.5	111.9
November	734.9	434.7	169.1	16.5	114.6
December	753.9	449.6	168.9	16.6	118.8
1954					
January	830.1	502.7	179.5	18.1	129.8
February	823.7	496.9	178.8	17.8	130.2
March	823.1	497.9	178.2	17.5	129.5
April	816.6	498.9	174.5	13.8	129.4
May	806.9	496.2	169.5	13.1	128.1
June	804.0	493.8	166.3	17.5	126.4
July	803.8	498.8	162.8	17.4	124.8
August	793.9[a]	499.8[a]	154.2[a]	17.3	122.6[a]
September	797.4	495.4	162.2	17.2	122.6

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


Rheem
Research
Production
Engineering

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[2]
1928	1,364	365	368	210	421[2]
1929	1,550	495	453	285	317[2]
1930	1,782	564	550	354	314[2]
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.
1953	6,760	N.A.	N.A.	N.A.	N.A.

N.A. Not Available.

[2]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)

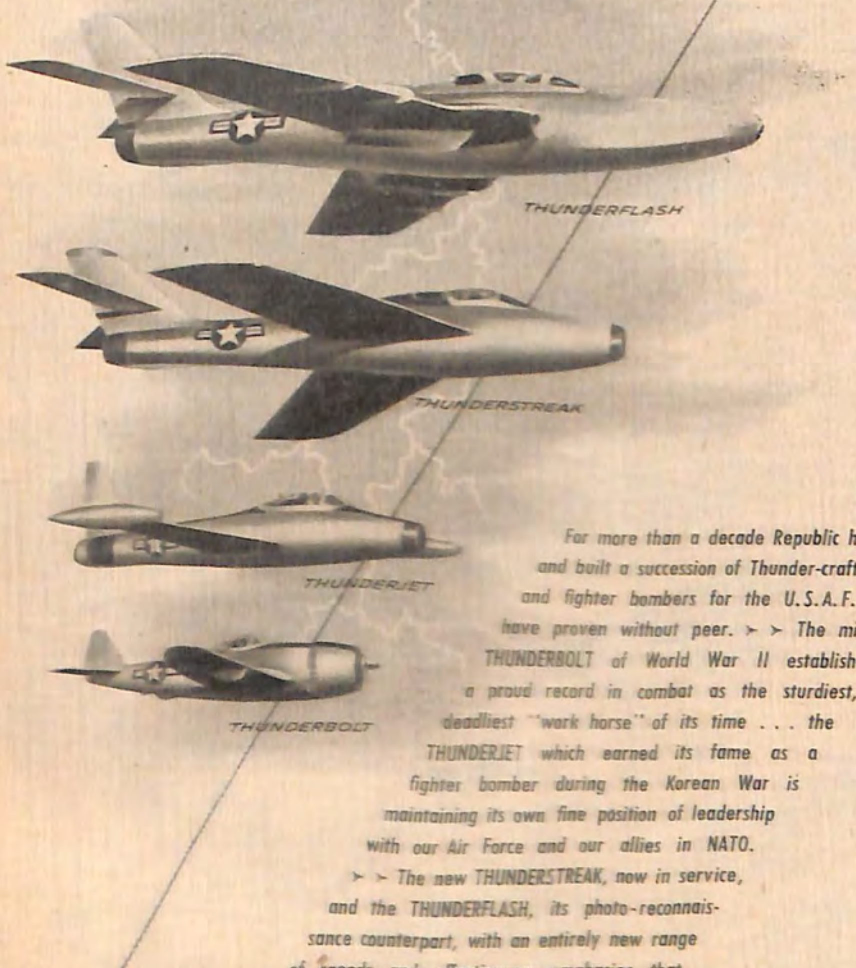
Year	Average speed (miles per hour)
1945	155.4
1946	160.2
1947	168.2
1948	171.9
1949	179
1950	181.2
1951	184.6
1952	190.8

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]
1954	13,900[e]	10,500[e]	3,400[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.

SUPERIORITY...



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Series 14..........................Rectangular Power Connectors
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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
1953	1,378[5]	91,137,326[5]	880,634,000

[1] 1913-18, fiscal years; 1919-53, 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.

U. S. CIVIL AIRCRAFT

By States

(Source: Civil Aeronautics Administration)

State	Number of civil aircraft[1] Jan. 1, 1953	Jan. 1, 1954	State	Number of civil aircraft[1] Jan. 1, 1953	Jan. 1, 1954
TOTAL	89,313	91,102	Montana	1,165	1,179
Alabama	752	747	Nebraska	1,790	1,763
Arizona	1,164	1,262	Nevada	439	471
Arkansas	1,080	1,093	New Hampshire	221	215
California	10,067	10,369	New Jersey	1,826	1,931
Colorado	1,263	1,256	New Mexico	754	772
Connecticut	603	629	New York	4,397	4,497
Delaware	275	210	North Carolina	1,547	1,600
District of Columbia	554	567	North Dakota	1,183	1,148
Florida	2,612	2,686	Ohio	4,157	4,309
Georgia	1,169	1,242	Oklahoma	2,026	1,996
Idaho	906	870	Oregon	1,747	1,760
Illinois	4,923	5,030	Pennsylvania	3,925	3,910
Indiana	2,679	2,757	Rhode Island	187	197
Iowa	2,126	2,064	South Carolina	598	592
Kansas	2,477	2,503	South Dakota	1,112	1,130
Kentucky	655	704	Tennessee	919	923
Louisiana	1,159	1,284	Texas	6,581	6,740
Maine	550	527	Utah	456	481
Maryland	837	864	Vermont	163	158
Massachusetts	1,425	1,431	Virginia	1,267	1,237
Michigan	3,876	3,899	Washington	2,219	2,260
Minnesota	2,092	2,164	West Virginia	609	602
Mississippi	802	868	Wisconsin	1,995	1,967
Missouri	1,924	2,050	Wyoming	509	506
			Outside U. S. A.	1,551	1,682

[1]Includes gliders.

CIVIL AIRCRAFT PRODUCTION

Number of Units

(Source: Bureau of the Census, Facts for Industry, Series M42 A)

Month	1950	1951	1952	1953	1954
January	167	255	224	365	278
February	225	239	227	382	240
March	326	272	248	358	312
April	329	247	291	402	359
May	377	248	330	417	309
June	369	216	335	339	316
July	321	207	353	402	293
August	354	171	349	350	204
September	301	184	337	359	265
October	204	124	293	235	......
November	242	162	268	275	......
December	305	152	254	250	......
TOTAL	3,520	2,477	3,509	4,134	......

NUMBER OF ENGINES PRODUCED

1917-1953

	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[c]	29,000[c]	5,382
1953	N.A.	N.A.	6,647

[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.
[c]AIA estimate.

Source: 1917-1747—AIA Aircraft Year Book, 1948, P. xxl.
1948-1952—Bureau of Census Facts for Industry Series M42A.

SHIPMENTS OF CIVIL AIRCRAFT ENGINES

1953

(Source: CAA Statistical Handbook)

Month	Number of Engines	Horsepower (in thousands)	Total Value (Thousands of Dollars)
January	583	268	3,657
February	476	189	2,387
March	667	305	4,107
April	671	378	5,471
May	500	391	6,537
June	523	400	6,636
July	576	401	6,583
August	607	378	6,109
September	465	418	7,221
October	493	463	8,083
November	559	413	7,171
December	527	395	6,892

CIVIL AIRPLANE OUTPUT

By Power and Types

(Source: Bureau of the Census, Facts for Industry Series M42A)

1937-1953[1]

		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

	1947	1948	1949	1950	1951	1952	1953
Total Civil	15,617	7,302	3,545	3,520	2,477	3,507	4,134
Personal	15,339	7,039	3,379	3,391	2,279	3,057	3,825
Transport	278	263	166	129	198	452	309
By Place:							
2-place	7,273	3,302	996	1,029	2,275	3,056	3,822
3- to 5-place	8,066	3,737	2,383	2,362			
Over 5-place	278	263	166	129	202	453	312
By Horsepower:[3]							
1-74	2,372	2,990	930	597	2,273	3,056	3,822
75-79	4,690						
100-399	8,246	4,026	2,440	2,789			
400-3,999	129	286	174	134	204	453	312
4,000 and over	180						

[1]1946 excluded.

[2]Exports excluded 1938-1941; no civil production during 1942-44; exports included 1945-50.

[3]Total rated horsepower of all engines.

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Airline Statistics

AIRLINE REVENUE PASSENGER MILES

U. S. Domestic Air Carriers By Months
(Source: Air Transport Association)

	Millions of Passenger Miles							
Month	1946	1947	1948	1949	1950	1951	1952	1953
January	331,714	380,757	401,214	429,935	481,428	742,598	877,482	1,070,830
February	331.965	372,276	356,859	432,226	479,650	683,196	823,887	1,030,858
March	406,403	493,864	440,106	533,548	568,162	861,466	953,855	1,188,332
April	461,703	526,188	483,233	577,852	636,440	860,750	1,026,739	1,243,900
May	512,625	563,771	539,431	608,302	684,940	888,380	1,006,840	1,257,142
June	562,722	546,685	588,677	676,842	784,870	958,610	1,153,923	1,363,953
July	569,875	543,541	561,075	640,718	746,463	949,311	1,121,926	1,351,668
August	624,481	611,838	569,583	627,127	775,238	995,394	1,187,847	1,381,237
September	611,961	609,756	549,539	634,088	741,777	967,436	1,160,558	1,303,595
October	557,223	578,889	534,758	608,837	757,721	952,359	1,159,536	1,266,785
November	468,734	435,083	452,441	504,939	639,826	840,837	100,4,905	1,099,775
December	507,643	441,231	486,355	478,164	705,953	862,682	1,050,820	1,202,208
Total	5,947,049	6,103,879	5,963,271	6,752,578	8,002,468	10,563,019	12,528,318	14,760,283

AIR CARRIER OPERATING EXPENSES

Domestic
(Source: Air Transport Association)

Year	Aircraft Operating Expenses	% of Total	Ground and Indirect Expenses	% of Total	Total Operating Expense
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	360,862,000	49.96	361,500,000	50.04	722,362,000
1953	436,906,000	51.50	411,467,000	48.50	848,373,000

BREAKDOWN OF DIRECT AIRCRAFT OPERATING EXPENSES

	Flying Operations	% of Total	Direct Maintenance Flight Equip.	% of Total	Depreciation Flight Equip.	% of Total
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	208,404,000	28.85	92,483,000	12.80	59,975,000	8.31
1953	252,843,000	29.80	101,920,000	12.02	82,143,000	9.68

Includes Trunks, Local Service and Territorial

COMPARATIVE TRANSPORT SAFETY RECORD

Passenger Fatalities per 100,000,000 Passenger Miles

(Source: Air Transport Association)

	1945	1946	1947	1948	1949	1950	1951	1952	1953
Domestic Scheduled Air Lines									
Fatalities	76	75	199	83	93	96	142	46	86
Rate	2.23	1.24	3.21	1.30	1.30	1.10	1.30	.4	.60
Buses									
Fatalities	120	140	1.40	120	120	100	130	100	NA
Rate	.17	.19	.21	.18	.20	.17	.22	.16	NA
Intercity Railroads									
Fatalities	142	116	74	52	32	184	126	14	31
Rate	.16	.18	.16	.13	.09	.58	.41	.04	.10
Pass. Autos & Taxicabs									
Fatalities	12,900	15,400	15,300	15,200	15,300	17.600	21,000	22,600	NA
Rate	2.9	2.5	2.3	2.1	2.1	2.2	2.4	2.8	NA

N. A. Not available.

ASSETS AND LIABILITIES

Domestic Trunk Airlines 1948-1953

(Source: Air Transport Association)

	1948	1949	1950	1951	1952	1953
Current Assets	$171,859,726	$175,472,186	$204,018,828	$286,240,499	344,115,976	333,527,000
Flight Equipment—Net	188,351,172	188,619,849	201,630,303	226,223,625	309,355,329	345,455,000
Other Op. Property	59,963,595	61,476,977	58,149,892	61,152,504	75,793,917	98,909,000
Non-Operating Property	5,779,353	2,704,375	1,117,230	758,591	714,939	258,000
*Other Assets	58,286,768	58,668,273	77,624,812	794,160	398,678	41,704,000
Total Assets	484,240,614	486,941,660	542,541,065	648,550,195	775,764,980	819,853,000
Current Liabilities	99,836,921	98,428,787	130,111,887	218,363,023	231,757,632	259,890,000
Long Term Debt	167,403,669	148,017,443	135,842,945	134,006,470	168,246,905	154,701,000
Capital Stock	121,312,622	123,710,057	123,467,063	120,286,647	145,132,929	139,615,000
Capital Surplus	53,428,648	56,289,876	57,499,411	63,698,098	81,882,841	88,455,000
Earned Surplus	12,952,554	35,285,887	64,365,672	96,249,920	130,653,833	121,455,000
Operating Reserves	2,387,158	3,635,427	3,970,701	3,682,245	4,169,446	4,252,000
**Other Liabilities	26,919,042	21,574,183	27,283,386	12,263,792	13,921,394	51,495,000
Net Worth & Liabilities	$484,240,614	$486,941,660	$542,541,065	648,550,195	775,764,980	819,853,000

*Investments and Special Funds and Deferred Charges.

**Deferred Credits, Capital Account, General and Appropriated Earned Surplus.

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]:		
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	5,981,003	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	12,528,318	65.60	69,261,570	41,324,306	119,501,666
1953	14,760,283	63.43	72,783,329	43,470,633	134,459,089
			INTERNATIONAL:		
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	3,019,860	62.28	27,713,051	....	72,627,275
1953	3,381,124	61.90	30,838,373	....	74,643,683

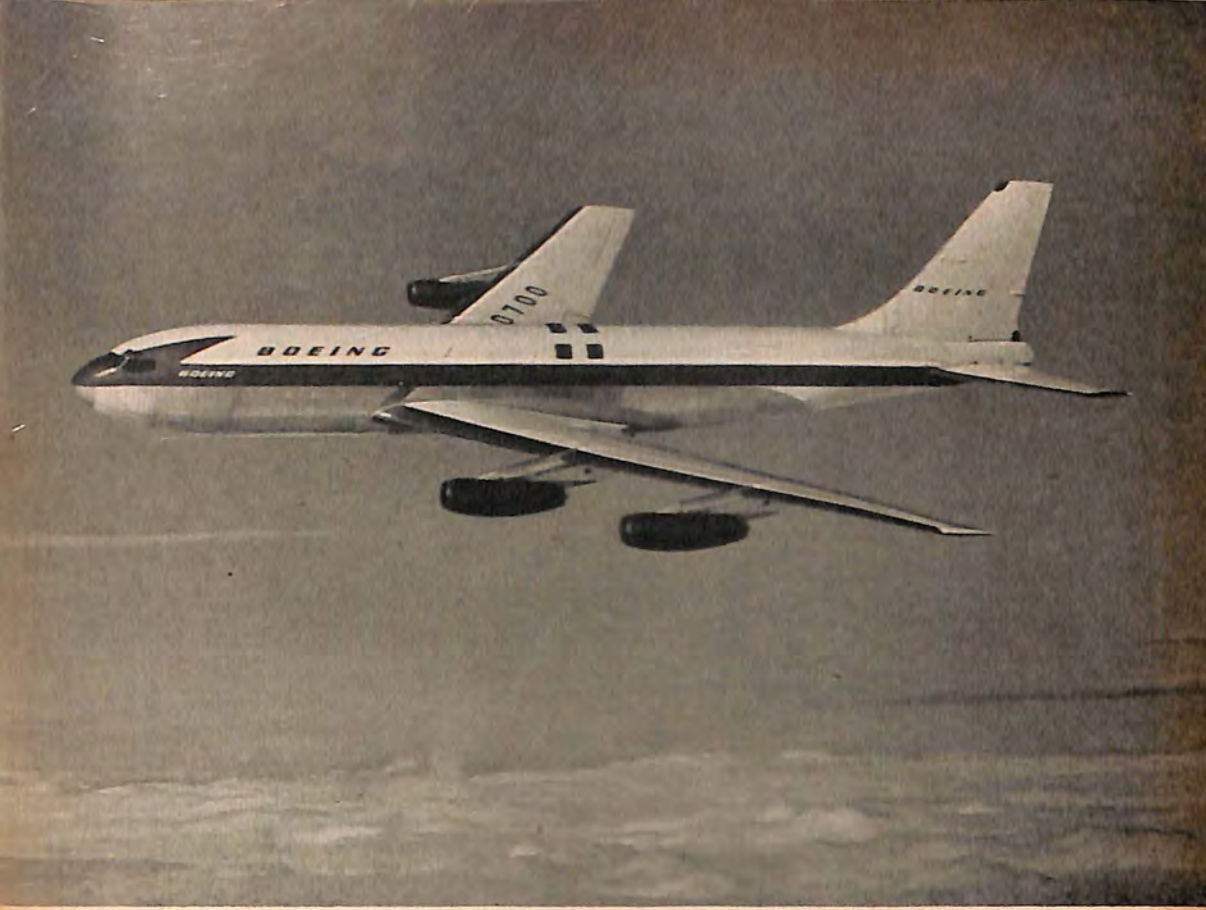
[1] **Includes Trunks, Local Service and Territorial Carriers.**

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:				
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	695,456,000	85.16	57,854,000	7.09	42,828,000	5.24	20,501,000	2.51	816,639,000
1953	803,859,000	85.99	61,937,000	6.62	47,787,000	5.11	21,294,000	2.28	934,877,000
	Domestic Lines include Trunks, Territorial and Local Service.								
					INTERNATIONAL:				
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	212,458,000	67.46	61,720,000	19.60	26,817,000	8.52	13,923,000	4.42	314,918,000
1953	232,539,000	68.94	63,303,000	18.77	27,331,000	8.10	14,113,000	4.19	337,286,000

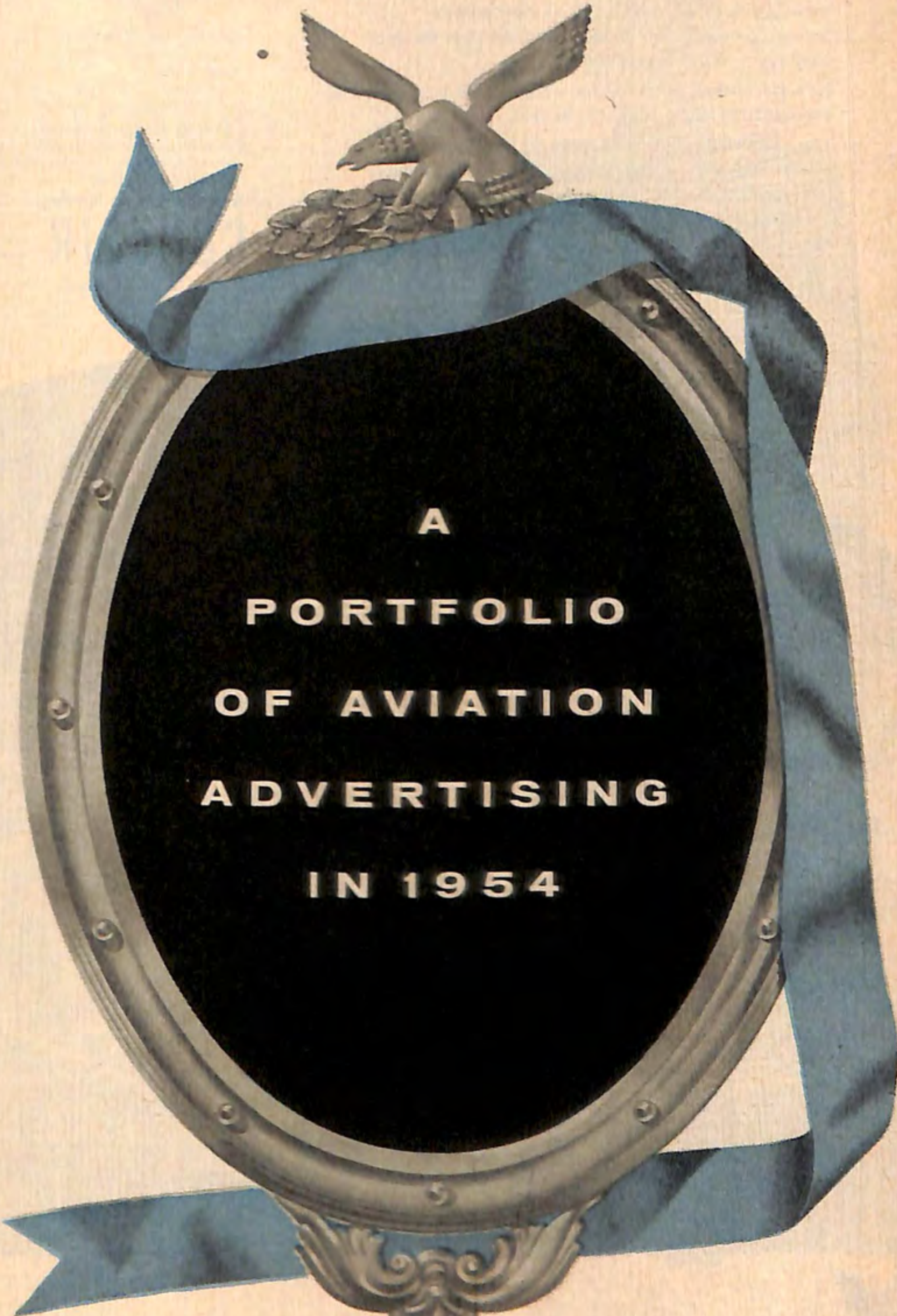

BOEING
0700

PLANES IN USE

Domestic Airlines

(Source: Air Transport Association)

		1944		1945		1946		1947		1948	
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	1.2	323	0.8	66	0.4	502	5.3	721	6.4	648
Boeing											
247-D	2	....	....	....	....	1.0	607	4.0	654	0.6	818
SA-307B	4	....	....	3.6	2,094	5.0	1,695	5.0	1,344	5.0	1,362
377	4	....	....	....	....	....	....	....	....	....	....
Convair 240	2	....	....	....	....	....	....	....	....	16.2	899
Douglas											
DC-2	2	....	....	....	....	....	....	....	....	....	....
DC-3	2	205.6	1,814	314.3	1,756	426.6	1,638	446.7	1,303	442.4	1,190
DST	2	....	....	....	....	....	....	....	....	....	....
DC-4	4	....	....	....	....	85.8	1,758	149.6	1,546	150.8	1,318
DC-6	4	....	....	....	....	....	....	21.1	1,462	54.4	1,864
Lockheed											
Electra	2	....	....	1.3	727	3.0	587	....	....	3.9	591
Lodestar	2	14.3	1,719	17.7	1,545	16.7	1,285	11.5	1,086	12.0	335
Constellation	4	....	....	....	....	6.6	1,190	21.3	1,742	32.0	2,067
Sikorsky S-38	2	2.8	240	2.0	184	0.1	100	....	....	....	....
Stinson											
Single Motor	1	10.6	377	10.9	404	11.0	445	7.8	420	7.0	447
Tri-Motor	3	4.0	148	4.0	61	....	....	....	....	....	....
Waco	1	....	....	....	....	....	....	....	....	....	....
Martin 202	2	....	....	....	....	....	....	2.0	782	17.6	859
404	2	....	....	....	....	....	....	....	....	....	....
Curtiss C-46	2	....	....	....	....	....	....	....	....	0.2	802
		1949		**1950**		**1951**		**1952**		**1953**	
Beechcraft	2	....	....	....	....	....	....	....	....	....	....
Boeing											
247-D	2	....	....	....	....	....	....	....	....	....	....
SA-307B	4	5.0	1,365	5.0	656	....	....	....	....	....	....
377	4	10.0	410	10.0	1,283	16.0	1,630	16	2,202	16	2,370
Convair 240	2	93.0	853	103.0	940	102.0	1,102	99	1,254	90	1,373
340								24	624	98	1,225
Douglas											
DC-2	2	....	....	....	....	....	....	....	....	....	....
DC-3	2	398.0	1,077	388.0	972	425.0	1.014	363	938	316	948
DST	2	....	....	....	....	....	....	....	....	....	....
DC-4	4	160.0	958	150.0	1,324	137.0	1,614	124	1,666	126	1,751
DC-6	4	104.0	1,655	111.0	1,751	139.0	2,207	161	2,321	175	2,394
DC-7								....	....	10	2,348
Lockheed											
Electra	2	....	....	....	....	....	....	....	....	....	....
Lodestar	2	11.0	975	11.0	969	11.0	1,152	11	1,184	11	1,212
Constellation	4	55.0	1,596	83.0	1,264	101.0	1,976	125	2,103	135	2,239
Sikorsky S-38	2	....	....	....	....	....	....	....	....	....	....
Stinson											
Single Motor	1	....	....	....	....	....	....	....	....	....	....
Tri-Motor	3	....	....	....	....	....	....	....	....	....	....
Waco	1	....	....	....	....	....	....	....	....	....	....
Martin											
202	2	24.0	1,255	33.0	954	12.0	786	21	1,017	25	966
404	2	....	....	....	....	18.0	1,089	96	1,206	100	1,373
Curtiss C-46	2	2.0	224	....	....	....	....	....	....	....	....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Airmen...

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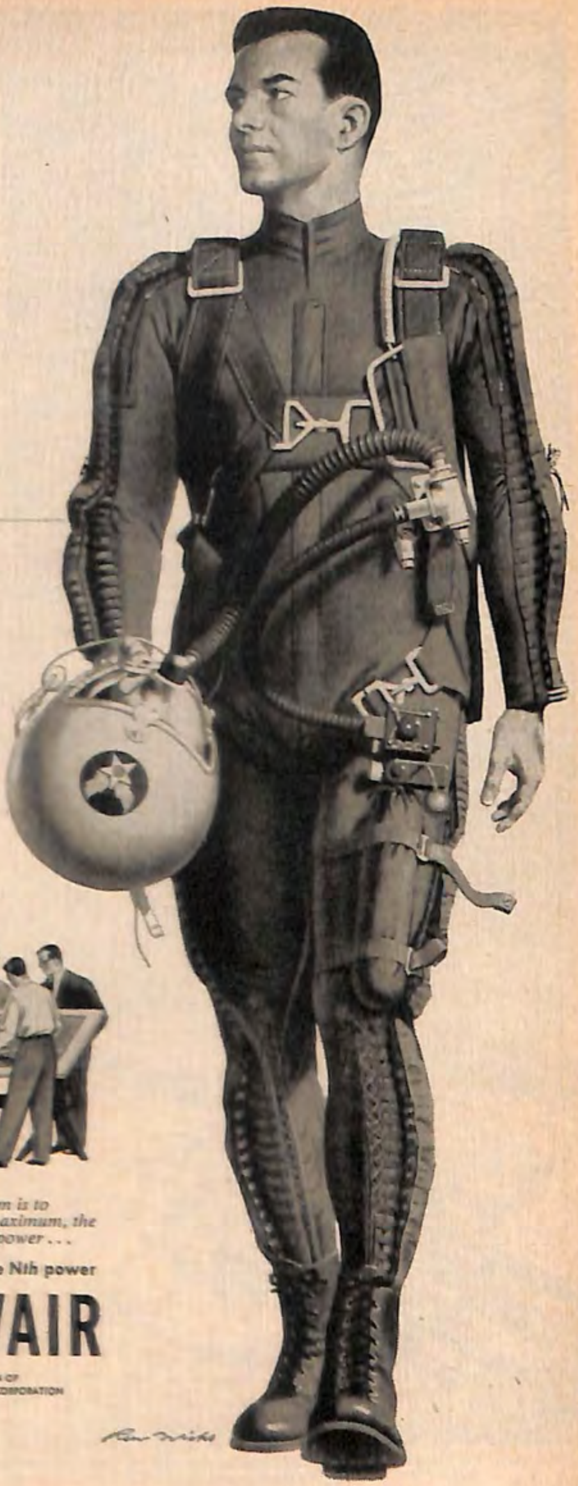

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United States Air Force
Washington 25, D.C.

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An air attack on America at any time is a grave possibility. And the target in the filter center "action indicator ring" could be your city ...dependent on Air Force interceptors like Convair's delta wing F-102's to destroy a (1) high (H), multi-engine (M), enemy bomber reported approaching on an unerring track (9).
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In a class by themselves... IN CONVAIR T-29 "FLYING CLASSROOMS"

MORE THAN 500 TWIN-ENGINE PLANES BASED ON THE CONVAIR DESIGN ARE ALREADY IN MILITARY AND COMMERCIAL SERVICE!

USAF Air Observer cadets are getting a big lift from Convair's famous T-29 "Flying Classrooms." These multi-place military aircrew trainers are helping to teach the ABC's of air power where it counts the most . . . aloft!

Latest version of the T-29 is the "D"—a combination navigation-bombardment school to train students in all phases of radar, optical bombing, and navigation with the same type of equipment installed in combat aircraft.

The T-29 series, like all Convair aircraft, is the result of engineering that aims at the *maximum* of air power . . .

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Engineering to the Nth power

NAVY'S XFY-1 TAKES OFF AND LANDS ON A DIME

Here's a new kind of aircraft for America's aviation arsenal...the Convair XFY-1, a vertical takeoff, delta wing Navy fighter. Powered by a turbojet engine, it is one of the world's fastest propeller driven planes.

The XFY-1 is as responsive as a hummingbird over a rose bud. It rises nose-up like a guided missile ...flies like a fighter at speeds beyond 500 mph...hovers motionless...darts forward, and sideways...backs down on its tail to a feather-light landing.

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Engineering to the Nth power

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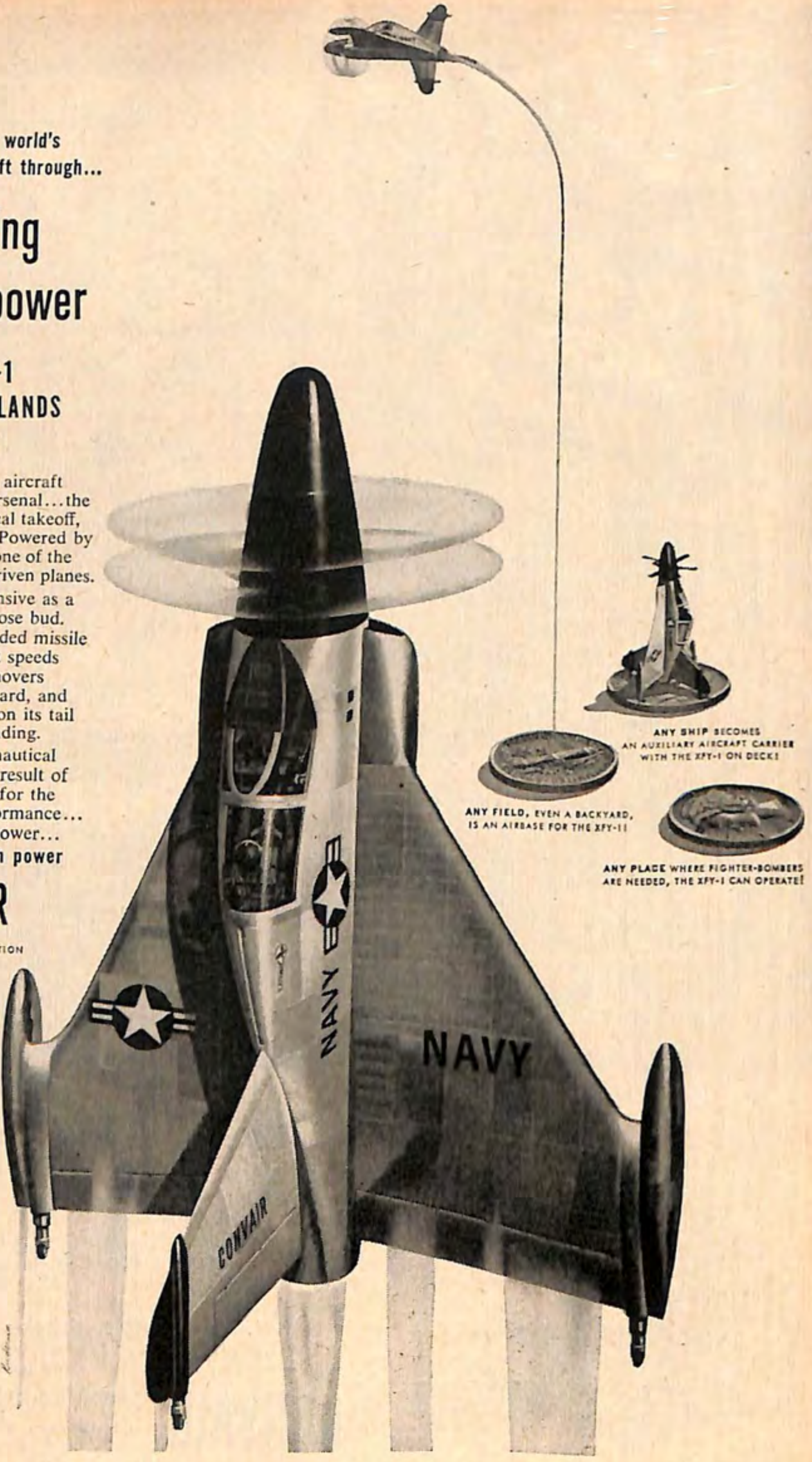


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DOUGLAS DC-7
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AVIATION EVENTS 1954

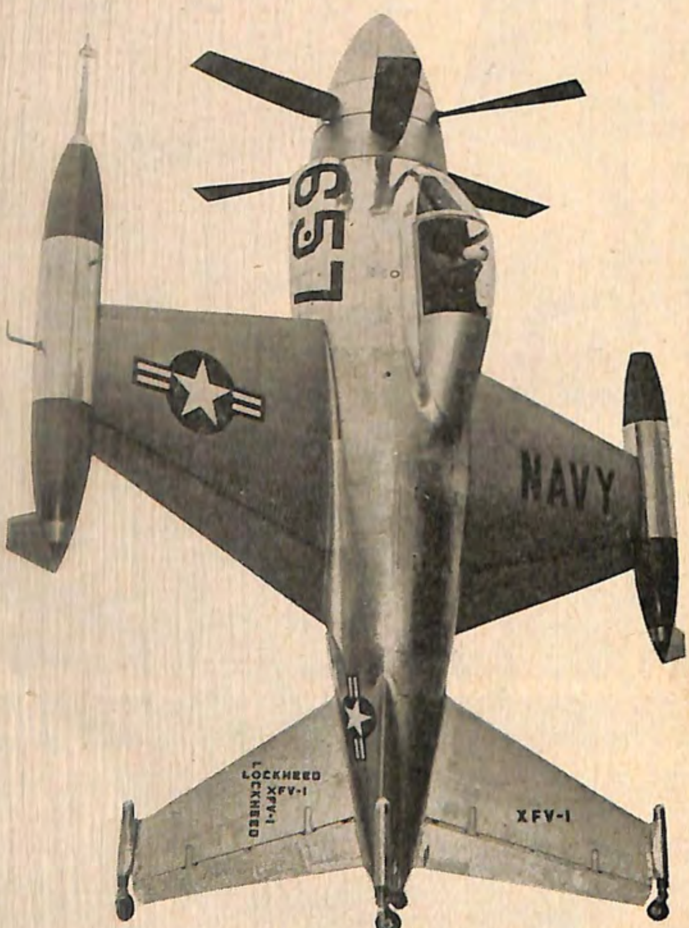
★

A pictorial review of some of the out-standing events in aviation during 1954

NEW PLANES

VERTICAL FLIGHT

Convair's XFY-1 and Lockheed's XFV-1 proved that vertical flight could be built into conventional airframe designs.



Advanced flight concepts were featured in planes that made news during the year.

BOEING 707

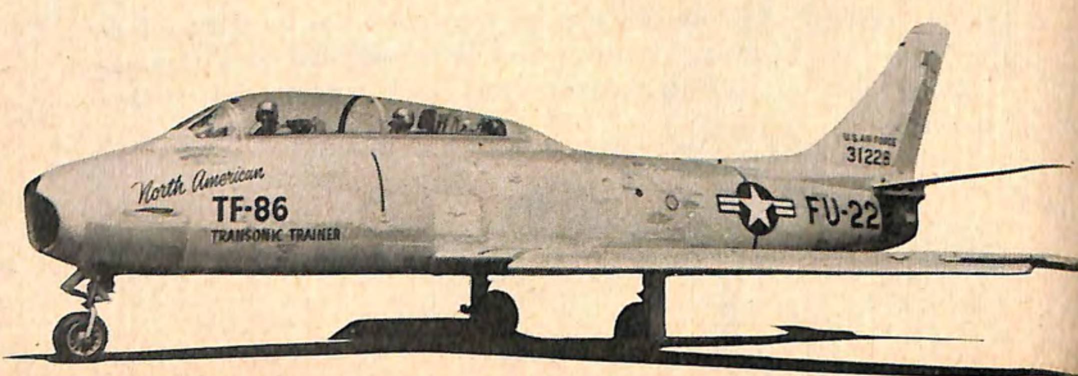
The Boeing 707, America's first jet transport, was built as a $15-million dollar private venture and is being used as a demonstrator for military tanker-transport and commercial airline service.

CONVAIR YF-102

1954 saw production of the delta wing YF-102, the Air Force's first all weather supersonic interceptor.

NORTH AMERICAN F-86F

First trans-sonic trainer, the North American F-86F, unveiled in 1954, is a two-seat trainer version of the famed Sabre Jet and is designed for advanced pilot training in high speed flight.



MISSILES

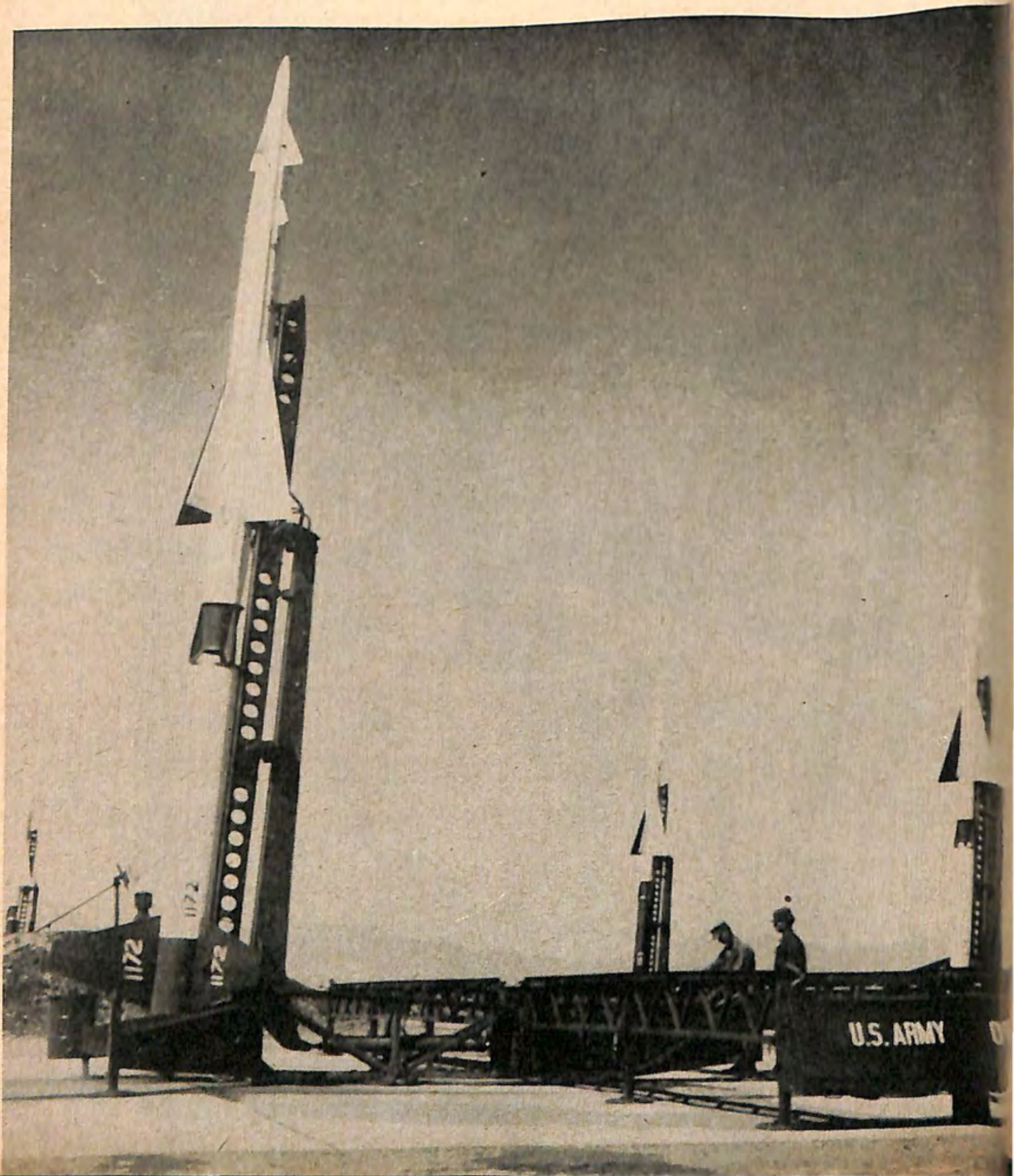
Highlighting an outstanding year in flight, missiles went on active duty as part of the nation's defenses.

MARTIN MATADOR

Early in 1954, following statement by Secretary of State Dulles on "massive retaliatory power to deter aggression," B-61 Martin Matadors, first pilotless bomber used by the United States, were sent to Germany to boost NATO defenses.

DOUGLAS NIKE

Here at home, the Department of Defense announced the Douglas Nike has been deployed as a first line of defense in case of air attack.



SPERRY SPARROW

For defense at sea the Sperry Sparrow, Navy's air-to-air production guided missile, travels as supersonic speeds but is light and compact enought to be carried in multiple units by fighter type jet aircraft.

CONVAIR TERRIER

For surface-to-air missile projection the Navy in '54 had a production model in the Convair Terrier, a supersonic missile developed by Applied Physics Laboratory of Johns Hopkins University.

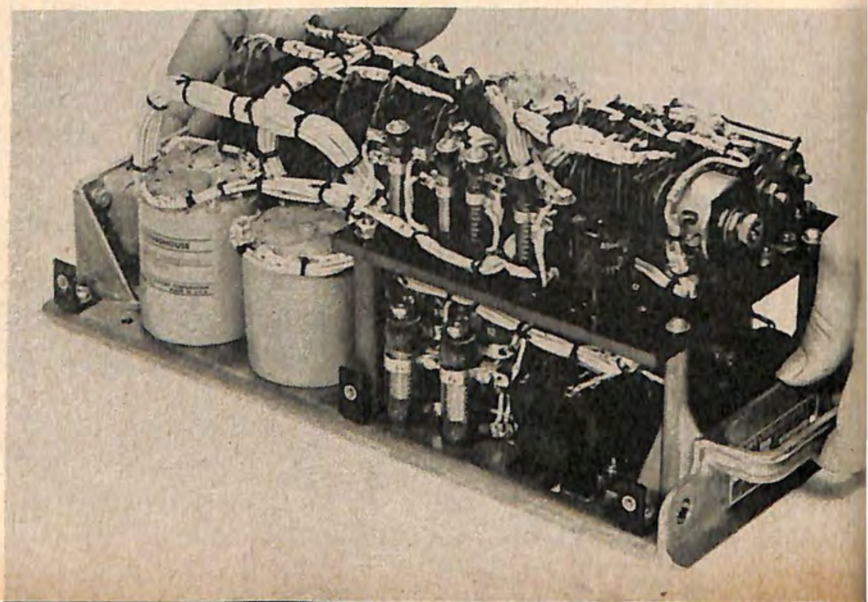
ELECTRONICS

SENSITIVE GYROSCOPE

In mass production during 1954 was the HIG gyroscope—described as the most sensitive airborne instrument ever built—developed by Minneapolis - Honeywell for Air Force use in automatic flight control systems and supersonic and pilotless aircraft.

MAGNETIC AMPLIFIER

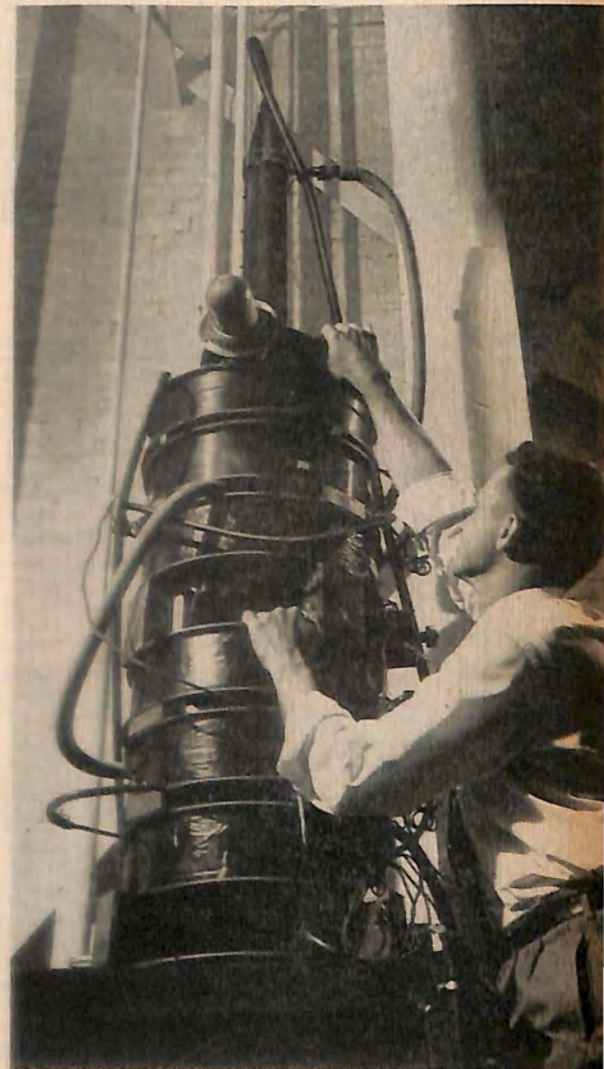
Early in the year the Westinghouse Corporation produced an aircraft alternator voltage regulator extending the sensitivity of magnetic amplifiers. The regulator has no moving parts, no electronic tubes, glow tubes, or hot wire devices.



During 1954 developments in electronics served as pacesetters for even more outstanding achievements in every phase of flight.

MEGAWATT KLYSTRON

In mid-1954 AR&DC and the Sperry Gyroscope Company announced the Megawatt Klystron, a giant electron tube which breaks the electron barrier and paves the way for super radars reaching far beyond present limits.



AIRBORNE RADAR

In addition, radar was successfully used in transports as shown by the co-pilot aboard a DC-3 checking out the Bendix RD-1 airborne radar system.

AIRBORNE NAVIGATION SYSTEM

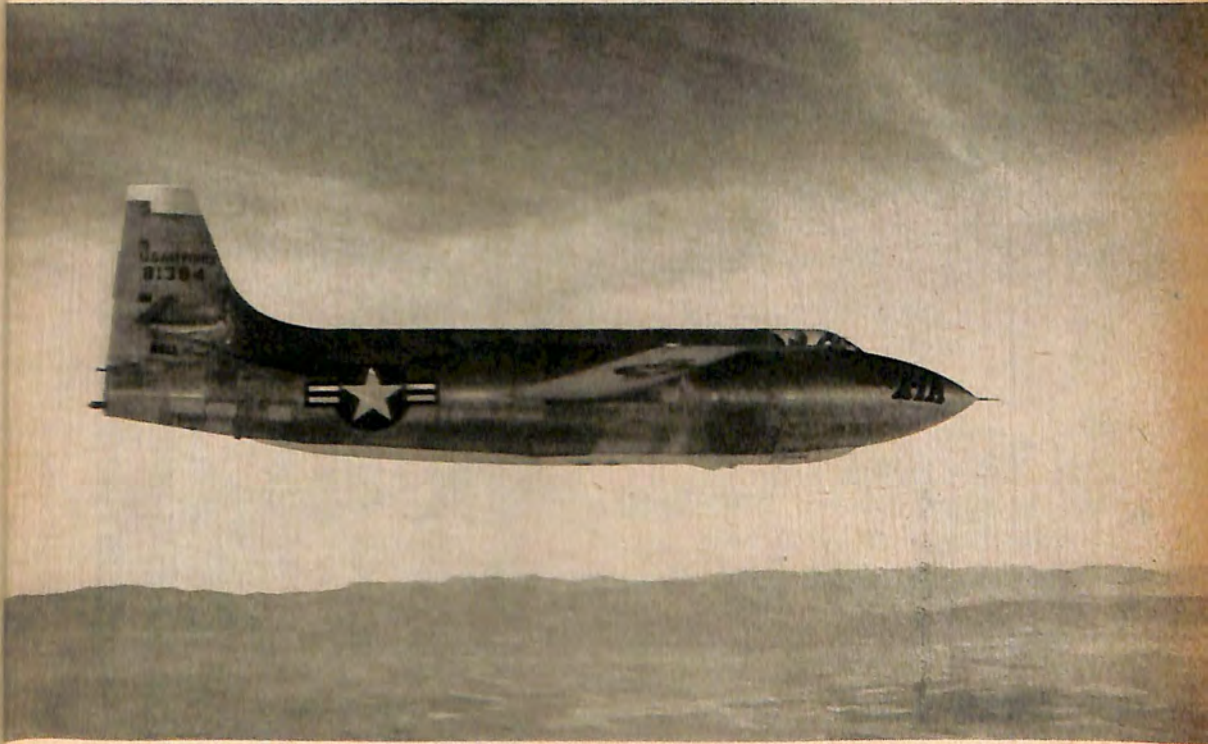
Further, an airborne dead reckoning navigation system used as a ground position indicator was produced by the Ford Instrument Company. This computer set is a complete navigation system which continuously determines and indicates present position, in latitude and longitude, from input data obtained from instruments solely within the aircraft.

RECORDS

1954 was a higher and faster year, with new records set in nearly every phase of flight.

ALTITUDE RECORD FOR PILOTED PLANE

Major Arthur (Kit) Murray piloted the Bell X1-A to 83,235 feet to set a new world's altitude record for a piloted plane.



HIGH ALTITUDE PARACHUTE JUMPS

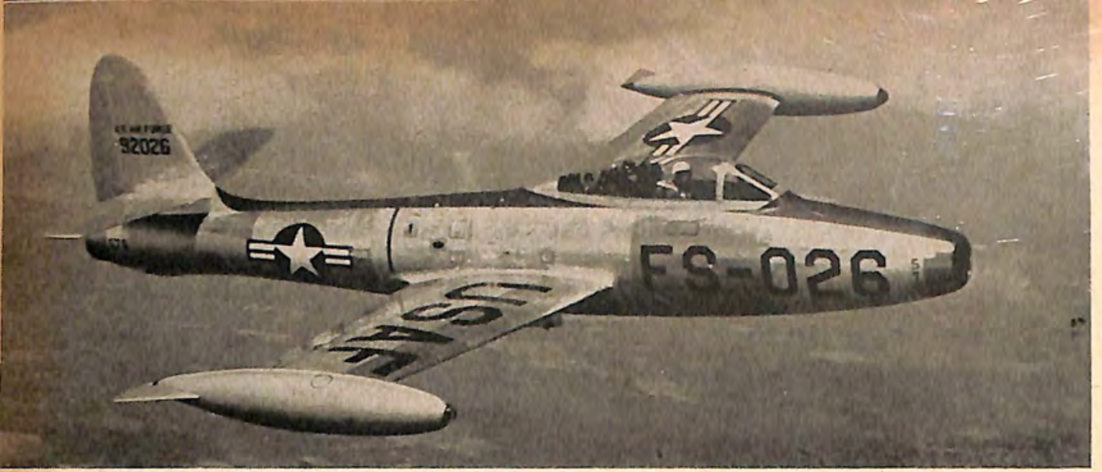
Record high for altitude jumps were made by Captain Edward G. Sperry and 1st Lt. Henry, who parachuted to safety from a height of 45,200 feet.

ROCKET ALTITUDE

Off to a new world's record in May, the Navy's Viking II climbed from its launching stand at White Sands New Mexico at 4,300 mph to a height of 158 miles.

HELICOPTER SPEED AND ALTITUDE

The Sikorsky XH-39 set a helicopter speed record of 156.005 mph over a 3 kilometer course. World's altitude record for helicopters of 24,500 feet (unofficial) was established on October 17.



NATIONAL AIR SHOW

Republic F-84F Thunderstreaks set a new speed record for the Bendix Trophy classic this year, achieving an average speed for the 1900 mile course of 616.208 mph. Pictured above is F-84 Thunderjet predecessor of the F-84 Thunderstreak.

POLAR FLIGHT

Late in the year a Douglas DC6-B, with Pratt and Whitney engines made the first scheduled commercial flight across the pole.

AWARDS

In recognition of contributions to aviation many awards were given. Among the outstanding:

COLLIER TROPHY

The Collier Trophy for "outstanding achievement in aviation" for 1954 was awarded to James H. (Dutch) Kindelberger for the North American land based F-100 and to Edward Heinemann for the Douglas F-4D by President Eisenhower at the White House on December 17.

AVIATION MAN OF THE YEAR

To traveling Secretary of State John Foster Dulles went the Air Force Association's Man of the Year award.

WRIGHT BROTHERS MEMORIAL TROPHY

"For public service of enduring value to aviation in the United States"—the Wright Memorial Trophy was presented to Dr. Theodore von Karman.

THE FRANK G. BREWER TROPHY

To Doctor John H. Furbay "for contributing most to the development of air youth in the field of education and training."

OCTAVE CHANUTE TROPHY

Award of the Octave Chanute Trophy went to George E. Cooper, NACA research pilot of the Ames Aeronautical Laboratory.

FLIGHT SAFETY FOUNDATION AWARD

Lt. Col. John Stapp, Director of Holloman Air Development Center, received the Flight Safety Foundation Award for his work with rocket sleds. Late in the year, he set a world land speed record of 632 mph.

DANIEL GUGGENHEIM AWARD

The Daniel Guggenheim gold medal was awarded to Honorable Clarence Howe, Canadian Minister of Trade and Commerce and Defense.

HARMON TROPHY

The 1954 Harmon International Trophy was jointly awarded to Jacqueline Cockran and Major Charles E. (Chuck) Yeager for their "most outstanding contributions to the science of flying."

CHAPTER ONE

The Industry

AIRLINES IN 1954 SURPASSED both Pullman and steamship traffic for the first time in history, the long-awaited military recognition of aviation as the first line of defense became a reality, and jet planes, particularly in the military, became production-line realities. Supplementing these aviation achievements was marked progress in the production and use of utility planes, especially by businessmen, a tremendous expansion in rocketry and guided missile development and manufacture, and marked growth in production and use of helicopters. Combined, these made the year one of the most significant in terms of solid progress in the history of the industry.

By year-end, aviation was unrivalled as the nation's largest manufacturing employer, and rivalled only in its growth by the spectacular expansion of electronics in aviation.

Almost without exception, individual companies either expanded their activities or branched out into the numerous new fields of development and production offered by the jet age. Although security currently masks much of this progress, indications are that the year, when the complete story can be told, was one of the outstanding, if not the most productive, in both jet engine and flight progress. Certainly, scores of planes in production turned in record performances, and other scores, still in the experimental stage, showed signs of making future aviation history of great significance.

An alphabetical account of individual company achievements during the year appears on the following pages.

AIRCRAFT MANUFACTURERS

Aero Design and Engineering Co.

As one of the younger companies of the aircraft manufacturing industry, Aero Design and Engineering company firmly established itself in 1954 with the announcement in June of the Aero Commander. The Aero Commander 560 superseded the first production model, the Aero Commander 520; 150 of the 520 models came off the assembly line before the start of production of the 560.

Production was established at about six and a half planes per month and year-end totals showed over 200 Commanders produced since the beginning of the manufacturing operations in 1951. The Commander first attracted attention in the aviation world when it made its 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.

The dollar sales volumes was expected to exceed 5-million dollars in 1954. The company employs approximately 450 people. Plans are being developed for a new manufacturing facility which will have a floor space of approximately 40,000 square feet. After the completion of this facility, a slight rise is anticipated in the employment figure.

Also announced by the company was the establishment of a Research and Development Center which was to be located at Norman, Oklahoma, near the Aeronautical Engineering Department of the University of Oklahoma. This Center has been established to look into the future of the market, to continue the development of present design and investigate the possibility of other projects.

Aero Commanders are now operating in Brazil, Ecuador, Canada, Mexico, Japan, Philippines, Korea and Europe. All Commanders in operation in Europe and the Far East were flown across the North Atlantic to their destination.

Avco Manufacturing Corp.

Avco enlarged its role as an aviation manufacturer of engines and precision parts and products during 1954, through increased activity by its Lycoming Division and Crosley and Bendix Home Appliances Division. Aircraft production encompassed both civilian and military products and final assemblies as well as components.

Lycoming announced that it was working on two classified contracts on gas turbine engines for the United States Air Force under the direction of Dr. Anselm Franz, vice president of turbine engineering. (See Lycoming under Engine section.)

Avco's Crosley and Bendix Home Appliance Division expanded its defense work at plants in Cincinnati, Ohio; Richmond, Indiana and Nashville, Tennessee. Chief among the material for the Air Force produced at these plants are electronic-mechanical fire control devices and wing components for fighters, bombers and transport planes.

Beech Aircraft Corp.

Four Beechcraft models achieved new popularity and greater sales during 1954 as Beech Aircraft Corporation engaged in the production of aircraft for both the military and a growing commercial market.

This year was the second year for the production of the Beechcraft T-34 Mentor for the United States Air Force. On June 17, the Navy announced the selection of the T-34 military trainer as the new primary trainer for Naval Aviation.

February, 1954, saw the first deliveries in quantity of the T-34 to a foreign country when twelve of the new planes were flown 6,000 miles south to Chile from Beech Field in Wichita. Their pilots were Chileans who had been checked out in the planes in Wichita, and the flight was believed to be the largest mass flight of planes to be made from the United States to South America since World War II. Thirteen more T-34's were flown to Chile in March.

The Republic of Colombia followed Chile's purchase of the Beechcraft T-34 with an initial order in October, 1953, and a contract for ten more in April.

An agreement with Fuji Heavy Industries, Tokyo, to build the Mentor in a plant in Japan was announced in November, 1953, and the Japanese planes, designed by Beechcraft, began to roll off the assembly lines there in 1954. In April, 1954, another agreement was announced, this time with the government of Canada.

Other Beechcraft planes also were chosen by foreign governments during 1954. The Chilean Navy chose versions of the Beechcraft Model 18 twin-engine trainer-transport as the first planes to be purchased for the new air arm of the Chilean Navy. The planes were delivered to Chilean Naval officers in ceremonies at Beech Field in September, 1954. Model 18's also went into service in many other countries throughout the year.

The company also continued rebuilding Beechcraft Model 18's for the Air Force throughout 1954, making new C-45H trainer-transports from older C-45, AT-7, and AT-11 models which had been built during World War II.

One other military plane emerged from Beechcraft production lines during the year, this one for the United States Army. The Ground Forces received delivery of a sizable quantity of L-23 twin-engine liaison and utility planes during the year, which promptly went into service in many areas throughout the world.

Other military projects included flaps and ailerons for the Republic F-84F Thunderstreak for General Motors in Kansas City, Kansas, and components for the F-101 Voodoo jet fighter for McDonnell Aircraft in St. Louis.

During the year, the company also made fuel tanks under contract from the United States Air Force, and contracted for extensive production of two different jet-engine starters, the C-26 and the MD-3 generators, both designed by Beech.

During 1954, a special emphasis was put on production of commercial aircraft. The year began auspiciously with a million-dollar "Plane-O-Rama" at the Beechcraft plant, at which three new commercial models were introduced. Beechcraft distributors from throughout the country saw a display of a million dollars' worth of airplanes, all arrayed under spotlights in the new Beechcraft Plant III in Wichita.

In 1954, for the first time, the Beechcraft Bonanza could be purchased with either the standard E-185-11 Continental engine or the more powerful E-225-8 engine.

The new Model B50 Twin-Bonanza was introduced as a six-place twin-engine high-performance commercial airplane in full production after five years of extensive testing during which time the company had devoted almost total effort to military responsibilities.

The "Plane-O-Rama" also introduced the new Super-18 Beechcraft, a re-designed and re-engineered plane based on the Model 18 twin-engine executive transport. The new plane made its first flight in December, 1953, was introduced in January, 1954, and first deliveries were made in August, 1954.

The Super 18 includes a 550-pound increase in gross weight and is better than the Model 18 in every phase of performance. The cruising speed has been increased to 215 miles per hour, top speed is 234 miles per hour, the range has been increased to a maximum of 1455 miles, and many new design and comfort features have been included.

Sales of all three commercial models boomed throughout the year. Production of the Bonanza was increased early in the year from one a day to one-and-a-half a day and the production of the Twin-Bonanza was established at the rapid rate of 13 per month, which enabled the company to produce and deliver more than 100 of these models by the middle of October.

The company announced in September its entry into the field of guided missiles. Dr. James F. Reagan, formerly chief engineer for Radioplane, Inc., San Diego, was brought to Beechcraft as the head of a new guided missile division in the engineering department.

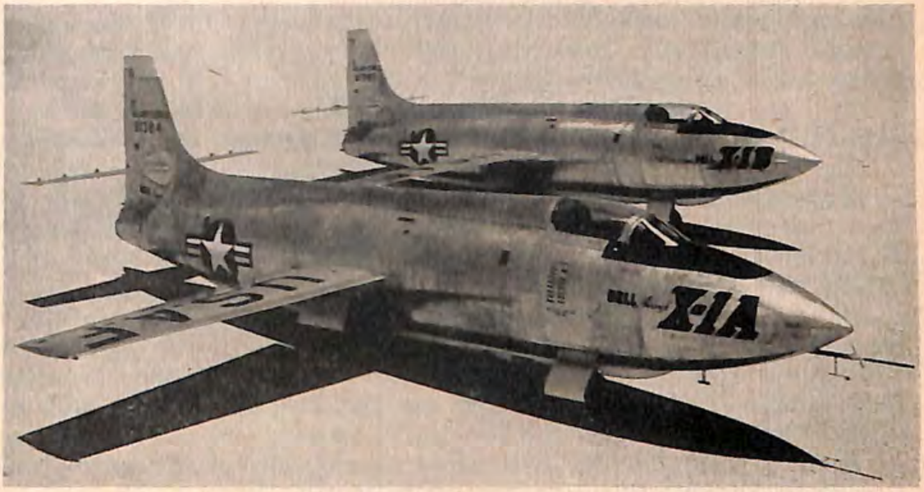
Bell Aircraft Corp.

Continued diversification, both within the defense structure and in the commercial field, keynoted Bell Aircraft Corporation activity during 1954.

In line with this diversification policy, Bell purchased two new companies, engaged in unrelated commercial activity, bringing to five its wholly-owned subsidiaries.

Early in 1954, the company obtained the common stock of the American Wheelabrator and Equipment Corporation, of Mishawaka, Ind., manufacturer of abrasive blasting equipment, fume and dust control equipment and abrasives.

Tied in closely with Bell activity in the military and commercial servomechanisms field was the firm's purchase of the Hydraulic Research and Manufacturing Company, of Burbank, Calif., achieved through an exchange of stock.



Bell X-1A and X-1B supersonic twins

Hydraulic Research manufactures small, lightweight, high-pressure hydraulic valves principally for aircraft application in landing gear systems, control circuits and brakes. Sales for the last three years have exceeded $1-million annually.

Other Bell subsidiaries are The W. J. Schoenberger Co., of Cleveland, O., the Bell Aircraft Supply Corporation, Glendale, Calif., and the Erie Insurance Company, Des Moines, Iowa.

Bell Aircraft military and commercial aircraft continued to make aviation news throughout 1954.

One of these was the Bell X-1A, which established a new altitude record over Edwards Air Force Base, California. Already the world's fastest airplane (1,650 miles an hour on December 12, 1953), the rocket-powered research airplane, according to the aviation press, topped 90,000 feet with Major Arthur "Kit" Murray at the controls. This figure was not confirmed by the U. S. Air Force, but it was acknowledged that the airplane exceeded the previous record of 83,235 feet.

Although the X-1A is the fifth in the X-1 series Bell has produced for the Air Force, it is essentially the same airplane which first smashed through the sonic barrier in 1946.

Main difference is that the X-1A is nearly five feet longer, and has increased propellant tank capacity and carries a turbine pump to force-feed the propellants, an alcohol-water mixture and liquid oxygen.

Full-powered flight for the X-1A is approximately four minutes with all four rocket chambers in use. Each develops 1,500 pounds thrust and the engine consumes about one ton of propellants under full power.

Major Charles E. Yeager, who gained fame with the X-1 as the world's first supersonic pilot, earned recognition during the year for the X-1A speed record of 1,650 miles an hour. Yeager was awarded the Distinguished

Service Medal and was chosen as the aviator-recipient of the Harmon International Award. The latter was presented by President Eisenhower on November 17 at the White House.

Delivery of the X-1B, sistership of the X-1A, to Edwards Air Force Base in October gave the Air Force a set of supersonic twins for its continuing high-speed, high-altitude research program.

Although details were lacking, it was disclosed that the airplane had been flight tested at the base. Identical except for instrumentation, the X-1B will permit acceleration of the increasingly important study of the aerodynamic effects of supersonic flights at high altitude.

Bell Aircraft also continued its research, development and production in the rotary-wing field.

Largest of its military helicopter products, the HSL-1, tandem-rotored Navy sub-killer, underwent exhaustive evaluation tests at the Navy's Patuxent River, Md., flight test center.

First of these aircraft to be delivered was flown 1,465 miles cross-country to the Maryland base from Bell Aircraft's Fort Worth helicopter plant without incident. This flight was described as the longest twin-rotor helicopter delivery flight on record.

The HSL incorporates a Bell-developed helicopter autopilot, first of its kind, which permits it to hover motionless for long periods during enemy submarine search, relieving the pilot of the fatiguing flight chore.

During 1954, the Navy disclosed that the HSL is equipped with the latest dipping sonar for submarine detection and is armed with lightweight homing weapons for destruction of the undersea craft.

In its present configuration, the HSL carries four crewmen, a pilot, co-pilot and two sonar operators. It has a flight endurance of nearly four hours.

Two new commercial versions of the established Bell Model 47 helicopter, military counterparts of which are used by all the services, were announced by the company during the year.

One of these, the Model 47H, is a deluxe version of the famous Model 47G, now in use throughout the world. The latest model can accommodate two passengers and a pilot in an automobile-type seat five feet wide. Interior appointments include leather upholstery throughout and a leather-covered instrument console to the left of the pilot.

Second of the deluxe commercial models announced by the company was the 47J, which earlier had been designated the 47G-1. This helicopter carries four persons, including the pilot, and has a similarly richly-appointed interior. One of its principal features is quick utility change. Passenger seats can be removed to allow for the installation of two litters for transporting wounded or injured, as well as a medical attendant. A trap door in the floor can be raised in the standard passenger configuration to permit use of an electrically-powered hoist for rescue of persons in otherwise inaccessible places. It is equipped with a 260 horsepower Lycoming 0-435 engine.

Production of both models was scheduled for early 1955.

Combining the helicopter and conventional airplane utility, a convertiplane also was approaching flight status at year-end. Designated earlier in the year as the XV-3, the Bell development incorporates tiltable rotors at each wing tip.

Bell Aircraft continued to strengthen its position in the field of guided missiles throughout the year and the U. S. Air Force disclosed for the first time that the company had developed and was building the XB-63 Rascal missile. (See Guided Missiles Chapter.)

In the sub-contracting field, the company was awarded a contract to produce jet-engine nacelles for the Boeing B-52. It was expected that the firm's nine Niagara Frontier Division facilities eventually would be involved in servicing this contract, although additional employment was not anticipated.

Bell will build both the inboard and outboard nacelles, each of which will contain two jet engines. Output will be delivered to Boeing's Seattle, Washington plant.

At year's end, Bell Aircraft had more than 40 major contracts and was servicing nearly 20 customers, some of them among the largest aircraft manufacturers in the country.

During the year floor space in the firm's Niagara Frontier Division climbed to 2,219,083 square feet and the Texas Division in and near Fort Worth, Texas, had increased to 679,422 square feet. Bell also had other operations at Holloman Air Development Center, N. M.; Edwards Air Force Base, California; Washington, D. C.; and Dayton, Ohio.

Total employment reached a postwar high of 17,725, with 14,075 in the Niagara Frontier Division, which has its headquarters at the Niagara Falls, N. Y., airport.

Helicopter development and production at Bell's Texas Division moved into a new phase during 1954 with emphasis on commercial business. Sales of the Model 47G, three-place utility machine, were 20 percent higher than the previous year.

In addition, the division unveiled two new commercial models, the 47H and the 47J. The H is a streamlined, deluxe version of the 47G and is designed for the executive and passenger market. The Model 47J is a four-place utility machine which features a new powerplant, the Lycoming 0-435-VI (250 hp). Like the 47H, the J has a custom interior for its passenger configuration. Noise level in both of the new models is greatly reduced.

Highlighting the military effort of the division during 1954 was the acceptance by the U. S. Navy of its first production HSL-1 and the subsequent delivery of additional production machines. The HSL-1 is a tandem-rotor craft designed specifically for anti-submarine work and is equipped with the latest type dipping sonar for submarine detection.

A Bell-designed automatic pilot for use in conjuction with HSL submarine detection equipment was announced during 1954. This device provides for fully automatic hovering of the HSL in relation to a submerged sonar ball.

Construction of Bell's XV-3 convertiplane prototype was nearing completion at year-end. Wind tunnel tests of the XV-3 scale model indicated that conversion of the tilting rotors will be possible in any flight attitude.

In the field of research and development, the division revealed preliminary design data on a flying wing helicopter. This design is basically a thick wing in which pilot and passenger seating, engines and fuel supply are completely contained. Side-by-side rotors are located at either tip of the wing.

The division maintained an employment level of approximately 3,800 throughout the year; occupied 320,762 square feet of space in the Fort Worth area; recorded a backlog in excess of $200-million and sales exceeding $17-million to September 1; and expended nearly $180,000 for construction of additional office and heliport space, test facilities and plant improvements.

Bellanca Aircraft Corp.

Bellanca Aircraft Corporation was engaged largely in sub-contract work during 1954. Major components were manufactured for the C-119, C-123, P5M, HUP25, and other aircraft. A large number of radar components were also manufactured. The company developed and produced the XM-24 Sonic Speed Aerial Tow Target, which was undergoing evaluation by Army Ordnance at year-end. Extensive research was conducted on reinforced plastics, drones, and guided missiles.

Boeing Airplane Co.

Rollout and flight of four history-making airplanes—the 707 jet tanker-transport, the production model of the B-52 series, the 500th C-97 Stratofreighter, and the 1,000th Wichita-built B-47 Stratojet—were the major events for Boeing Airplane Company during 1954.

On May 14, the 707, America's first jet transport, came out the door of the Boeing plant at Renton, Wash., and on July 15, "Tex" Johnston, Boeing chief of flight test, took the four-engined, sweptwing plane into the air for the first time. Within a matter of days the airplane had been flown at an altitude of more than 42,000 feet and at speeds exceeding 550 miles per hour as an intensive flight test program was inaugurated. Three weeks after the maiden flight the Air Force announced that a limited number of tanker versions of the new Boeing would be purchased, and would be designated KC-135.

Later, the plane averaged 636 miles per hour on a point-to-point 13-minute flight from Seattle to Portland, Ore.

The 707 prototype is essentially a military model, complete with two large cargo doors and provisions for installation of cargo tie-downs and aerial refueling equipment. Plans also called for the airplane to be demonstrated to commercial airlines. It represents a private investment by Boeing of more than $15-million.

The KC-135 configuration, an advanced version of the 707, will make possible greater range, striking power and mobility for the Air Force's present and future jet air fleets. With a cruising speed in the 550 mile-per-hour class, bettering by some 100 per hour the fastest jet transport yet built, the new plane as a commercial airliner will be capable of regular transcontinental flights in less than five hours, and non-stop New York-to-London service of less than seven hours. Depending on range and payload requirements, the new Boeing will carry from 80 to 130 passengers, cruising at an optimum operational altitude between 30,000 and 40,000 feet. The KC-135 will be called Stratotanker, with the commercial version named Stratoliner.

In the B-52 field, while flight testing of the two prototypes continued, the first of the production airplanes, a B-52A, came out of the factory at Seattle on March 18 and took to the air for the first time on August 5. The company's Wichita, Kans., Division continued to tool up toward second-source B-52 production. Plans also were announced during the year for construction of a $10-million flight test facility for the B-52 program at Larson Air Force Base, Moses Lake, Wash., with operations scheduled to start early in 1955.

The B-52 production airplane differs from its two experimental predecessors in having side-by-side seating for pilot and co-pilot instead of the tandem arrangement in the "X" and "Y" ships. In addition, the B-52A is about three feet longer, giving it an overall length of 156 feet.

The B-52's eight Pratt & Whitney engines are mounted in pairs on sharply-raked-forward pods under the thin, high-speed wing. The main landing gear units retract into wheel wells in the body.

At Renton, the 500th airplane of the Stratofreighter series came out the door on February 8, and at the same time it was revealed that new cost-saving and production records for four-engine heavy transport aircraft had been set by Boeing in its C-97 program. Production of the double-deck, 350-mile-an-hour C-97's had been on schedule for a total of 54 consecutive months with but one break in December, 1950, when the production quota was missed by a single airplane.

In world-wide use by Strategic Air Command and Military Air Transport Service, the Boeing Stratofreighters are now the standard USAF aerial refueling tankers.

Since Boeing delivered the first production type Stratofreighter, a C-97A in July, 1949, production costs continually were reduced.

The KC-97G of 1954 benefited from more than 300 improvements incorporated in the airplane through its 11 models, with the gross weight raised from the original 120,000 pounds of the XC-97 to 175,000 pounds for the KC-97G.

Boeing also revealed during the year that a saving to the government of almost $4.5-million had been realized on a KC-97 contract recently completed. This was made possible through increased manufacturing efficiency, which under the USAF fixed price-incentive type of contract resulted in substantial savings to the government and additional profit to the manufacturer.

October 14 saw the 1,000th Wichita-built B-47 roll out of the Kansas plant, marking the 34th consecutive month of on-schedule production. It made its appearance just seven years, one month and two days after the original XB-47 came out of the Boeing plant, thus establishing the largest single production program in aviation history.

Stratojet No. 1,000 was a B-47E which was powered by six General Electric J47 engines developing 6,000 pounds of thrust as compared with the 5,800 pounds of thrust provided by engines on the preceding model. Two other available power increases were announced during 1954: one, a new collar-type rocket rack mounted beneath the fuselage has positions for 33 ATO (assisted takeoff) units of 1,000 pounds of thrust each and can be dropped from the plane after power is expended; the other, installation of a water injection system in the J47 engines, providing a 17 percent increase of available power when needed.

Still another B-47 innovation revealed during the year was the installation of Pratt & Whitney J57 engines in the outboard pods of two Stratojets for accelerated high altitude engine testing. The specially-equipped medium bombers are being used as part of the B-52 test program.

RB-47E Stratojets accompanied the standard B-47E's off the Wichita production line during 1954. Boeing's Wichita Division also has under way an 18-month modification program, bringing older Stratojets scientifically up to date.

A new Boeing gas turbine engine, combining the advantage of greater power and more economy over its predecessor, was announced in June. Designated the Model 502-10, the engine is a development of the Model 502-2 which powers a variety of vehicles, aircraft, boats, pumps, compressors and generators. The new engine produces a maximum of 270 horsepower with a normal rated power of 240 horsepower, an increase of 65 horsepower over the earlier type. Fuel consumption, meanwhile, was reduced by 25 percent. The 502-10 weighs only 245 pounds dry, or 320 pounds complete with lubricating oil, accessories, engine mounts and oil cooler.

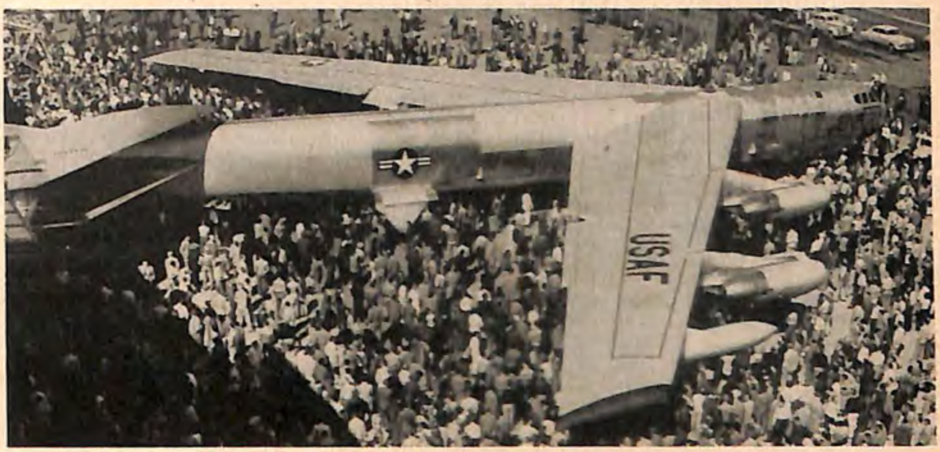
Boeing's new $5.8-million flight test hangar was in full operation early in the year. With a length of 785 feet, width of 200 feet and a height equal to that of a seven-story building, the hangar can comfortably house five B-52's and will be able to accommodate airplanes of the future with wingspans up to 300 feet.

Boeing moved into a new electronics building in Seattle early in the year, while at Wichita a new two-story cafeteria-engineering building served to meet expanding needs there. Also at Seattle, construction was started in mid-year on a $1.5-million B-52 pre-flight facility on Boeing Field, and later in the year on a new material handling building measuring 600 by 484 feet.

In the field of missiles Boeing continued in the development of its Bomarc F-99 pilotless interceptor while an engineering study of the application of nuclear energy to aircraft also was continued.

The company's total employment at year-end was more than 65,000.

In the research field, practical designs were developed for jet engine reverse thrust devices to enable jet transports, bombers and fighters to



Rollout of first production Boeing B-52

operate from the majority of existing airports. The devices are designed to divert the tremendous power of jet engines so that it is easily, quickly and safely made available for braking purposes once the airplane's wheels have touched down on a runway.

With more and more titanium being used in aircraft production, Boeing's engineering process unit developed two processes. One process inhibits scale formation while the other converts normal scale to a form which later permits more convenient removal.

Laminated glass blades were installed in Boeing's transonic test facility at Seattle. Seventy-two blades are used, 36 to a stage, in the tunnel's two-stage fan. Made of laminated glass cloth measuring .014 of an inch thick for each layer, the thickness of the blades tapers from 56 laminations at the root to eight at the tip. When set in the fan the tips of the three-foot plastic foam-filled blades describe a 24-foot diameter circle and rotate at a maximum of 480 revolutions per minute.

Cessna Aircraft Co.

Completion of tooling, first flight and acceptance by the U.S. Air Force of the T-37 as the Air Force's official jet trainer was the outstanding event for Cessna Aircraft Company during 1954. This side-by-side jet trainer emphasizes the new look for training command in preparing Air Force pilots for first line fighter jets. The seating arrangement will simplify jet training by utilizing visual as well as oral instruction.

During the year, Cessna built and sold 1171 commercial airplanes, totalling more than $12-million. Cessna also produced 198 military airplanes during 1954, for a total of 1369 airplanes.

The year brought the phasing-out of the L-19 Bird Dog, and receipt of an IRAN contract (Inspection, Repair as Necessary) which is intended to condition the aircraft for continued field use. Within the contractual life of the L-19, Cessna built and delivered 2480 of these airplanes.

First production deliveries on Cessna's twin model 310 were made also in 1954. By early 1955, the production rate was expected to be one model per working day.

The company continued with its production record of delivery on or ahead of schedule on all military sub and prime contracts. Military subcontracts were being accomplished for Boeing Airplane Company, Lockheed Aircraft Company, and for Buick, Oldsmobile, Pontiac division of General Motors on the F84-F. At year-end the backlog was about $35-million.

At the Cessna Prospect Plant work progressed on the CH-1 helicopter.

Cessna's hydraulic division showed a sales increase over the previous year. A climb from a total sales volume of $2-million in 1953 to $2.25-million in 1954 was a 12½ percent sales increase.

During 1954, the Research and Development department devoted a greater portion of its time to research on boundary layer control with respect to fixed wing application. The flying article known as the 319A is Cessna's experimental BLC aircraft. With the system used on the 319A which consists of two high speed axial flow fans actuated by hydraulically operated motors, the article has developed a lift coefficient as high as 4.0.

Work was accomplished also on a turbo engine installation known as the XL-19C. The power plant is a Continental Artoust 210-1 weighing 266 pounds and developing 280 hp on take-off.

A large subcontract was received in 1954 from the Boeing Airplane Company for the B-52 stabilizer assembly. Work was well under way on the installation of new jigs.

An improved version of the combat-proved L-19 made its first flight during the year in the form of the OE-2. Designed with specific missions in mind, the OE-2 has a top speed of over 180 mph, yet is capable of operating from as small, unimproved fields as did the L-19. The OE-2 is powered with a Continental super-charged 265 hp engine. The original contract calls out 25 OE-2's which will go to the Marine Corps.

Chance Vought Aircraft, Inc.

Chance Vought Aircraft, Incorporated, one of the oldest airframe producers in the aircraft industry, became a completely independent corporation July 1, 1954, completing a cycle that began 37 years earlier when Chance Milton Vought founded the company in Long Island City, New York, in 1917.

Previously a division of United Aircraft Corporation, East Hartford, Connecticut, since 1939, the common stock of Chance Vought was distributed by United Aircraft on July 1, 1954, and now Chance Vought has no legal or corporate connection with United.

All officers of United resigned from Chance Vought's board of directors and the board now consists of five Texas business men and four of Chance Vought's officers. F. O. Detweiler, formerly general manager of the division, became president at the time the new corporation was formed and C. J. McCarthy, formerly vice-president of United Aircraft Corpora-

Cessna enters helicopter field with CH-1

tion, resigned to become chairman of the board of directors of Chance Vought Aircraft, Incorporated.

The spin-off found Chance Vought engaged in an important new project, the XF8U-1, a high-performance Navy day fighter for which the company won a design competition in 1953, and in production of the F7U-3 Cutlass and Regulus guided missile.

The F7U-3, a twin-jet fighter aircraft in the more-than-650-miles-an-hour class, was built and delivered to the Navy in quantity during 1954, with large numbers of the craft reaching the Fleet.

The F7U-3 is the successor to the F7U-1 Cutlass, the first sweptback-wing fighter to fly from a Navy aircraft carrier and the first U. S. fighter designed from its inception to incorporate jet-engine afterburners.

The Regulus guided missile, designed and produced for the Navy, is a surface-to-surface missile capable of being launched from ships, submarines and shore bases. The Regulus is highly versatile, one of its versions being equipped with landing gear to permit recovery after a test mission. Test missiles have been flown and landed repeatedly, some as many as 15 times, and offer an economical method of training Navy personnel in the use of this complex and important weapon.

In announcing the existence of the XF8U-1 day fighter, the Navy stated that "details of the new jet fighter are being withheld until it is in operation, but it will have higher performance than previous Navy day fighters. The design chosen was considered by the Navy fighter design and evaluation experts to be the best suited for Navy requirements from designs submitted by eight aircraft manufacturers."

In addition to being a substantial prime contractor for the Navy, the company manufactures components for the Boeing B-47 Air Force jet bomber and for the Lockheed P2V long-range Navy patrol bomber.

Chance Vought occupies 2,300,000 square feet of floor space at the Naval Industrial Reserve Aircraft Plant, Dallas, Texas, under a lease with the United States Government. Since occupying the Dallas facility in 1948, the company has made substantial expenditures for manufacturing and engineering equipment, including extensive machine shop equipment, tool-manufacturing machines, engine-test equipment, a fully equipped foundry and other auxiliary manufacturing equipment.

In addition to the company-owned equipment, Chance Vought has financed substantial improvements to the leasehold which have greatly increased the capacity of the plant, including an engineering building and a production hangar, the costs of which already have been amortized.

The total of all such expenditures, including improvements to leased property, amounted to approximately $14,000,000 during a six-year period. Chance Vought expected to complete early in 1955 a $900,000 low-speed wind tunnel as an additional improvement.

Since the beginning of the Korean emergency in 1950, the Navy has made available for expansion the sums of $12,540,740 for additional machine-tool equipment and $9,562,270 for new construction as part of the defense buildup of the Naval Industrial Reserve Aircraft Plant facility. Of these amounts, approximately $7-million has been expended for machine tools and equipment. Approximately $7.4-million has been expended for new construction, the major items being a warehouse and manufacturing building, a structures-test building, and a missile installation and test hangar.

The plant population during 1954 stood at approximately 14,500, slightly under the peak employment total in World War II. The company's payroll averaged more than $1,000,000 a week. Sales for the six months period ended June 30 amounted to $77,666,640 on aircraft, guided missiles, parts and services, and the company had a backlog of unfilled orders, including letters of intent, of more than $280,000,000.

Approximately 250 employees are stationed in California, in connection with Regulus testing operations, while an engineering facility in Boston, Massachusetts, established in 1953 as the result of a survey which indicated that engineers were available in that area, employs another 250 persons. Chance Vought's engineering force includes approximately 1,700 trained engineers.

Convair
A Division of General Dynamics Corp.

Merger of Consolidated Vultee Aircraft Corporation into General Dynamics Corporation; the first free vertical-to-horizontal-to-vertical flight of the world's first vertical takeoff fighter; official Navy announcement of successful employment of Navy's new anti-aircraft weapon, the supersonic Terrier guided missile; first flight of the world's first turboprop seaplane transport; initial flight of America's first twin-engine turboprop military transport; first supersonic flight of a seaplane; official announcement that the world's first known supersonic bomber is in production in America; and continued high output of commercial transports and military trainers highlighted 1954 development, production and management activities of Convair.

With the filing of formal documents on April 30, 1954, Convair, a Division of General Dynamics Corporation, came into being. With the merger, Convair retained its name, identity, and organizational structure, and began functioning as an operating division of General Dynamics Corporation. Gen. Joseph T. McNarney, USAF (Ret.), continued as president of Convair and also became a senior vice president of General Dynamics.

First free vertical flight of the Navy XFY-1 delta-wing vertical takeoff turboprop fighter, built at Convair-San Diego, occurred August 1, 1954, at Moffett Naval Air Station, California, following a series of vertical flights in a tethering rig. The revolutionary fighter made its first transitional flight—rising vertically, leveling off at 175 feet into horizontal flight, and backing down to land vertically—on November 2, 1954, at Brown Field Naval Auxiliary Air Station, near San Diego.

The world's first turboprop seaplane transport, the Navy R3Y-1 Tradewind, made its first flight off San Diego Bay February 25, 1954, while its assault transport counterpart, the Navy R3Y-2, first flew from the Bay October 22, 1954.

First flight of America's first twin-engine turboprop military transport, the Air Force C-131C, was made from Convair-Fort Worth on May 20, 1954.

In October, the Air Force announced that it had ordered an undisclosed number of B-58 supersonic bombers—first of the type ordered in this country—to be built by Convair-Forth Worth.

At Convair-San Diego, nearly 70 Convair-Liner 340 commercial transports were built during 1954 while production of Air Force T-29 navigator-bombardier trainers reached a peak toward the end of the year.

Meanwhile, at Pomona, Calif., in a new government-owned plant, Convair was engaged in a comprehensive program of research, development and production of Terrier guided missiles for the U. S. Navy Bureau of Ordnance. This includes weapons, systems analysis and the preliminary design of new and improved guided missiles systems.

On November 12, Navy announced that in the air defense phase of the Atlantic Fleet's largest postwar exercise, Lantflex 1-55, the 37-year-old converted battleship USS Mississippi successfully employed Navy's Terrier.

The Terrier, capable of being fired from either shipboard or ground stations, has completed its test program which began in the spring of 1952 at Naval Ordnance test station, Inyokern, Calif.

This slim, needle-nosed missile is designed to intercept aircraft at much longer ranges and higher altitudes than conventional anti-aircraft weapons under any conditions of visibility. Because of the high percentage of successful flights in the Terrier's test program, almost all launchings against target drone aircraft have been made by dummy missiles that did not carry explosive war-heads. The dummy signals a kill by releasing a puff of smoke near the target plane. Even without war-heads, the missile has smashed several targets by direct collision.

The Terrier is the result of joint Navy Bureau of Ordnance, Convair and Johns Hopkins University Applied Physics Laboratory Development program. Production is being carried on by Convair at its Pomona plant.

Production continued at Fort Worth on B-36J models throughout the first eight months of 1954. The J version differs from earlier B-36s in that its maximum gross weight is more than 400,000 pounds as compared with 358,000 pounds for earlier models. B-36 output ended in August, but all of the Strategic Air Command's fleets of B-36s will be rotated through Convair-Fort Worth every two years for modernization, inspection and maintenance.

Convair-Fort Worth also had begun work late in 1954 under an Air Force contract to modify an undisclosed number of RB-36 reconnaissance bombers into carriers for Republic RF-84 reconnaissance fighters in Project Ficon, wherein the parasite fighter can be launched and retrieved by the mother bomber while in flight.

Flight testing of two Air Force C-131C turboprop transports was being handled by Convair-Fort Worth crews. In March, the Texas plant was awarded a subcontract to build an undisclosed quantity of tail fins and outboard wing assemblies for the Boeing B-52 bomber. Fort Worth plant employment on October 10, 1954, totaled about 17,500.

Convair-San Diego maintained a high level of production during 1954. Approximately 70 Convair-Liner 340s were delivered; late in the year they were being produced at a rate of six per month.

Besides building the 340s for commercial and foreign carriers, the San Diego plant was producing two versions of the transport for the Air Force, the C-131D and C-131B.

Production of Air Force T-29 Flying Classrooms accelerated during the year, reaching a peak toward the end of 1954.

Engineering flight testing of the Air Force's first supersonic delta-wing all-weather interceptor, the F-102, was under way at the Air Force Flight Test Center, Edwards Air Force Base, California. Production flying of the plane was being accomplished at Palmdale, Calif., where Convair had begun negotiations to build a $2.5-million facility for handling the F-102 program.

Convair-San Diego continued flight test programs for both the Navy R3Y-1 Tradewind turboprop seaplane transport and the R3Y-2 turboprop assault seaplane. For assault operations, the R3Y-2 lands in offshore waters, taxis to the beach, opens its bow door upward, drops a ramp and debarks loaded vehicles or troops onto the beach. Upon leaving, the pilot reverses the propellers and the plane backs away and takes off. The multipurpose R3Y-2 can carry 24 tons of cargo, on the main cargo deck of extruded magnesium which is 88 feet long and more than 9 feet wide. The 80-ton bow-loader is designed to handle four 155mm. howitzers, three 2½-ton trucks, six jeeps, two half-tracks or other types of military equipment. Bow door opening is 8 feet 4 inches wide and 6 feet 8 inches high. The transport can be fitted with 102 demountable rearward-facing seats for normal transport operations. It can also carry 92 litters and 12 attendants if the plane is needed for air evacuation purposes.

Development of the Navy XF2Y-1 and YF2Y-1 Sea-Dart delta-wing jet seaplane fighters continued off San Diego Bay during 1954. Test pro-

Convair YC-131C turboprop transport

grams included supersonic flights in shallow dives and rough-water landing and takeoff tests on the open ocean. The Sea-Dart utilizes retractable hydro-skis for improved rough-water landing and takeoff performance.

Convair's XFY-1 vertical takeoff turboprop fighter was tested early in 1954. The delta-wing XFY-1 takes off and lands vertically, but it flies horizontally at speeds exceeding 500 miles per hour. It is designed to operate from the decks of ships at sea and on land where no runways are available Tactically, the plane can protect ships at sea from enemy air attacks or provide close air support to ground troops.

Powered by a General Motors Allison YT40-14 5850-horsepower turboprop engine turning a six-bladed contra-rotating Curtiss-Wright propeller, the XFY-1 was first tested in a tethering rig in a 184-foot airship hangar at Moffett Naval Air Station, California.

The plane was removed in September from Moffett to Brown Field, where on November 2, Convair Test Pilot J. F. Coleman pulled the craft up vertically, leveled off for its first horizontal flight, lasting 21 minutes, and returned to base, landing vertically.

Convair-San Diego, in addition to its aircraft projects for commercial and military customers, also was at work during 1954 on a number of restricted programs, including development of guided missiles and electronic systems, and advanced-type aircraft.

At year-end Convair-San Diego employment totaled around 21,000.

The net income of General Dynamics for the 9-month period ending Sept. 30 totaled $12,392,834 after Canadian and United States taxes, as against $9,377,061 for the like period in 1953.

Research and development programs in support of long-range planning policies continued during 1954 at the four plants of Convair: San Diego and Pomona, Calif., and Fort Worth and Daingerfield, Tex.

At Pomona, Convair was engaged in a program of research and development, as well as production, of guided missiles for the U. S. Navy's Bureau of Ordnance including weapons, systems analysis and the preliminary design of new and improved guided missiles' systems. These projects were being performed in the new Naval Industrial Reserve Ordnance Plant (NIROP) facilities operated by Convair under Bureau of Ordnance contract.

Convair's Daingerfield plant, otherwise known as the Ordnance Aerophysics Laboratory, continued operating in 1954 for the U. S. Navy Bureau of Ordnance under the technical direction of The Johns Hopkins University Applied Physics Laboratory. OAL was principally engaged in development and testing supersonic ramjet-powered guided missiles for the Navy's Bumblebee program.

The Laboratory comprises essentially a supersonic wind tunnel, two sea-level ramjet engine test cells, a high-altitude engine test cell, and the necessary supporting groups, including shops, electronics and instrumentation, photographic, facility and design, and accounting.

Among facility and instrumentation developments at the Laboratory were the design and development of equipment to indiciate and record test data and to calculate corrected coefficients and data from the supersonic wind tunnel and ramjet engine tests while the tests are in progress. The basic data include force, moment and pressures. Considerable progress was noted in the techniques of visual observation of flow patterns around models in a supersonic wind tunnel, including color Schlieren, vapor screen and shadowgraphs.

Plans were announced during 1954 for Convair-San Diego to construct the first model seaplane towing basin on the West Coast, a 700-foot hydrodynamic laboratory with four units—two 300-foot towing basins, a 100-foot square turning basin, and an office structure.

Construction of a $100,000 data reduction laboratory at San Diego started in October. Completed during the year was a $250,000 test facility atop Point Loma, San Diego, for a project of restricted category. A major structure is a steel tower covered with aluminum sheeting on three sides. Other portions of the facility include two sheds and a horizontal testing fixture for vibration and air-pressure tests.

A large solar furnace was put into operation in 1954 at San Diego for the study of various metals and ceramic materials in connection with research projects.

It was announced during 1954 that more than a thousand engineers and technicians would be added to the plant's Engineering Department within a year. Four hundred of the new personnel were to be electronics engineers and technicians assigned to long-range projects under development for the armed services.

Aircraft research projects at San Diego included water-based types for the Navy, supersonic types for the Air Force, and turboprop transports for commercial operation. In connection with classified projects, wind tunnel studies were conducted in the San Diego laboratory; the Southern California Cooperative tunnel, Pasadena; the Naval Ordnance Laboratory, Silver Spring, Md.; and NACA's supersonic tunnel at Langley Field, Va.

Flight research studies were conducted with the Navy's R3Y-1 and R3Y-2 turboprop seaplane, the Navy XF2Y-1 and YF2Y-1 delta-wing jet seaplane fighters, the Air Force F-102 delta-wing supersonic all-weather interceptor, and the the Navy XFY-1 vertical takeoff turboprop fighter.

Placed in operation in 1954 at Convair-Fort Worth was a small U. S. Air Force low-power reactor, used as a source of radiation for engineering test purposes in connection with Convair's development of nuclear aircraft.

A 750-ton capacity press was built for the Fort Worth plant to be used in stretching and twisting sheets of metal into airframe parts, thus saving much costly tooling. It is designed to handle ⅜-inch aluminum alloy stock or its equivalent.

Three titanium projects were concluded at Fort Worth during the year. The first called for use of alloy titanium to replace stainless parts in two B-36 jet pods. The other programs were concerned with replacing chrome-molybdenum and stainless steel with commercially pure titanium in B-36 engine nacelles.

Increased emphasis was placed on the importance of electronics in the research development and production of aircraft and guided missiles during 1954 in the four plants of Convair.

Electronics activity was stepped up, including initial production of the Charactron special-purpose cathode ray tube; the establishment of a pilot assembly line to study latest electronic production techniques; work in the fields of airborne mapping radar, radar homing, and long-range tracking and guidance; and the formulation of electronic and control equipment required in designing and developing overall weapons systems.

Electronic activity at Pomona was associated with Convair's research, development and production of Terrier guided missiles for the U. S. Navy, Bureau of Ordnance. At Daingerfield, considerable electronics activity was involved in the development of instrumentation for the testing of missiles and ramjet engines.

Production of the special-purpose cathode ray tube, the Charactron, began during 1954 and was scheduled to reach 30 units a month by early 1955.

In San Diego, where 400 of the 1,000 new engineers expected to be hired were scheduled for assignment as electronics engineers and technicians on long-range projects for the armed services, the Engineering Department's electronics laboratory set up a pilot assembly line to study the latest production techniques for assembling electronic systems for which Convair holds contracts.

Also at San Diego, where a large portion of electronics activity was in the areas of airborne mapping radar, radar homing, and long-range tracking and guidance, the largest effort was expanded in the mapping radar field. Work was under way on six radar projects, some essentially research devices, others advanced to the point of limited production. A study was initiated to establish the configuration of a compact bombing computer to use with these radar systems.

A large portion of the electronics activity at Convair-Fort Worth was directed toward systems engineering, a specialized type of engineering effort accomplished through the aerophysics section of the Engineering Department. This section was directing the formulation of electronic and control equipment required in designing and developing overall weapons systems.

As an adjunct to this activity, the aerophysics section operated a modern computing laboratory which handled digital- and analog-type problems. An IBM 701 electronic data processing machine is used for digital solutions. Selected combinations of REAC and Electronic Associates analog equipment operating through a single console are used for problems requiring an analog solution. The digital computer is used extensively to solve problems whereby a large number of variables is introduced and special emphasis placed on obtaining results of a dynamic nature.

Douglas Aircraft Co.

With a balanced production program including both new and established models of airplanes and guided missiles, Douglas Aircraft company enjoyed one of its most successful years in 1954.

Manufacturing activity, number of personnel and plant area all were expanded during the year to meet increasing delivery requirements. Major production effort was directed toward the manufacture of twelve models of airplanes and three types of missiles.

Two of the airplanes in full production for the military services made their first flights in 1954. They were the swept-wing, twin-jet RB-66 developed for the Air Force and the Navy's compact A4D Skyhawk, the nation's smallest atom bomber.

Douglas also continued production of three major commercial transport aircraft on the flexible assembly line of its Santa Monica Division. These were the DC-6A Liftmaster cargo plane, the DC-6B passenger liner and the newer, faster DC-7 series of airliners. Military versions of the Liftmaster also rolled from the same multiple-tooled assembly line.

At the company's Long Beach Division, where the RB-66 and B-66 light bombers were being produced in quantity, manufacture of the huge C-124 Globemaster transports continued for the Air Force.

Four separate models took wing from the Douglas El Segundo Division for the Navy: the new A4D, the record-holding F4D Skyray jet interceptor, the large A3D Skywarrior and two versions of the propeller-driven AD-Skyraider series. The AD-5 is the "multiplace" plane capable of shipboard conversion for a variety of missions and the AD-6 is the single-place attack bomber. The turbo-propeller powered A2D Skyshark was phased out in 1954.

At Tulsa, Oklahoma, Douglas was producing the Boeing-designed B-47 Stratojet bombers as well as portions of the B-66 series for the Air Force.

Rounding out this diversified production, the Santa Monica plant turned out three major missiles: Nike and Honest John for the Army and Sparrow I for the Navy.

To accomplish this heavy manufacturing assignment, the company employed between 65,000 and 72,000 men and women during the year. This compares with a high of 63,000 for 1953 and represents the largest employment since the peak production of World War II.

Douglas A4D-1 Skyhawk

Plant area also was expanded by the acquisition of new sites and enlargement of previously-existing facilities to a new post-war high of 13,-460,000 square feet of covered area—an increase of nearly 1,260,000 square feet over the previous year.

Most significant expansion was through the lease of a facility bordering the Tucson, Arizona, airport. Assigned to the Long Beach Division as an Air Force facility, the Tucson plant encompasses 197 acres on which there are 20 buildings. Not all of the 900,000 square feet of covered area was employed as the year ended, but tooling was in progress for production of parts of the C-124 and B-66 series. A modern electronics laboratory also was being installed in an air-conditioned, reinforced-concrete structure.

The Tucson plant also will be established as a flight center for production testing of Air Force aircraft.

A new electronics laboratory at Long Beach accounted for more than 30,000 square feet of increased plant area.

A major addition to the El Segundo plant was a $2,000,000 building of advanced design to house the engineering staff, and a three-unit steel assembly building for production of the bantam Skyhawk. The Torrance, (Calif.,) location of the El Segundo Division also was expanded during the year with completion of three-story brick administration building.

Pending acquisition of a new site for construction of a combined production and office addition, the Santa Monica Division leased a number of office, plant and warehouse buildings in the surrounding industrial area.

The increasing role of missiles in the Douglas production program was emphasized during 1954 with the announcement that the company, in conjuntion with Western Electric company, will begin production of Nike missiles at Charlotte, North Carolina. Originally an automobile assembly plant and subsequently acquired by the Army for use as a Quartermaster Depot, the 76 acre establishment will be designated the Charlotte Ordnance missile plant. It provides 1,200,000 square feet of floor area for quantity production of the nation's first combat-ready guided missiles. This will be in addition to production of Nike on the West Coast under the Santa Monica Division.

Two previously classified Douglas missile projects were made public during the year. One is the Honest John long-range artillery rocket, a fearsome surface-to-surface missile capable of delivering either an atomic or conventional high-explosive warhead. The other is the Sparrow I air-to-air guided missile developed in conjunction with the Sperry Gyroscope company for the Navy. Airframes for this supersonic rocket, carried in multiple units on jet aircraft, are also produced at Santa Monica.

In view of the importance of Honest John as a primary military weapon, Douglas is justifiably proud of its quick development. The original proposal for a rocket based on Army Ordnance specifications was submitted by the company in 1950. Detailed design, development and manufacturing was culminated in a successful test-firing program in August, 1951. Further tests of improved rockets resulted in the award of contracts in 1953 for large-scale production of the type of rocket now being delivered to troop units.

New airplanes, flown for the first time in 1954, also captured public attention. The A4D Skyhawk was hailed as a major forward step in the design of lighter, less complicated—and consequently less expensive—airplanes. This tiny bomber, smaller than many operational jet fighters, made its first flight on June 22, just 19 months after engineering had been started.

Six days earlier the RB-66, first in a versatile series of twin-jet light bombers, made its successful maiden flight. This sleek, swept-wing speedster was developed for the Air Force from the basic design of the Navy A3D Skywarrior. The reconnaissance version is equipped to perform high or low altitude missions deep within enemy territory. First of the subsequent bomber versions also was flown before the year ended.

The Long Beach Division, keeping ahead of schedule on its heavy commitments for delievry of giant C-124 Globemasters, also completed the prototype YC-124B. This was an adaptation of the basic Globemaster configuration to utilize four turbo-prop engines which will power a subsequent C-133 logistic support transport. The YC-124B was test flown for the first time on February 3. It is the first four-engine turbo-prop transport developed for the Air Force, and the flight test program demonstrates that aircraft using that type of propulsion are able to lift greater loads over longer ranges at higher speeds than conventional piston-powered cargo carriers.

Production of commercial transports at the Santa Monica Division was highlighted during the year by roll-out of the 500th airliner of the DC-6/7 series. Many of the 27 world airlines which have purchased these famous airplanes participated in the roll-out ceremony on July 23.

Early production was started in 1954 on an advanced, long-range model of the DC-7 series. Labeled the "Seven Seas", the DC-7C will be able to operate at full capacity over its normal range of 5000 miles. This permits non-stop operation, in both directions, between principal cities of Europe and the United States.

Because the new model will be able to cruise at 350 miles an hour with a full payload, it will enable airlines to maintain faster long-range schedules than any other commercial transport in existence or production.

Compared with earlier models of the DC-7 series, the "Seven Seas" has ten feet greater wing span and slightly more than three feet longer fuselage.

Standard DC-7s, which inaugurated non-stop transcontinental flight service in both directions near the close of 1953, racked up scores of speed records in the year just passed. These included flights from San Francisco to New York in five hours, 57 minutes; San Francisco to Chicago in four hours, 52 minutes; Santa Monica to Jacksonville, Florida in five and one-half hours; Santa Monica to Miami in five hours, 50 minutes; Los Angeles to Washington, D. C., in five hours, 26 minutes; and New York to Los Angeles in seven hours, seven minutes.

Probably the most important employment of a Douglas commercial transport during the year was in regularly-scheduled trans-polar flights linking the West Coast of the United States with Europe. This service, inaugurated by Scandinavian Airlines System on November 15, is offered with standard over-water versions of the DC-6B airliner.

Sales and deliveries of both commercial and military airplanes were at high levels, making the outlook for continued high earnings for Douglas. Sales of the DC-7 series alone reached 123 transports in 1954, and the backlog of commercial airliners of the DC-6A, DC-6B and DC-7 series insured continuous delivery through the last quarter of 1956.

Net sales at the close of the company's third quarter were $699.5-million some $67-million above the comparable data on 1953, and the backlog at the close of the calendar year was in excess of $2-billion dollars.

Fairchild Engine and Airplane Corp.

A varied program, ranging from development of a new operations base in Florida to the manufacturing of a new plane alongside the C-119 Flying Boxcar production lines at Hagerstown, Md., highlighted the year for Fairchild Aircraft Division.

Early in 1954, the Division received an official commendation from the United States Air Force for its outstanding record in meeting its military production requirements. Building of the C-119 Flying Boxcars was slowed down by Defense Department production orders, but original contracts continued in effect. Average employment figures approximated 8,250.

A modification center was established on 500 acres of land adjacent to the St. Augustine, Florida, Municipal Airport. It will be used to improve military aircraft.

In July, Fairchild rolled the first production model of the C-123B Avitruc assault transport from the final assembly line. Extensive engineering modifications were made on the C-123 after the Air Force awarded a production contract in October, 1953. Component parts are being manufactured by the Aircraft Division for the Boeing B-52 jet bomber. Vertical fins and outer wing panels have been built at Hagerstown and transported by special rail flat cars and by air to Boeing's Seattle, Washington plant.

Extensive modification work on Flying Boxcars was also started at Hagerstown. The C-119's have been undergoing revision at the Fairchild plants in an IRAN program.

First C-119 troop and cargo carriers were delivered during the year to the Strategic Air Command and the Air Training Command.

New and improved methods of parachuting men and supplies in combat operations were developed during the year by the Air Force and Airborne infantry divisions using Fairchild C-119's in maneuvers throughout the United States. A series of training problems rehearsed Army Airborne units for the major Exercise Flash Burn—TacAir 54-7 conducted jointly by the Army and the Air Force in April at Ft. Bragg, N. C. More than 100,000 men participated in the maneuvers.

Throughout the year, additional maneuvers were held at Ft. Bragg and at Ft. Campbell, Ky.

Errands of mercy were again booked by C-119's as they airlifted wounded French and Vietnamese forces from Dien Bien Phu and other Indo-China areas. Flying Boxcars were also used to drop thousands of tons of military and medical supplies to the French Nationalist forces throughout Indo-China. C-119's also delivered supplies and medicine to flooded areas of Damascus, Baghdad and Pakistan and at home in Iowa.

Fairchild Engine Division operations for 1954 were highlighted by three important developments: receipt of a development contract from the USAF for a small turbojet engine of an entirely new design; in June, laying of the keel on U.S. Navy's first midget submarine inaugurated construction operations on the first vessel; and the beginning of construction operations for a new main plant and advanced turbine test laboratory at Deer Park, Long Island.

The new turbojet design project is aimed at the development of a lightweight powerplant for target drones and pilotless aircraft.

Construction of Fairchild's new advanced turbine test laboratory is part of a long range propulsion systems development program.

In addition to the laboratory, Fairchild's new main plant will provide approximately 400,000 square feet and will cover approximately 80 acres of the 210-acre site.

Production of the J44 small turbojet powerplants continued for the U.S. Navy and operational use in the major military commands as power for guided missiles and target drones. Guided missile and experimental installations are still held under wraps. However, Fairchild continued production of J44's for U.S. Navy, Ryan-built Q2 Firebee target drones.

Construction also continued on the Fairchild-designed midget submarine for the U.S. Navy.

Productionwise, Fairchild Engine Division continued subcontract manufacturing of turbine wheels, front frame and rear frame assemblies, and nozzle diaphragms for General Electric J47 turbojet engines. It also maintained output of special-purpose, precision-built compressor equipment for the Atomic Energy Commission.

During the year the Fairchild Guided Missiles Division devoted its primary emphasis on the design, development and production of missiles and missile weapons systems for the military services. There was a 25 percent increase in employment in the Division during the year. The Guided Missiles Division also completed a number of missile systems study and evaluation programs for various branches of the military services.

The Division produced both land-based and shipboard radars for use with missile systems. It also manufactured radar simulators. These are used in conjunction with flight simulators and are part of mobile training units designed to simulate jet night fighters for ground training of combat crews.

Further developments were made in the applications of molded reinforced plastics to missile components and to other armament and commercial products. A transistor analyser designed as a laboratory tool for the evaluation and testing of transistor performance was marketed during 1954.

The Stratos Division during 1954 developed a high capacity airborne refrigeration system which was installed and flown in the X-3 supersonic research airplanes. Other new Stratos refrigeration systems were built for a variety of combat fighters and jet bombers for both the Air Force and the Navy. Stratos also produced the cabin air-conditioning system for the Boeing Model 707.

Fairchild C-123 assault transport

The Division expanded its production of air turbine drives for accessory equipment, adding several new models to its line. It also produced a mechanical fuel proportioner for use in aircraft with multiple tank installations. The proportioner accurately meters the flow from a number of tanks in accordance with pre-established proportions.

During the year, the Speed Control Division of Fairchild developed and produced mechanical, electrical, and hydraulic variable speed drives for general industrial use as well as specialized aircraft and military applications.

Engineering studies were under way by the Division to develop a variable speed drive for use in flight refueling systems to maintain constant tension on the fuel line under various air conditions. Studies were also under way toward adaptation of variable speed transmissions for use in flight simulators.

In the Spring of 1954, the Fairchild Engine and Airplane Corporation acquired the American Helicopter Company, Incorporated. Among the projects under development is the Army XH-26 single-place, pulse-jet helicopter. The XH-26 progressed to the military evaluation stage of development during 1954.

The early success of the pulse-jet-powered XH-26 helicopter stimulated the initiation of development of the MX-1660 project, a three-ton-pay-load pulse-jet-powered helicopter. The complete preliminary design and establishment of certain physical test facilities were accomplished in 1954. The American Helicopter Division operates in three locations: the Division's Administration and Engineering Headquarters are located at Manhattan Beach, California; the Plastics Research Plant is located at Costa Mesa, California; and the third plant is located at Falcon Field, Mesa, Arizona.

Goodyear Aircraft Corp.

During the year, Goodyear Aircraft Corp. enlarged its productive capacities, enlarged its research and development facilities and increased its employment roll and physical capacity.

More than 10,000 employees worked on assignments in the six Akron plants and at the Wingfoot Lake Airship Base. Another 2,000 employees were active at the company's Goodyear Arizona plant.

A production milestone was reached in May when the Goodyear XZS2G-1 airship, newest addition to the U.S. Navy's anti-submarine warfare team, was flown for the first time. The craft, a prototype model, is a newly-designed and planned replacement for airships which were used so effectively in anti-submarine warfare service by the Navy during World War II. An undisclosed number of the airships will be built.

Speed of the craft is in excess of all previous K-types. It has an inverted "Y" configuration of three stabilizers and control surfaces on the stern of the ship. Flight controls may be operated manually or by automatic pilot. It is manned by a crew of eight officers and men.

Goodyear X52G-1 planned to replace famed anti-submarine airship

The company is also building for the Navy an undisclosed number of Goodyear ZPG-2 airships, largest nonrigid aircraft in existance, and Goodyear ZSG-4 airships, designed as intermediate search craft.

First production model of the Goodyear ZSG-4 was flown at Wingfoot Lake Airship Base in April.

A world record for sustained flight without refueling of an aircraft under power was established in August by a Goodyear ZPG-2 airship. The craft was flown for 200.2 hours, eclipsing by more than 29 hours the previous record, set in 1946 by a Goodyear-ZPM airship. Flight was made to demonstrate the airship's potential for extended flight.

Work was completed this year on a radically new and improved winged tow target for aerial gunnery practice at high altitudes. Designed and constructed by Goodyear Aircraft in cooperation with Wright Air Development Center, Dayton, O., of the Air Research and Development Command, the target is being given extensive tests by GAC and U.S. Air Force engineers. The 1400-pound all-metal target, which has a 25-foot wing span, is capable of being towed at speeds in excess of 500 miles per hour.

During the year, production in the airplane wheel and brake, canopy and laminates, vinyl products and metalcraft divisions remained steady. Goodyear also manufactured airframe parts (such as wings and other components) for newest types of military aircraft; radar antennas, radomes, canopies, BONDOLITE (lightweight metal structural material), ducting, crosswind landing gear, artillery carriages as well as complete aircraft. Of particular significance was the company's increased work with guided missiles and guided missile systems.

The firm expanded its extensive line of GEDA electronic computing equipment to comprise some 13 items.

Grumman Aircraft Engineering Corp.

The first flight of its latest Navy fighter, the supersonic F9F-9 Tiger; occupation of a new, modern plant for final assembly and flight testing of jet aircraft, and the development and phasing into production of a faster, more maneuverable Cougar fighter, were the outstanding accomplishments of the Grumman Aircraft Engineering Corporation, during 1954.

Grumman moved its plant for final assembly and flight testing of jet aircraft from Bethpage, Long Island, to less-populated Peconic River. This modern, Navy-built facility was the first to be constructed for jet operation. It has two runways, one 10,000 feet long, and the other, over 7,000 feet.

Here, on August 6, Grumman unveiled its latest Navy jet fighter, the F9F-9 Tiger, a combat airplane which is capable of supersonic speeds in level flight.

The Tiger, designed around the Navy's concept of a powerful carrier striking force equipped with fast, hard-hitting aircraft with retaliation ability to take the fight to any enemy's home ground, carries modern armament, including air-to-air and air-to-ground missiles.

The construction of the Tiger was simplified in all possible respects, including manual folding wing tips and the use of one-piece machined aluminum alloy skins for the upper and lower wing sections. The first flight was made in less than 15 months after receipt of the Navy's Letter of Intent.

The Tiger's indented fuselage, which is nipped in at the wing roots, is designed to reduce drag at transonic speeds. Powerplant is a Wright J65 Sapphire axial-flow turbojet, rated at 7,200 pounds of thrust, and augmented by an afterburner. Present Tiger contracts exceed $190-million.

On April 1, Grumman's F9F-6 Cougar, the Navy's first operational sweptwing jet fighter, set an unofficial coast-to-coast speed record. Taking off from San Diego, and, refueling in midair over Hutchinson, Kansas, three Navy pilots completed their flight to Floyd Bennett Field, Brooklyn, in less than four hours. The first pilot was clocked in three hours, 45 minutes and 30 seconds.

The following week, Grumman announced that an even faster Cougar was being phased into the production line to replace the F9F-6. Designated the F9F-8, the new model's improved performance was achieved by modifying the leading and trailing edges of the wing and lengthening the fuselage. Grumman engineers saved much time in gathering performance, stability and control data by converting an F9F-6 into an aerodynamic prototype of the new model.

The Cougar's movable wing slat was replaced with a fixed, cambered, leading edge and the trailing edge was extended, increasing the chord by 15 percent. The resulting relatively thinner wing gave the Cougar added speed, while the larger wing area and cambered leading edge improved its maneuverability and low-speed handling characteristics. Elimination of the hydraulic system in the wings and lengthening of the fuselage made space for additional fuel. Both the F9F-6 and F9F-8 are powered by Pratt and Whitney J48 turbojet engines.

Grumman during 1954 was in production on the Albatross, a utility and rescue plane, used jointly by the United States Air Force (SA-16A), Navy (UF-1) and the Coast Guard (UF-1G). The SA-16A Albatross, flown by Air Rescue Command pilots, participated in missions of mercy in all parts of the world.

In addition to the Tiger, Cougar and Albatross assembly lines, the company was also in production on the S2F sub-killer. This twin-engine plane was the first aircraft launched from a steam catapult aboard an American aircraft carrier. This took place in June from the deck of the USS Hancock, off San Diego.

Fully equipped with the latest search, destructive and navigational devices, the S2F is capable of performing the two-fold function of hunter and killer, previously accomplished by two planes. Powered by two Wright R-1820 engines of 1425 hp each, the S2F has exceptional single engine performance and can operate from the decks of the smallest carriers in the fleet.

Hiller Helicopters

Hiller Helicopters in 1954 continued as its major production activity the building of H-23B utility helicopters for the U. S. Army, and became a key manufacturer of helicopters for the Army's constantly expanding helicopter program. Commercial Hiller 12-Bs were also manufactured for commercial customers and foreign governments throughout the world.

In October the Hiller 8RJ2B ramjet engine was certificated by the Civil Aeronautics Administration as the first ramjet engine to be certificated in United States aviation history. This engine, certificated for installation on the two-place Hiller Hornet, is also the first CAA approved tip mounted power plant for helicopters.

An additional quantity of two-place Hornets (Army designation H-32, Navy designation HOE-1) was ordered by the government for field evaluation testing as a followup to the initial quantity ordered for evaluation at military test centers.

Additional distributors were added both domestically and in foreign countries to build Hiller worldwide distributorships.

In the field of operations, the U. S. Army continued its program of helicopter familiarization by utilizing H-23s in an ever increasing number of camps and Army posts. The Transportation Corps, as the biggest user of helicopters, also became the agency most interested in their development. National Guard units also obtained H-23 helicopters for training purposes at locations throughout the United States.

Kaman Aircraft Corp.

First flight of the Army-Navy sponsored twin-turborotor helicopter took place at Kaman Aircraft Corporation's plant early in 1954. This ship, a standard HKT-1 helicopter built by Kaman, was modified by installation of two Boeing 502-2 gas turbines in place of the single standard Lycoming O-435 piston engine.

The twin turbines, which together produce 380 horsepower, are mounted side by side in the same location as was the single 240 horsepower piston engine which they replaced, and their combined weight does not exceed the weight of the single piston engine which originally powered the HTK-1.

During the year, Kaman, under a contract with the Navy's Bureau of Aeronautics, conducted a Rotor Tip Light Study. The tip lights consist of small electric light bulbs housed in transparent plastic covers at the end of each rotor blade. Purpose of the project was to determine the feasibility of the tip lights as an aid to other aircraft during night flights and as an aid in night formation flying of helicopters.

Kellett Aircraft Corp.

During 1954, Kellett continued its rotary wing research and development activities for the Air Force, Bureau of Aeronautics, and Office of Naval Research, as well as its subcontract manufacture of aircraft components for the larger prime contractors. The year saw the successful flight testing of the Model KH-15 helicopter, a small, one-man, rocket-powered craft designed to show the effectiveness of a unique gyratory stablilizing system considered applicable to helicopters of various sizes and configurations.

Another Navy project dealt with development of a compound helicopter, for which a flying test bed was scheduled for flight testing early in 1955. Additionally, research studies were conducted for the Air Force, relating to rotor blade aero-elastic investigations and the study of a helicopter employing large flapping hinge offsets. Work on the modiflcation of a service-type tandem helicopter was initiated during the latter part of the year.

Lockheed Aircraft Corp.

During 1954 Lockheed Aircraft Corporation introduced eight new aircraft models. Also, the company continued its production of Super Constellations, the Navy's veteran Neptune and the family of Lockheed jets.

New aircraft from Lockheed in 1954:

1. XFV-1. Lockheed's vertically rising fighter for the U. S. Navy can take off and fly and return to land from a spot no larger than its wingspan.

2. F-104. In late 1954, the U. S. Air Force announced that a contract had been let for quantity production of this day jet fighter. With photographs and drawings of the supersonic craft still unreleased, and all performance data classified, virtually nothing further can be announced about it.

3. C-130. Four turboprops producing 15,000 hp give the USAF's new Lockheed transport the boost to carry loads up to 40,000 pounds at high speeds and high altitudes. To be produced at Lockheed's Marietta, Ga., facilities, the C-130 is an assault transport, cargo carrier and hospital ship rolled into one aircraft.

4. R7V-2. The Super Constellation took on four big turboprops for the U. S. Navy's use. Capable of cruising 440 mph, making it the fastest propeller-driven transport in the world, the jet-engine-and-propeller powered aircraft will cut cross-continent flight time to six hours. Lockheed

Lockheed RC-121 and WV-2 seeing-eye airplanes

also is building a version of the same aircraft for the Air Force, under the designation C-121F.

5. P2V-7. This is a submarine hunter-killer which can also do duty as a minelayer, torpedo bomber or patrol craft. This newest Neptune has two jet pod engines to supplement its two turbo-compound engines, besides a stinger tail to house MAD gear for its submarine-killing jobs.

6. New jet trainer, U.S. Navy T2V-1, Lockheed's successor to the T-33 has speed and climb equal to many combat jet aircraft.

7. 1049G. Latest in the line of commercial Super Constellations, this new model will have a gross takeoff weight of 137,500 pounds, tip tanks for increased range and provisions for weather radar in its nose. Already ordered by nine airlines, the new 1049G is convertible from a 43-siesta-seat luxury configuration to a 99-passenger coach aircraft with Lockheed's quick-change interior.

8. 1049D. This is the commercial cargo version of the Super Constellation. It can carry an 18-ton load across the Atlantic and cruise at 335 mph. It has 5568 cubic feet of cargo space and an 83-foot-long interior with big, double doors.

Total sales since 1932, under the present management, passed the $5-billion mark during 1954 and sales of jet aircraft and equipment reached $1-billion. Lockheed had produced more than 6,000 jet aircraft at mid-year.

Lockheed in 1954 began an accelerated delivery program which saw a different airline each month receiving new Super Constellation equipment.

On January 1 of this year the company formally launched a Missile Systems Division to consolidate its efforts in the guided missiles field. By October it had more than 1000 employees and covered 350,000 square feet of floor space in its plant at Van Nuys, Calif.

The Missile Systems Division is carrying out an active program of construction and testing of a classified device, plus research and development in the entire field of missile systems. The Lockheed corporation has allocated $10-million for an intensive research program in the Missile Systems Division.

Lockheed's Georgia Division at Marietta is now building B-47 jet bombers as well as rushing production on another project: the C-130 for the U. S. Air Force.

In the first half of 1954, Georgia Division sales climbed to $111.8-million as compared to $80-million in the first half of the preceding year. The Division received a substantial order for quantities of the C-130 turboprop transports during the third quarter of 1954.

At Lockheed's Burbank facilities, orders were received in late 1954 for the F-104, Super Constellation radar planes for the U. S. Navy (WV-2) and the U. S. Air Force (RC-121D), the P2V-7, additional R7V-1 piston-powered Super Constellations for MATS use as cargo-personnel-evacuation transports, and the company's jet trainers, both T-33 and T2V-1.

A pioneer in the development of integrally stiffened aircraft structures, Lockheed continued to make progress in this field during 1954. Machining of integrally stiffened parts has been made more efficient through the utilization of a new mill process for heavy aluminum plate. Stretcher-leveling puts five percent permanent set before heat treat and two percent set after heat treat before aging. It has all but eliminated the warpage which has been heretofore associated with machined skins. Stub wing panels were stretched on the 8000-ton Birdsboro press and, when subsequently machined, showed vastly improved flatness.

Epoxy resins were introduced to the tooling division. These materials have unusual properties of strength, resilience and stability, and in addition bond firmly to metal. Tools and dies are being made of this new plastic in one-fifth the time formerly required, and they are produced to closer tolerances at one-third the cost.

During 1954 Lockheed engineers continued their research in the application of titanium to aircraft structures. Methods were developed for forming titanium in the Hydro press for simple flanging operations. It was also found that titanium could be readily drop-hammer formed at temperatures from 700 to 900-degrees Fahrenheit. A method was also developed for draw-forming deep-beaded parts for cargo doors. Titanium was introduced into the engine nacelle of the new C-130 turboprop cargo transport.

Lockheed also made advancements in the field of flash-welding.

Considerable research work was done with 17-7 PH stainless steel. This material, unlike conventional stainless steel, can be hardened or strengthened by heat-treatment. This factor makes it possible to form complex shapes in the annealed condition and subsequently elevate the strength to high levels.

A significant development in the field of hot forming occurred at Lockheed during 1954 with the application of "Hydrotherm," a high-temperature, heat conducting liquid to the heating of various hot-forming tooling operations. A design has been produced for a hydrotherm heating and pumping unit which can be connected to a tool which has been cast with tubular fluid passages.

Research was initiated at Lockheed in 1954 to develop a compression-forming method for eliminating the "springback" in metal forming. Results are promising and the work is continuing.

At the end of September, the corporation employment totaled 42,386, including 26,609 in the California Division and corporate offices, 14,827 in the Georgia Division and 950 in Missile Systems Dvision.

McDonnell Aircraft Corp.

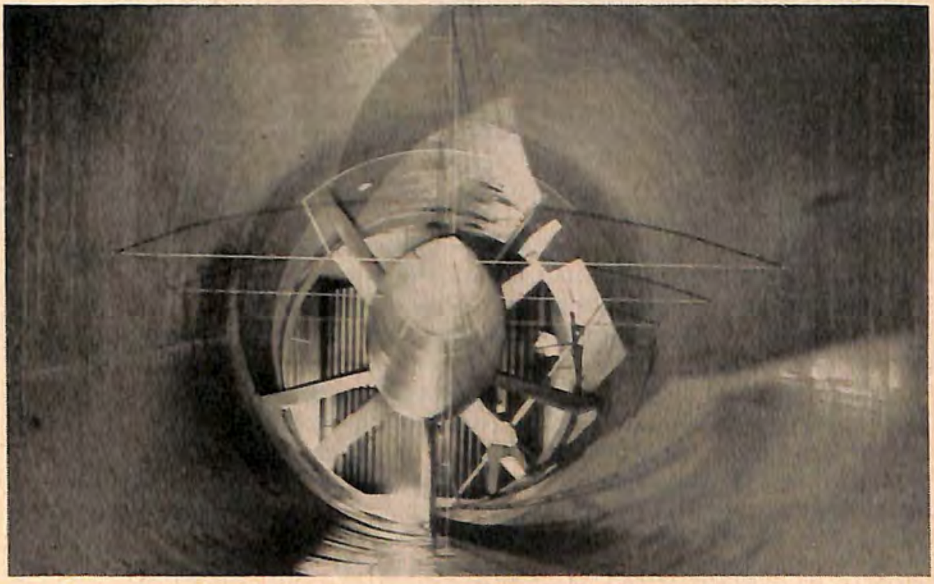
During 1954, McDonnell Aircraft Corporation observed its 15th anniversary year with achievements in engineering research and production development; completion of a $20-million Facilities Program; and a total year-end backlog for fiscal 1954 of $441-million-plus, a large part of which is comprised of Demon and Voodoo orders.

Sales for the fiscal year (ending June 30) were $123,091,691, with earnings after taxes of $3,621,417. Regular dividends of $1.00 per share were continued; $2,918,557 of the fiscal 1954 earnings were retained to continue the growth of the company, and the book value per share increased from $22.66 to $25.87. The capital stock and earnings for growth increased from $15,535,108 to $18,625,065.

Production deliveries on the F3H-1N Demon, a single-jet carrier-based fighter, continued. Designed as a general purpose Navy fighter, the Demon is adaptable to a wide range of combat missions.

The new version Demon, to be designated the F3H-2N, will be powered by a newer, more powerful engine, the J-71. Production deliveries are scheduled through 1955 and 1956.

Blower section of McDonnell wind tunnel



F2H-2, F2H-2P, F2H-3, and F2H-4 Banshees are currently seeing duty with Navy and Marine operational units in the Mediterranean, Atlantic, Pacific, and United States.

In June, a F2H-3 Banshee was the first jet to be launched by steam catapult from an aircraft carrier, the U.S.S. Hancock.

Extensive work has continued on the F-101A Voodoo for the Air Force. This long-range, sweptwing fighter is powered by two J-57 turbojet engines, and is designed to have versatile combat capabilities enabling it to perform a variety of operational missions.

A photo-reconnaissance version of the Voodoo, the RF-101A, is under development.

On October 26, McDonnell announced the receipt of a $38,700,000 contract from the U.S. Navy for development of an advanced experimental all-weather attack fighter type aircaft. This is McDonnell's first design entrance into the field of this type aircraft.

In the field of helicopter engineering, McDonnell has unveiled the XV-1 Convertiplane. First to utilize the principle of pressure jets and high disc loading, the Convertiplane embodies a completely new conception of flight, known as the "unloaded rotor" principle—a machine equipped with a rotor for vertical flight and wings and propeller for forward flight.

The XV-1 is a joint development of the Wright Air Development Center of the Air Force, the Transportation Corps of the U.S. Army and McDonnell.

The versatility of the Convertiplane will permit studies on its tactical use for observation and reconnaissance, and further research will be made of its design for use as an artillery or tank spotter. Exploration will also be made in the application of the convertiplane principle to larger aircraft.

Research and development work continued on the XHCH-1 cargo unloader helicopter for the Navy. The rotor of the XHCH-1 is also pressure-jet driven, enabling it to carry heavy loads.

In the rapidly growing missile engineering division, research and production activities continued to expand. A current backlog of approximately $12-million in missile work includes ground-to-air, air-to-air, and air-to-ground projects, of which a major one is participation in the development of the Talos missile system.

The missile division is also developing electronic devices, such as automatic fire control and stabilization equipment for fighters as well as automatic guidance systems for missiles.

A four-year $20 million Emergency Facilities Program has virtually been completed at the company, with the exception of the modification of the Southern California Cooperative Wind Tunnel in which the company owns a one-sixth share. This wind tunnel, which will be used for transonic and supersonic speed testing, should be finished in 1955.

The new low speed wind tunnel at McDonnell went into operation during the summer, as did a new manufacturing building addition. In this new factory area, which provides a 502,937 gross square foot increase in leased floor area, a 10,000-ton hydraulic press is being erected.

These additions give McDonnell 2,585,863 gross square feet of floor area on 312 acres of land, of which 1,556,332 square feet and 267 acres are owned by the company. The integrated plant on Lambert-St. Louis Municipal Airport consists of 2,353,240 gross square feet, with the remaining office, manufacturing, and storage space being leased elsewhere.

The Glenn L. Martin Co.

Highlights in 1954 for Martin Aircraft were the delivery of USAF B-61 Matador pilotless bombers to NATO forces in Germany, and the completion of the prototype XP6M-1 SeaMaster—a multi-jet seaplane built under contract for the Navy. The Matadors, which can be launched from mobile launchers at secret locations, are the first pilotless bombers to be placed in operational use by the United States.

Full-scale production continued on USAF B-57B twin-jet bombers, the Tactical Air Command's night interdiction light jet bombers which are undergoing testing and training flights with TAC squadrons. Delivery of the first B-57 aircraft to the Twelfth Air Force in Europe also was announced. New versions of the B-57 developed during the year were the RB-57 reconnaissance aircraft, and the B-57C dual control aircraft used for night instrument pilot training.

Early in the fall, Martin delivered the first of its new "T"-tail P5M-2 anti-submarine Marlins to active-duty Navy patrol squadrons. Marlin patrol planes are now in service with Navy squadrons in both Atlantic and Pacific fleets, as well as with coastal Coast Guard squadrons in North Carolina, Florida, California, and New York.

In May, Martin Vikings first tied and then exceeded the altitude record for single-stage rockets at the White Sands, N.M., proving ground. Viking missile No. 11, carrying 700 pounds of delicate instruments and telemetering equipment designed to probe the upper atmosphere, rose to a record height of 158 miles on May 24, after travelling straight upwards at a maximum speed of 4,300 miles per hour.

In June, Martin disclosed a new technique for packaging Matadors for shipment to distant destinations. The bird is packaged in seven waterproof crates, thus making it possible to assemble a combat-type aircraft in the field using completely interchangeable parts.

In the field of electronics, Martin developed a method of packaging a multiplicity of airborne electronic devices in a manner affording effective heat transfer from aircraft electronic compartments to the outside atmosphere, while at the same time utilizing a minimum of space.

The company announced development of a successful method of driving titanium rivets on portable and stationary production riveting equipment. Also a new process was developed whereby titanium can be spot-welded in a liquid coolant to form a solid weld nugget for use in machining bolts, pins, and other aircraft parts.

Martin's sales for the first nine months of 1954 were $187,178,497 as against $116,904,036 for the same period of 1953. Employment fluctuated during the year from a low of 18,000 to a high of more than 20,000 employees.

In September the company established a new Advanced Design Department for the purpose of anticipating the technical requirements of future aircraft, and to conduct specific studies in gravity, nucleonics, rocketry, and space flight.

Gravity studies will center on Einstein's unified field theory—the concept of the basic law of the universe, and will cover methods of devising anti-gravity power plants and/or the means of producing a new force to defy gravity. Nuclear physics studies will probe ways in which to improve, or eliminate altogether the shielding for an aircraft nuclear reactor as it is known today. Radioactive tracers as aids in manufacturing and inspection will come under study for use in probing the behavior of boundary layer air in windtunnel tests.

The new department will also devote attention to simplifying guidance systems in studies of both air-to-air and air-to-ground guided missiles. As these missile designs will call for increasing high speeds, theoretical studies will be conducted at universities on such specific projects as dissociation of gases—data of use in designing missiles that will not burn up as they hit the "heat barrier."

Following the unveiling of the new multijet XP6M-1 SeaMaster, Martin continued to devote attention to seaplane handling facilities, based on the concept that the seaplane must remain in the water as much as possible for servicing and maintenance operations.

During the year Martin expanded its electronic effort aimed at designing and producing improved missile guidance systems. Increasing attention was also paid to the fields of electronic reconnaissance and countermeasure devices for the Armed Forces, as well as to the development of equipment associated with anti-submarine warfare. Considerable work was done with transistors, as applied to airborne digital computing devices, and efforts were being made to complete a 3-dimensional display of weather radar information.

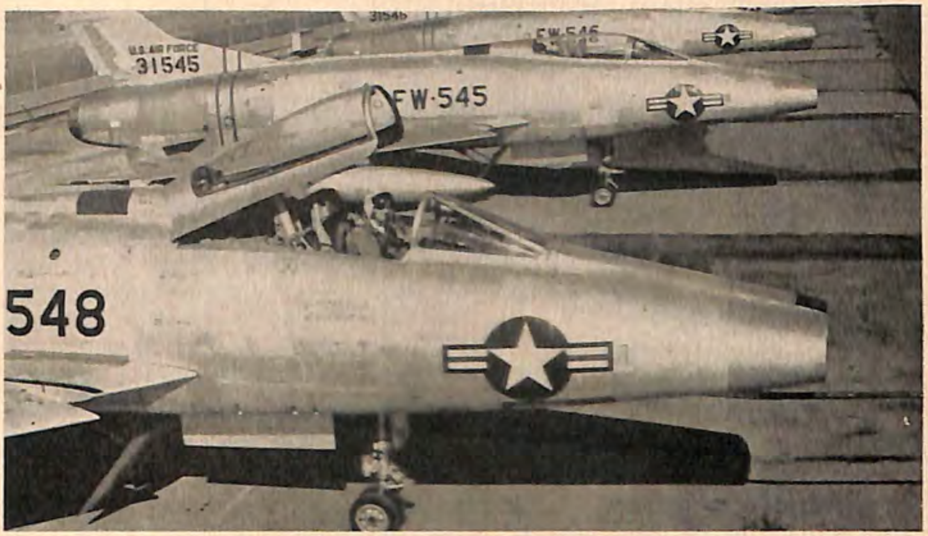
Mooney Aircraft, Inc.

Production was resumed July 1, 1954, at Mooney Aircraft under new management and ownership. In production since July 1 was the M-18C, Mooney Mite, a single-place private aircraft. Eleven units were produced and sold up to November 1.

The prototype of a new four-place model, the M-20, Mooney Mark Twenty, was modified, and flew late in the year. Production was scheduled for early '55.

North American Aviation, Inc.

The 20,000th fighter aircraft designed and built by North American Aviation, Inc., was delivered early in the summer of 1954. On May 14 an FJ-3 Fury Jet was accepted by the Navy at North American's Columbus, Ohio plant, where the fighters are produced.



North American F-100 Super Sabre Jets

Earlier in the year, production had begun on a later version of the Fury Jet when the Columbus Division announced receipt of a contract from the Navy for an undisclosed number of FJ-4s. Aerodynamically improved over its predecessors, the FJ-4 is powered by the Curtiss-Wright J-65 engine similar to the earlier FJ-3. First flight of the FJ-4 was made at Columbus, October 28.

Another new airplane produced by North American during the year was the F-86K, sixth model of the Sabre Jet series, which made its maiden flight from the Los Angeles plant July 15. An all-weather jet fighter, the new Sabre Jet is actually a 20-mm cannon-firing version of the F-86D, differing in configuration only by the additional eight inch length of fuselage necessary to rebalance the plane with its new armament. The Air Force contract calls for an undisclosed number of "K's" to be procured with Mutual Defense Assistance Program funds for delivery to NATO countries.

Also making its first test flight during the summer was the modified two-seat, transonic TF-86 Sabre Jet trainer. Designed for advanced pilot training in high speed flight, gunnery, and dive-bombing, the Sabre Trainer is essentially an F-86F redesigned to accommodate tandem seats, controls, and instrument panels. Only two modifications to the fighter-bomber airframe were necessary to compensate for the additions: the fuselage was lengthened 63 inches between nose and wing roots, and the 35-degree swept wings were moved forward eight inches. The TF-86 is powered by a General Electric J-47-27 turbojet engine of over 5,800 pounds thrust, as is the F-86F, and retains most of the performance characteristics of the fighter-bomber.

Production of the F-100 Super Sabre, the nation's first operational fighter to exceed the speed of sound in level and climbing flight, gained momentum during the year and was given further impetus with an additional order in excess of $100-million for an undisclosed number of Super Sabres.

In that same month the Air Force Tactical Air Command took delivery of its first F-100s, and the 436th Day Fighter Squadron at George AFB, California, became the country's first supersonic fighting unit.

The famed F-86 Sabre Jet also continued to rack up records for itself during 1954.

The last "F" models of the F-86 came off assembly lines at the Los Angeles and Columbus plants during the year, with Columbus also phasing out production of the FJ-2 Fury Jet. At Los Angeles the F-86F program was completed on schedule.

While Los Angeles remained busy with F-86D, F-86K, and F-100 production, Columbus activity, which included the F-100, FJ-3, and FJ-4, was increased when the T-28B Navy trainer manufacturing program was moved in from the Downey, California, plant. The remaining work on present orders for the trainer will continue for approximately two years in Ohio, while the vacated space at Downey is being taken up by expanded guided missile and electro-mechanical work. Orders for an additional $37-million worth of FJ-3s for the Navy were also received by Columbus in the fall.

Expansion of company facilities continued throughout the year, with the new $2-million engineering flight test hangar at Palmdale completed and occupied by mid-August. At the Los Angeles plant a new high bay building for final assembly, fuselage and wing manufacturing, and electrical sub-assembly of the F-100 was begun. The 174,000 square foot building would house more than 1,000 production personnel when full operations are underway early in 1955.

More than 120,000 square feet of additional floor space were provided for receiving, inspection, warehousing activities, and purchasing offices at Downey upon completion of a $557,000 warehouse building for the division.

Expansion projects that were organized for the near future were highlighted by the granting of a construction contract for the major portion of a $5-million wind tunnel capable of testing airplane and missile designs at speeds from 347.826 knots (400 mph) to more than three times the speed of sound.

Among the company's major new facilities will be a Propulsion Development Center for rocket engine manufacture for the USAF and Nuclear Physics Research Laboratories for the continuation and advancement of already well-established research in the atomic energy field. By year's end North American Aviation planned to start construction of these facilities on a 56-acre site in the San Fernando Valley community of Canoga Park.

During the year the Downey Division figured in the development of several electronic innovations for both civilian and military use, including an Angle of Attack Calibrator, a Vane Jump Angle Computer (NAVJAC), a miniature two-way communications unit, and an emergency traffic control system (NATECS). The Angle of Attack Calibrator measures an airplane's natural angle of attack in unaccelerated, trimmed flight to obtain the difference between its designed and actual angles. This deviation data is incorporated in the fire control computing systems of each rocket-firing military airplane during production flight test. The NAVJAC computes the relative jump angle of rockets fired during straight line, trimmed flight conditions of planes traveling at high speed, which information is then used for aim correction by the fire control system.

The communications unit, available for both military and commercial aircraft, occupies less than one cubic foot of space and weighs only 20 pounds. The eight channel crystal control transmitting and receiving device is available for either code or voice communication. NATECS, which is designed for ground vehicles, is a system to clear traffic out of intersections a quarter of a mile ahead of speeding vehicles (ambulances, fire engines, etc.) on emergency calls. The system consists of a transmitter carried in the emergency vehicle and a receiver wired into the controlling circuit of the traffic signals at intersections.

North American's pioneering work in research and development of peacetime power from atomic energy was increased in size and scope in 1954. The unit doing the work, previously called the Atomic Energy Research Department, based at the Downey plant, changed its name to the Nuclear Engineering and Manufacturing Department to better describe the company's activity in the field, which includes the design, manufacture, and supply of reactors and associated equipment, as well as complete engineering services for reactor development and operation. The most recent developments of the department include the design and construction of a powerful "percolating tea kettle" (water boiler type) reactor for special nuclear research, now in operation by the Livermore Research Laboratory of the U. S. Atomic Energy Commission in Livermore, California. Developing 100 watts of power, the reactor is unique in that it is the largest unit of its type to operate with a closed cycle, or "self contained" system. It is possible for the reactor to run for as long as 10 years without refueling.

In midsummer a new $10-million reactor project to be jointly financed by the company and the Atomic Energy Commission was announced. North American is assuming $2½-million of the cost and furnishing the land for the reactor, to be designated SRE (for Sodium Reactor Experiment), which will be a "sodium-graphite" type generating 20,000 kilowatts of energy in the form of heat. The reactor will be part of the AEC program to develop competitive electrical power from nuclear energy. A site for the project was chosen on North American property near the company's present rocket engine field laboratory in the Santa Susana Mountains north of Los Angeles. To avail qualified scientific and industrial groups of a complete list of the research reactors it is prepared to design and build, the Downey Division published the first known atomic energy "catalog" in the nuclear field, under the title "Nuclear Reactors for Science and Industry."

Meeting at the Columbus, Ohio, Division on September 10, the directors of North American Aviation, Inc., increased the regular quarterly dividend from 50 to 75 cents per share on its 3,435,033 shares of capital stock outstanding. This was the fourth quarterly dividend for the 1954 fiscal year, and brought the total to $2.75 per share compared to $1.50 the year before.

Northrop Aircraft, Inc.

The year 1954 found Northrop Aircraft marking its 15th anniversary, while in the midst of peak production on Scorpion F-89D all-weather interceptors for the U. S. Air Force, continued development of the Snark XB-62 pilotless bomber, production of opto-mechanical devices for the U. S. Army Ordnance Corps at its Anaheim (Calif.) Division, and production of target airplanes at the Radioplane Company of Van Nuys (Calif.), a wholly-owned subsidiary.

Northrop has a work force numbering approximately 24,000 with an annual payroll of $111-million.

Scorpion F-89 all-weather interceptors were assigned to fighter-interceptor squadrons of the Air Defense Command and Alaskan Air Command. Also during the year F-89 airplanes became based at Thule Air Base in Greenland, the Air Force's northernmost defense post deep within the Arctic circle and with the Icelandic Air Defense Force at Keflavik, Iceland.

The rocket-armed F-89D carries its armament punch in permanently mounted wing tip pods, and can fire its 104 2.75-inch rockets with deadly accuracy in a single salvo or in a series of bursts. The 600-mph-class F-89D flies at altitudes above 45,000 feet. Its two-man crew is guided to the target by advanced electronic equipment through inclement weather or darkness. During the year F-89Ds were equipped with more powerful Allison J35-A-35 turbojet engines with afterburners, to provide higher altitude capabilities.

F-89Ds are now rolling off one of the aircraft industry's shortest final assembly lines. Exacting refinement of "upstream" assembly techniques has enabled Northrop to develop a final assembly line for the F-89Ds that measures only 550 feet long and contains only 11 stations.

During the year, Northrop, in conjunction with the Air Force, installed the nation's largest sheet metal stretch press. The new Sheridan stretch press is capable of forming substantially large sections of fighter plane fuselage and wing skins in a single operation and will accommodate aluminum sheets measuring as large as 14 by 20 feet. The new press has a rated stretching force of 750 tons.

The company continued development of the Snark XB-62 pilotless bomber under a program that began in 1946. Northrop maintains an operating facility at the Air Force's Missile Test Center at Cocoa, Florida, where a proving program is currently being carried out jointly with the U. S. Air Force.

In mid-1954, Northrop's new production flight testing facility at the U. S. Air Force's jet test center at Palmdale (Calif.) Airport was completed.

Now in its third year of operation, Northrop's Anaheim (Calif.) division, occupying a 33-acre site, continues production of opto-mechanical devices for the U. S. Army Ordnance Corps, and is also engaged in manufacturing aircraft and guided missile components for the U. S. Air Force.

Research and development projects in the field of fire control and related products are also being carried out there.

Construction began in August, 1954, on a new 198,000 square foot materiel warehouse at Northrop Aircraft's El Segundo (Calif.) facility. The additional building will provide for complete centralization of all Northrop materiel functions including purchasing, warehousing, receiving, shipping and receiving inspection.

In late 1954, Lt. Col John Stapp, U. S. Air Force aero-medical research scientist, traveled 632 miles per hour on a Northrop-built rocket sled breaking his own ground speed record of 421 miles per hour attained earlier in the year, which had earned him the title, "fastest man on earth."

The record runs were made on a 3500-foot research track at Holloman Air Development Center with the "world's fastest land passenger vehicle," a two-unit rocket sled built for the Air Research and Development Command by Northrop. The purpose of Colonel Stapp's project is to find means for insuring the safety of pilots who find it necessary to bail out of aircraft at supersonic speeds.

Scientists at Northrop are now devoting facilities of a new and extensive research laboratory to exploration of the "thermal barrier," testing materials and finishes for use in aircraft to be built 10 years from now.

Temperature resistant steels and the new titanium alloys are among the metals now being tested in the Northrop lab that offer promise of some solution to the thermal barrier program.

During the year, Northrop developed a "giant sling shot" acceleration test facility, capable of providing acceleration loads up to 25 G's for testing of aircraft components. A 250-pound aluminum carriage is pulled along a 45 foot track at high speed by a pneumatically-driven steel cable. The carriage rides on wheels located above and beneath the track to prevent it from leaving the rails at high speed. The sled can apply forces up to 25 G's to

Northrop F-89D final assembly area

light weight components. Components weighing as much as 1200 pounds can be tested at forces up to 8 G's.

The Northrop subsidiary, Radioplane Company of Van Nuys (Calif.), continued production of the OQ-19 target drone system. The OQ-19 is a pilotless, radio-controlled airplane used by all branches of the armed services and allied military forces as a gunnery target. During the past year, Radioplane Company has concentrated its research and development work on missile development, new target drones, and aero-mechanical research involving parachute recovery techniques in the field of guided missiles.

Sales for the final quarter of 1954, when initial deliveries of airplanes were made under major fixed-price contracts, reflect the high rate of production during the year. For the three months ended July 31, 1954, sales were $61,958,503, compared with $45,927,249 for the same period a year earlier.

Northrop's consolidated backlog at July 31 was approximately $512-million, compared with $508-million at July 31, 1953.

In October, Northrop announced that it had employed Pereira and Luckman, nationally-recognized planning, architectural and engineering firm, to prepare a master plan providing for multi-million dollar development and expansion of facilities at its main plant site at Hawthorne, California.

As the result of a master plan approved by Northrop's board of directors in December, a multi-million dollar expansion of facilities keyed to one of the nation's most advanced engineering and research centers will begin soon at Northrop. The new engineering and research center alone will encompass a quarter-million square feet and is expected to be the most modern in the nation. The master plan is being prepared by Pereira and Luckman.

Piasecki Helicopter Corp.

The announcement of the completion of the 40 passenger twin engine shaft turbine powered YH-16A "Transporter" and the receipt of a development contract for an even higher powered twin turbined version, highlighted activities at Piasecki Helicopter Corporation in 1954.

Following the first flight of the YH-16 late in 1953, the aircraft was subjected to an extensive ground endurance and fatigue test qualification run. This world's largest transport helicopter (the first aircraft) is now engaged in a comprehensive flying qualities and performance determination program. The YH-16A (second aircraft) was completing ground tests and approaching the first flight stage by year-end.

Prime production effort is concentrated on the H-21 Work Horse series being manufactured for the U. S. Air Force and Army. 1954 saw these 14 to 22 place transport helicopters enter service with the Air Force in Labrador and at various Army installations in continental U. S.

The year marked the first delivery of Piasecki helicopters to Canada with HUP's to the Royal Canadian Navy and H-21A Work Horse helicopters to the Royal Canadian Air Force. The Piasecki Helicopter Com-

Piasecki H-21A Work Horses

pany of Canada, Ltd., is under contract to the Canadian government to assist in the support of these aircraft.

The HUP fleet helicopter has rescued over 400 dunked aviators since entry into naval service in 1950. In 1954 innumerable mercy missions were carried out in ship disasters, floods, hurricanes and earthquakes in many places throughout the world. Of particular note were the missions performed by 16 HUP's operating from aboard the aircraft carrier USS Monterey in supplying food and medicine to thousands of isolated persons in the Honduras floods. Thirteen HUP's aboard the carrier USS Saipan also supplied necessities of life to the stricken area of Haiti after hurricane Hazel.

The 339th and last of the HUP and H-25A "Army Mule" series were delivered to the Navy and the Army in 1954. This was followed by a development contract to incorporate an engine of higher power in each of two of the six place HUP helicopters.

A major step forward was taken when 254,500 gross square feet of manufacturing space was leased. This brought the total gross plant area to 860,000 square feet, which doubles the available net direct manufacturing area. This provides area to manufacture or subassemble items previously subcontracted and to perform substantial amounts of new business.

Employment averaged approximately 3700 for the year.

Piasecki's military backlog of unfilled orders remained at approximately $100-million during the year.

Piper Aircraft Corp.

Putting the twin-engined Piper Apache into full production with a delivery rate of one per day reached by fall of 1954 was the major highlight of Piper Aircraft Corporation's activity during the year. In April the first production Apache was delivered and by the end of the year, over 100 had been purchased. As of the end of the year with production slated to go to one and one half per day, the company had a backlog of five and one half months for the ship.

The Apache is powered by two 150 horsepower Lycoming engines with constant-speed, full feathering Hartzell propellers. Cruising speed is 170 miles per hour at 7000 feet on 75 percent power. Single engine ceiling at full 3500 pound gross is over 6500 feet, over 8000 feet at 3100 normal gross.

Production of the Piper Tri-Pacer continued at a high rate during 1954. This four-passenger ship, powered with a 135 horsepower Lycoming engine, has tricycle landing gear and inter-connected controls. Demand for it continued heavy from businessmen, farmers and ranchers, and the ship found a number of uses quite different than its peaceful role in the United States. A squadron of Tri-Pacers bearing RAF insignia and equipped with bombs were in use during the year hunting for Mau Mau terrorists in Kenya with considerable effect.

The 135 horsepower Super Cub and its companion PA18-A agricultural model were also in heavy demand during 1954. A 105 horsepower version, the PA-18-T was used for initial training at all U. S. Air Force contract schools with cadets receiving their first 25 hours of flight instruction in the Super Cubs before transition to heavier aircraft. Research continued on more effective dispersal equipment on the agricultural models, most popular being the combination 18-A which can be used either with dry or liquid chemical. A new venturi to provide wider swath with dust was introduced and a capacity of up to 15 gallons per acre for liquid spray was made available.

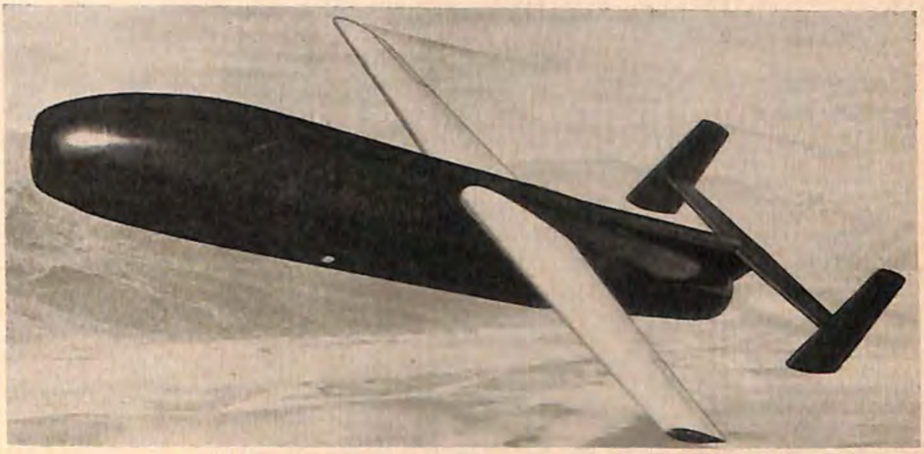
In November Piper introduced more powerful versions of both the Tri-Pacer and the Super Cub. Both were introduced with the 150 horsepower Lycoming engine to replace the 135 horsepower engine used heretofore.

Employment at Piper's Lock Haven plant averaged around 1200 people during the year.

Radioplane Co.

Radioplane Company of Van Nuys, California, subsidiary of Northrop, devoted its major production efforts to the OQ-19 series of target drone aircraft in 1954. The greatest portion of the 1955 production contracts called for delivery of the OQ-19B target drone system, an out-of-sight radio controlled airplane target with newly developed radar corner reflectors rendering the vehicle valuable for plotting board target missions.

Two target drones, designated XM20 and XM23E1, underwent tests at White Sands Proving Ground and at Fort Bliss for Army Ordnance. Another in this series, the OQ-19E, was flight tested at Holloman Air Development Center. This version incorporates a six cylinder engine smoke generating system, and corner reflectors. The Navy Bureau of Aeronautics is also initiating a flight test program for the evaluation of this vehicle, designated the XKD2R-4, which includes the C-2 autopilot system. Other systems under development at Radioplane facilities included a laminated Fiberglas airframe.



Radioplane YQ-1B Drone

Republic Aviation Corp.

Republic Aviation Corporation's F-84F Thunderstreak, USAF's first sweptwing fighter-bomber, and its combat twin, the RF-84F Thunderflash high speed reconnaissance fighter, joined the battle-renowned Thunderjet in 1954 on active duty around the world.

The first Thunderstreaks were delivered to Air Force combat units in January, 1954, and by the end of the year were serving in six USAF commands, and the Air National Guard. The first U. S. Air Force units in Europe were also equipped with the plane during the year. North Atlantic Treaty Organization (NATO) nations were scheduled for delivery of Thunderstreaks at the beginning of 1955.

The first Thunderflash photo reconnaissance squadrons were formed at Shaw Air Force Base during the year and modification work was initiated on a number of RF-84F's for use in FICON as the "kangaroo" plane with the GRB-36 aerial carrier.

The Thunderjet, still active in 16 nations around the world, logged its 2,000,000th hour at the end of 1954, setting a new record for total time by jet aircraft.

The T-Jet received two first place trophies and one second from the three-event USAF world-wide gunnery meet and the Mackay Trophy, awarded to the 40th Air Division for "Operation Longstride." In "Longstride" Thunderjets flew 4,485 miles across the Atlantic to Lakenheath, England, and to Nouasseur, North Africa, setting a new world's non-stop jet fighter distance record and demonstrating the Strategic Air Command's global mobility.

Following in the path of its predecessor Thunderjet, the Thunderstreak set a new speed record for the 1900-mile Bendix Trophy classic during the National Aircraft Show, when Capt. Edward W. Kenny of Air Training Command flew his F-84F past the finish pylon in three hours, one minute and 56 seconds, achieving an average speed with refueling stops of 616.208 miles an hour.

Earlier in the year the Air Force disclosed that the speedy Thunderstreak, like the Thunderjet, had joined the ranks of America's atomic bombers.

Three new Republic aircraft were revealed in 1954: the F-103, a radically advanced experimental interceptor; the XF-84H, a turboprop fighter incorporating for the first time an afterburner for jet thrust augmentation which operates in conjunction with the turbojet-drive propeller; the YF-84J, a super-Thunderstreak fighter-bomber powered by a J-73 engine.

Republic's research department, with cooperation from Simmonds Aerocessories, Inc., and Electronics Corporation of America, developed and demonstrated a compact fire and explosion suppression system, providing vulnerable areas of aircraft with protection from the hazards of gunfire.

A new ejection seat tested by the company features an automatic lap belt release mechanism to insure separation of the pilot from the seat after bail out.

In 1954 several new items of equipment were installed in Republic's $1-million research laboratory. A 600,000-lb. capacity test machine which can apply either compression or tension loads was installed for aircraft structural testing. The 15-foot long machine base is used to support test specimens up to 4½ feet in width during bending tests.

To provide capacity for testing larger fuel systems the Fuel Laboratory was equipped with an additional 600 gallon a minute fuel pump and an alternating current power supply for running aircraft fuel pumps and equipment during tests.

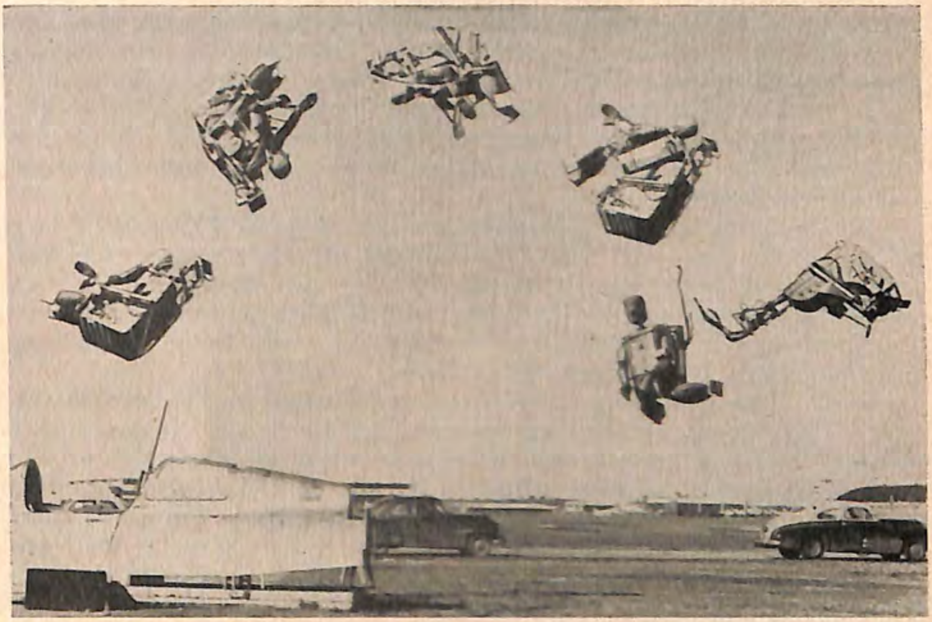
In the field of manufacturing research Republic continued its activity in plastic tooling, developing several new compositions of reinforced plastic resins and applying them to new tooling developments.

In one development, large stretch-forms used to shape sheet metal such as wing skins are being made as laminated epoxy shells. In another, Republic is substituting laminated plastic (paper-based phenolic) tubing for metal as reinforcing members in plastic jigs and fixtures. One 240-pound tool made of glass cloth-reinforced epoxy resin replaced a 3,100-pound Kirksite equivalent which required a 1,000-pound dolly to prevent sagging. The plastic tool required no dolly and was easily handled by two men.

The company continued to expand its facilities. A fourth plant, at Hicksville, Long Island, consisting of 31,500 square feet, was equipped for guided missile and plastics activities.

Almost an acre of floor space was added to the Farmingdale facilities by construction of a new engineering mezzanine to accommodate the F-105 engineering project.

Largest addition during the year resulted from the purchase of the adjacent Fairchild Engine Division plant in Farmingdale consisting of 425,000 square feet of floor area. A natural acquisition because of its prox-



New pilot ejection seat tested by Republic

imity to Republic's main plant buildings, the Fairchild facility will enable the company to consolidate engineering and experimental operations. Occupancy of the plant is expected during 1955.

The addition of 494,500 square feet during 1954 brings total floor space to 2,813,000 square feet as compared to 1,650,000 square feet before the Korean war. New shop areas, office space and research installations were equipped with the most modern facilities.

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 $6,167,055. Sales for the period amounted to $225,834,526.

Ryan Aeronautical Co.

A renewed emphasis in the field of prime contracts, in which Ryan Aeronautical Company held eminence in World War II and the years immediately following, marked the company's progress in 1954.

During the Korean War, Ryan's vast array of machine tools and know-how in the production of components for the "hot" parts of engines, both piston and jet, was put to capacity use in turning out thousands of units for the nation's leading engine and aircraft manufacturers.

At the same time, Ryan's long interest in airframes and its pioneering work in guided missiles was bearing fruit. Stepped-up activities in both fields were reflected in 1954 as the award of prime contracts for such projects as the Firebee, pilotless jet drone missile; guidance systems, navigation systems, and helicopter hovering devices, were awarded. In addition, Ryan is working on a $7-million project directly for the Air Force.

By year's end, more than 25 percent of Ryan's work was in the prime contract category, as compared with only five percent in 1953. Subcontract jobs remained at a high level, but the gap between prime and subcontracts was being narrowed.

To keep pace with its jet engine research, Ryan in 1954 built a large test cell in the San Diego area. The $175,000 structure will provide Ryan with advanced knowledge in the development and manufacture of high-temperature components for jet engines and complete afterburners, and will also assist in improving designs and applications of jet propulsion to Ryan airplane designs, both piloted and pilotless.

In the electronics field, Ryan's expanded engineering division worked during the year on a variety of advanced Air Force and Navy contracts with substantial amounts of new electronics work being negotiated.

A self-contained airborne helicopter hovering device is being produced by Ryan for the airborne equipment division of the Navy Bureau of Aeronautics. Ryan airborne navigational systems are being utilized by the Navy.

The Firebee drones, on which an extensive testing program has been conducted at Holloman Air Development Center, are occupying an increasingly important place in the Ryan production picture. The Navy, which along with the Air Force and the Army has sponsored the original development of this high-speed, remote-controlled, recoverable jet drone, ordered a production quantity of the Firebees. At year-end it was being tested at the Pt. Mugu guided missile test center for operation in support of the fleet anti-aircraft, aerial gunnery and guided missile training program.

Firebees are now being evaluated by all three services for use as a target drone, but its potentialities as a guided missile are also envisiond by Ryan officials.

Disclosed officially for the first time in 1954 was Ryan's contribution to the Corporal surface-to-surface missile. Several years ago, Ryan began production of these engines for Douglas Aircraft Co., when that firm built the first of these surface-to-surface missiles. Ryan in 1954 was producing these engines in volume for the Firestone Tire and Rubber Company, which holds the prime contract.

Based on the financial report for the first nine months of the fiscal year, 1954 was expected to be the most successful year, from a profit standpoint, in the company's history. Net income for the first nine months was $1.6-million, approximately 20 percent higher than the $1.3-million for the comparable 1953 period, and above the profits for the full 1953 fiscal year. It appeared likely that 1954 would be Ryan's first $2-million profit year.

Sikorsky Aircraft Div.
United Aircraft Corp.

Sikorsky Aircraft division introduced three new models in 1954: the S-56, the S-58, and the S-59.

The S-56 was announced publicly January 18 when it was shown to representatives of the various U.S. military services and the press. Primarily a Marine Corps and Army development, the S-56 is powered by two Pratt & Whitney R-2800s with a combined rating of over 3,600 hp. Known as the HR2S-1 (Marine designation) and the H-37A (Army), the S-56 features a five-bladed single main rotor and a four-bladed anti-torque tail rotor. The landing gear is retractable. The craft carries 26 fully-equipped troops and, in eventual commercial production, it is planned to seat 30 to 35 passengers. Full production is scheduled for the fall of 1955.

The S-58, a Navy and Army development, was announced to the military services and the press June 3. Essentially an anti-submarine warfare development, the S-58 is designated the HSS-1 by the Navy, the H-34A by the Army, and is currently in production at Sikorsky's Bridgeport facility and units have been delivered to the Navy.

Powered by a single Wright R-1820 engine developing 1,425 hp, the S-58 has approximately twice the payload of the famed S-55. Anti-sub gear may be removed to haul passengers or cargo. Like all Sikorsky helicopters, the S-58 features a single main rotor (four blades) and a torque-compensating tail rotor (also four blades). Somewhat resembling the S-55 in forward configuration, the S-58 is an entirely new aircraft of vastly improved performance.

August 29, the Army announced a new world's helicopter speed record —156.005 mph, set by the Army Sikorsky XH-39 at Windsor Locks, Connecticut. Another record, 24,500 feet for a new world altitude mark, was set at Bridgeport on October 17.

The XH-39, commercially designated the S-59, is powered by a Turbomeca Artouste II, a French development. The engine is made under

Ryan Firebee landing at sea

license in the U.S. by Continental Aviation & Engineering Corporation and is known as the T-51.

The new development, the first turbine-powered aircraft in Sikorsky history, started as an experimental powerplant project on the Army YH-18 (S-52). Experimentation evolved an entirely new aircraft of different configuration and, of course, radically improved performance capabilities. The S-59 has a four-bladed single main rotor, a four-bladed tail rotor, and retractable landing gear.

Active and potential commercial helicopter operators have expressed interest in all three models.

Also begun in 1954 was construction of a new multi-million-dollar branch plant in nearby Stratford, Connecticut. The new plant, expected to be ready in the fall of 1955, will provide over 700,000 square feet of manufacturing space.

Meanwhile, production continued of the famed S-55, the only CAA-certificated transport type helicopter in the world. S-55s in commerical service continued to make helicopter news in 1954. Sabena Belgian Airlines announced it carried 18,000 passengers during the first year's operation of its international helicopter passenger service. Over 4,000 used the inter-airport (LaGuardia, Idlewild and Newark) helicopter passenger service offered by New York Airways, which also extended its passenger service to New Jersey and Connecticut. By special authorization of the CAA, New York Airways inaugurated night passenger service between the airports. Los Angeles Airways continued expansion of its freight and mail service and expected to start passenger flights sometime within the year.

Sikorsky sales to foreign markets went up substantially in 1954. Canada, Japan, India, Sweden and Thailand all accepted delivery of one or more units during the year.

Plant area at the Bridgeport facility remained at 600,000 square feet not including various testing sites and service areas outside the plant proper.

Although concentrating mainly on the development of the three new models announced in 1954, research projects, dealing particularly with component design and performance, continued.

Stroukoff Aircraft Corp.

During the year, Stroukoff Aircraft Corporation expanded and improved its manufacturing facilities completing a new 64,000 square feet hangar building suitable for major airframe assembly in an area adjacent to its existing plant and acquired also, by long term lease, adjoining acreage to provide for future planned expansion.

High point of the year's activity was the completion and first flight of the Air Force XC-123D Boundary Layer transport, just 54 weeks after the initial authorization. This incorporated a new wing and is the latest in a series of wing designs by Stroukoff in which is employed for the first time the principles of Boundary Layer Control developed in cooperation with the Air Research and Development Command and the Wright Air Development Center. Take-off and landing distances are cut sharply, stall speed is reduced and greater operational range is made possible without sacrificing top speed. Stroukoff was actively engaged in continuing research in this field directed toward application of the Boundary Layer Control principle to jet fighters and bombers as well as other projects related to the development of military cargo and personnel transport.

Taylorcraft, Inc.

Late in 1954, Taylorcraft flew for the first time its new light airplane with a tough glass and plastic hide. Advantages claimed for the Fiberglas-reinforced plastic exterior were great strength combined with light weight, almost complete resistance to corrosion and sharply reduced maintenance costs.

The plane, which utilizes a basic Taylorcraft design, is 24 feet long, has a 36-foot span, weighs about 1300 pounds, and is equipped with a 145 horsepower engine.

At year-end, Taylorcraft's plant facilities covered approximately 50,000 square feet, and three new Fiberglas models were in production: the Ranch Wagon, the Skyliner and the Topper.

Temco Aircraft Corp.

In 1954 the Temco Aircraft Corp., acquired two new multi-million-dollar production contracts, overhauled and modified fleets of the three largest civilian type transports used by the military, and welcomed as its first vice-president-engineering, one of the industry's top missile and aircraft developers.

In March, 1954, Boeing Airplane Company's Wichita Division awarded Temco a contract for tooling and production of two major fuselage sections of the B-52 Stratofortress.

Four months later Temco won a contract for production of aft fuselage sections for Republic Aviation Corporation's F-84F Thunderstreak fighter-bomber. This contract, in quantity and dollar value, was the largest single order ever received by the nine-year-old concern.

The B-52 and the F-84F maintained at six the number of first-line military aircraft for which Temco is producing major components.

At its Dallas plant, Temco manufactured aft fuselage sections for the Boeing B-47 Stratojet; outer wing panels for the Lockheed P2V Neptune, and large assemblies for McDonnell's F3H Demon and F-101 Voodoo jet fighters. At its Garland, Tex., plant, the company produced fin and cockpit assemblies for the F-84F and wing assemblies for the F3H.

Overhaul and modification operations were centered at Temco's Greenville, Tex., plant. Here the company continued modification of Navy C-97s to VC-97 "Flying Hospitals."

Conversion of Navions to Riley Twins, started during 1953, continued throughout 1954 at the Greenville plant. In October an improved version of the popular light twin was introduced.

Designated the Riley '55, the new model is equipped with two Lycoming 170-hp engines, a redesigned control quadrant and front seats, and bladder fuel cells and optional wing tip tanks which extend range up to 1200 miles.

Also at Greenville, Temco reconditioned C-47 aircraft for the Air Force; de-sealed and re-sealed fuel tanks on 30 Air Force C-54s; modified a number of Air Force T-6G trainer to LT-6G configuration, and modified a Convair 340 transport for executive use by the king of Saudi Arabia.

Two other large aircraft reconditioning projects were underway at the Dallas plant during 1954. In March, the first of a substantial number of Navy R7V Super Constellations arrived for progressive heavy maintenance. In April the company began work on another contract for progressive heavy maintenance of 33 Navy DC-6s.

Temco in July created the new post of vice-president-engineering for I. Nevin Palley, formerly chief of missile design for Chance Vought Aircraft Corporation. Palley, who directed the Regulus guided missile program, combined Temco's Engineering and Electronics Departments into a single department which he reorganized on a "weapons systems" pattern.

The new department is designed to integrate the development of airframe, electronics and other equipment for missiles, military and commercial aircraft. It contains four divisions: administrative operations, systems research and development, systems design and systems fabrication.

Prominent in Temco's physical expansion during 1954 was the completion of a unique cantilevered production hangar at the Greenville facility. The 435-by-161-foot structure has a suspended roof which leaves the interior free of vertical supports. Vertical clearance in the hangar measures up to 45 feet. It shelters three C-97s simultaneously.

Net earnings for Temco for the nine months ending September 30, 1954 amounted to $2,291,090, or $1.37 per share, as compared to $1,499,280, or $.89 per share for the corresponding period of 1953.

Sales for the current nine months' period were $43,041,694, as compared to $41,888,179 for the same period last year.

Employees at the three Temco plants total about 7500.

United Aircraft Corp.

Because United Aircraft Corporation's three divisions operate autonomously, discussion of the company's 1954 activities are found under the names of the divisions: Pratt & Whitney Aircraft (engines), Hamilton Standard (propellers and aircraft equipment), and Sikorsky Aircraft (helicopters). Chance Vought Aircraft (airframes and guided missiles), of Dallas, Texas, became a separate corporation last July.

High level production was maintained in all divisions during the year. The corporation had under construction a major expansion of the Andrew V. D. Willgoos Turbine Laboratory, Pratt & Whitney Aircraft's gas-turbine engine development facility. The engine division also occupied a new structure in South Windsor for work on development of an atomic aircraft engine.

A 60,000-square-foot addition to its multi-million dollar plant at Bradley Field, Windsor Locks, Connecticut, was completed for Hamilton Standard, which also acquired a branch plant at nearby Broad Brook. The branch plant will be used for electronics development work.

A new 700-000-square-foot factory in Stratford, Connecticut, is being built to supplement Sikorsky Aircraft's Bridgeport facilities. It is expected to be ready late in 1955 and will be used to augment production activities of the main factory at Bridgeport.

Activities for the year were highlighted when Leonard S. Hobbs, vice-president for engineering of United Aircraft Corporation, was awarded the Collier Trophy for conceiving the 10,000-pound thrust J-57 axial-flow gas-turbine engine.

Unfilled orders for United amounted to $1.5-billion when 1954 began.

The Research Department of United supplemented the research and development work undertaken by its manufacturing divisions during the year.

The 18-foot subsonic wind tunnel, which has an 8-foot alternate test section providing Mach numbers to .95, was occupied with tests of various military aircraft models and high-speed propellers. Considerable testing of the aerodynamics of jet-engine components was accomplished during the year. Helicopter model testing in the department's wind tunnels pointed the way to improvements in helicopter performance. Extensive tests were conducted in small scale equipment on transonic and supersonic flow.

An extension to the Research Laboratory was under construction. This will contain a battery of intermittent transonic and supersonic wind tunnels of various types and sizes from Mach 0.6 to 10.0.

New developments at Pratt & Whitney Aircraft included expansion of the Andrew Willgoos Turbine Laboratory. Designed to test Pratt & Whitney turbine engines in development, the laboratory originally housed four test cells and a central power station. Three altitude test stands, each capable of handling the largest jet engines being developed, were added to the laboratory.

In addition a complete "blow-down" system was installed to provide high-pressure, high-temperature air for various phases of engine development. Extremely high-speed airflow, with conditions varying from sea level to high altitudes, can be simulated by pumping up the storage tanks for one hour while the storage air is being heated during the same period. The system is put into operation when the main shut-off valve is opened. The pressure and temperature is carefully controlled to duplicate speeds as high as Mach 2.75. The duration of air flow from tank to engine or component can be varied. This system was scheduled to begin operation in early 1955.

During the fall the construction of a 97,000-square foot building was completed in South Windsor, Connecticut. The building, leased by Pratt & Whitney, is an expansion of the company's present facilities for work on development of an atomic-energy aircraft engine. The Air Force announced plans to construct a multi-million dollar atomic research facility in Conn. to be operated by Pratt & Whitney Aircraft.

Hamilton Standard's engineering development program continued to expand in 1954 under the impact of increased interest in the division's turbine propellers and orders for aviation equipment.

The long development of the Turbo-Hydromatic propeller culminated in its successful operation on the Lockheed R7V-2 Constellation powered by the Pratt & Whitney Aircraft T-34 engine. Engine testing began during the year on a new concept in turbine propellers known as the nose-mounted type, which will be available for supersonic military applications and subsonic high speed transports.

Basic research on supersonic blade configurations continued, and a new one-piece type of hollow steel blade reached the experimental production stage.

Synchro-phasing of propellers to hold blade positions constant in relation to those of other propellers on multi-engined airplanes moved into the flight testing stage on a Lockheed 1049C Constellation. As the next step beyond RPM synchronizing the new development for commercial, piston-engined transports was adapted from the synchro-phasing system used on Hamilton Standard's Turbo-Hydromatics.

Major attention was given by the division's engineering staff to the many problems of the thermal barrier occasioned by sharp increases in aircraft flight speeds and cooling requirements. The weight of air conditioning and cockpit refrigeration units was reduced, and new designs capable of operation at the higher temperatures and pressures of high speed flight were evolved. In this connection, a design for refrigeration units which relieves high bearing temperatures by permitting cold air to flow over the bearings, and a radical and simple water separator with no moving parts, were outstanding developments. Currently Hamilton Standard is engineering complete air conditioning systems for both fighter and bomber types.

Advanced concept hydro-mechanical controls for turbojet and turbine-propeller engines were placed in production and gave excellent performance in service. Electronic controls went into wide use on Boeing B-52 bombers and a tailpipe temperature limiting control system for the Orenda jet engine was placed in production.

The division developed its line of pneumatic starters during 1954 and had different models in production. Development work on self-contained starting systems was accelerated, and a propyl nitrate-powered starting system was delivered to the Air Force. Substantial progress was made on a military contract for a fuel-air starter.

The division continued volume production on several high speed, variable displacement pumps ranging from a small version with an output of two gallons a minute at 2,000 psi and operating speed of 11,500 rpm to a large model with an output of 24 gallons a minute at 3,000 psi and operating speed of 8,000 rpm.

Sikorsky Aircraft continued to intensify its research and development program on rotary wing aircraft by developing existing designs and investigating advanced helicopter configurations.

Development of rotor blades played a large role in the success of the Sikorsky helicopter series. To make possible research in this field of aerodynamics Sikorsky engineers designed, built, and instrumented a rotor test stand. This 1,000 horsepower research unit will be augmented by a second test rig of 4,000 horsepower capable of increase to 8,000 horsepower to prepare for the larger helicopters of the future.

Scientific data obtained from rotor stand test runs coupled with research results in bonding of metals led to the development of Sikorsky's blades—the only individually interchangeable all-metal main rotor blades in production.

Translating the results of this research program into production, Sikorsky Aircraft flew three new designs in 1954—a large single engine antisubmarine machine; a twin engine transport type; and a fixed shaft gasturbine powered helicopter that established world altitude and speed mark in its first 20 hours of flight time.

ENGINE MANUFACTURERS

Aerojet-General Corp.

The year 1954 brought continued expansion at Aerojet-General, particularly at its Sacramento, California, plant. In addition to 9,000 acres previously owned by the company, Aerojet-General acquired approximately 5,000 additional acres to provide a buffer zone for its rocket manufacturing and testing facilities. Solid propellant manufacturing lines were also expanded at Sacramento and design criteria was completed and ground broken for liquid-propellant rocket test facilities.

Other significant advances during the year included the 5KS-4500 solid-propellant assisted-takeoff rocket which provides 4500 lb. thrust for five seconds. Twelve such units are used at one time on the Navy's A3D

Douglas Sky Warrior takes off with twelve 5Ks-4500 Aerojet-General smokeless JATO's

Douglas Sky Warrior, a carrier-borne bomber. Flight tests were successfully completed on a high thrust liquid-propellant assisted-takeoff rocket for the Air Force's B-47 airplane. Two of these rocket powerplants are installed in the B-47; one on each side of the fuselage. The rocket is an integral installation which extends when in use and retracts when not in use leaving the aircraft aerodynamically clean.

Although the 14AS-1000 standard JATO was still being produced, it was supplemented by the new smokeless 15KS-1000 JATO which is being mass produced at the Sacramento facilities.

At Azusa, mass production of metal parts for 2".75 Navy ordnance rockets continued at a high rate. Significant cost reductions were realized in this program as well as that of the 15KS-1000 production line.

Production of the Aerobee rocket for upper air research continued during 1954 and the altitudes reached have exceeded 90 miles.

Solid propellant rocket research at Aerojet-General continued as a large segment of the company's research activity. Emphasis was placed on creating various propellant formulations that may make possible the use of one group of metal parts for varying thrusts and durations. Solid propellants also have found desirable applications for such things as pilot ejection seats, signal rockets, turbojet starters and many types of ordnance weapons. Research and development also continued on solid-propellant gas generators.

In the liquid-propellant rocket field, missile powerplant work greatly increased.

Several highly successful programs for assisted takeoff and in-flight thrust augmentation for piloted aircraft were also underway at Aerojet-General.

Aircooled Motors, Inc.

During the year, development work continued on new versions of the Franklin 335 and 425 cubic inch engines for both helicopter and fixed wing installations. A new version of the 200 horsepower helicopter engine was released with major improvements to greatly increase service life. Development was completed on a 300 horsepower version of the 425 cubic inch engine employing a new turbosupercharger developed by Aircooled Motors which results in an engine of efficiency in power, weight, altitude performance and fuel consumption.

Allison Div.
General Motors Corp.

At Allison in 1954 production was completed on the T40 turboprop engine. This was the first turboprop put into production in this country. It consists of two identical power sections, each only 19 inches in diameter. Through shafts, turning at 14,300 rpm, each power section drives a dual rotation propeller through a common reduction gear. The power sections are connected together so that, in effect, they form a single unit; however, each power section drives through a clutch located in the reduction

Allison employee removes burrs from impeller of J33 turbojet engine compressor

gear which permits flexible operation of either one or both of the power sections.

Beginning with a design target of 4250 hp, Allison successively raised its sights to 5850 hp, the present guarantee on the engine. In addition, production engines consistently have demonstrated more than 6000 hp.

Principal use of T40 engines is in the Convair R3Y Tradewind which was nearing operational status by the year-end. A bow-loading configuration also offered by Convair was of interest to the Marines as a flying landing craft.

A specialized use of the T40 turboprop engine was in the VTO aircraft produced by Convair, the XFY-1, and Lockheed, the XFV-1. These two aircraft made their first flights in 1954 and were being test flown to determine the practical usefulness of aircraft which could take off vertically, cruise at fighter speed in horizontal attitude and then land tail first in a restricted area.

VTO aircraft require engines which can develop more pounds of propeller thrust than the weight of the complete aircraft. Since they produce more than two hp for each pound of engine weight, T40s meet this specification.

A secondary advantage in a twin-power section turboprop engine is that one power section by itself can be used as a separate engine. Thus one-half of a T40, with a new reduction gear, becomes the T38 rated at 2925 hp.

There is no military application for this engine, but during 1954 a great deal of flight experience was accumulated on T38 engines powering the twin-engine Allison Turbo-Liner. This is a conversion of a Convair 240 to turboprop engines.

Several hundred flights of this nature were made during 1954 on the West Coast, East Coast, military installations and airline centers. Reactions to the demonstrations were most favorable and close attention was paid particularly to the lower noise level, better take-off and climb characteristics as well as speedier descent and shorter landing run. At every demonstration it was pointed out that the Turbo-Liner in itself is an obsolete aircraft and does not represent an optimum installation of turboprop engines. Nevertheless, as a demonstrator the Turbo-Liner did point the way toward faster, more economical transports of the future.

The T56, like the T38, is a single power section engine and which develops nearly 30 percent more power than the T38 with improved fuel economy. First flights of the T56 were made during 1954 with five aircraft. First was the B-17 Allison flight test bed with the T56 installed in the nose. Five days later, Lockheed's test bed, Constellation "1961," made its first flight with a T56 in one nacelle. The first aircraft to be powered wholly by T56 engines was the first of two Convair C-131C aircraft purchased by the U. S. Air Force. This was followed by the first flight of the second C-131C, and finally the first flight of the first Lockheed YC-130 was made.

All of these aircraft continued to accumulate flight test hours during 1954. With small diameter engines developing well over two hp for each pound of weight, each aircraft was distinguished by clean tapered nacelles. It was estimated that these new nacelles provided less than half the drag of standard nacelles. Further, these new engines have good fuel economy. These and other factors add up to serviceable engines which set new standards for transport aircraft in speed, load-carrying ability and economical operation.

Allison also made further progress in 1954 in the development of turbojet engines. The new high-thrust J71 met its model test requirements and was flying in the twin-engine Douglas RB-66, which made its first flight on June 28. A flight test program also was initiated on two J71 engines installed in a Northrop F-89E. No production program is contemplated for this aircraft which is to be used only for flight experience with the J71. At the same time additional J71 flight time was being accumulated as the fifth engine in a North American B-45.

In the J71 Allison has demonstrated the highest compression ratio ever achieved with a single-compressor turbojet. It retains the same basic diameter as its predecessor, the J35, yet produces nearly double the thrust. The J71 is of rugged construction and is capable of field maintenance.

Meanwhile, the J33 and J35 engines continued to give excellent service and added to their reputations for durability and dependability. Tyndall Air Force Base operated one J33 engine to 1400 hours before overhaul.

This was the maximum current allowable time on J33 engines, and the Tyndall achievement represented the first time the 1400 hour mark had been achieved with a jet engine. Another type of J33 engine was announced as the powerplant in the Martin Matador, first guided missile to go into operational use. The J33 engine also powers the Navy's Regulus missile, produced by Chance Vought. Large quantities of the J33 model also were produced for the Lockheed trainer, T-33 for the USAF and TV-2 for the Navy.

Production quantities of the axial-flow J35 also were supplied Northrop for the F-89D Scorpion which during the year went into service in additional far northern defense bases.

With the completion of additional jet engine test facilities, Allison prepared for further engineering development of present engines as well as taking sights on new power plant requirements for the future. At the year-end employment totalled approximately 14,000 with more than 5-million square feet of floor space in use by the Division.

Continental Aviation and Engineering Corp.

Continental Aviation and Engineering Corporation, a subsidiary of Continental Motors, continued to expand its small turbine activities during the year. Deliveries to the Air Force of the MA-1 gas turbine compressor started in January and continued throughout the year. This gas turbine is used to supply compressed air for starting the large turbojet engines in the North American F-100, the Convair F-102 and the Douglas B-66 airplanes.

Production deliveries of the J69-T-19 turbojet engine for the Ryan Q-2 target drone were begun during the latter part of the year. Another version

Cessna T-37 trainer is powered by two Continental J-69-T-9 turbojets

of this engine, the J69-T-9, was put into production for use in the Cessna T-37 twin-jet trainer.

Prototype applications of the XT51-T-1, 280 hp., turboprop engine, were made in the XL-19C observation plane. A prototype installation of the XT51-T-3, rated at 420 hp., was made in the XH-39 Sikorsky helicoper, which established a new speed record of 156 miles per hour on August 26, and a new (unofficial) altitude record of 24,500 feet on October 17.

Curtiss-Wright Corp.

Four additional installations of the Curtiss-Wright Corporation's J65 turbojet brought to eight the total number of announced modern military aircraft for which it has been selected. No other jet engine has been chosen for as many advanced tactical plane types, and the engine is in other programs of classified status.

Other developments included:

Production started on Turboelectric propellers for new, high-powered turboprop engines, and further progress was made in extruded blade production methods and in the development of supersonic blades.

Design work was completed on new and advanced types of simulators for electronic crew training.

A diversification program was commenced with the acquisition of licenses to manufacture a variety of new products in the fields of electronics and plastics.

And installation work was completed on a 12,000-ton horizontal steel extrusion press—of its type the largest in the world.

The J65, originally produced as a 7220-pound engine which has consistently exceeded its guaranteed thrust rating, was revealed during the year to exist in various models of advanced rating. One of these is a 7800 pound configuration installed in the North American FJ-4. Another is an afterburner version which has been announced for the Air Force's Lockheed F-104 and the Grumman F9F-9 Tiger, a shipboard fighter that the Navy has disclosed is supersonic in level flight.

The other J65 installation disclosed during 1954 was, beside the FJ-4, F-104, and the F9F-9, the Douglas A4D Skyhawk lightweight attack plane. Previously announced have been the North American FJ-3 Fury, Martin B-57 twin-jet bomber, Republic F-84F Thunderstreak fighter-bomber, and the RF-84 reconnaissance fighter.

Now in service with the military, the Curtiss-Wright J65 has proved to be economical in operation, with fuel consumption as much as six percent below specification.

Development of another Curtiss-Wright turbojet, the J67, a two-spool axial-flow engine designed for extremely high output, continued during the year.

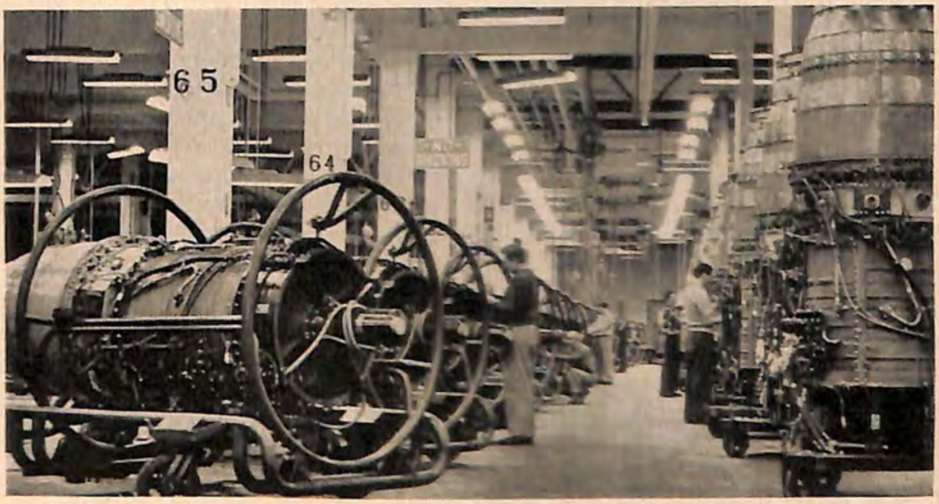
The company's T49 turboprop engine was revealed to be installed at year-end in a Boeing XB-47D bomber in preparation for flight testing early in 1955.

Progress was also made in the rocket and ramjet fields, although no specific information was made available.

Curtiss-Wright's Turbo Compound engine passed the two million miles performance mark in military and commercial service during 1954. More than 5,400 of these engines have been delivered and development of advanced models is continuing.

Presently rated at from 3250 to 3700 horspower for takeoff, the Turbo Compound has acknowledged capacity for greater output. It is presently powering a variety of military aircraft as well as the Lockheed Super Constellation and Douglas DC-7 commercial transports. These planes have been selected by 27 leading world airlines for their new long-range, high-speed fleets.

In addition to U. S. military aircraft, the Turbo Compound during 1954 was chosen for installation in Bristol Britannias by the Royal Canadian Air Force. Intended for long-range duty, this plane, designated the CL-28, will be the largest aircraft ever produced in the Dominion.



Curtiss-Wright J65 turbojets

A new Douglas DC-7C model, for non-stop flights up to 5,000 miles in range, was announced during the year. To power this transport, Curtiss-Wright has developed the EA-1 Turbo Compound, a commercial version rated at 3400 horsepower for takeoff that has been service-proven by the U. S. Navy. This engine, which provides additional METO power as well, will be type-tested in 1955.

Designed by the company's Propeller Division, Turboelectric propellers are now in production for the new cargo, turboprop-powered Lockheed C-130 and Douglas C-133A airplane. Curtiss-Wright Turboelectric propellers are also in operation or will be operating on the Douglas YC-124B, Lockheed YC-130, Convair XFY-1, Lockheed XFV-1, Boeing YC-97J, and Boeing XB-47D airplanes.

Additional flight testing of supersonic propellers will also be accomplished during 1955.

Production of the Propeller Division's regular line of hollow steel bladed Curtiss Electric Propellers for both commercial and military use continued during 1954 while production was accelerated in fabricating the single-piece extruded hollow-steel blade.

At the corporation's Electronics Division there were delivered during 1954 a variety of Curtiss-Wright Dehmel training equipment. Undisclosed numbers of Simulators were delivered to the Air Force for advanced training of crews assigned to the Convair B-36 bomber and the Douglas C-124, Boeing C-97, and Fairchild C-119 transports. During the year orders were received for and design work was started on Simulators for the Boeing RB-52 eight-jet bomber, and these four military transports: the Douglas C-118A, Lockheed RC-121, Lockheed C-130 turboprop, and Convair C-131.

Duplicators, another all-electronic instrument flight training aid produced by Curtiss-Wright, continued in production during the year. Numbers of these units were delivered to the Air Force, which now uses them at many domestic and foreign bases. Commercial airlines, including Iberia, Air France, Eastern Air Lines, and TWA, also took delivery of Duplicators during 1954.

A Curtiss-Wright engine-propeller combination propelled a U. S. Navy ZPG-2 to a new world's record of 200.2 hours for a non-stop flight of aircraft and fuel without refueling. The Goodyear blimp is powered by two 800 horsepower Wright Cyclone 7 engines turning two 16-foot, 7-inch Curtiss Electric propellers with hollow steel blades.

Announcement was made during the year of still further expansion of Curtiss-Wright's manufacturing activities, which already include products outside the aircraft field. Licenses and engineering agreements were concluded with Swiss and German companies to provide the corporation with rights to produce scientific apparatus for the fields of electronics and ultrasonics. These include devices for measuring, computing, and control.

During 1954 Curtiss-Wright published the third volume in the Machinability series. Prepared for the Resources Planning Section, Industrial Planning Division, Air Materiel Command of the Air Force, the book was made available to industry as its predecessors had been. The new volume carried the program into the new field of machining titanium.

Installation had been completed by the end of 1954 of the world's largest horizontal extrusion steel press at the company's Metals Processing Division plant at Buffalo, N. Y. This 12,000-ton press can handle steel, titanium, or non-ferrous metals and is capable of extruding a 9,000-pound billet to a 40-foot length.

The Division is presently producing in quantity approximately 40 different types of blades for gas turbine engines, some forged and some cast, and the foundry is making a variety of stainless steel castings, also for jet engine use.

Another large installation completed during the year was that of a large addition to the ramjet laboratory at the Wright Aeronautical Division in Wood-Ridge, N. J.

The laboratory addition, costing $7.7-million, is being erected in cooperation with the U. S. Air Force and will provide a means for testing large capacity engines under simulated conditions of high speeds and high altitudes.

Curtiss-Wright Europa, N. V., with offices in Amsterdam, the Netherlands, continued during 1954 to service and supply the corporation's products to NATO nations.

The sale of spare parts and servicing of Curtiss-Wright engines and other equipment for the military, the airlines, and private plane operators is a function of Caldwell-Wright Airport, Inc., another corporation division.

Marquette Metal Products, a corporation subsidiary at Cleveland, O., continued producing electric and hydraulic windshield wipers for all types of aircraft, including high-speed jet fighters.

The Plastics Division increased its lines of consumer and industrial products during the year and developed new processes in its field. Its facilities include molding equipment with capacities up to 48 ounces.

Curtiss-Wright reported for the nine months ended September 30, 1954, a consolidated net profit of $11,454,782 after provision for federal income taxes. This compared with a consolidated net profit, after taxes, of $8,058,376 for the nine months ended September 30, 1953.

Consolidated net sales for the first nine months of 1954 amounted to $348,261,589 compared with consolidated net sales of $317,885,461 for the first nine months of 1953.

Unfilled orders, plus scheduled production under advance contracts, for Curtiss-Wright Corporation and its subsidiaries totaled approximately $736-million as of September 30, 1954.

General Electric Co.

During 1954 twenty-one of the General Electric Company's product departments and divisions were directly involved in the research, development and manufacture of aircraft products, components and systems.

The battle-tested J47 series engine was further improved and developed by many engineering advances. Among these was the introduction of low pressure drop nozzles and detergent additives which allow higher flow rates for the water and alcohol "highballs" served to the J47 jet engines.

Another improvement was the introduction of a ceramic coated combustion liner, which resulted in significant savings of the strategic materials.

The J47-27 turbojet engine was installed as the power plant for the new North American TF-86, the two-seater training version of the Korea-famed Air Force B-86 Sabre Jet.

During the year the B-47E, operational bomber, and the RB-47E photo-reconnaissance airplane were equipped with J47-25 engines capable of 6,000 pounds of thrust each. This gave these Stratojets 50 percent more power than that which took the XB-47 into the air at Seattle, Washington, for the first time seven years ago.

Speed records set by G-E powered aircraft during the year include a new cross-country mark of four hours, eight minutes from New York to Los Angeles; a new world's record of 649.3 miles per hour in the 500 kilometer speed run; and a new mark of 692.8 miles per hour in a 100 kilometer event.

In June, twelve of the nation's top jet fighter units met in Las Vegas for the finals in the Air Force's jet target shooting competition. Both the winners and runners-up were the Air Training Command's marksmen flying J47-powered F-86-F Sabre Jets.

In July, a B-47 bomber completed flights totaling more than 600 hours without having to overhaul or replace a single engine, setting a jet engine endurance record for this type of plane. During its 600 hours, the B-47 participated in the SAC Navigation and Bombing competition at Davis-Monthan AFB, Arizona, last October, two trans-Atlantic, non-stop flights and a 12-hour special mission in the U. S., as well as dozens of routine flying operations.

General Electric's newest production engine, the J73, was powering the North American F-86H. During the year, airplane and engine evaluation flights were made in the J73 powered Republic F-84J, the latest in the series of Thunderjets and their successors, the Thunderstreaks. Newest and most powerful of General Electric production engines, the J73 has considerably more thrust and lower fuel consumption than the J47, yet it is the same size.

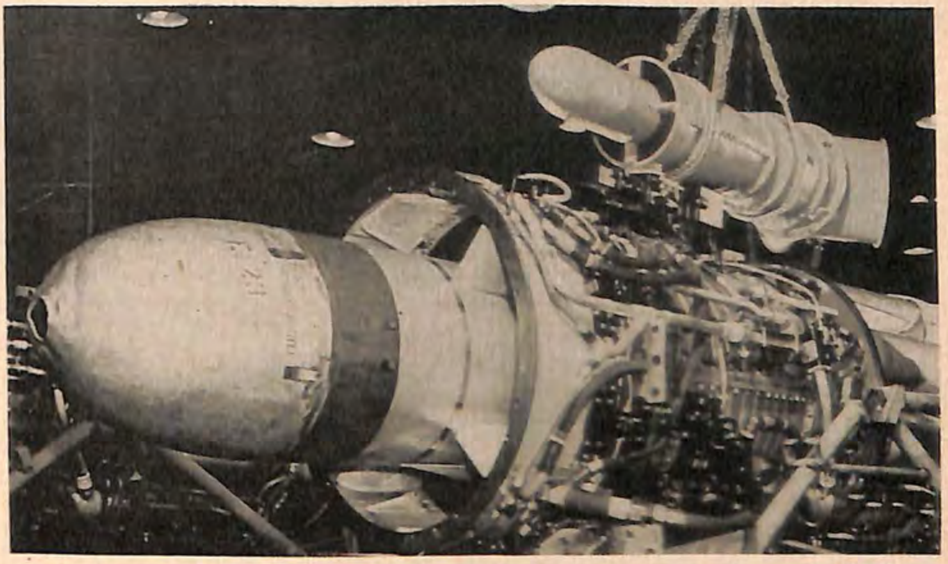
New developments in titanium alloy and their fabrication made possible even greater use of these alloys for jet engine applications. The weight of the J73 production engine was reduced by the use of titanium alloys.

A new and unusually large compressor house was added to the division's facilities to test some of the advanced designs of compressors, combustors, turbines, and other jet engine components. In conceiving the design of the air moving plant, it was determined that the system should supply air to and exhaust from the test cells over a complete range of 0.0625 to 100 pounds per second and 0.05 to 20 atmospheres. Essentially, this air moving plant must, each minute, compress a volume of air equivalent to more than 20 box cars full into a volume equivalent to one box car full.

General Electric established and equipped an entire department within the Aircraft Gas Turbine Division solely for the purpose of investigating, developing, and demonstrating basic new principles in the fields of aircraft and missile propulsion systems and turbine driven aircraft accessories. Investigations were made in areas which bear on future products, including aerodynamics, mechanical design, controls, combustion, materials, processes, and measurements.

The consummation of component development programs was the demonstrator engine. This is a test vehicle which is designed, built, and tested to demonstrate and evaluate basic new engineering principles under actual operating conditions.

In addition to its own development and research facilities, the Com-



Mock-up model of G.E.'s new gas turbine engine next to J47-17

pany's division was backed up in its engine development programs by two research organizations in Schenectady. At the G-E General Engineering Laboratory, advanced measuring systems were developed so that AGT Development Department engineers could study phenomena such as the effect of geometry on the vibration characteristics of engine parts. At the G-E Research Laboratory, the Department programs were supported through research in metalluragical, chemical, aerodynamic, and combustion phenomena.

At the Aircraft Accessory Turbine Department the company reached volume production in its full line of accessory power equipment for reciprocating and jet engines. At its Lynn, Mass. headquarters, this department produced turbo-starters for the Martin B-57, afterburner fuel pumps for the North American F-86D, turbo-hyraulic pumps and turbo alternator drives for a new USAF bomber. In addition, production of turbo superchargers for military and commercial piston engine aircraft continued at a high rate.

Placed in production during the year was the new model CH-10 turbosupercharger, developed for use on the Boeing Super-Stratocruiser now making non-stop trans-Atlantic flights for Pan American World Airways.

The Small Aircraft Engine Dept. was developing a gas turbine engine for helicopters which will be comparable in size to the conventional piston power plant but many times as powerful. Designated XT-58, the engine is being designed for the Navy's Bureau of Aeronautics primarily to power helicopters. However, with some modifications, it can be adapted as a power plant for fixed-wing aircraft either as a turbo-prop or turbojet.

GE's Electronics Division continued the search for better radar in 1954. The Tube Department announced development of a new five-inch cathode ray tube for radar, with a high-resolution electron gun which provides an exceptionally narrow trace on the screen to considerably aid target identification. It also unveiled a three cm. pulse magnetron, designed for reliable operation without pressurization up to 60,000 feet, for use in airborne radar gunsights.

At the Company's Electronics Park in Syracuse, N. Y., a powerful new radar height-finder was in production. It detects planes three times as far as previous units of this type. Meanwhile, the Light Military Electronic Equipment Dept. at Utica, N. Y., produced the most powerful airborne radar ever built. It is installed in a new Lockheed long-range, high-altitude reconnaissance scout plane, patterned after the Super Constellation transport, and is used by Navy and Air Force as a flying radar station over the Atlantic and Pacific.

During the year the company found new aviation uses for silicones in answer to a number of problems. The Construction Materials Division with headquarters in Bridgeport developed a silicone rubber wire answering the problem of the increase in ambient temperature of military planes.

Several silicone rubber compounds were developed by the Chemical Division in Pittsfield during 1954: The Plastics Department began production of super-tough Silicone rubber for use in jet engines and other aircraft equipment. Gaskets and "O" rings made from this type rubber have proved to be effective seals for synthetic base oils at temperatures as high as 375 degrees Farenheit.

The Silicone Products Department produced silicone fluids, named Viscasil Fluids, which can be poured freely at temperature extremes.

A lightweight, flexible tubing, highly resistant to wide temperature and pressure ranges, was deveioped from G.E.'s SE-100 silicone rubber compound as part of the de-icing system of the Grumman S2F-1 Sub-Killer airplane. It can withstand temperatures ranging from 250 to —65 degrees Fahrenheit and requires practically no replacement for the life of the plane.

The Company's Carboloy Department began production in 1954 of vacuum melted, high-temperature alloys for turbine wheel buckets of jet engines and other applications. The new alloy, developed by the G-E Research Laboratory in Schenectady, N. Y., is capable of withstanding higher temperatures than any wrought alloy now in production.

The Company's Lamp Division at Nela Park, Cleveland, Ohio, announced availability of an improved airplane landing lamp that is expected to provide a longer and more uniform service life, a more stable beam pattern, lower maintenance costs, and greater assurance of safety than in previous lamps.

To aid in designing and testing aircraft motors, the Company's Specialty Component Motor Department, located in Ft. Wayne, Ind., installed new testing facilities for shock tests up to 100 G's, vibration to 100 cycles per sec., cold tests to —112 F., and altitude work up to 100,000 feet.

The department develops and builds motors for both aircraft and missile applications. These motors are usually designed for 24-volt d-c, or 400-cycle, 208-volt systems. Major applications include tail wheel retractors, wing flap control, propeller pitch control, cowl flap actuators, radio tuners, phasing control, radar spinners, synchronizers, and computer, pump, and servo-motors.

Continuous scientific research and technological development for better instrumentation and metering of aircraft equipment in flight functions was being carried out by the Instrument Department's Measurements Laboratory at Lynn, Mass. Among the developments announced during 1954 was the MA-1, a light weight compass system for aircraft. This new navigational aid has a free gyro drift rate of less than 4° per hour, far surpassing the old 12° to 18° drift rate standard. The department manufactures over 50 kinds of aircraft meters and instruments, including tachometers, magnetic compasses, fuel indicators, temperature and pressure indicators, flap and landing gear position indicators, and mass fuel flow meters.

The Apparatus Sales Division's aviation engineering unit developed an automatic aircraft generator and protective system which parallels an aircraft's 400 cycle alternators without human supervision. Also developed during the year were two a-c electrical systems which require no attention from the pilot.

Placed in production during the year was a new a-c generator protective and control system specially developed for the Douglas B-66 bomber which provides greatly improved protection against over and under excitation of paralleled generators.

During 1954 information was released concerning Vulcan, a rotating gun firing mechanism with an extraordinarily high rate of fire, which was developed by the Aeronautic & Ordnance Systems Division for the Army Ordnance Corps. Vulcan underwent installation and firing tests during the year. The Aeronautic and Ordnance Systems Division which is responsible for a wide range of highly engineered systems and products, includes an Aircraft Products Department, a Naval Ordnance Department, and a Guided Missiles Department. It also is responsible for the operation of the Company's Flight Test Laboratory in Schenectady, New York.

Improvement on the FC-5 flight control system continued, and a contract was signed for installation of the system in a new Air Force fighter.

Production and delivery of the G-E designed remote-controlled radar-directed defensive armament systems for Boeing B-47 Stratojet bombers continued, and a contract for installation of an improved version of the system in Douglas B-66 bombers was announced during the year.

The Flight Test Laboratory continued extensive developmental and experimental testing of the Company's aviation products and jet engines. Three new planes on embailment from the Air Force were added to its fleet of jet and piston engined "flying laboratories," making a total of nine available.

Testing programs completed during the year included those on the Company's newest jet engines, flight and engine control equipment, radar, armament systems, and other electronic equipment.

Lycoming Div.
Avco Manufacturing Corp.

During 1954, it was disclosed that the Lycoming Division was working on two confidential contracts for gas turbine engines for the United States Air Force. The work on the division's first gas turbine engine was substantially advanced by the end of the year.

At the beginning of the year, the division, previously separated into a Bridgeport-Lycoming division (Stratford, Conn.) and Lycoming-Spencer division (Williamsport, Pa.) was consolidated into one division, with headquarters at the Stratford plant.

Lycoming continued production of aircraft engines for commercial and military uses in horsepowers from 65 to 1525. In addition to more than 55 Lycoming engine models, Lycoming builds the R-1820 and R-1300 radial engines for the military under license from Curtiss-Wright.

Lycoming-built engines are used by more than 32 different aircraft manufacturers, including: Aero Design and Engineering Corporation, Aerocar, Beech Aircraft Corporation, Bell Aircraft Corporation, Bellanca Aircraft Corporation, Brantley, Call Air, Colonial, Convertawing, Doman Helicopters, Fokker Aircraft Company, Glenview, Goodyear, Grumman, Helio Aircraft Corporation, Johnson, Kaman Aircraft, Kawasaki Aircraft, Lear, Inc., Mooney Aircraft, North American Aviation, Piaggio and Co., Piasecki Helicopter Corporation, Piper Aircraft Corporation, Royal Aircraft Corporation, Ryan Aeronautical Company, Saab Aircraft Company, Skylark, Sikorsky, Temco and Transcendental Aircraft Corporation.

During the year, Lycoming announced the development of a new air compressor for the starting of jet aircraft, the CA125, which could be mounted on skids, on a trailer, on a truck, or as part of a self-propelled vehicle. It continued its production of complete assemblies, such as the rotor assembly for Piasecki helicopters, of component parts for jet aircraft, of gears and machine parts, of castings, of hardened and ground precision parts and of industrial engines.

Marquardt Aircraft Co.

Late in 1954, Olin Mathieson Chemical Corporation acquired a substantial interest in Marquardt Aircraft Company. Olin Mathieson counts among its activities the development and production of high energy fuels and holds a substantial interest in Reaction Motors, Inc., producer of rocket engines for guided missiles.

Marquardt observed its tenth anniversary during the year. Employment for the company totalled 1100 at year-end.

Much of the achievement recorded by Marquardt in the field of supersonic ramjets remained cloaked in military security, but the engines established records for speed, distance and endurance well up in the supersonic range. Most of these records were established in 1954 under actual flight conditions on missile test beds. In all cases the supersonic ramjet performed as predicted and in some instances exceeded performance expectations.

Substantial additions were made to the Marquardt Jet Laboratory during the year, including the installation of new test cells, sponsored by the U. S. Air Force, which provide for more versatile use and control of air employed in testing ramjets and related components. The U. S. Navy sponsored a modern facility for testing gas turbines and afterburners. This test cell has complete instrumentation facilities and thorough silencing of intake air and exhaust gases.

In all, Marquardt Jet Laboratory embraces a total of seven test cells, while its compressors and air storage tanks provide the equal of 165,000 horsepower in rate of discharge.

Additions to the company's manufacturing and engineering facilities also were made during the year. These included the acquisition and installation of machine tools, and the construction of a company-financed engineering building which added 30,000 square feet of space to the plant facilities.

During the year Marquardt made significant strides toward its objective to engage in the volume production of the products it develops. These strides were evident particularly in the field of air turbine powerplants and turbojet and afterburner exit nozzles. One type of the latter incorporates a reverse thrust nozzle which increases the safety, range and operating efficiency of turbojet powered aircraft.

Development work related to afterburners for turbojet engines represents a susbtantial portion of Marquardt's volume of business. In addition to the development of complete afterburner, the company has orders for test quantities of variable exit nozzles from several manufacturers of turbojet engines, thus broadening the base of operations in this field.

As part of its work in the ramjet field, Marquardt has developed auxiliary air power turbines and controls for ramjet engines. As other applications developed, the company became more active in the field of auxiliary air power turbines for piloted aircraft. Orders for a quantity of these drives was received from the USAF for a new fighter aircraft. A contract for the development of a turbine drive supplying both hydraulic and electric power for a new Navy fighter represented another facet in the company's diversification program.

Pratt & Whitney Aircraft Div.
United Aircraft Corp.

Quantity production of the company's J-57 turbojet engine moved into high gear during 1954, research and development facilities at the Andrew Willgoos Turbine Laboratory were greatly expanded, work on the development of an atomic aircraft engine continued, and the Air Force announced a contract for a new Pratt & Whitney Aircraft jet engine, the YJ-75. The company announced that it has a new turboprop engine, the T-57, under development.

During the year production models of the Air Force-sponsored Boeing Aircraft Company's B-52 intercontinental bomber flew. The B-52 is powered by eight J-57 engines. During the 1954 National Aircraft Show at Dayton, a B-52 traveled faster cross country than the jet fighter which was the winner of the Bendix Speed Race. The B-52 averaged 624 miles per hour and the fighter, 616.2 miles per hour.

As 1954 drew to a close, increasing numbers of the North American Aviation's F-100, powered by J-57 engines with afterburners, were being delivered to the Air Force for operational use.

Besides the F-100, two other J-57 powered fighters with afterburners exceeded the speed of sound in their first flights. These were the production model of the Douglas Aircraft Company's F4D Skyray, a Navy fighter, and the Air Force's twin-engined F-101 Voodoo, manufactured by McDonnell Aircraft.

Flight testing of the Convair F-102, Air Force fighter, powered by the afterburner J-57, and the Navy's twin-jet (J-57s) attack bomber, the Douglas A3D, were begun during the year.

Boeing's 707 tanker-transport first took to the air on July 15, 1954. Four P&WA J-57s power this aircraft. The Air Force has ordered the tanker version of this aircraft, designated the KC-135, into production.

Working under Air Force and Atomic Energy Commission contracts for the development of an atomic aircraft engine, P&WA continued its research during the year. In October, an additional 97,000 square feet of new working space in South Windsor, Connecticut, was leased by the company. P&WA is recruiting the services of qualified nuclear engineers. The Air Force announced plans to construct a multi-million dollar atomic engine research facility in Conn. to be operated by Pratt & Whitney Aircraft.

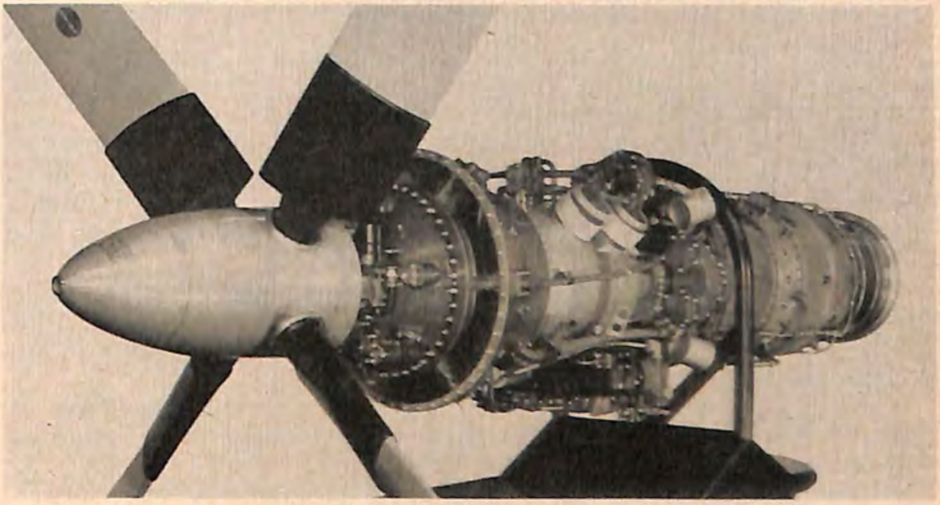
The 5,700 horsepower Pratt & Whitney Aircraft T-34 turboprop engine was in the advanced stages of flight testing as 1954 drew to a close. Two four-engined aircraft, the giant Douglas YC-124B Globemaster for the Air Force, and the Navy's Lockheed R7V-2 Super Constellation took to the air. A T-34 powered version of the Boeing four-engined C-97 Stratofreighter (the YC-97J), is slated to fly early in 1955.

Production of the 7,250-pound-thrust J-48 centrifugal-flow jet engine continued in 1954. This engine was slated to be phased out by the last quarter of the year but the Navy ordered a substantial additional quantity of the J-48-P-8 engines. Delivery of these engines will start in 1955. The Navy has also ordered parts to modify an earlier version of the J-48 (the J-48-P-6) to the more powerful P-8 model. The conversion will include the installation of Waspaloy turbine blades and an increased rear inlet screen.

The J-48 powers the Navy's F9F-5 Grumman Panther and the Grumman F9F-6 and F9F-8 Cougars, carrier-based fighter planes. The J-48 with afterburner powers the Air Force Lockheed F-94C, all-weather interceptor.

On April 1, 1954, three J-48 powered Grumman F9F-6 Cougars set a new transcontinental speed record by flying from San Diego, California, to New York City in less than four hours. The fastest time was recorded by Lieutenant Commander Francis X. Brady, who flew the 2,438-mile route in three hours, 45 minutes and 30 seconds.

In addition to jet engine production at the main East Hartford plant,



Pratt & Whitney Aircraft T-34 turboprop

assembly and testing of R-4360 Wasp Majors and R-2800 Double Wasp piston engines continued at a steady pace. Present models of the R-4360 are expected to be phased out during the second half of 1955, but production of the R-2800 will continue through 1955 and beyond.

The Andrew Willgoos Turbine Laboratory, largest privately owned gas-turbine laboratory in the world, put three large new test cells into operation during the year. These test cells were built to accommodate the largest engines now under development.

A dam and pump house was constructed on a brook running through company property at East Hartford and was put in operation in September. A 4,000,000-gallon reservoir collects drain water which is pumped into the test cells for spray-cooling exhaust gases from afterburner jet engines.

In July Pratt & Whitney Aircraft metallurgists announced the development of a nickel-based, heat-resisting alloy called "Waspaloy" for use in jet engine turbine blades. Waspaloy turbine blades installed in the J-48 engine have boosted that engine's power rating to 7,250 pounds of thrust.

Jet parts manufacture was extended into the branch plants at North Haven and Southington, Connecticut. While the main function of the branch plants continued to be the machining of parts for the R-4360 Wasp Major and the R-2800 Double Wasp piston engines, several piston departments were rearranged and jet parts production installed.

More than 33,000 people, working on three shifts, were employed by P&WA at the end of the year. Production, engineering, research, inspection and warehouse space totaled more than 6,000,000 square feet, all located in Connecticut.

Reaction Motors, Inc.

During 1954, Reaction Motors, Inc., producer of liquid propellant rocket engines, continued its growth in the rocket industry. December marked the company's thirteenth anniversary.

RMI 20,000 pound thrust engines have powered the entire series of Martin (Navy) Viking high altitude research rockets. In May 1954, Viking No. 11 under RMI rocket power rose to a world's record altitude for single stage rockets of 158 miles and achieved a peak velocity of over 4300 mph.

The newest RMI development in rocket power was unveiled during 1954. Tiny rotor-tip rocket engines to provide helicopters with added lift have been successfully tested in Marine Corps helicopters resulting in appreciably greater aircraft performance.

Early in the year, the Mathieson Chemical Corporation, producer of industrial chemicals, agricultural chemicals and pharmaceuticals, acquired an interest in Reaction Motors, Inc.

A joint Navy-RMI $4-million construction program was underway at year-end 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 programs. RMI will occupy these new facilities in January 1955.

Westinghouse Electric Corp.

Expansion and consolidation of plant facilities, and continuation of extensive programs for development and production of equipment for aircraft and airborne operations keynoted the 38th year of Westinghouse activity.

As part of the Company's current $296-million expansion program, now 75 percent complete, a new development laboratory with ultra modern facilities will be constructed at the Westinghouse Aviation Gas Turbine Division.

Carrier trials of the Chance-Vought F7U-3 Cutlass, powered by two Westinghouse J-46 engines, were successfully completed early in 1954. This engine develops about 6000 pounds thrust and is designed for multi-engine airplanes.

Westinghouse designed and constructed large axial-flow compressors and drive motors (83,000 horsepower) for the Air Force's giant Propulsion Wind Tunnel at the Arnold Engineering Development Center, Tullahoma, Tenn. By mid-1955 it was expected that checking and calibration of the transonic tunnel would be underway. Equipment for the companion supersonic tunnel was being assembled on the side. Each tunnel will be served by its own enormous axial-flow compressor and both will be driven by four motors totaling 216,000 horsepower.

A 30-kva, constant-speed (5700 to 6300 rpm) alternator was built by the Small Motor Division to contend with the extreme conditions of air temperature, flow, and moisture content encountered in modern flight. Because of the plane speed the cooling-air temperature at low altitudes is 200 degrees Fahrenheit, and the alternator must also be able to accept up to nearly two quarts of water per minute in the air stream.

Silicone insulation is used throughout the machine. This permits operation with hot-spot temperatures of 480 degrees Fahrenheit. Air is bled from the main stream at eight different places plus an air bleed through the shaft to maintain the rear bearing at normal temperature.

Another development in aircraft alternators was a 400-cycle alternator that will develop 40 kva with intake air at sea level at an effective temperature of 250 degrees Fahrenheit, and at 50,000 feet, of 100 degrees Fahrenheit. Also, aerodynamic considerations at supersonic speed permit only ¾ the weight of air flow ordinarily available at high altitude.

Westinghouse engineers have designed a control that automatically starts up and parallels the alternators of an aircraft electrical powerplant. Not only does this mean one less thing the pilot has to do, it also means better electrical performance, less likelihood of the pilot making an error, elimination of considerable wiring, and a few pounds net reduction in weight.

In multi-engine planes, such as the eight-engine Boeing B-52, should one generator fail, another is cut in automatically. This transfer scheme comprises two units—a transfer contactor and the control unit that senses when transfer is necessary. The sensing element embodies a saturating reactor operating in a high-gain circuit and includes a time-delay element to override system transients.

Material engineers at Westinghouse have developed a new diaphragm sensitive to minute changes in air pressure. Design factors: the flexing of only a few thousandths of an inch be essentially the same at −30 degrees C and at 110 degrees C as at room temperature; the diaphragm be air tight, not absorb moisture, and be able to withstand vibration and shock common to airborne apparatus; production models of the diaphragm possess a high degree of uniformity.

A new radar coupler developed by the Company's Air Arm Division combines the abilities of the fire-control radar system with the W3A autopilot. Once the radar has picked up a target, it directs the autopilot, which then proceeds to align the fighter plane for the kill. When the pilot presses a button, rockets are launched automatically as soon as the enemy craft is in range. An indicator system then advises the pilot to bring the plane out of the attack to prevent collision.

A dime-sized gyroscope motor has been designed by Westinghouse for application where space is at a premium—on the moving antenna of aircraft fire-control radar. The "inside-out" synchronous motor has a tiny wound stator; the rotor is also the inertia wheel of the gyroscope. This inside-out design, common to gyroscope motors, permits an element with a large polar moment of inertia to be built into a small space. The 2-phase, 400-cycle motor operates on less than a volt per phase, and revolves at 8000 rpm. The gyroscope measures the angular movement of the antenna, enabling computers to calculate firing information.

Another development of the Company's Air-Arm Division was a magnetron power supply for conventional magnetrons (such as the 4J50) used in radar systems. It is composed completely of static parts—saturating reactors, linear reactors, and capacitors. Operating as a pulse modulator, it supplies 400 or 800 pulses per second, with pulse widths from a fraction to several microseconds. The new device is designed for airborne radar applications where conventional tube modulators cannot pass vibration and shock specifications.

In the field of transistors, Westinghouse expanded its available products during the year. The Company announced that three new germanium PNP junction transistors were available from the Company's Electronic Tube Division.

The transistors (Types 2N54, 2N55, and 2N56) are designed for low-power, low-frequency amplifier applications. Each is capable of dissipating 200 milliwatts at 25 degrees C. All are provided with leads for wired-in installation. The average cutoff at the 6-milliwatt power level is 500 kilocycles.

The average current gain of the transistors are: 2N54—0.97; 2N55—0.95; 2N56—0.92.

A new lubricant, formulated solely of silicone monomers, with no additives, was undergoing trial by Westinghouse Research engineers during the year. The tests at year-end indicated from 100 to 200 degrees Fahrenheit greater range in thermal stability. It was tested to loads above 2400 pounds per inch of gear tooth face, exceeding the military specification requirements by more than 700 pounds.

During the year Westinghouse engineers were designing a 4000-horsepower d-c motor to drive a stand used for testing helicopter blades, the largest vertical d-c motor ever built by Westinghouse. It is quite similar to vertical waterwheel generators, having a thrust bearing at the top and a guide bearing at the bottom. It was being designed so that the power on this test stand can be subsequently doubled by adding an identical motor in tandem with this first unit.

Helicopter blades must not be subjected to sudden accelerating torques, especially at slow speed. In addition to a "soft" start and smooth control over the entire operating speed range (125 to 275 rpm) extremely accurate positioning of the rotor blades for adjustment is necessary. The control can index the shaft within two degrees over a sector of 45 degrees.

In 1954 the aircraft department of the Small Motor Division completed a four-engine mock-up facility for aircraft a-c electric power systems that is larger, more flexible, and can duplicate more conditions that might be experienced in flight. It incorporates hydro-mechanical, constant-speed drives commonly employed in aircraft. The motors that supply the primary power are each of 200 hp, enabling alternators of 90 kva to be tested. Provision is made for quick set-up of a system. Instrumentation is extensive, of permanent type, and is supported with oscillographs, oscilloscopes, and recorders. Meter readings can be recorded photographically—a necessity in view of the 60 instruments employed. Special provision is made for simulating the more common system faults. Such situations as an alternator slipping a pole can be created and the results measured.

A specially-designed vacuum-treating equipment is used for Fosterite impregnation of transformers and other components at the Westinghouse Air Arm Division. Fosterite-treating improves heat dissipation and dielectric properties of the component, and renders it impervious to atmospheric conditions.

The Fosterite process was developed to give airborne electronic equipment maximum environmental protection with a minimum of size and weight. An outer coat of highly-viscous resin is applied and cured; the impregnating resin is then introduced under vacuum to provide complete filling.

The aircraft department of the Small Motor Division now has a bearing tester possessing several novel features. It provides for independent variation of four parameters: load (both thrust and radial), speed, temperature, and vibration.

A horizontal table has space for two sets of 24 bearings. The table is spring-mounted so that its own natural frequency is low. A circular vibratory motion (similar to that experienced in aircraft service) is imparted to the table by a motor driving through a connection with an unbalanced weight. A force of 3380 pounds at 10,000 rpm can be developed. Eleven different frequencies from 86.4 to 287.5 cycles per second are obtainable.

While the tester is not yet fitted for supersonic research, it will reproduce the other environmental conditions likely to be encountered on aircraft. To isolate the effect of temperature, one set of bearings can be held at any convenient temperature while that of the set is varied at will up to 160 degrees C, all other conditions of load, speed, and vibration meanwhile being held common.

Westinghouse dime-size motor

Another research tool completed last year by the aircraft department of the Small Motor Division was a high altitude chamber that can duplicate conditions of 65,000 feet on a 120-kva machine or 80,000 feet on one of 90 kva. For some equipments altitude equivalents of 100,000 feet are possible. The new quarter-of-a million dollar high-altitude laboratory can not only carry the temperature down to —55 degrees C, but also up to 120 degrees C. Thus, rotating machines can be subject to a temperature range of 175 degrees C (314 degrees F.)

Another new research tool of the aircraft department was a new feedback test stand devised to meet the requirements of large aircraft alternators. Alternators are now tested in pairs, loading one against the other, so that the total energy supplied is only that of their combined losses. A 100-hp d-c motor drives a gear with two output pinions, one to drive each flange-mounted alternator. The flange-mounting plate for one, however, can be rotated through several degrees by a small motor driving through a gear. Thus the phase difference between the two machines on test can be varied continuously. Since torque depends on phase difference, any desired real load up to about 300 horsepower can be applied. Power factor is varied by changing excitation, instead of using large, expensive, and unwieldy reactors.

PROPELLER MANUFACTURERS

Aeroproducts Operation, Allison Div.

General Motors Corp.

Dayton, Ohio, has experienced a year of increasing activity in the development of propellers for turboprop aircraft. Significant progress in turboprop development was made in 1954 with the successful flights of the converted Convair 340 to the Air Force C-131C equipped with Aeroproducts propellers, powered by Allison T-56 turbine engines. Over 200 hours of multi-engine flight time have accumulated on propellers on this installation, which is the first Air Force sponsored turboprop on flight status. Also, 1954 brought the total propeller flight time to nearly 1000 hours on the Allison Turboliner, the first American commercial turboprop, which has proven the practicability of the turboprop aircraft. Aeroproducts is supplying contra-rotating turbo propellers for the Convair R3Y Tradewind, the Navy's first turboprop seaplane transport, powered by four Allison T-40, 5500 eshp turbine engines. Other turbo propellers are under development at Aeroproducts, and recently a new model for another Air Force installation has passed engineering tests at Wright-Patterson Air Force Base.

Although considerable emphasis has been given to development of turbo propellers, Aeroproducts has continued to supply propellers for the Air Force Fairchild C-119 "Flying Boxcar," the North American T-28 trainer, and the Navy's Douglas AD series carrier based aircraft.

There has been a continuing program at Aeroproducts of manufacturing self-locking hydraulic actuators, with an electric emergency drive, for installation on the Republic F84F jet fighter. The emergency electric feature of this actuator enables pilots to trim the "flyable tail" and safely land their aircraft when failure of the aircraft hydraulic system occurs.

Delivery of Aeroproducts Synchronized Linear Hydraulic Actuators also began in 1954. These actuators are installed on jet engines of undisclosed design to operate variable exhaust orifices, and on the air inlet doors of a ram-jet engine. Four units are required on each engine, and will operate in synchronized travel regardless of the load differential at each actuator. Aeroproducts synchronized actuators include the special features of low inertia of synchronized parts, and the lubrication of moving parts by the operating hydraulic fluid. Infinitely variable positioned brakes can be incorporated into actuators of this design to provide fail-safe systems or controlled locking. This brake enables aircraft engineers and designers to provide emergency actuator operation by incorporating a pneumatic override system.

Air Driven Emergency Generator units which are lowered from fuselages of aircraft during emergency electrical power failure are now being manufactured by Aeroproducts Operations for installation on the Navy Douglas A4D Skyhawk. These generators were designed to meet the aircraft industry's need for a dependable yet light weight emergency electrical power source.

Aeroproducts air driven generators consist primarily of two bladed variable pitch windmills. A simple fly-weight-type governor maintains a constant RPM of the generator rotor by mechanically changing the pitch of the propeller blades. This governor maintains a constant RPM of the generator rotor by mechanically changing the pitch of the propeller blades. The governor mechanism is entirely mechanical and does not rely on the electrical system in any way for its operation. When extended into the airstream, the blades unfeather automatically and the generator accelerates to the designed speed in less than five seconds.

An increase of 9000 square feet in the manufacturing area was under construction at Aeroproducts. Requirements for this expansion became necessary following contracts for additional propellers for installation on Air Force C-119 Fairchild "Flying Boxcar" and the Navy Douglas AD carrier based aircraft.

Hamilton Standard Div.

United Aircraft Corp.

Hamilton Standard's operations during 1954 were marked by continued growth of its aircraft equipment business, expansion of its experimental and production facilities, delivery of its first production turbine propeller, the Turbo-Hydromatic, and continued production of its Hydromatic propellers for commercial and military aircraft.

In the commercial propeller field deliveries of the 43E60 reversing Hydromatics continued for Douglas DC-6A's and DC-6B's, Convair 340's and Lockheed 1049 Super Constellations. Also important, commercially, were deliveries of 34E60 reversing Hydromatics for Douglas DC-7's and

DC-7C's and 22D30 Hydromatics for Beech D-18's. During the year the entire modern DC series (DC-6 and DC-7) as well as the Boeing 377 Stratocruiser series became 100 percent equipped with Hamilton Standard propellers.

In the military field, propellers were in production for the Lockheed C-121C, R7V and other versions of the Constellation; the R6D and C-118 versions of the DC-6; the Boeing KC-97F, the Fairchild C-123 and the C-119F version of the Packet; the North American AJ-2 and T-28B; Lockheed P2V, Grumman S2F-1, UF-1 and SA-16A; Consolidated Vultee C-131A, and T-29B, C and D, and the Martin P5M.

Production was resumed of the old 12D40 controllable counterweight propeller which was first designed and produced in 1933. The re-order was for replacements for Air Force and Navy trainers.

Delivery of the first production Turbo-Hydromatic propellers was of major significance. Backed up by an exhaustive laboratory and flight test program at Hamilton Standard, the Turbo-Hydromatics were installed on the Lockheed R7V-2 Super Constellation. They helped give the R7V-2 a cruising speed of 440 mph, making it the world's fastest propeller-driven transport.

During the year, Hamilton Standard continued to produce air conditioning systems, refrigeration units, starters, fuel controls, hydraulic pumps and valves for major manufacturers of turbine engines and aircraft. Thirty-eight different aircraft models were using one or more of the division's equipment products.

Among the turbine aircraft for which Hamilton Standard equipment was either in production or on order: Boeing B-52, C-97J, 707; Canadair F-86E; Chance Vought F7U-3, F8U; Convair F-102, R3Y, YC-131; Douglas B-66, A3D, F4D, A4D; Grumman F9F-9; Lockheed F-94C, C-130; McDonnell F3H; North American F-86D, FJ-2, 3 and 4; F-86H, F-100.

Among the engine builders using the division's equipment items were Pratt & Whitney Aircraft, Wright Aeronautical, General Electric, and, in Canada, A. V. Roe.

In England, deHavilland received its first production order for its version of a Hamilton Standard air conditioning system, for which licensing arrangements were completed in 1953. The system will be used in a new Royal Navy Supermarine carrier fighter. In addition, deHavilland, which has been building Hamilton Standard propellers under license for over 20 years, last year signed a license to manufacture Hamilton Standard Hydromatic pumps.

Construction of a two-story addition to Hamilton Standard's pneumatics laboratory was completed and operations were in full swing in the new structure by the end of the year. The steel and concrete building doubles the floor area available for the division's research and development in pneumatics. It houses highly-specialized equipment reflecting the growing demands imposed on aircraft air conditioning and pressurization systems and starters by the jet age and by the widely-varying operating and climatic conditions under which such equipment is used.

Among the test devices in the new structure: A sand and dust test chamber, a shock test rig, a centrifuge (for whirling parts on a beam to simulate tight turns and pull-outs of jet aircraft), a spin pit (for whirling turbine rotors to destruction), a simulated jet plane cockpit, an altitude chamber, an environmental chamber (to simulate various conditions of climate throughout the world), an electronic vibration machine (for fatigue testing of air conditioning equipment), four air conditioner test booths and five valve test rigs.

Also completed during the year was a 60,000 square-foot addition to the factory. One section of the addition will house two huge tube-reducing machines and a hot form press with ten times the capacity of the division's present steel blade equipment. A branch plant was opened in nearby Broad Brook, Connecticut, in facilities purchased from the Broad Brook Company, a textile firm. Situated in the plant are a variety of machining and inspection operations, most of them of an experimental nature; electronic experimental and assembly work, and engineering drafting. Employment remained at about the 8,000 mark throughout the year.

ACCESSORY MANUFACTURERS

The **Aero Supply Mfg. Co. Inc.,** Corry, Pennsylvania, 38-year-old manufacturer of aircraft hardware and components, closed 1954 operations with a new president and a new board of directors, and with a substantial rise in sales as a result of these moves. William H. Coleman moved into the presidency of the firm last April following the new board's election of company officers.

In 1953, sales for the first six months were $3,018,000, jumping to $3,850,000 for the same period in 1954.

The installation of an incentive system, which hiked the plant's production; the inception of an aggressive public relations program which is acquainting the industry with Aero's potential, and a vast improvement in labor-management relations contributed to the firm's better business outlook.

In an effort to encourage new thinking in the fields of aircraft fuel systems and fuel system components, the company in 1954 announced the inception of the Aero-Corry Research Award competition, open to all students in accredited engineering colleges and universities in the United States and Canada. The competition is designed to attract new ideas and to engender an interest in the plant among potential young engineers.

Major new-product advance by the firm this year was the acquisition of the manufacturing rights to the Eckel valve, a recent development of V. W. Eckel of Northridge, California. Under the agreement Aero Supply will manufacture and sell a unique solenoid-operated shutoff valve about one-half the size and weight of most conventional type units.

Also in the field of new developments, Aero Supply has moved to eliminate the shortcomings of conventional flapper valves. The company's engineers have developed new type valves which act as flappers only when their action is needed, during flight maneuvers of the aircraft and in case of occurrence of forces which would cause undesirable movement of fuel in tanks. On the ground, however, during the level movement of the aircraft, or under other preselected conditions Aero Supply's new valves remain safely locked in the open position and permit unrestricted fuel flow in both directions. The tanks can be fueled at the downstream side of the valves without the danger that the valve will be sucked into the closed position.

Ultrasonic research and development was the chief activity of **Aero-projects, Inc.,** West Chester, Pa., during 1954. Successful accomplishments in this field caused the company to expand its facilities to 15,000 square feet of floor space, a 150 percent increase over the previous year.

The most important phases of the programs were the application of ultrasonic energy at power levels in metallurgical problems and in emulsion manufacture. Of particular significance was the development of ultrasonic soldering equipment known as Sonobond which makes it possible to solder a variety of metals without the use of flux.

Ultrasonic soldering of aluminum also offers new weight-saving possibilities. With a practical means for soldering aluminum, steel and other metals can be replaced by aluminum.

A wide range of Sonobond equipment has been developed, from small hand models to heavy industrial units. Successful techniques have been developed for using this equipment to solve production problems.

Air Associates, Inc., Teterboro, N. J., designer, manufacturer, and distributor of aircraft products and electronic equipment, expanded its activities to new market areas in 1954 with the establishment of an international division. The new division will act as a central export sales agency for the other company divisions.

During the year, the company unveiled facsimile equipment which transmits and receives any printed or written matter over telephone or microwave circuits. Specially designed to speed-up inter/intra plant and office communication as well as record duplication, this electronic messenger delivers copies of any material up to 8½ x 14 inches in a matter of minutes.

Air Associates also introduced a new low-cost Aerotron line of radio and navigation equipment.

The company's product research and development program included such projects as a newly designed pneumatic valve which restores to a jet pilot the instinct-guiding feel in his automatic power controls; a test stand to check and trouble shoot pneumatic valves; a compact valve system capable of withstanding high temperatures and pressures; a complete line of lightweight, high performance 400-cycle (a.c.) motors; and several other products.

Outstanding events for the **Aircraft Radio Corporation,** Boonton, N. J., during the year included: choice of ARC radio by Navy and Air Force for their new primary trainer, T34; by the Air Force for their new intermediate twin jet trainer, T37; and by the Indonesian Air Force for their light aircraft.

The 430 employees of the corporation continued during the year to

Alcoa's 14,000-ton extrusion press

manufacture airborne and navigation equipment and associated test equipment for both military and commercial uses, with over 80 percent of the work being military. Sales for 1954 totaled $8.2-million.

In 1954, **Aluminum Company of America** developed: a new super-strength aluminum forging alloy; new facilities for producing big forgings; the world's largest extrusion press; and a giant rolling mill for the production of tapered sheet. During the year, Alcoa's production of primary aluminum increased over 8 percent.

Probably the most important development of the year was the addition of an extrusion press of 14,000 ton capacity. During the spring of 1954, production was initiated on the 14,000 ton extrusion press at Alcoa's Lafayette (Ind.) works. This unit, which extended greatly the size of extrusions available, was the first major press to begin operations under the Air Force Heavy Press Program. The press can produce an extrusion having a finished weight as much as 2500 lbs. and at the same time measuring as long as 110 ft. The size that can be produced in that length has increased with the operation of the 14,000 ton press from 5.4 lbs. per foot to 22.7 lbs. per foot.

In combination with the 14,000-ton press, Alcoa installed a giant, 180 ft. long stretcher with a pulling capacity of 3,000,000 lbs. This unit can stretch-straighten extrusions long enough to finish at 110 ft. after cutting off grip marks.

For the past three years Alcoa has been operating a 15,000-ton forging press at the company's Cleveland (O.) works. Late in 1954, this unit was joined by a big 8,000-ton press. In the spring of 1955, two presses having 35,000 and 50,000-ton capacity were to be added.

Larger forgings from these giant presses will help provide an increase in the size of one piece aircraft structural components. A section made in one piece rather than one assembled from smaller components provides savings in assembly costs and weight in combination with better strength.

Alcoa also developed a new aluminum forging alloy, X7079, during the year. Alloy 7079 allows an improvement in the transverse ductility in heavy sections with strengths comparable to those of 7075 (75S). Because this new alloy develops these properties in heavy forging (over 3 in. thick) cross sections, it will be particularly valuable for use in the big forgings that will be produced on presses of the 50,000 or 35,000 ton class. The better uniformity of properties in heavy sections is made possible because X7079 is less quench sensitive than 7075. These factors allow forgings to be delivered after heat treatment with normal guaranteed properties in sections up to 7 in.

Another advance achieved by Alcoa for its aircraft forgings was an improvement in tolerances offered. Press forgings in general are now available with very low draft angles (often 0° is possible). Design proportions have been cut by 25 to 50 percent.

The expansion of the company's Vernon (Calif.) works was accompanied in 1954 by another west coast expansion at the Vancouver (Wash.) works where a new extrusion plant was put into operation.

Alcoa kept pace with demand for larger tapered sheet and plate during 1954 by initiating production on a big 144 in. tapered sheet mill at its Davenport (Ia.) works. The giant mill, leased to Alcoa by the Air Force, is capable of rolling tapered sheet and plate up to 10 ft in width.

During 1954, the company installed facilities at all of its five foundries for the production of castings under the Alcoa Plaster Process. This marked the perfection of the new process for large scale production.

In 1954, **Anderson, Greenwood & Co.** continued to expand its military business, accelerating design and fabrication of ground handling and launching equipment for pilotless aircraft, and initiating a contract involving jet-assisted projectiles.

Ground handling and launching equipment for pilotless aircraft proved to be a large project requiring investigation into complicated problems resulting in simple and economical solutions. Company high speed testing facilities were built in developing a private project, jet-assisted projectiles, for which, after two years of work, a government feasibility contract was received.

During development of high pressure ground equipment for pilotless aircraft, it was noted that in certain instances no accessory equipment was available to satisfy certain high pressure requirements. In solving this problem, the company developed valves, dessicators, and quick-disconnects that are now in production for both commercial and airborne use.

Engineering modification of B-47 aircraft, in process since 1952, was continued in 1954 for the Wichita Division of the Boeing Airplane Co. Complete engineering changes were handled both for aircraft on the production line and aircraft in service, for which kit changes were designed.

For **Avien, Inc.,** Woodside, N. Y., 1954 was marked by introduction of the company's Gravimetric Flowmeter. Requiring only a single wire between transmitter and indicator, and eliminating the necessity for intermediate power units, the system features true mass flow measurements for either integrated or rate indication, with totalizing available for multi-engine application.

Adapting its capacitance type fuel gage to the problem of gaging liquids under extremes of temperature and pressure, Avien also introduced its Liquid Oxygen Gage, bringing previously unattainable accuracy and system simplicity to the function of measuring breathing oxygen.

The company's Exhaust Gas Thermometer made available accuracy approaching that of laboratory equipment through the application of Avien's d-c reference source and cold junction compensation, and use of servo-driven, long-scale indicator.

Other new products introduced during the year included the Thervel Liquid Level Switch and Remote Position Indication Systems.

In fuel gage manufacture, Avien continued its program of simplification and weight reduction with the full scale production of its two-unit system, including lightweight 2-tube tank units, single package indicator-amplifiers, and its moisture-proof subminiature connectors.

Production during the year averaged 1500 systems per month; plant and administrative employment totaled 550. Manufacturing and engineering floor space reached 80,000 square feet. Engineering facilities were expanded with the formation of a subsidiary, Control Laboratories, Inc., to carry out basic research and development on servo systems and controls. The company's customer service activities were enlarged wtih the formation of Avien Service Corporation of California, at Culver City, California, to handle sales engineering and technical service for the West Coast area.

The BG Corporation, Ridgefield, New Jersey, during 1954 developed a new spark plug for installation in all of the current engines requiring a long-reach shielded spark plug. This development is a departure in design from current non-platinum aircraft spark plugs to provide excellent durability and performance. Testing to date has indicated promising results, and early approval is anticipated. Platinum electrode spark plugs are continuing in production at a high level.

BG also continues to manufacture ceramic terminal sleeves and spark plug and ignition harness test sets for use in conjunction with piston engine operation.

In the gas turbine engine field The BG Corporation is concentrating heavily on the development of igniter thermocouples and thermocouple harnesses for all of the major gas turbine engine manufacturers. Of special interest is the further success with the development of the semi-conductor igniter for use in conjunction with low tension capacitance discharge ignition system. New also is a vaporizing igniter for use in gas turbine engines utilizing low grade fuel oil.

In the field of gas turbine thermocouples and thermocouple harnesses, BG has now developed an integral thermocouple and harness assembly which is light weight and durable.

For the Electronics Industry, The BG Corporation has increased its line of special ceramics and is in large scale production on high alumina ceramic hermetic seal terminals and bushings in a variety of sizes.

At **Bendix Aviation Corporation's** Eclipse-Pioneer Division in Teterboro, N. J., 1954 activities were varied and rapidly being adjusted to a competitive peace-time level.

Product activity at Teterboro continued to emphasize research and development in the fields of air turbine-driven accessory equipment, automatic flight systems, airborne precision components, and flight, engine and navigation instrumentation.

One area of research to which considerable effort was directed during 1954 was a Vacuum Tube Reliability Control Program aimed at the elimination of defective and potentially short-lived electronic tubes destined for critical airborne applications. The program provided data relating to the rate of change of prime criteria from which life expectancy computations could be made.

One of the most heavily-stressed areas of development during the year was Eclipse-Pioneer's air turbine-driven accessory program. By the end of the year an ever-widening variety of turbine-driven equipment was coming from Eclipse-Pioneer's development laboratories and being processed through the Division's expansive Air Turbine Facility. One of the developments to come out of this program was an air turbine starter for turbojet and turboprop engines which pioneered the use of titanium turbine wheels.

Other new turbine-driven units included a standby power supply for gyro flight instruments. Operable by either air pressure or vacuum, the unit developed 100 watts of 115-volt, 400-cycle power, included frequency regulation of $\pm 5\%$ and was capable of starting and operating as many as four gyro flight instruments. In a late stage of development was an afterburner fuel pump and metering system by which afterburner performance in jet aircraft could be modulated.

Included among the turbine-driven units which were in production as the year came to a close were such items as afterburner fuel pumps, water alcohol pumps, in-flight refueling pumps, and lightweight 9 and 15 KVA constant speed generators.

Long a leader in the manufacture of gyros, E-P placed substantial emphasis during 1954 on various levels of gyro development and improvement. A gravity shift erection system was also developed in E-P's gyro laboratories for use on various gyro flight instruments, including E-P's new remote attitude indicator system, reverse sphere attitude gyro, and vertical gyro transmitter.

On May 18, a flight under the guidance of a completely transistorized autopilot system was made in the Division's B25 Flying Laboratory. During April of the same year a completely transistorized autopilot system was delivered to the Air Force for evaluation in high performance aircraft and by year's end it had undergone numerous ground tests and installation checks.

Development of a PB-20 autopilot, representing a completely new design philosophy, was completed, and an executive autopilot, similar in design to E-P's PB-10 commercial autopilot, but lighter in weight and developed particularly for executive aircraft, was being readied for production. Earlier in the year Eclipse-Pioneer also made delivery of an autopilot for use on the Lockheed-built Vertical Take-off Navy fighter.

During 1954, the Pioneer-Central Division of Bendix Aviation Corporation at Davenport, Iowa, was made completely autonomous in the sales, service, design, and production of oxygen equipment. Production of oxygen regulators and liquid oxygen converter systems was steadily increased during the year and intensive development continued on new types of oxygen breathing equipment.

Production and development of gyro equipment and fuel flow transmitters continued with the start of production of several new models.

Ultra-sonic cleaners, originally developed to meet the microscopic cleanliness requirements of breathing oxygen equipment and other products of this Division, were put into production for sale to other organizations.

The Hamilton Division of Bendix continued manufacturing jet engine fuel controls, flow dividers, aircraft carburetors, fuel pumps and other aircraft engine accessories requiring precision manufacturing techniques and extensive testing. In addition, a program of overhaul of jet engine fuel controls was initiated.

The Engineering Department of this division continued to develop jet fuel controls for engines in the low thrust class and on fuel and hydraulic pumps for both aircraft and missiles.

Up-to-date engineering facilities were provided in a new building with complete and modern laboratory equipment for development of engine and related components. The laboratory equipment includes a jet engine test cell for jet engines up to 5,000 pounds thrust and dynamometer equipment for pump development having power requirements up to 150 horsepower.

The gasoline filter manufactured during the year by the Bendix-Skinner Division is a filter and water separator used for gasoline and propellant fuel. The filter consists of a single demulsifier element and 12 filter elements mounted in a fabricated tank.

The tank assembly is welded nickel and copper alloy construction. A mounting plate is welded around the inside diameter of the tank to support the 12 filter elements. The lower portion of the tank forms a sump for collecting water, and pressure gage connections and vent valve are provided near top of tank.

The cover assembly contains a 2-inch inlet flange, Navy Standard B-176, and a vent valve and pressure gage connection. A sump gage assembly is provided for observation of the water level in the sump.

The demulsifier assembly consists of a pleated demulsifier element assembly filled with fibre glass and a nickel and copper alloy housing.

Each filter element assembly consists of a pleated element, spring and retainer, buffer plate, mounting ferrule, and gasket.

Four mounting brackets are welded to the outside of the tank.

Backwashing, or reversing the flow, may be used to remove accumulation of solids from the 12 filter elements.

A new Aircraft Temperature Indicator was developed by the Friez Instrument Division of Bendix which is especially suited to temperature indications of metal surfaces, carburetor air, cabin, cockpit, radome, and engine intake air. All can be shown on a single dial connected to a multipoint selector switch.

It is unique in that Thermistors are employed as the temperature sensing elements. The Thermistors can be made in various sizes and shapes. The sensing element, consisting of two pellet-type thermistors, is for surface temperatures. The indicator itself is compact, weighing less than one pound, and requires no amplification.

The indicator consists of a standard aircraft panel meter with a complete bridge circuit and power supply built into the back of the meter. The unit can be provided with a regulated voltage supply built in if required.

Bendix-Pacific increased its engineering facilities in 1954 with a new 23,000 square foot building. Several engineering achievements were added to the Bendix-Pacific hydraulic, electromechanical and electronic product lines.

A new self-displacing accumulator was developed to eliminate operational handicaps in remote installations and in closed loop aircraft surface systems. The accumulator incorporates double chambers and double pistons joined by a piston rod. Half the unit operates as a conventional accumulator while the second half acts as a displacement sump. The accumulator enables faster operation of powered flight controls with a reduction in size of pressure and return lines to remotely located servo valves.

A new line of high response servo valves for guidance systems of both missiles and aircraft also was developed. The small valves weigh less than a pound, are capable of operating on 8 milliamperes maximum differential current, and have a rating of approximately 10 horsepower.

A telemetering system using transistors was successfully developed and flight tested. A complete 3-band telemeter including the transmitter can be packaged in a cylinder 1 inch in diameter by 6¼ inches long.

The Electro-Span system of digital control designed for remote measurement and control functions such as shaft positioning, on-off switching and proportional control was released by the division during 1954. This system may be used in conjunction with any electrical transmission medium, including VHF radio, telegraph lines and microwave links. Voice communication can be time shared with telemetering and control where voice channel band-width exists. Operation of a true digital system such as Electro-Span is unaffected by such transmission vagaries as distortion, frequency drift or phase shift. Accuracy and resolution of a ten digit system is 0.1 percent.

Several new aircraft products, resulting from recent research and development programs, were in the production stage at the Bendix Products division, at South Bend, Ind., during the year.

Torque link power steering was produced for carrier based aircraft. Cerametallic brake lining had both military and civilian usage, and fuel metering controls were supplied for use on many of the newer, more powerful jet engines.

Direct fuel injection has been adopted on the new turbo-compound engines being used on the DC-7, Super Constellation and other airplanes. Direct injection equipment is also used on military planes such as the B-29's, B-50's and B-36's.

Bendix continued its fuel metering research and development activity including hydraulic mechanical improvement, electronic and magnetic applications and combinations. The Bendix approach is for complete systems including tail gate actuation, afterburner control and modulation, primary engine control with twin spool applications, variable inlet guide vanes, and so on.

This activity is supported by efforts for better engine instrumentation and engine analysis work such as the universal control or knob box applications. Basic development work was, in most cases, completed and engine type tests and airplane flight test were conducted.

Bendix Radio Division reported that the new Bendix RDR-1 airborne radar system for weather mapping and navigation was demonstrated for the first time at the annual meeting of the Aircraft Writers Association in Miami in June. The system, designed especially for airline and private aircraft use, was the first commercial one to be marketed in the country.

The RDR-1, weighing less than 137 lbs., was engineered to a specification prepared by the ARINC Airlines Electronic Engineering Committee, except for the frequency of operation. Instead of the specified frequency of

PPI Indicator on Bendix Airborne Radar System

5400 mc (5.7 cm), Bendix Radio engineers chose 9300 mc (3 cm) or "X" band radar for the RDR-1.

In addition to the radome, which is not supplied by the manufacturer, five major units comprise the system: nose-mounted antenna scanner, control unit, PPI indicator, synchronizer-amplifier-power supply, and transmitter-receiver. The indicators and the control unit are normally available in the cockpit, while the remaining units are mounted in the radio rack.

RDR-1's gyro-stabilized antenna scans 360 degrees, utilizing a pencil beam which will present an angle up to 120 degrees to either side of the aircraft's heading, depending upon the configuration of the plane's leading edges.

Maximum range of the radar sweep is 150 miles. A switch on the indicator permits the display of ranges of 0-20, 0-50, or 0-150 miles. Range markers provide calibration at 5, 10 and 25-mile intervals respectively. An antenna tilt control provides adjustment of the beam elevation angle over a 30-degree range.

While designed primarily for weather purposes and as a storm warning device, RDR-1 has provisions for ground beacon navigation and terrain mapping.

While the A.C. power consumption is given for single-phase condition, the equipment can be used with single-, two- or three-phase supplies. The unit transmits on 9375 or 9255 mc., with a peak power output of 40 kilowatts, a PRF of 400 cps, and a pulse length of 2 microseconds.

The antenna rotates continuously at 15 rpm. Horizontal polarization is used and stabilization of the antenna may be maintained by use of the plane's autopilot gyro, or from a separate gyro if the plane is not equipped with an autopilot.

The Bendix ADF-70 radio compass receiver, also announced in 1954, was designed to replace previous Bendix receivers insofar as function is concerned. It requires only a ½ ATR mounting space and will be considerably lighter. Approximately 20 tubes are employed, all of which are miniatures, except the rectifier.

The LPA-70A flush-mounted loop antenna for the Bendix ADF system went into production in October. Another new product added to the list of Bendix Radio devices was the SCL-3 Selective Calling System.

The new ASR-3 airport surveillance radar and the PAR-2 precision approach radar, GCA equipment designed and built for installation by the CAA at major airports during the year, was also sold abroad by the Bendix Aviation Corporation.

During 1954 the Bendix Red Bank Division completed developments in the field of special purpose electron tubes and aircraft electric power generating and regulating system components. One was the mass production of a new Hard Glass Miniature Beam Power Amplifier RETMA 6094. This tube has been ruggedized to withstand extreme stress conditions and with an envelope of hard glass, it will operate at a bulb temperature of 572 degrees Fahrenheit for a minimum of 1000 hours as compared to 356 degrees Fahrenheit for present tube types employing soft glass. The hard glass feature will help to break aviation's heat barrier created by high operational bulb temperatures and limiting space factors.

Red Bank has also developed a line of high temperature (type C) AC Generators designed for high speed high altitude military aircraft. Generators in a range of 20, 30, 40 and 60 KVA have been qualified. Complete systems including Feeder Fault Protection have also been designed for the generators and regulators are of the mag-amp (static) type with no moving parts.

Red Bank also developed during the year a 2500 VA Inverter incorporating mag-amp (static) regulators for both voltage and frequency control. This represents the first high output Inverter with static regulators capable of withstanding the extreme vibration and shock conditions encountered in missile operations.

The Bendix Scintilla Division produced in 1954 a new jet engine ignition system known as the TMGLN. This system differs from the conventional design in that electrical energy is provided by the system itself and not from an outside source.

A magneto is provided in the TMGLN system to generate the required electrical energy. This ignition system is standard equipment on the Curtiss-Wright J65W-4 engine.

New applications have been developed for the miniature jet ignition systems which are being used on air generators, aircraft heaters, auxiliary power units, compressors, and gas purge generators.

A high temperature electrical connector was developed by the Scintilla Division that provides a positive fire barrier for at least 20 minutes, and uninterrupted power for at least five minutes, when vibrated during exposure to a 2000 degree Fahrenheit flame.

Pesco Products Division, **Borg-Warner Corporation,** Bedford, Ohio, continued its development of aircraft fuel and hydraulic pumps and special application electric motors during 1954.

Introduced during the year was a line of small centrifugal fuel booster pumps for guided missiles, helicopters and executive aircraft. A new type line mounted centrifugal fuel transfer pump was also made possible by a new concept of impeller design, which provides fuel flow through long inlet lines and is instantly self-repriming in the event the inlet becomes uncovered during maneuvers.

A plug-in type fuel booster pump was made possible by the new impeller design. Mounted in the side of the fuel tank with an inlet line extending into the sump, the pump may be removed from a fuel tank without loss of fuel. This pump is self-priming and is equipped with a Pesco designed and built 400 cycle AC motor. For minimum weight, there is no seal between the pump and motor, and the motor runs full of fuel.

Pesco's gear type pressure-loaded pumps kept pace with jet-engine development in their requirements for high pressure fuel. Latest developments incorporated three gear-type high pressure pumping elements and a centrifugal inlet booster in one housing with all of the necessary valves and filters.

In the field of hydraulics, Pesco continued development of Cartridge Pumps for propeller governors and guidance servo controls. These pumps provide pressures to 3000 psi without the necessity of drive shaft seals or external connections.

A high speed hydraulic pump was developed especially for guided missiles. Operating at 12,250 rpm, the pump is rated at 2.4 gpm at 3000 psi discharge pressure pumping hydraulic fluid at 250° F., yet weighs only 3 pounds.

Late in the year, the opening of Pesco Pacific Service Center in North Hollywood, California, was announced. This facility was expected to be in full operation by the beginning of 1955.

Boston Insulated Wire & Cable Company of Boston, Massachusetts, during 1954 supplied the 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 exceed 100 degrees Centigrade.

BIW Type PFGGV-600 was 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 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. Development work also was carried out 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 was an important project at the company with production of 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.

An entirely new design of electrical wiring for guided missiles was developed by the company in 1954 and after long periods of testing by the missile manufacturer, this cable was chosen as the most satisfactory to withstand the very unusual service conditions of extreme heat and cold as well as other rigid requirements. Production facilities were set up and production established in the necessary quantities of this cable.

Plastic coated leads and wiring harness have been developed for use on ground radar equipment, missiles, sonar equipment, and other such applications. These leads and harness are thoroughly resistant to fuels, oil, ozone, acids, tearing, age, abrasion, moisture, fungus, and flame. The design of this equipment permits convenient adaptation to new installations.

The **Connecticut Hard Rubber Company,** New Haven, Conn., during 1954 developed new constructions for low temperature and high temperature resistant silicone rubber coated fabrics using glass cloth, Nylon, Orlon and Dacron as base materials. In addition, a line of fire resistant silicone rubber coated glass cloth found increased applications as fire wall seals and duct covering.

Activity was stepped up in extruded silicone rubber seals and fabric covered silicone rubber and silicone sponge rubber seals for heavy duty applications. Cohrlastic HT, a silicone rubber compound with double the tensile strength and abrasion resistance of commercially available silicone rubber, was announced during the year. A silicone rubber inflatable cockpit seal was also developed.

Work in electrical de-icing and heating continued at a high level in 1954 with the development of heating elements laminated and sealed between metal skins.

The **Dow Chemical Company** of Midland, Mich., in addition to being a supplier of primary magnesium metal and alloy ingot to various aircraft foundries and other magnesium fabricators, produces magnesium sheet, extrusion, and tooling plate. This material is produced on 4-hi coil mills ranging from 18 inches to 84 inches wide and extrusion presses ranging from 1700 to 13,200 tons. At Bay City, Mich., the company operates a magnesium foundry and a fabrication plant in which aircraft assemblies and airborne equipment of magnesium are produced. A magnesium die casting plant and research laboratory facilities are located in Midland, Mich.

Dumont Aviation Associates, Long Beach, Calif., manufacturer and distributor of aircraft hardware and hydraulic fittings, operated under Air Force surveillance single cognizance inspection in 1954. Dumont manufactures their own aircraft bolts, screws and rivets, and during the past year acquired additional facilities for manufacturing to government and manufacturers' specifications.

Production at **Fletcher Aviation Corporation**, Rosemead, Calif., continued throughout 1954 with jettisonable fuel and napalm tanks as the main product. Sales for 1954 were $18-million and employees averaged 750.

A 123,000 square-foot factory building was completed and by year-end, work was being done in the new factory. Adjoining the factory is a 3,000-foot airport. A new lift slab 60,000 square-foot office building has been designed, building permit applied for, and preliminary building preparation work is underway.

One hundred of the new Fletcher "Utility" all-metal agricultural planes have been ordered by the Cable-Price Corporation of New Zealand, and a production line was rolling by the year's end. Eleven of these aircraft were shipped to New Zealand in assembled form while the remaining 89 will be shipped as pre-drilled kits.

A new electric welder that causes no interference to radio, television or radar was developed by Fletcher Aviation and is now undergoing field service tests. The 55 hp air-cooled Porsche engine, coupled with jet cooling, is being refined for a number of as yet unannounced projects.

During the year, **Flight Refueling, Inc.**, completed its relocation from Connecticut to the Friendship International Airport at Baltimore, Md. Here the firm constructed and occupied a new manufacturing plant and test facility which integrated all activities of research, design, testing and producing of Probe and Drogue inflight refueling systems and related aircraft fuel system components. Production centered around delivery of A-12 Hose Reel units to the Air Force and Navy and on the FR Flexible Pipe Connector. Engineering and research efforts, in conjunction with the Armed Services, were in the areas of advanced configurations for flight refueling systems. The company's employment increased from 60 to 300 employees during the year.

The **Garrett Corporation** of Los Angeles, primarily engaged in research, development and manufacture of aircraft accessories and components through its AiResearch Manufacturing Divisions, acquired three new companies during the year. These included Air Cruisers Co., Belmar, N. J., and Aero Engineering Co. of Mineola, N. Y., now divisions of The Garrett Corporation, and The Garrett Manufacturing Company of Canada, Ltd., a subsidiary. The corporation structure now contains seven divisions and two subsidiaries, and a total of 7100 people are employed.

At AiResearch, Los Angeles, greatest volume increase in production was recorded in cabin pressure controls, cabin air compressors, and transducers used in air data computing systems, jet engine pressure ratio systems and other integrated computing systems necessary for sustained high speed flight.

Other products manufactured in volume included air turbine motors and starters, actuators, cabin air compressors, cabin pressure valves, cooling turbines, electronic computers and air data systems, temperature controls, miscellaneous valves, heat transfer equipment, gas turbine engines and cooling fans.

New items in production were stainless steel heat exchangers, reactor pumps, extended surface heat exchangers, new type water separators, and transducers.

At the AiResearch Manufacturing Company of Arizona at Phoenix, dollar value of products shipped increased by 123 percent, with increases recorded in turbo machinery production including gas turbine compressors and air turbine starters. Pneumatic valves and electronic equipment were also produced.

Expanded facilities in the various divisions of The Garrett Corporation brought total floor space to 983,000 square feet.

The AiResearch Aviation Service Company Division completed over 1000 jobs in its CAA approved hangars at Los Angeles International Airport. Engineering developments by this division include: a package modification program for Douglas DC-3's; design, fabrication and installation of nylon fuel cells for Lockheed Lodestars; and creation and installation of custom interiors for executive type and other privately owned aircraft. A new self-sufficient radio and electronics department, CAA-approved, was established to round out the Division's activities.

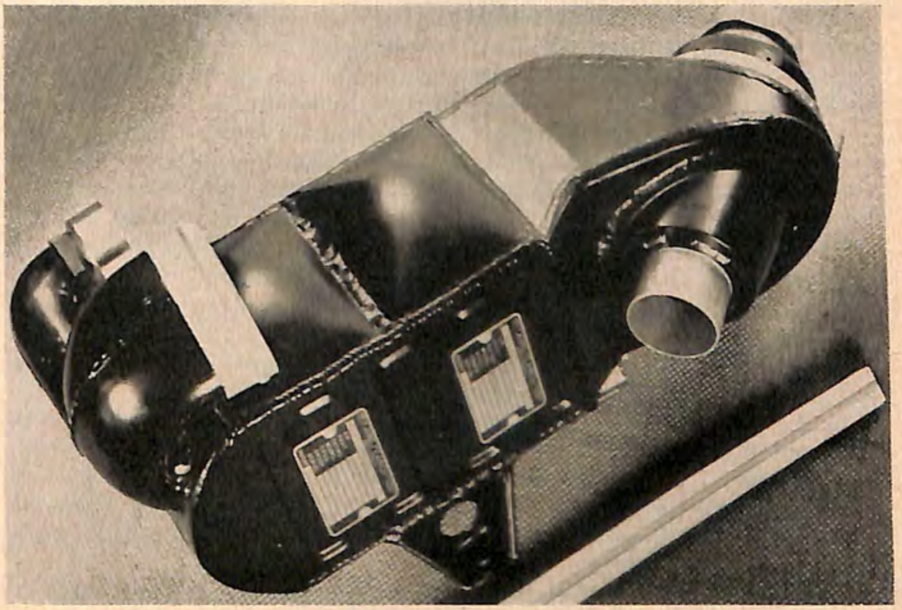
The newly acquired Air Cruisers Division of The Garrett Corporation is engaged in the manufacture of rubberized flotation equipment. Its life rafts, the newest model of which accommodates 25 people, are standard equipment on most of the over-water airlines. Donut type aircraft floats are another Air Cruisers product along with weather balloons.

Consolidated sales for the year for the corporation reached more than $101-million. Backlog amounted to approximately $100-million, about 90 percent of which is for products with a military end use.

The Garrett Corporation increased its laboratory facilities both in Los Angeles and Phoenix. A new production test center, in addition, will be available in 1955 at Phoenix, increasing the company's total development and testing facilities to approximately 147,000 square feet.

General Laboratory Associates, Inc., in Norwich, New York, continued during 1954 to produce ignition equipment.

High energy Capacitor Discharge ignition systems were specifically



AiResearch Manufacturing Co.'s Air Turbine Refrigerator

tailored to the requirements of the later model turbojets. The energy level was raised to four times the rating of models previously in use. At the same time temperature levels have been increased, to keep pace with turbojet and turboprop developments.

Refinement and development continued on surface type igniter plugs and surface systems.

Research was also continued of specialized ignition units for large aircraft heaters, auxiliary gas turbines, missiles and missile launchers, and flame throwers.

One of the busiest and most successful operations of **Grand Central Aircraft Co.,** Glendale, Calif., during the year was conversion of standard or military aircraft to the executive plane.

The company continued during the year as one of the outstanding airplane and engine overhaul, modification, conversion, and repair organizations in the country.

The industry's acceptance of 6066 and 7001, two aluminum alloys perfected by **Harvey Aluminum,** Torrance, Calif., for structural applications in aircraft, accented the developments made by that firm during the year. Using 6066 extrusions, aircraft fabricators can retain all the characteristics of 6061 and still gain the advantages of higher strength and greater weight savings.

The other alloy credited to Harvey is 7001, which has the highest strength of any commercial aluminum alloy yet developed.

Both are wrought alloys which can be made in any form of wrought product such as extrusions, rod and bar, forgings, and so on.

Harvey Aluminum also supplied the aircraft industry with flattened integrally stiffened 24-inch wide wing panels for production use. Used on Lockheed's XFV-1 vertical takeoff fighter plane, it resulted in a 7½ percent savings on the wing weight and a 5 percent savings on the tail weight. Substantial savings in machining and fabricating costs and greater strength also were realized by the use of these extra wide aluminum shapes.

In the production of aluminum forgings for the aircraft industry, tonnage progressed satisfactorily with Harvey making advances in metallurgical developments and manufacturing techniques in complex forging operations during 1954.

Ground breaking for a major expansion program to be completed in 1955 was one of the year's highlights for the company.

In the forging division, the new equipment ready for installation includes one 8,000 ton capacity forging press and two 4,000 ton capacity forging presses. In the extrusion division of Harvey Aluminum, the expansion program will see the installation in 1955 of one 8,000 ton extrusion press and one 12,000 ton extrusion press as part of the USAF Heavy Press Program.

A revolutionary new stretch-wrap forming machine featuring full 360-degree arm rotation was announced by **Hufford Machine Works, Inc.,** El Segundo, California, in 1954.

The Carousel model, so named because the operator rides either arm during forming, not only is capable of producing many parts heretofore impossible by a single machine, but still produces all conventional parts from both extrusions and sheets up to 22 inches wide.

With its 360-degree arm rotation around a stationary die and table, the Carousel model quickly forms full circles. In addition, the stretch-wrap forming operation can be complemented with a following roller or wiper which operates simultaneously. This roller, attached to one of the rotating arms, may be operated clockwise or counter-clockwise and is unlimited in the number of passes which can be applied to the work. Other Carousel operations include bulldozing, joggling, stretch-straightening, forming reverse bends and "S" curves.

The Hufford Carousel has been designed in conjunction with Douglas Aircraft Co., El Segundo Division, to expedite formation of parts now employing several types of machines. It is believed with the many types of forming incorporated on one machine that forming costs can be materially reduced because a great deal of hand forming has been eliminated, as well as second operations and handling time.

At **Hydro-Aire, Inc.,** Burbank, Calif., these products played a major role during 1954:

HY-V/L Fuel Pumps: Named for their ability to handle a high ratio of vapor to liquid, this new line of fuel booster and transfer pumps can successfully handle boiling fuel at high altitudes without the vapor-stall characteristics always thought of as inherent in these units.

The LO-U/C Turbine: First of a series of new products to result from Hydro-Aire turbo-machinery research and development program during 1954, was a new class of accessory-drive turbines with a low ratio of speed vs. pressure-head. The new design represents a more efficient turbine for operation within the limited range of the accessory-drive field.

Following the announcement of this new turbine, Hydro-Aire received a contract from a major airframe manufacturer for a turbine driven fuel transfer pump. This new unit combines the HY-V/L pump with the new LO-U/C turbine, thus combining all the design advantages of the turbine with the outstanding features of the pump.

The Frijadrive Twin Turbine System: This is the first twin-turbine system to combine the functions of a bleed air driven turbine and an air cycle machine. The Frijadrive serves two purposes in the airplane; air conditioning of the cabin and supplying a steady source of accessory-drive power for the aircraft.

During 1954, Hydro-Aire's new Electronics Division made great strides in the continued development of transistors and transistorized circuitry. The company now offers a complete line of germanium transistors and diodes to the industry and a new power transistor has recently been brought on the market.

Jack & Heintz, Inc., Cleveland, Ohio, during the past year evolved new designs for all major components of a-c electrical systems. Prominent among the new a-c equipment designs were generators, control panels, voltage regulators, and circuit breakers.

The air-cooled A-C generators cover the range from 10 through 120-KVA. Typical of design is the G281. This 40-KVA unit, with new high-temperature insulation and a special water-separator device, is capable of operation at environmental temperatures as high as 120 degrees Centigrade.

Jack & Heintz has two vapor-cooled generators: the 12kva, G75 and the 30kva, G188. The company also has two oil-cooled machines: the 40kva, G190 and the 20kva, G192. In addition to the environment-free feature, the oil-cooled machines are at least 10 percent smaller than comparable air-cooled units and permit more compact installations.

The A-C control panels developed in 1954 include: over-voltage protection; phase sequence protection; under-speed or under-frequency protection; anti-cycling; generator control relay; power indication; field flashing; and special interlocking. A principal feature of the new panels is the over-voltage relay. This component has been designed to be insensitive to acceleration forces. The panels can operate either from the D-C bus or independent of it.

The Jack & Heintz A-C regulators developed during the year are of the static-magnetic-amplifier type. Weighing only 12½ pounds, the new regulators feature a magnetic reference which eliminates the use of electronic tubes, and provision is made for reactive load function.

The new line of circuit breakers represented by the 40kva, GC86 have balanced rotary latch, direct solenoid-actuated contacts, noncritical adjustment of interlock contact and simplified inspection. These features make possible important performance improvements over conventional breaker designs.

Other developments by the company included: a high-altitude inverter, a magnetic brake, and a turbo-hydraulic power pack.

Total sales for the year were between $30-35-million and the backlog of unfilled orders was at approximately $30-million. Employment totaled 30,000, and total productive floor space exceeded 500,000 square feet.

During 1954 production of standard flight and navigation instruments continued steadily at **Kollsman Instrument Corporation,** Elmhurst, N. Y., wholly-owned subsidiary of Standard Coil Products Co., Inc.

Among the new products launched were: a Pressure Ratio Indicator System for use on jet aircraft; the C-2 True Airspeed and Mach Number Computer, filling a $1-million order with the Air Force; and the Sky Compass, an instrument for accurate aerial navigation in high latitudes, which gives the true heading of an aircraft by determining the position of the sun when it is below the horizon.

In demand, particularly for guided missile application, were the Kollsman Synchrotel Transmitters required for the remote electrical transmission of data such as true airspeed, indicated airspeed, absolute pressure, log absolute pressure, differential pressure, log differential pressure, altitude and Mach number. Kollsman Pressure Monitors which provide control signals that are functions of altitude, absolute pressure, differential pressure, and so forth, also had wide application in this area.

Many new units were added to the Kollsman special purpose motors family. These consist of Induction Motors and Induction Generators which are supplied either separately or combined in a single case one inch in diameter. The motors are designed to give maximum torque per watt ratio with minimum rotor inertia, while the generators provide maximum output voltage with minimum residual voltage and phase shift. A principal feature is interchangeability of parts which permits numerous electrically different combinations of motor and generator windingst within the case.

Among the unclassified projects completed during the year by the Kollsman Research and Engineering Laboratories was a cabin pressure system that utilizes Pressure Monitors and which eliminated the vacuum tube completely by the use of a transistor amplifier. Ready for the designers of tomorrow's high performance aircraft and missiles is a highly sensitive Acceleration Monitor. This unit will act as a supplement to, or, in many applications, as a replacement for the gyro. By measuring acceleration rather than displacement or rate, as in the case of the gyro, the new monitor anticipates changes in motion and influences the automatic pilot to compensate rapidly, thereby keeping deviations to a minimum.

1954 saw increased concentration in the field of precision optics at Kollsman. The company engaged in the development of, and in some cases produced in quantity, optical devices and systems such as binoculars, photographic lenses containing as many as eleven elements, drift sights, periscopic sextants, periscopic bombing sights, anti-aircraft fire control sights for use in radar bombing and navigation systems, photo-electric sextants, astro-compasses, and photoelectric trackers. Optical components produced include, among others, lenses, windows and prisms, aspherical objectives and mirrors, cones and rods for ranging devices, hyper- and hypo-hemispherical sighting domes, retroreflectors, roof prisms, angular prismatic scales and special reticles.

Lear, Inc., Santa Monica, Calif., estimated shipments of well over $50-million in 1954. Over 212,000 square feet of plant floor space were added during the year, bringing the company's total to 527,700 square feet.

The Grand Rapids Division during the year developed automatic flight control and stabilization systems and components for helicopters, jet fighters and bombers, and other types of aircraft, and on remote actuating and positioning equipment. One new product was the MB-2 autopilot ordered by the Air Force for Republic F-84F jet fighters. Another was the Electrolink remote actuator system, which provides electrical actuating forces of an order previously available only in hydraulic devices. Volume production continued on Lear F-5 automatic pilots and increased quantities of Lear Vertical Gyro Indicator systems were produced.

The Lear-Romec Division, at Elyria, Ohio, put into quantity production the military type B-26 and B-18B submerged type fuel booster pumps, special ground test sets for measuring air tightness of airborne electronic equipment, universal bombsight desiccators, a two KW heat exchanger for cooling airborne electronic equipment, a portable electric motor driven barrel pump for ground use, and new pressurizing equipment for antenna wave guides and for radar transmitters and receivers operated at high altitudes.

LearCal Division at Santa Monica produced in quantity the ARCON automatic rudder control device for all types of aircraft. Also developed by the division during the year was the new NAFLI instrument flight system developed to facilitate instrument flight instruction by providing simplified, natural, flight attitude references immediately recognizable by non-instrument pilots.

The big event at the Lear Aircraft Engineering Division during 1954 was the first flight of the Number 1 production Learstar executive airplane, followed by its complete CAA "4b" certification flight testing and the delivery of several production Learstars to corporate purchasers. The Learstar, while largely a new airplane, is built around the basic airframe of the Lockheed Model 18 Lodestar, which makes possible its production at a cost approximately half the estimated cost of a similar, entirely new airplane.

Also during the year, receipt of military aircraft modification contracts launched the Aircraft Engineering Division into the fields of aircraft prototyping and retrofitting.

The Lear Research and Development Division, Santa Monica, Calif., conducted programs in the fields of automatic controls for airplanes, missiles, drones, helicopters, and VTO aircraft; airborne and ground radio communications and navigation equipment; aircraft and marine radar; commercial power steering devices; gyro instruments; pumps; and many other electronic and electro-mechanical devices.

1954 marked the thirty-second year **The Liquidometer Corporation** of Long Island City, N. Y. has devoted to the development and production of a wide range of tank contents gages and position measuring systems for storage tanks, diesel locomotives, marine craft of all types and aircraft.

In the field of aircraft fuel measurement Liquidometer produced a completely new series of miniature coaxial connectors and a weight-volume fuel gaging system. The connectors meet all of the operational and environmental requirements of capacitor fuel gaging systems. They are 1/2 to 1/4 the size of BNC types and anywhere from 2/3 to 4/5 lighter. All the metal parts of the connectors are gold plated to eliminate corrosion and give positive contact. They will withstand 1500 volts, R.M.S.

Both gravimetric weight and volumetric readings are obtainable from a single indicator with a new Liquidometer weight volume fuel quantity gage. This is obtained thru a single gaging system by a new application of the correction of fuel dielectric. The pilot can select either reading simply by throwing a toggle switch.

Another new unit is a pointer-counter type indicator. The dial face of this instrument consists of an easy-to-read counter indicating exactly the amount of fuel remaining and an end mounted pointer which travels around the outside edge of the dial to show the percent of fuel remaining.

Tank units are now made of either aluminum or reinforced plastic tubing. In addition to sensing fuel quantity, some of the tank units contain thermistors to control liquid level.

The new units are being installed on or have been specified for a wide range of advanced aircraft types.

In addition to the plants in Long Island City, Liquidometer maintains additional manufacturing facilities in Bellows Falls, Vermont and overhaul and service facilities in Los Angeles and Montreal, Canada.

Longren Aircraft Company, Torrance, California, pioneers in full metal monocoque fuselage construction and in developing metal forming techniques, completed its twenty-fourth year in the production of aircraft and missile components, sub-assemblies and specialized precision metal parts.

During the past year, Longren continued to produce a wide variety of formed metal structural units and sub-assemblies for major airframe and missile manufacturers including wing slat assemblies and wing attach fittings for the Northrop F-89; wing attach fittings and wing spars for North American F-86 and F-100; engine mounts and wing tip assemblies for Boeing B-47 and B-52; wing pods for Republic F-84; fuselage components and nacelles for Lockheed C-130 and F-94; canopy and fuselage components for Convair F-102, F2Y and T-29; wing fittings for Douglas RB-66; components, fins and stabilizers for Douglas and Firestone missiles.

The company ended 1954 with 250 profit-sharing employees, a plan for the addition of 80,000 square feet of manufacturing facilities and 10,000 square feet of engineering and office facilities on its ten-acre site at the Torrance, California airport, added to its present 67,000 square feet of floor space, and with a backlog of over 2¼ million dollars.

Advances have been initiated in research and development at Longren. Important contributions to the field of shrouded propellers have been made under a study program sponsored by the USAF Wright Air Development Center. Development programs are under way on high speed parachute control and instrumentation, collapsible liquid containers and multi-purpose aircraft maintenance vehicles. With the increase of activity in the field of electronics, Longren has applied its precision metal fabricating ability to the manufacture of electronic metal components.

During 1954 the **MacWhyte Company** of Kenosha, Wis., continued production of Hi-Fatigue cable assemblies, Safe-Lock terminals and Hi-Fatigue aircraft control cables.

In addition to these items and a general line of wire ropes of varying sizes and grades, the company manufactures tie rods for internal and external bracing of aircraft.

For **Minneapolis-Honeywell Regulator Company**, the year 1954 saw another milestone in the field of autopilot production. Honeywell commemorated production of its 40,000th electronic autopilot.

During the year Honeywell also announced development of its new E-10 model which introduces new concepts of flight control including control stick steering and flight path stabilization. Other autopilot variations include stabilization systems for Q-2 drones, helicopter flight controls and special navigation and landing aids.

Associated with its flight control developments has been the application of servo mechanisms to flight path stabilization of both airplanes and guided missiles.

Equally significant to the company and to the aircraft industry was development of the first power-type transistor (now in mass production by another Honeywell division) and its application to aircraft fuel measurement.

Another development was a fuel-level switch utilizing a semi-conducting material in a special application which eliminates troublesome mechanical problems associated with float switches.

During the year Honeywell continued development of precise gyroscopes, announcing the first mass production of the HIG units.

The company made strides in the application of electronics to highly complicated jet control problems during the year. Sub-systems or elements of these controls have also been made available separately for the measurement of exhaust gas temperatures, engine thrust, engine speed and operating pressures.

Vigorous research was continued into the application of electronics to a wide variety of other control problems. These include improved automatic landing systems capable of landing planes on aircraft carrier decks, navigation couplers for automatic tie-in, and new concepts of fire control coupling and weapons system developments which can be adapted to a variety of planes and missions.

In 1954 **The New York Air Brake Company** continued as major suppliers of both constant and variable delivery hydraulic pumps to builders of military aircraft, rockets and guided missiles as well as those producing transport and civilian planes. with both constant and variable delivery hydraulic pumps.

Progress was made with a new constant displacement pump which, in smaller sizes, delivers 3000 psi at operating speeds to 10,000 rpm. Pumps of this 66 series in the larger capacity sizes advance the maximum continuous speed from 3750 to 4500 rpm and permit intermittent speeds to 6000 rpm. Extensive laboratory and service tests demonstrate an ability to operate at substantially higher temperatures than conventional pumps, with excellent performance at temperatures to 350 degrees Farenheit. These pumps do not require reservoir pressurization but will operate with system pressurization to 80 psi and function efficiently at today's maximum operational ceiling.

A second development of special interest was a new series of electric motor-driven pumps for primary, secondary and emergency circuits.

Operations at **Pacific Airmotive Corporation,** Burbank, Calif., in 1954 were divided into five basic aircraft activities: airframe overhaul, engine overhault, aircraft parts sales, manufacture of aircraft pressurization and temperature control units, manufacture of test and ground handling equipment.

Industry acceptance of PAC-manufactured aircraft pressurization and temperature control units increased steadily. The Aero-Pneumatics Division was occupied with the design, development and manufacture of proprietary air pressure control equipment. Principal types of control valves developed were cabin pressure regulators, cabin safety valves and modulating air flow control valves. This division also produced a variety of allied supporting equipment such as motor-actuated shut-off valves, and solenoid-actuated valves.

Modernized versions of PAC's specially-tested air pressure equipment were developed during the past year for the military. PAC's new lightweight cabin pressure regulator and relief valve were designed especially for Douglas' new midget A4D Skyhawk. Backlog of this division was approximately $1.5-million.

The Test and Ground Handling Division was engaged in the design, development and manufacture of various types of aircraft test and ground handling equipment. A substantial portion of the business was concerned with proprietary items such as cabin pressure regulator test stands, engine tear-down stands, fabric burst testers and liquid oxygen conversion benches. Other PAC-designed and manufactured test benches include hydraulic test stands, magneto testers, portable power supply units and propeller governor test benches.

The **Parker Appliance Company's** Rubber Products Division, with plants in Cleveland, Los Angeles and Berea, Kentucky, continued in 1954 to furnish synethetic rubber rings, to applicable military and government specifications, for sealing applications in aircraft fuel and hydraulic systems.

Parker's Engine Accessories Division, in Cleveland, manufactured jet nozzles and other highly engineered and precisely made components for jet engines.

The Tube & Hose Fitting Division, with plants in Cleveland and Eaton, Ohio, produced tube-working equipment—tube cutters, hand tube benders and bench-mounted benders, hand flaring tools and power flarers—for tube fabrication in aircraft production and maintenance.

The **Radio Corporation of America** experienced its largest production year in 1954, and aviation electronics provided a major contribution to this record. Large scale production was carried out on airborne communications and intercommunications equipment for the Air Force including such items as the RCA developed, high-intelligibility Intercommunication set, the AN/AIC-10. Loran, Shoran, Navigational Radar and Fire Control Radar were also produced during 1954 for the Air Force. Design and development continued at an accelerated pace on such items as intra-red detection devices and missile guidance systems.

RCA, working with the U. S. Signal Corps, continued to advance techniques of Airborne Reconnaissance Television. RCA cameras were installed in L-20 reconnaissance planes and have been used for intelligence gathering, artillery spotting and for the relay of vital information to command posts. These TV equipped planes become the "Eyes" of the commander, relaying the course of battle instantaneously for his evaluation and his decisions.

Commercial Aviation activity also increased at RCA during 1954, and was climaxed by the successful development of the first airborne weather radar designed exclusively for commercial use. This device, designated the AVQ-10, is a C-Band (5.5 cm) radar built entirely to ARINC specifications. The set weighs less than 115 pounds and employs conservatively-rated tubes and components which provide reliability and long life. The AVQ-10 was extensively flight-tested during the fall of 1953 by United Airlines. The results of this evaluation substantiated the theoretical conclusions of Drs. Hitschfeld and Marshall of McGill University. These men had theorized that C-Band Radar was the most ideal frequency for weather mapping purposes. The United test concluded that C-Band had the ability to "see" significant storms at long range and still provide true scope information so necessary for storm penetration and reconnaissance in areas of heavy rainfall. The AVQ-10 will be in production early in 1955.

Reynolds Metals Company, Louisville, Kentucky, increased the capacity of its primary plants and also its mill facilities in 1954. New equipment was installed in many cases to replace outmoded equipment but in the majority of instances the new equipment represented modernized production techniques, expansion of the Reynolds line of mill products, and advances in size.

At the Reynolds Extrusion plant in Phoenix, Arizona, noteworthy progress was made in the Rectangular Container Program. This program is sponsored by the Air Force in the interest of procuring rectangular configurations that are not now available except by the employment of expensive milling operations.

Other experimental work at Phoenix was the development of hydraulic straightening devices for handling integrally stiffened wing skin extrusions. These extrusions have been successfully produced in widths up to and including 30 inches.

Reynolds Metals Parts Division has recently completed a facility survey and report for the Glenn L. Martin Company, Baltimore, Maryland, regarding the aft section for the Matador pilotless bomber.

Reynolds Metals Phoenix extrusion plant has developed a satisfactory method of producing 2.75 in. Rocket Tubing to the exacting requirements of Navy Specifications. This year a prime contract was executed between the U. S. Navy and Reynolds for the finishing, machining, anodizing and painting of the Mighty Mouse Navy Rocket. Tests are now being conducted by the Armed Services on a new 2 in. rocket. Tubing for these tests was supplied by the Phoenix extrusion plant.

Rohr Aircraft Corporation, Chula Vista, California, continued its program of growth and expansion. Substantial gains in sales, earnings, working capital and net worth of the company were realized in the fiscal year which ended on July 31, 1954. Sales amounted to $101-million as compared to $63-million for 1953.

Most of Rohr's expansion during the year was the addition of new manufacturing facilities. Part of this new equipment was equipped with electronic positioners and electronic controls for profiling and three-dimensional work.

Currently, Rohr is producing nine different types of power packages (complete engine assemblies) for 12 different airplanes. In the commercial field Rohr builds the power packages for the Convair 340 Liner, the Douglas DC-7, and the Lockheed Super Constellation. In the military field, Rohr's packages power the Boeing all-jet B-52, the Boeing KC-97 Stratotanker, the Convair T-29 and C-131, the Fairchild C-123, and the Lockheed P2V, C-121, R7V and the turboprop C-130. The company also manufactures wing tip fuel tanks and aft fuselage sections for the B-52, jet tailpipes and variable nozzles, reciprocating engine exhaust turbine nozzle boxes, and pneumatic system components.

At year-end Rohr's square footage exceeded 1,265,000. Average employment for the year was 8,705, an increase of 1,395 over the 1953 average of 7,310.

The year saw a continued increase in the amount of design engineering Rohr supplied to its prime contractors on items of major importance. The company also continued and augmented its efforts toward the development of new products and in the field of manufacturing techniques. One example of this was the design and production of aircraft pneumatic system components. Rohr engineers also engaged in research and development in connection with sandwich structures, and the company manufactured flat, tapered and double-contoured panels that have satisfactorily met design requirements.

Simmonds Aerocessories, Inc., during 1954 continued developmental work in the field of capacitance type fuel measurement and fuel management.

Among the new installations was that for the fleet of Vickers Viscount turboprop transport aircraft that will be delivered in 1955 to both Capital Airlines and to Trans-Canada. This installation of the Simmonds Pacitron Fuel Gage System includes a circuit for measuring the contents of the water methanol tanks, as well as provision for automatic load limit control, which affords an automatic cut-off of fuel taken aboard in accordance with the flight plan for the aircraft. Simmonds also introduced during the year a two unit Pacitron System that comprises an amplifier-indicator unit, installed behind the instrument panel, and one or more sensing probes, or tank units, depending on the size and shape of the tank whose contents are to be measured. A thermistor level switch is available to provide low level warning light if required.

Additional fuel management functions include both center of gravity control, which provides automatic control of the distribution of fuel weight, and telemetering, a continuous transmission of information concerning available fuel for remote reading. This latter feature was incorporated in an installation made during the year in a guided missile.

The Simmonds SU Fuel Injection System for gasoline engines up to 600 hp is currently being installed on helicopter and other aircraft engines.

The company's Explosion Suppression Systems were installed during the year on three advance type military aircraft. Explosion Suppression is the new protective technique designed to provide protection against explosions resulting from the ignition of fuel/air mixtures. Simmonds is currently working with the U. S. Air Force and with a group of leading airframe manufacturers in the further development and perfection of this system.

Work continued during the year in the development and manufacture of precision push-pull controls, heavy duty aircraft latches and fasteners, and a related line of aircraft and engine accessories.

Two small gas turbine engines have been developed and placed in production by **Solar Aircraft Co.,** San Diego, Calif.: the Mars, a 50 hp engine, and the Jupiter, of about 500 hp. Aircraft auxiliary power units driven by the Mars are now in use on the Douglas C-124C Globemaster and the Lockheed C-121C, military transport version of the Super Constellation.

In July of 1954 the first APU to be installed on a Globemaster was removed for overhaul after 500 hours of trouble-free service. The Mars is also used in portable shipboard fire fighting pumps and ground power units for starting jet aircraft. The Jupiter model powers a shipboard electric generator set and is under study as a helicopter powerplant.

Large metal bellows, 28 feet in diameter, were built at the company's San Diego plant for a supersonic wind tunnel at NACA's Lewis Laboratory in Cleveland.

A development program was launched to produce high temperature all-metal sandwich structures by means of high temperature brazing. The honeycomb structure, trade named Solite, consists of a core of foil-thin ribbons arranged in honeycomb pattern securely sandwiched between metal facing or skins and shows promise as a solution to this problem.

Research and development work continued on ceramic coatings for the protection of high or low alloy steels against oxidation or corrosion. Solaramic coatings are currently being applied to aircraft manifold systems, jet engine transition liners and inner chambers, afterburner components, aircraft bellows and turbohoods for the Wright turbocompound engine.

Rearrangement of existing space and new construction brought total floor area in San Diego to 541,900 square feet, and in Des Moines, a $2-million expansion program brought total floor space to over 500,000 square feet. Sales for the year were $65-million and net income was $2-million. Total employment over the year averaged 5400.

At **Sperry Gyroscope Company,** production volume of civil and military aeronautical systems and equipment continued for a second year to exceed the combined output of equipment for military ground forces, merchant and naval ships, and other non-aeronautical activities. Volume of automatic flight controls, guided missiles, radars, and bombing systems topped the list of 1954 production activities covering more than 30 types of aeronautical systems and instruments plus supporting ground equipments and lesser items for all types of civil and military aircraft.

On the research and development side, expansion of more numerous and diversified programs for the creation of future systems required the addition of more engineering personnel, bringing engineering division employment to 3450. Total company employment remained above the 16,000 level.

The year was highlighted by first official announcement of the Sparrow I air-to-air guided missile system for the Navy. (See Guided Missiles chapter.)

A new, compact airborne Sperry radar that assures greater safety for troop-carrying transports and essential cargo planes was announced by the Air Research and Development Command. Officially designated as radar set APN-59, the new device is the smallest and lightest radar system for its high power and wide range of aircraft uses, so far introduced.

A single, five-inch radar screen combines many radar functions of search and surveillance over distances up to 240 miles, accurate navigation over uncharted airlanes, detection of distant storms and best weather routes, anti-collision warning of mountaintops and tall structures, or of other nearby aircraft while flying at any altitude up to 50,000 feet.

Production continued on K-type bombing-navigational systems for the newest Air Force heavy and medium bombers. Assembly line volume was also maintained on A-4 "triple threat" radar gun-bomb-rocket sights for day fighter and interceptor aircraft. Existence of the A-4 sight, an improved design superceding the A-1C sight, was made public at Nellis AFB in June, during the Air Force's first all-jet gunnery competition.

A new robot bomber pilot that enables automatic bombing operations in the Boeing B-52 heavy bomber reached full production during the year. The electronic device is an entirely new type of multi-function automatic pilot, known as the Sperry A-14, designed especially to match high-speed performance of the new USAF eight-jet, swept-wing Stratofortress and aids the bombardier as well as the human pilot in their complex duties.

Other non-classified types of automatic pilots in production include the USAF A-12D for the Boeing B-47 bombers, Navy A-12Y for fighter aircraft, and the USAF type E-4 for other military aircraft.

Development of an integrated instrument system, being readied for production, was also announced. The new flight instrument system, which can be integrated with any Sperry automatic pilot, consists of three new panel instruments that present to the pilot the information of three existing instruments in greatly improved form plus improved flight director information, without requiring additional panel space.

Existence of a powerful giant electron tube that paves the way for super radars reaching far beyond present limits was revealed by the Air Research and Development Command. Known as a megawatt klystron, the eight-foot tall tube is the prototype of a new series of klystrons that are the first to produce over one-million watts of precisely controlled radar power for military systems.

Among other Sperry electronic activities during the year was the establishment of the Electronic Tube Division to produce klystron tubes in greater volume for microwave radars, communications, navigation systems, and television.

During 1954, **Sundstrand Aviation**, Division of Sundstrand Machine Tool Company, Rockford, Illinois, took over the entire 250,000 square-foot plant formerly shared with another division and continued to manufacture and develop Constant Speed Drive Systems and several types of hydraulic pumps and motors for the aircraft industry.

Extensive flight testing was executed during the year which established the satisfactory operation of Sundstrand Drives using engine oil. This work was carried out on three aircraft, each employing a different type of drive: the F3H with the J71-A2 and J40-WE22 engines, the F-101 with the J57 engine, and the RB-66 with the J71-A9 engine.

Highlight of the year for **Transco Products, Inc.**, Los Angeles, Calif., was a new line of miniature coaxial switches. This is a single pole two throw unit weighing less than 5 ounces and capable of being stacked to provide multiple pole installation. Also announced was a single pole four throw switch, weighing only 12 ounces, complete with mounting bracket. These new additions to the Transco line of remotely and manually controlled coaxial switches provide units for frequencies to 8,000 mc.

To meet increased demand for Ram and Hot Air valves of both butterfly and sliding gate types, engineering testing and production facilities were augmented. Production of valves for use in aircraft air conditioning systems increased steadily during the year as did fractional horsepower rotary actuators, for use in 28 volt d.c. and 115 volt 60 cycle and 400 cycle a.c. systems.

Vickers Incorporated, Detroit, Mich., manufacturer of hydraulic devices, continued during the year to design and build major accessories for 3000 psi aircraft hydraulic systems. The company introduced several new units in its oil-hydraulic valve, motor and pump aircraft products lines during 1954.

The Flow Sensitive Pressure Regulator announced early in the year prevents stall-out in emergency hydraulic systems. A decrease in oil flow brought on by a reduction in torque available to the pump from the emergency power source causes the new accessory to automatically decrease relief setting. Thus, even though a 3000 psi emergency circuit may deteriorate to 1000 psi or less, the pump will not stall and hydraulic flow will continue to be available to permit use of the system.

Another new Vickers product was the Hydraulic Motor with Manifold Head used in the Douglas DC-7 cabin supercharger. The special multipurpose head (valve plate) includes an integral relief valve, a temperature bulb port and two special ports for circuit replenishing as well as standard inlet and outlet ports. The new design eliminates eight connections and two lengths of hose previously required and weighs less.

Another design introduced in 1954 was the Double-Acting Relief Valve. Consisting of a Vickers conventional aircraft relief valve and four poppet-type check valves combined in a single housing, this reduces the number of required pressure connections from twenty-eight to four. The new valve provides savings in weight and cost.

The Lightweight Oil-Hydraulic Pump was announced in October. Extensive redesign of functional components coupled with proper material application has produced a variable displacement piston-type aircraft pump that achieves up to 37 percent saving in weight and 33 percent reduction in size.

During 1954 the **Franklin C. Wolfe Company,** Culver City, California, continued expansions of facilities begun in 1953, adding several thousand square feet of floor space, mainly in outside acquirements. In addition, the company increased production facilities by purchasing and building new rubber presses, new metals production machinery and specialized tools.

Besides a heavy increase in research and design to assist guided missile, aircraft and electronic manufacturers in solving sealing problems peculiar to applications in their field, the firm brought out several new sealing products. Chief of these in general application was the flush rivet seal and the flush bolt seal.

CHAPTER TWO

Department of Defense

THE year 1954 was a significant one for military aviation in the United States, marked by redeployment of forces after the end of fighting in Korea, a rescheduling of production slanted toward a near-future goal of a 100 percent jet propelled Air Force, and a re-casting of strategic emphasis for the nation's long-range military policy.

New aviation records were set—in speed and in altitude by the Air Force's rocket-powered flying laboratory, the Bell X-1A, in helicopter speed and altitude by the Army's new Sikorsky XH-39, in refueling flight by a Boeing B-47 jet bomber. New planes were added to the military arsenal, with perhaps the most significant development disclosed by the Navy when it unwrapped the advanced stage of vertical take-off design in two experimental aircraft.

There was progress in development and sharply stepped-up production in the field of missiles. Continuing progress in the A- and H-bomb program was indicated by the Atomic Energy Commission's announcement that it was preparing the Nevada Proving Ground for a new series of tests early in 1955, probably beginning in February. Further strides were made also in the use of nuclear energy for aircraft as well as surface ship propulsion.

Primarily, however, economy and the international situation directed attention in the Pentagon to the problem of being ready, with budget-limited forces, for either a major war or more police actions of the type of Korea or Indo-China. The result was searching new looks at the "new look" in strategy. Admiral Arthur Radford, Chairman of the Joint Chiefs of Staff, summed it up like this:

"In essence, the military planners are confronted with a double-barreled preparedness problem. We must be ready for tremendous counter-offensive blows in event of a global war; and we must be ready for lesser military actions in local hot-spots when and as directed by our Government. In other words, we must cultivate and promote both national strength and collective strength."

Air Force

Substantial achievement marked the year in the Air Force, despite budget cuts and a rigid personnel ceiling. President Eisenhower gave his approval to a 137-wing program, to be achieved in 1957, and the 1954 goal of 115 wings was reached by late summer. Ten more wings are to be activated in the 12 months beginning July 1, 1955.

Training schedules involving rotation of entire wings overseas for extended training assignments were intensified, and Tactical Air Command units were added for the first time to this program, which has become standard for Strategic Command wings. A new Continental Air Defense Command embracing all services was set, with the Air Force given primary responsibility and General Benjamin W. Chidlaw, already commander of Air Defense Command-USAF, named Commander-in-Chief.

The new speed record by the Bell X-1A actually was racked up in mid-December 1953, when Major Charles E. (Chuck) Yeager dropped from the "mother" B-29 at 30,000 feet, flew the experimental craft at 1650 miles an hour. In the summer of 1954, Major Yeager, again flying the X-1A, reached an altitude not yet officially reported, but understood to be in excess of 17 miles.

During 1954, also, the big 6-jet, 185,000-pound Boeing B-47 Stratojet bomber broke its own distance and endurance record of the previous year by staying in the air 35 hours and flying 17,000 miles in a non-stop refueling flight.

Every fighter plane operational in Air Force combat units is now powered with jet engines, and the day of the all-jet Air Force came noticeably closer when the production of Boeing B-52 Stratofortresses was stepped up and the new Convair B-58 supersonic bomber ordered into production about the time the last of the huge Convair B-36 bombers came off the assembly line.

These orders, announced by Secretary of the Air Force Harold E. Talbott in October, were part of the extensive re-programming of Air Force production which resulted from intensive study that lasted through the first half of the year.

At the same time, Secretary Talbott announced that the new Lockheed F-104 lightweight supersonic air superiority fighter had been ordered into production, little more than 18 months after the contract was signed for the prototype. Its performance characteristics still classified, the new fighter, powered with a Curtiss-Wright J-65 jet engine, was delivered as the XF-104 and first test-flown at Edwards Air Force Base, Calif., in February, less than a year after it was ordered. It was still being put through airworthiness tests in late summer, but by October 16 had been ordered as a production model.

Accelerated production of North American F-100 Super Sabres was ordered in February, when the Air Force decided to cut back its orders for Republic Thunderstreaks and substitute the later and faster plane. Although engine and airframe difficulties which produced major delays in the F-84F production schedule were overcome, they had moved the program back so far that it was decided to phase the F-100 into the later stages. Only about 15 percent of the total F-84F program was affected. The changeover also cut back production orders for the Curtiss-Wright J-65 engine, used in the F-84F.

A second source of F-100's was set up in September, when the Air Force gave North American a \$100-million order for production of an undisclosed number of the Super Sabres at its Columbus, Ohio, plant. The earlier orders for the plane, powered with the Pratt and Whitney J-57 turbojet engine and the first aircraft to exceed the speed of sound in level flight, were for production by North American at Los Angeles.

Following three accidents involving F-100's in the autumn, in two of which the pilots were killed, the Air Force grounded all its Super Sabres pending investigation to determine the cause of the crashes. In view of the numbers of the aircraft in operation safely, however, the inquiry was not expected to turn up any major structural defects.

In addition to the Convair B-58 bomber and the Lockheed F-104 fighter, a third new plane was ordered into production after mid-year 1954 by the Air Force—the Boeing KC-135 jet tanker, commonly known as the Boeing Model 707. Powered by four Pratt & Witney J-57 engines, with a designed speed in excess of 500 mph, this large, swept-wing airplane is the prototype of this country's first jet transport.

Also in the late summer and early autumn rash of orders stemming from the Air Force's new look at its procurement program was a conract of undisclosed size with Pratt & Whitney "for the construction of YJ-75 engines"—presumably prototypes of a new and even more powerful development of the J-57 engine, with its 10,000-pound thrust.

Contracts totaling \$72-million were placed at the same time with Pratt & Whitney and with Ford (Chicago) for additional J-57 engines; another for \$34-million with Allison for J-71 engines, and one for \$35-million with Allison for T-56 turbo-prop engines to be used in Lockheed C-130 aircraft; and a \$21-million order with General Electric (Evendale, Ohio) for J-73 jet engines.

Additional orders for aircraft, with neither numbers nor dollar amounts disclosed, were placed in the same program with Sikorsky at Bridgeport, Conn., for H-37 helicopters for the Army; with Lockheed (Marietta) for additional C-130 turbo-prop planes; with Convair (San Diego) for additional C-131 transports, and with Beech (Wichita) for T-34 trainers.

A successful first flight of the RB-66A, a modification of the Douglas B-66 bomber, was announced in June. The modification was designed to give Tactical Air Command a swift, twin-jet reconnaissance bomber. In November, the Air Force announced it had placed a $41-million order with Douglas for RB-66 production at Tulsa, and a $87-million order with the same company for production of both B-66 and RB-66 types at its Long Beach plant.

At the same time, Lockheed was given a $7-million order for production of T-33 jet trainers at Burbank.

In the field of aircraft armament, the Air Force disclosed during the spring of 1954 that it had developed, in cooperation with the Ordance Department-U. S. Army and the Ford Motor Company, a new 20mm automatic gun, firing an explosive shell, with a considerably higher rate of fire than any other aircraft gun now in operation—specifically, with greater rapidity and higher muzzle velocity than the 1200 rounds per minute of the .50 caliber aircraft machine gun standard in the Air Force. Designated the M39, it was installed in F-86F fighters and tested in combat against MIG-15's in Korea.

The top secret label still cloaked most of the intensive work which continued on missiles, but the Air Research and Development Command let a little be known about some of its work in other fields.

For example, ARDC announced in early autumn the development of an experimental thrust-reversal device for jet aircraft. Installed on a Republic F-84F fighter, powered with a Curtiss-Wright J-65 turbojet engine, the device employs a series of "cascades" and two movable "flippers" to divert the hot gases from the engine's tailpipe, turning them forward in the direction of flight. The effect is a reverse thrust not unlike that produced by a reversible propeller. It can be used as an aerodynamic break in flight, permitting contact with slower enemy aircraft; to reduce speed in landing approaches, permitting a steeper descent; and, after landing, as a substitute for friction brakes or parachute to halt the forward roll.

The drag parachute was applied during the year to the Boeing B-47 jet bomber to reduce landing speed and permit steeper angle of approach. It will be standard equipment on all future B-47's. The new drag parachute attachment is for use in the air for landing approaches, and does not replace the 32-foot diameter deceleration parachute which has been standard equipment on B-47's for several years.

ARDC in September took the wraps off a new airborne radar, in development several years with Sperry Gyroscope, which weighs only 150 pounds, has a single 5-inch screen, but combines the functions of search and surveillance, accurate navigation aid, distant storm detection, and anti-collision warning up to an altitude of 50,000 feet. In the same field, ARDC disclosed its development, in cooperation with General Electric, of a new radar height-finder which concentrates the radar energy in a narrow beam and nearly trebles the search range. It is intended for use in combination with search radar to determine distance, altitude and flight direction of detected aircraft.

After thousands of tests, ARDC in October approved for production the air traffic control system called Volscan, for installation at Air Force bases. First announced in December 1953, Volscan is an almost completely automatic electronic device for the control of incoming planes at busy airfields. It does not replace Ground Control Approach or Instrument Landing System, but takes long-range control of approaching aircraft, guiding them to the final runway approach. It can bring planes in at intervals of 30 seconds, and virtually eliminates the problem of "stacking up." Developed during the last five years by ARDC's Cambridge Research Center, Volscan won the Thurman H. Bane Award of the Institute of Aeronautical Sciences for Ben Greene, project scientist. A contract for production of Volscan has been awarded the Crosley Division of AVCO Manufacturing Company, with the first three units due for delivery in the autumn of 1955.

The Air Force appropriation for Fiscal '55—the 12 months beginning July 1, 1954—included $5,750,000 to build the first unit of a laboratory in which Pratt & Whitney will conduct studies of nuclear propulsion of aircraft. Equipment to be installed by the Air Force will probably run the cost to about $10,000,000. As the year 1954 ended, a search was in progress for a site within a 50-mile radius of the present Pratt & Whitney plant at Hartford, Conn.

On its own, Fairchild Engine & Aircraft began in 1954 flight-testing an experimental turbojet installation to give its C-82 packet—and perhaps its C-119 Flying Boxcars also—more take-off power, to increase take-off loads and rate of climb. Using the small J-44 engine designed by Fairchild for powering target drones and guided missiles, the company hopes to boost take-off load maximum by as much as two or three tons.

The first jet plane specifically designed as a trainer to be developed for the Air Force, the Cessna XT-37, made its first test flight at Wichita in mid-October. Development order for the lightweight, twin-jet plane was placed in December 1952.

In May, the activation of the first USAF Airborne Early Warning and Control Division was announced. Specially modified Lockheed Super-Constellations, completely equipped with electronic, communications and navigational equipment, will be based on both east and west coasts, and maintain 24-hour, 7-days-a-week patrol far out over the Atlantic and Pacific Oceans.

During the year, two pilotless bomber squadrons of the Tactical Air Command, equipped with the Martin B-61 Matador, were transferred to Germany and added to the NATO forces defending Western Europe. A third squadron equipped with the Matador was activated during the summer.

A new kind of "first" was announced in the spring. The Republic of Colombia became the first Latin American nation to buy U. S. jet aircraft, paying the Air Force $1,162,000 for six Lockheed T-33 trainers. The T-33 is a two-seat trainer version of the Lockheed F-80 Shooting Star.

Training programs were marked in March by "Exercise Check Point," in which the U. S. and Royal Canadian Air Forces carried out their largest joint air defense maneuvers to date. The number of Strategic Air Command wings rotated to Europe and North Africa for extended training missions was increased, and both fighter-bomber and troop carrier units of Tactical Air Command were deployed to Europe on training assignments for the first time. For the first time also, the rotation of heavy bombers to the Far East for extended training duty sent a wing of B-36's in October non-stop from Spokane to Guam for 90 days of rotational training.

The Air Force and the entire military establishment were saddened in the spring by the death of Gen. Hoyt S. Vandenberg, who had retired as USAF Chief of Staff on June 30, 1953.

The senior Air Force officer and commander of Tactical Air Command, General John K. Cannon, retired March 31 after 37 years' active military service.

In June, Secretary Talbott announced the selection of a site eight miles north of Colorado Springs as the permanent location of a new $125-million Air Force Academy, which will begin classes in the fall of 1955 in its temporary quarters at Lowry AFB. Lt. Gen. Hubert R. Harmon, USAF-Ret., was named Superintendent of the Academy, Brig. Gen. Don Z. Zimmerman, Dean of the Faculty, and Col. Robert M. Stillman, Commandant of Cadets.

The Air National Guard reached a strength just under 50,000 men in early summer, the highest in its eight-year history. The total of 5,622 officers and 43,445 airmen did not include the 3,500 Air Force ROTC graduates who accepted appointment in June as second lieutenants in the Air National Guard. Approximately 40 of the Guard's 87 tactical squadrons were equipped with jet aircraft by the time their summer training encampments began.

The year's most notable recognition of civilian services by the Air Force was the award of the Exceptional Service Award, highest honor the Air Force can confer on a civilian, to Edward A. Link, inventor and manufacturer of the Link trainer and other flight simulators.

Naval Aviation

Easily the biggest news in Naval aviation during 1954 was the disclosure that two new aircraft designed for vertical take-off and landing had been successfully test-flown.

The announcement that the Convair XFY-1 and the Lockheed XFV-1 had reached the point of engine and pre-flight tests was made by the Navy in March.

Under construction for nearly three years, both planes are designed to rest on the ground in vertical position, to take off and land vertically, to assume normal horizontal flight position after getting into the air. They have specially designed propellers powered by turbo-jet engines.

The first free vertical take-off in history was achieved by the Convair XFY-1 at Moffett Field, Calif., on Sunday, August 1, when J. F. "Skeets" Coleman, engineering test pilot, lifted the new turboprop plane 20 feet into the air at 9:30 a.m. On flights during the next two days, Coleman climbed to 150 feet before backing down to a landing. And on November 2, at Brown Naval Auxiliary Air Station near San Diego, Coleman lifted the XFY-1 to 175 feet, at that altitude made the transition to horizontal flying position, picked up flying speed quickly, flew back across the field, pointed the nose skyward, and backed down to a vertical landing. The flight lasted 21 minutes.

The Lockheed XFV-1 had made eight successful horizontal take-off flights by the time its rival was flown, but was still being readied for its first vertical take-off when Coleman lifted the XFY-1 into the air on August 1. The Lockheed horizontal test flights were made at Edwards Air Force Base.

In June, the Navy unveiled its "midget" carrier-based bomber, the Douglas A4D Skyhawk, built in the record time of 18 months from the beginning of design to prototype delivery. A single-place, low-wing monoplane, the bantam bomber is designed to out-perform many current jet fighters twice its size. So small it was designed without the traditional folding wings of carrier aircraft, it still is capable of carrying any weapons or missiles of an attack plane, including atomic bombs. The Skyhawk is powered with a Curtiss-Wright J65 turbojet engine. Deliveries to fleet squadrons are expected to start in June 1955.

The Navy's newest jet fighter, the Grumman F9F-9 Tiger, was flown successfully in August. Designed for supersonic speeds in level flight, the plane has a "coke bottle" fuselage configuration developed by Grumman engineers for optimum drag characteristics at sonic speeds. It is powered by a J65 Sapphire axial-flow turbojet with afterburner, produced by Curtiss-Wright under license from Armstrong-Siddeley Motors Ltd.

The first production model of the McDonnell F3H-1N Demon, an all-weather carrier fighter, was announced by the Navy early in January. More than 59 feet long, it has a wingspan of 35 feet 4 inches, and stands 14 feet high. Present production models are powered by a single Westinghouse J-40 turbojet engine with afterburner. Later models will have a more powerful Allison J-71 powerplant.

The new Martin P5M-2 Marlin, an improved version of the earlier P5M-1 models already in patrol service in both the Atlantic and Pacific Fleets, started its active duty in October. The first production models were delivered to the Navy in June, and after serviceability tests at the Patuxent River Naval Air Test Center, were assigned to Patrol Squadron Forty-Seven at Alameda, Calif. The new version of the big, gull-wing, anti-submarine seaplane features a high "T" tail designed to give better control during slow air speeds and in water maneuvers. The P5M-2 is powered by two Wright turbo-compound engines rated at 3450 horsepower each.

The Beech T-34 Trainer was adopted during the summer by Naval Air Training Command as its primary trainer, with only slight changes in the Air Force version necessary to meet Navy requirements. The Navy's present basic trainer, the North American T-28B, will be used in the future for the second stage of flying training. The T-34, a two-place tandem trainer, is powered by a Continental 225 hp engine, and has a top speed of about 180 mph.

Called the world's fastest propeller-driven plane, a new turbo-prop super-Constellation built for the Navy flew for the first time September 1 at the Lockheed terminal at Burbank, Calif. Designated the R7V-2, the transport is powered by four Pratt & Whitney T-34 engines rated at 5500 hp each, and cruises at 440 mph.

In October, the Navy ordered additional production of Pratt & Whitney J-48 turbojet engines. The J-48 Turbo-Wasp powers the Navy's Grumman F9F-5, F9F-6 and F9F-8 fighters, and—with an afterburner—the J-48 is also the powerplant for the Air Force Lockheed F94-C Starfire interceptor. Production of the engine had been scheduled to end in the autumn, but its high performance led to the new order, on which deliveries will begin early in 1955. Three Navy Grumman F9F-6 Cougars, powered by the J-48, set transcontinental speed marks in 1954, all three crossing non-stop from San Diego to New York in less than four hours.

A new system of boundary layer control was perfected during the year by John S. Attinello, an engineer in the Navy Bureau of Aeronautics. By bleeding air from the jet engine through holes in the duct and forcing it out over the trailing edge of the wing, Mr. Attinello's system increased the lift capacity of a Grumman F9F-4 Panther by 3,000 pounds, and allowed a landing speed 20 knots slower than normal. After thorough tests at Patuxent River Naval Air Test Center, the modified plane was sent to the USS Bennington for carrier tests.

Successful tests of two new developments employing rocket motors on undersized helicopters were announced by the Navy in midsummer 1954. In one of the research projects, Gilbert Magill, president of Rotor-Craft Corp., Glendale, Calif., developed the first U. S. rocket-powered helicopter, the RH-1. The midget, one-man craft is propelled by two thumb-size motors at the tips of the helicopter blades. As project "Pinwheel," the RH-1 has been under development nearly four years, and first flew in tethered tests the summer of 1953. The other research project, under development by Kellett Aircraft at Camden, N. J., incorporates gyro-stabilizing controls designed to give helicopters greater stability in the air. Tests show that it also cuts vibration considerably. The Kellett KH-15 also is rocket powered. Engines for both craft were built by Reaction Motors Inc., Rockaway, N. J.

In the late spring of 1954, the Navy began receiving scheduled deliveries of a new air-to-air guided missile, the supersonic Sperry Sparrow I, rocket-powered and fully maneuverable at supersonic speeds. The performance characteristics and the guidance system were not disclosed, but the Navy said the missile was light and compact enough to be carried in multiple units and launched from fighter-type jet aircraft. More than 100 prototype missiles were constructed and test-flown before the Navy settled on the production model, which is being manufactured by Sperry Farragut Corporation at Bristol, Tenn.

The Navy also announced in October the development of the first high-altitude target for guided missiles. It is a rocket-carried parachute, automatically opened at predetermined altitude. Developed for the Bureau of Ordnance by the Physical Science Laboratory of the New Mexico College of Agriculture and Mechanical Arts, the target is a silk parachute, 20 feet in diameter, and coated with a thin layer of metallic silver, which makes it resemble an airplane on the radar scope at high altitudes.

A demonstration of new Naval aviation developments for correspondents at San Diego, Calif., in November, primarily to show them the vertical take-off planes, ended in tragedy when a Sea Dart, the delta-wing Navy jet fighter which incorporates the revolutionary hydro-ski for water takeoffs, exploded during a routine flight over the water. The Convair YF2Y-1, second model of the plane, had exceeded the speed of sound in a shallow dive at 34,000 feet on August 3, with Convair's engineering test pilot, C. E. Richbourg, at the controls. The first Sea Dart, the XF2Y-1, made its first flight at San Diego in April 1953.

Delays in major component deliveries, including propulsion equipment, put off the launching of the USS Forrestal, the Navy's new 60,000 ton carrier, until late in the year. She is being completed at Newport News, Va. A second carrier of the same class, the USS Saratoga, is under construction, and a contract for a third, to be named the Ranger, was awarded to the Newport News Shipbuilding and Drydock Company in February. A fourth carrier of the same class also is scheduled for building in the Navy's current fleet construction program.

Army Aviation

Intensifying its studies of air transportability of combat troops and airborne equipment, the Army conducted two major field exercises in the spring, one employing only Army aircraft, the other using planes of Tactical Air Command in a joint maneuver.

Exercise Sky Drop II, held at Fort Bragg in March, was a series of fixed-wing and rotary wing comparative exercises to determine the number of each type of aircraft required under combat conditions for a field army.

Exercise Flash Burn, carried out in the Fort Bragg-Camp Mackall area of North Carolina in April, was a training exercise, using air drops and airlanding of troops. Army airplanes participated, and Army helicopters were used for deployment of combat troops, supply missions, and medical evacuation. Tactical air support, aerial resupply, and troop carrier missions were carried out by units of Tactical Air Command.

In June, the Army split off the Communications and Electronics, and Airborne Service Test, Divisions from Army Field Forces Board No. 1, and made them the nucleus of the new Army Field Forces Board No. 5, organized at Fort Bragg to work closely with XVIII Airborne Corps and 82d Airborne Division on airborne materiel development and test projects.

The training of Army aviation personnel has reached such proportions that the Army Aviation School had to be moved in the summer from Fort Sill, Okla., where it was interfering with operation of the Field Artillery School, to Camp Rucker, Ala. Camp Rucker, vacated by the move of an infantry division to Fort Benning, has three large runways and ample facilities to support aviation training, which has been given a high priority by the Army. The Army Aviation Section, 11th Airborne Division, has set up an Instrument Flying School in compliance with an Army directive requiring all Army pilots to check out on instruments.

An Army aviator, Warrant Officer Billy I. Wester, set a new unofficial altitude record for helicopters on October 17 at Bridgeport, Conn., flying a new Sikorsky XH-39 to an altitude of 24,500 feet. Mr. Wester also holds the unofficial helicopter world speed record of 156.005 mph, which he established at Windsor Locks, Conn., on August 26.

In October, the Army awarded a contract of approximately $64-million to Sikorsky for production of cargo helicopters.

In March, delivery of helicopters to Army units of the National Guard was started, with 88 scheduled for Guard units in the first 12 months of the program, and an eventual total of 272 to be delivered. Guard units in First, Second and Third Army areas will get Bell H-13's, those in Fourth, Fifth and Sixth Army areas Hiller H-23's.

Marine Corps Aviation

New developments in Marine Corps aviation during 1954 were concerned exclusively with helicopters. This did not mean that Marine aviation was in a decline—far from it; but the Marine Corps relies on the Navy for its research and development work, and most of the technical developments of interest to the Marines were included in the Navy's program.

In September, however, the Marines disclosed their ROR—rocket on rotor—development, designed by Research Motors, Inc., in cooperation with Sikorsky to give Marine helicopters greater lift. Small liquid-propellant rocket engines, mounted at the tip of each rotor blade of an HRS-2 helicopter, gave the aircraft an appreciably greater load-lift at takeoff, notably at altitudes of 5,000 feet or higher. The Marine Corps announced also that ROR improves glide performance and control in case of main engine failure, and greatly improved rate of climb and hovering ceiling at any fixed gross weight. The tiny rocket engines, weighing about one pound each, are powered by hydrogen peroxide. A small, dome-shaped tank mounted on the rotor hub contains fuel for about seven minutes' operation—deemed more than ample for routine operations, since the 'copter needs ROR only in take-off, hovering, or autorotation conditions.

Also during 1954, the Marines demonstrated for the first time their XHR2S helicopter, the development of which by Sikorsky to Marine Corps specifications had been announced earlier. The largest 'copter now in production, the XHR2S is a transport aircraft which is believed also to be the first helicopter with retractable landing gear, contributing to its top speed in excess of 150mph. It is a twin-engine, single-rotor craft, comparable in size to the Douglas DC-3 transport, powered with two Pratt & Whitney R2800 engines. It is equipped with automatic pilot and de-icing equipment, and will carry two combat assault squads—26 men, fully equipped.

CHAPTER THREE

Guided Missiles

DURING 1954, GUIDED MISSILES and pilotless planes, cloaked for more than a decade in security, began for the first time to figure substantially in the news. Glimpses of things to come had been released from time to time previously. In '54, the Department of Defense revealed some outstanding examples of the work being done and indicated more clearly than ever before the major role that guided missiles are destined to have in the nation's defense program.

Two missiles made headlines by going on active duty, each built by leading companies in the field. The Glenn L. Martin Matador, Air Force B-61 pilotless bomber, was transferred on Jan. 15, 1954, to the Tactical Air Command to be made combat-ready. On March 9, the First Pilotless Bomber Squadron, Matador-equipped, departed for Germany — the first overseas deployment of this type of unit. The second Matador squadron, the 69th, reached Germany in Sept. 1954. On May 12, Sperry Gyroscope Company's Sparrow I, an air-to-air guided missile system designed for the Navy, was announced as being readied for combat.

A third made a record. The Martin Viking, a high altitude research unit, on May 24 set a new world's altitude record for single-stage rockets of 158 miles. (A two-stage WAC Corporal, boosted by a V-2, holds the all-time altitude record of 250 miles and the all-time speed record for any man-made object—5,000 miles per hour.)

Also figuring in the news during the year was the Chance Vought Regulus, designed for launching from submarines, surface ships and shore bases, and already in mass production.

Information on the more than thirty missile projects now under way was otherwise officially brief or totally blanketed by security.

The Douglas Aircraft Company's Nike, two-stage, supersonic, surface-to-air rocket, went into mass production following nearly a decade of research and development, and large-scale production continued on the Douglas surface-to-surface, free-flight Honest John, designed for use by the Army field forces.

Ryan Aeronautical Company's Firebee, already a production success as a drone, was evaluated as a target missile for anti-aircraft, air-to-air and guided missile gunnery.

In April, Firestone Tire and Rubber Company was authorized by the Army to announce the Corporal guided missile as a new weapon for use in support of ground troops, and the Chrysler Corporation announced its Redstone, a ballistic rocket designed for the Air Force.

For the most part, other companies active in the multi-billion-dollar missile field were authorized officially to say just that and no more, although a few were permitted to be specific about the name of a project.

Very little on any of Bell Aircraft Corporation's missile projects has been released by the military except the fact that they are building a pilotless bomber for the Air Force—the XB-63 Rascal.

Bell, among the first companies in the rocket propulsion field, also was continuing research in development in high-thrust rocket engines and was delivering production versions of one of its rocket products to another aircraft manufacturer for guided missile use. Announcement also was made that an extremely accurate electronic remote control system, designed, developed and produced by Bell, was being used in the flight test program of the Chance Vought Regulus missile, permitting undamaged recovery which cut millions of dollars from the overall cost of the program.

Convair's guided missile projects, big enough to rate a division of the company at Pomona, Calif., continued to operate under a tight security lid, as did extensive activities at Bendix Aviation Corporation. General Electric, whose Guided Missiles Department celebrated its tenth birthday anniversary on November 15, released a number of facts, including data on the Hermes A-1, a surface-to-surface test vehicle.

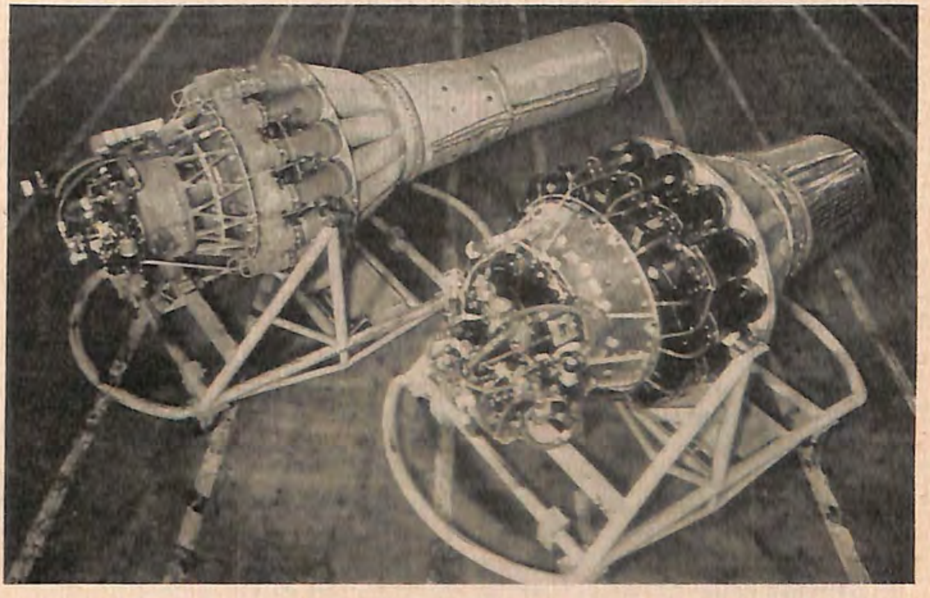
North American Aviation reported continued research and development in all major phases of guided missiles. Republic Aviation Corporation also was active. North American revealed that they are working on a missile called the Navajo, and Northrop announced continued progress on developing its Snark, another pilotless bomber.

While security still sheltered the majority of the projects, a number were also revealed in some detail.

Typical was the Douglas Nike, a pencil-shaped missile named for the famous Winged Victory of Greek mythology, and capable of intercepting and destroying enemy aircraft regardless of evasive action.

The Nike began as a project in 1945 for assignment to anti-aircraft battalions. It was developed by a service-industry team composed of engineers of the Army Ordnance Corps, Western Electric Company, Bell Telephone Laboratories and Douglas Aircraft Company.

Mass production of the control equipment is largely done by Western



Allison J33-A37 Matador power plant (left), and J33-A35, latest in J33 series (right)

Electric, while rockets and components of the associated ground-handling equipment are produced by Douglas.

Nike is a two-stage rocket classified as a surface-to-air weapon. It is a dart-like rocket with sharply swept cruciform fins near the nose and similar fins near the after end. It is about 20 feet long and one foot in diameter.

The missile is attached to a booster section which also has stabilizing fins at the base. After a period of initial thrust which attains supersonic speed, this booster portion drops off and a sustaining rocket motor takes over.

An explosive warhead and electronic guidance equipment also are carried in the body of the basic missile. As a safety measure, the warhead is designed to explode only when in flight.

The rocket is an integral part of a complex spotting and guidance system which electronically picks up and tracks a target plane and automatically launches a rocket at the proper moment to intercept the aircraft.

Essentially a defensive weapon, the Nike system provides strategic areas of the United States with a far greater degree of anti-aircraft protection than was possible with the more limited ranges and altitudes reached by conventional anti-aircraft guns.

The missile operates effectively regardless of weather conditions or visibility.

Nike may be employed either from fixed or mobile battery installations.

All of its units, except steel launching racks, are housed in all-weather van-type trailers, also designed by Douglas. The entire system is designed to be transportable by air.

Should enemy aircraft approach a strategic area defended by the Nike system, this would be the sequence of events:

1. A Nike battery receives information that hostile aircraft are approaching, and radar follows the target automatically.
2. Nike missiles are readied in vertical position on their launching racks.
3. Radar provides a running account of the target's changing position.
4. When the target crosses Nike's distant and invisible deadline, the missile is fired.
5. Within seconds, it closes in on the airplane.
6. When it reaches the target, the warhead explodes and destroys the plane.

The Nike project was initiated when Army Ordnance asked Bell Telephone Laboratories to undertake a study of the problems involved in the construction of a new anti-aircraft system. As a result of their recommendations, the Army authorized a development contract.

Douglas became a full partner in the enterprise and was assigned responsibility for about half the development effort, including design of the missile and the launching equipment.

Nearly five years were required to solve the new and complex technical problem posed by the Nike system. During this time, test firings to improve launcher and booster designs were made at the White Sands Proving Ground in New Mexico. Meanwhile, development of the guidance equipment proceeded at Bell Laboratories.

The Army has made public still and motion picture photographs demonstrating the interception and destruction of a pilotless "drone" bomber by a Nike missile.

Douglas also released considerable material on its Honest John, surface-to-surface, free-flight long-range artillery rocket capable of carrying atomic warheads for use tactically to give close fire support to ground troops. A free-flight weapon is not a guided missile, but this one developed as part of the Douglas program in that field.

Approaching the accuracy of standard artillery weapons, and having no electronic controls, Honest John is simple in design and simple to operate. Normal crew training and standard fire control techniques are employed. Range is equivalent to that of medium-to-long range artillery. The weapon has considerably more battlefield mobility than conventional artillery and one high explosive round can deliver on a target the same demolition effect of hundreds of artillery shells.

Honest John consists of a rocket weighing several tons and a highly mobile, self-propelled launcher. The rocket itself comprises a forward compartment which houses the warhead; a motor at the center, in which the rocket propellant is fitted; and a fin assembly at the rear.

Major parts of the Honest John rocket—such as the head compartment, pedestal and motor, and fin assemblies—are assembled at the factory or arsenal. Final assembly of the explosive warhead and fins to the rocket occurs at a point close to the firing site. Once assembled, the rocket is moved rapidly forward on a self-propelled launcher. On site, the rocket is aimed much the same as a gun is laid on its target, and fired.

The development history of Honest John began for Army Ordnance in May, 1950. Shortly thereafter, Douglas Aircraft Corporation submitted proposals for a rocket based on Ordnance specification. Initial tests completed at the White Sands Proving Ground in August 1951 justified production of additional models.

By January, 1953, further successful tests with improved rockets manufactured by Douglas and fired from self-propelled launchers, developed by Army Ordnance, resulted in contracts for large-scale production of the present type rocket. Delivery is being made to troop units.

Besides releasing data on its Hermes A-1, General Electric during 1954 announced that it had flight tested a new and considerably advanced guided missile, had developed a new guidance system, and conducted research in high-performance fuels and propulsion system refinements.

The Company entered the missile business during World War II, when it signed a contract with the Army Ordnance Corps for a program of investigation in all fields of guided missile research, development, and manufacture. Code name for the program was Project Hermes after the figure of Greek mythology who was messenger for the gods.

In 1945, the Ordnance Corps also assigned G-E the task of firing a number of captured German V-2 rockets. It was during this program that the two-stage WAC-V-2 reached a velocity of 5000 mph and a height of 250 miles, the fastest and highest a man-made object has ever gone.

Another operation for the Navy launched a V-2 from the deck of the aircraft carrier Midway.

In addition to conducting the V-2 tests, G-E engineers were also designing and developing new missiles. In 1950 the first of these G-E designed missiles was launched at White Sands. Given the designation Hermes A-1, it was smaller than the V-2 and was designed as an anti-aircraft missile. A series of these missiles were launched during the following year. Later the A-1 was modified for use as a surface-to-surface test vehicle rather than surface-to-air.

Other G-E rockets were being designed during this period, too. Missiles given the designations Hermes A-2, A-3, B, and C-1 were undergoing development programs. While all of these were not produced, lessons learned from them were incorporated in other missile designs.

The missiles own by G-E since 1951 have resulted in many new contributions to missile guidance and propulsion systems.

Research and development achievements of "Project Hermes" include the first launching of a large rocket in this hemisphere; design, construction, and operation of the first large rocket static test facilities in this country; the development of an engine with the highest specific impulse ever achieved in rocket flight; the first command control of a missile in flight in this country; the first large-scale high supersonic ramjet work; the conception and development of two basically new guidance systems for surface-to-surface guided missiles, and the flight testing of the largest solid propellant rocket ever built.

Highlight of Sperry Gyroscope Company's 1954 missile history came with the May 12 announcement of the advanced status of the supersonic Sparrow I. Training of ship and shore personnel immediately got underway for operational use of this weapon by carrier-based jet aircraft of both Atlantic and Pacific fleets.

Present readiness activities brought only partial disclosure of the "Sparrow" missile, after more than seven years' development by the Navy Bureau of Aeronautics and the Sperry Gyroscope Company. Announcement of the missile was withheld until after the start of production from another special Navy facility, the Sperry Farragut Company at Bristol, Tenn.

More than 100 prototype missiles were constructed and critically test-flown from 1948 to 1951, including air launchings from Navy aircraft since 1949. These were evolutionary models, marking planned steps in the scheduled development of new combinations and improvements in robot flight controls and automatic guidance systems.

Defense and Navy officials decline to specify details of the missile types selected for first and second phase production runs, other than stating that these are systems capable of accurate control when the missile is fired from a speeding jet plane.

The Sperry Sparrow is rocket powered and fully maneuverable at supersonic speeds, yet light and compact enough to be carried in multiple units by fighter-type jet aircraft. Exact weight, range, type of warhead and performance data are still classified.

Prime responsibility for development and manufacture of the complete system was assigned to Sperry Gyroscope Company by the Bureau of Aeronautics in 1947. Evolutionary work included studies of tactical requirements and basic design criteria; engineering and design of telemetering equipment for unusually exhaustive tests; development and manufacture of control systems and airborne guidance of optional types; operational and maintenance training of Navy instructor personnel, as well as production of the Sparrow I missile itself.

As a factor in high performance of this operational weapon, Sperry Gyroscope Company made special acknowledgment of valuable cooperation by Douglas Aircraft Co. in the design and production of airframe elements. Similar tribute was extended to many other subcontract firms who supply essential component parts from their factories in many areas of the United States, in some cases without knowing what the parts were intended for.

Sperry Gyroscope is engaged in a number of other missile projects, particularly in guidance and stabilization. However, aside from Sparrow I, only its stabilization of Regulus has so far been announced.

First details were released in April by the Air Force and Sperry on a robot system used to control the Lockheed QF-80 pilotless jet aircraft, which participated in the nuclear tests at Nevada Proving Grounds during the spring. The QF-80 drone, a pilotless version of the standard F-80 jet bomber, collected data on radiological hazards within an atomic cloud.

The Sperry system enables "NULLO" flight by the QF-80 (No Live Operator Aboard), under direction by radio and radar from the beep-box control signals of two ground stations, worked by specially trained "beeper pilots," or from a nearby "director" aircraft.

The pilotless jet takes off and lands itself, and firmly holds any compass course, altitude or speed. While airborne it maneuvers easily, from take-off speed to Mach limit, and from sea level to 40,000 feet.

The QF-80 corrects itself for any unwanted deflections and holds constant airspeeds, even while automatically adjusting for nose-up or nose-down angles of flight. Accurate control is maintained up to full capacity of the aircraft, through take-offs and climbs, dives, level flights, flat turns and bank turns.

Chance Vought Regulus Guided Missile

Designed and produced by Sperry, the system was top secret for more than six years. Working with the Air Materiel Command and the Air Development Command, Sperry has equipped and delivered to the Air Force since 1949 numbers of these modified jet robots and jet "directors," and is now engaged on more advanced, improved designs.

A vital element of the QF-80 system is the Sperry E-4 precision autopilot, similar to the one which automatically flies long-range jet bombers on precision courses. The present QF-80 drone system is a further development of the wartime control of U. S. bombers over target, and an Air Force 1947 automatic flight across the Atlantic and back without pilots touching the controls. The automatic pilot is considered the key feature in such operations.

The remote control system of the QF-80 provides a degree of exact, automatic control of jet airspeeds not attainable before. Such stabilized airspeed is a critical matter in landings and precision maneuvers. The use of drones in atomic tests in Nevada demonstrated the progress made in "mating" radio, radar, gyros and servomechanisms into integrated systems of flight control.

The Chance Vought Regulus, designed for launching from submarines, surface ships and shore bases, made news on active duty. The submarine Tunny was recommissioned on the West Coast March 6th, specifically modified to launch the Regulus. The Tunny is a converted World War II submarine that has been modernized by the addition of the snorkel and stream lining of the hull and conning tower. While in the shipyard a tank for stowing a guided missile and a launching rack was installed.

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 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 the Regulus missile are equipped with tricycle landing gear so that it 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. Several test missiles now in use have been flown many times at subsonic and supersonic speeds and have been recovered without damage.

The Navy states that as many as 15 flights have been made with a single vehicle, cutting to one-tenth the cost of a comparable operation involving loss of a vehicle or missile for each test.

The tactical missile has no landing gear but carries a warhead.

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

In production since 1953 at Chance Vought's Dallas, Texas, plant, the missile was initially developed in 1948, and first flown at Edwards Air Force Base in 1950.

During 1954, Republic Aviation Corporation's Guided Missiles Division progressed into the research and development phase of operations, necessitating relocation of the Division at Hicksville, N. Y., near the company's main plant.

Republic's Guided Missiles Division was established in 1952 to consolidate and increase efforts in the field. During the first two years of operation the nucleus of a sound engineering organization was formed and several major feasibility studies were carried out for the armed forces.

For the research and development phase Republic has set up at Hicksville a Guided Missiles Engineering Department, electronics and servo laboratory, computer installation and experimental shop.

Republic's Guided Missiles Division is presently engaged in the development of a new air-to-surface guidance system as well as work in the special weapons field for the armed services.

Within its Missile and Control Equipment operation (MACE) at Downey, Calif., North American Aviation is carrying on one of the most inclusive programs in guided missile history.

Under the direction of company Vice-President L. L. Waite and Administrative Director H. R. Raynor, the Missile and Control Equipment operations are made up of three major technical departments: Aerophysics, headed by J. G. Beerer; Electro-Mechanical Engineering, directed by Dr. N. E. Edlefsen, and the Rocket Engine Facility, managed by S. K. Hoffman.

MACE'S 5,000 scientists, engineers, and technicians — some of the world's leading scientific brains—are creating missile configurations to withstand blistering heat at tremendous speeds. They are creating electro-mechanical brains to pilot missiles to distant targets with incredible accuracy —as well as related electro-mechanical products. They are designing and developing rocket engines for propulsion.

The company's Aerophysics department is in advanced stages of aerodynamics, aerothermodynamics, and stress and structures work for missile designs.

In the constant effort to reduce weight of missile structural parts, North American Aviation's Downey plant has developed a chemical milling process which has met with immediate success. With this process, called Chem-Mill, the Aerophysics department's Materials Research and Process Development Group produces lighter aircraft and missile parts to accuracies of .002 of an inch. Through Chem-Mill, it is possible to etch formed parts that cannot be handled by conventional milling methods. Entirely new designs are possible through chemical milling.

Important in the electro-mechanical engineering program is reducing size and weight of electronic components through sub-miniaturization. Some components are potted (hermetically sealed in a viscous plastic material) to make them better able to stand shock, humidity and extremes of temperature.

Another major MACE operation is the Rocket Engine Facility in East Los Angeles, where advanced work in rocket propulsion is being conducted. Not long ago, the company announced a 50,000 pound thrust, liquid propellent rocket engine capable of powering a test sled on rails at speeds above 1,500 miles per hour, reaching that speed from a dead stop in 4.5 seconds.

The Rocket Engine Facility is presently doing research and development work toward producing larger rocket engines. Thrust ratings are classified.

Firings of the company's rocket engines are conducted at the Rocket Engine Field Laboratory in the Santa Susana mountains northwest of Los Angeles.

Ryan Aeronautical Co., whose Firebee is in mass production, reported continued progress in three facets of missile science, aerodynamics, power plant and electronics. Since 1946, when Ryan designed and built the Air Force's first air-to-air missile—The Firebird—the company has conducted work in the field of electronics for guidance systems.

Today Ryan is building the rocket engines for the Army's newest atomic weapon—the Corporal Guided Missile. Ryan is also building jet type power plants for other missiles which cannot be revealed.

A top missile production story came from the Firestone Tire and Rubber Company, which during the year began construction on a new plant in Los Angeles to be employed exclusively for production of the Corporal guided missile.

Equipped with either an atomic or conventional type warhead, the Corporal is a surface-to-surface vehicle capable of engaging tactical targets far beyond the ranges of artillery. The weapon gives the field commander far greater firepower on the battlefield and enables him to strike selected targets deep in the enemy rear areas.

The Corporal follows a ballistic trajectory in its flight to the target. Weather and visibility conditions place no restriction on the use of the weapon. Motive power is supplied by a powerful rocket motor. The missile travels through space at several times the speed of sound.

Essential components of the weapon's system include the missile, a mobile launcher and guidance equipment. The launcher is a comparatively simple device consisting of a light metal take-off pedestal. A self-propelled, hydraulically operated erector places the missile in firing position on the take-off pedestal.

Almost concurrent with the announcement of the deployment of Martin B-61 Matador missiles to the Air Force's first pilotless jet bomber squadron in Bitburg, Germany, near the Iron Curtain, was the revelation of Allison as the Matador engine manufacturer.

The B-61 engine, designated the Allison J33-A-37, is based on the proven Allison J33 centrifugal flow jet engine which has acccumulated more than 2,500,000 hours of flight in such piloted aircraft as Lockheed's F-80 Shooting Star, T-33 trainer, F-94 night fighter and in Grumman F9F Panthers and Cougars.

In the development of the missile power plant it was necessary for Allison to design a J33 model incorporating reduced material, manufacturing and testing costs and still maintain a 100 percent reliable engine for a short but exacting flight life. This program resulted in major changes to the piloted version of the J33 engine and a total cost reduction of 30 percent. The J33 also powers Chance Vought's Regulus, a surface-to-surface missile. A third missile is also powered by an Allison turbo-jet, details of which cannot yet be released.

CHAPTER FOUR

Government and Aviation

Civil Aeronautics Administration

DURING 1954, THE Civil Aeronautics Administration completed a general reorganization and streamlining of its functions, reduced its costs of operation, returned to the field of federal aid to airports, and asssisted the aviation industry in continuing its long practice of breaking safety records year after year.

It was a good year for almost every segment of aviation. The scheduled airlines ran ahead of all forecasts of their growth; the non-scheduled operators had a record of 16 months of operation without a fatality; executive fliers increased in numbers and in utilization of their aircraft; aviation manufacture became the nation's leading industry in number employed; and industrial flying, including agricultural flying, continued its steady growth. Pleasure flying, difficult to isolate in statistics because many plane owners combine business and pleasure flying in the same plane, did not increase during the year, the only segment of the industry that failed to gain.

In the all-important matter of air carrier safety, the scheduled airlines came up with a record—estimated near the year's end—of .09 passenger fatalities per 100,000,000 passenger miles. In September, the non-schedule airlines completed a full year of operation without a passenger fatality, and they appeared headed for the end of the year with the same good record.

International scheduled lines produced an estimated record of NO passenger fatalities per 100,000,000 passenger miles.

A new policy of safety enforcement was adopted during the year. CAA Aviation Safety Agents in the field specialized in working directly with responsible management officials to encourage industry to undertake company-wide safety improvements on their own initiative and to assume more responsibility for detailed procedures and practices. Agents stopped arbitrary inspections of air operators, and concentrated their efforts where they would yield the greatest safety results.

Throughout the year the CAA worked with the non-scheduled airlines to prevent accidents, and especially in a program to raise the operational safety level of the C-46. The CAA's Aeronautical Training Center at Oklahoma City cooperated with the Aircraft Engineering Foundation in a special education program for chief pilots of member companies using this aircraft. These companies had no fatal accidents with this type of plane since the beginning of the program.

The non-scheduled lines had piled up a fatality-free record of 16 months at year's end, and were shooting at the all-time fatality-free period record of 17 months made by the scheduled airlines in 1938-1939.

Three new-type aircraft were certificated during the year, bringing opportunity for highly important studies by the CAA. They were the turbine-compound powered transports, the Douglas DC-7 and the Lockheed Super Constellation, and the Hiller ram-jet helicopter. CAA engineering specialists worked with industry engineers in devising safety standards for testing and refining these modern aircraft.

A comprehensive report on turbine-powered transports was completed early in the year, resulting from a year of study, discussion and travel by CAA safety specialists. The book will serve as an aid to the CAA and industry in establishing regulations for turbine-powered transports. At the year end, the CAA was working with Capital Airlines and Vickers-Armstrongs, Limited, which manufactures the Viscount, turbo-powered transport. When certificated in the U. S. the Viscount is to be put into service on Capital's lines.

To develop medical knowledge essential to aircraft design and operation, the Medical Division of the CAA established the Civil Aeronautics Medical Research Laboratories at Ohio State University at Columbus. The program there includes instruction of civilian physicans and others in aviation medicine.

For pilots, the CAA produced a new type examination for commercial pilot certificates, which includes a realistic, true-to-life flight situation to be worked out by the applicant. Manual 20 "Pilot Certificates" was prepared to improve the quality of pilot training and produce uniformity in flight tests. Continuous work was under way for improvement of examinations and tests that will insure pilot ability and improve safety.

The CAA took over in 1954 the investigation of accidents occurring to planes in the under-12,500 pound class, while the Civil Aeronautics Board retains its duty of determining probable cause of accidents to larger planes.

A $22-million Federal Aid to Airport Program was in operation shortly after mid-year, the result of a supplementary appropriation by Congress. The airport program had been discontinued for a year by the Department of Commerce while a special study of the whole practice of federal aid was completed. This study resulted in recommendations for continuing this practice, but recommended that federal money be used only in preparation of the landing area and the acquisition of ground outside the airport needed for clear approaches. No buildings will be built with federal aid, and airports may have federal aid under new criteria: if they have 3,000 airline passengers enplaning during the year, or if they have 30 aircraft permanently based. By the end of the year action was under way on 164 grants for airport construction or improvement, involving $15-million for projects within the United States, $750,000 for projects in Alaska, Puerto Rico, Hawaii and the Virgin Islands, $1.25-million for administration and $5-million designated as a discretionary fund for distribution by the Administrator. An additional $1.5-million was available, carried over from the 1953 program.

Airport pavement for handling heavier transport planes was the subject of a new booklet prepared by the CAA, and the lighted taxi guidance signs developed by the CAA were installed at New York International, Greater Pittsburgh and Newark airports.

Airways progress continued. At the end of the year the VHF airways were an estimated 95 percent complete as far as VOR ranges were concerned, and all Distance Measuring Equipments planned but four were installed and ready to be turned on. Air Carrier fleets estimated to be 80 percent equipped for use of the ranges, but very few, perhaps less than 1 percent of their planes, were ready to use DME.

New problems in traffic control kept the CAA studying and planning, and resulted during the year in an Airways Operations Evaluation Center at the CAA's Technical Development and Evaluation Center at Indianapolis. Tests of new ideas were under way in the field, with the CAA and the Military cooperating in opening the first Radar Approach Control Center (RAPCON) at MacDill Air Force Base in Florida, and 18 other such centers being planned. Defense planning activity was continuous throughout the year with the CAA and the military cooperating in matters of communication, identification and establishment of flight corridors in defense zone areas.

CAA's International Region continued to increase its services abroad, piling up an impressive set of statistics. The Region had certificate responsibility for 55 air carriers operating over 215,512 miles of unduplicated routes, using 657 airports, 1,742 pilots, 291 navigators, 662 flight engineers, 233 dispatchers, 5,205 mechanics and 136 radio operators. CAA Safety Agents abroad serviced 14 major maintenance bases, 12 sub-bases, 7 repair stations and 19 foreign repair stations. Some 68 aviation safety technicians handled this work and the 960 aircraft engaged in international transportation.

Important developments in the CAA's foreign operations were the assignment of a mission to Spain for modernizing the airway system there and train Spanish Nationals to operate it; assistance to India in planning and installing navigational aids; establishment of a training center for airways operators in Formosa; and some 10 other technical missions operating abroad in addition to the foreign visitors being given training in the United States.

To keep CAA agents current in the rapidly-developing fields in which they work for safety, the Aeronautical Training Center at Oklahoma City began operating its Dehmel trainer simulating the Boeing Stratocruiser during the year, and planned another simulator for training in the operation of jet-powered aircraft. Some 421 persons took the Center's Aviation Safety courses during the year, of whom 17 were foreign nationals and 13 airline personnel from large non-scheds. More than 500 received training at the Center in major subjects of airways operations, and of these, 239 were Air Force personnel and 37 foreign nationals.

The Technical Development and Evaluation Center of the CAA at Indianapolis received an award in 1954 from the Flight Safety Foundation for its work in detection and extinguishing of aircraft fires in flight. Results of the work of this group were appearing more and more on aircraft in operation. The Center's dynamic traffic control simulator was at work throughout the year, studying improvements applicable to complex air traffic problems throughout the country.

The Center worked during 1954 with a contractor in developing a fantastic magnetic drum for processing and storing messages for airway operation, looking toward a time when increasing traffic will require greater volume and faster action than possible by human beings.

Requirements for establishing and operating airway aids resulted in many continuous planning activities during the year. A booklet on "The Air Commerce Traffic Pattern," valuable for planning by the industry and the CAA, was printed covering calendar year 1953, and will be issued semiannually hereafter. The industry has found many uses for another CAA publication, "The Airplane at Work for Business and Industry" in 1952 provides a comprehensive review of all phases of general flying.

Concerned by the lagging interest of young people in aeronautics and aeronautical activities, the CAA originated the Aviation Incentive Movement in 1954. The aim was to carry out Senate Resolution No. 292 which said that "the CAA is requested and directed" to take steps to "capture and hold the interest of youth in aviation careers" and to develop incentives to achieve that end. Organization of a national committee and obtaining the cooperation of the industry were first steps in the campaign.

Washington National Airport, the only civil airport owned and operated by the CAA, finished the year in the black again, and with an estimated 3,065,000 passengers enplaned and deplaned on commercial air carriers, a new record. Discussion waxed during the year on establishing a second airport for Washington to meet the steadily-increasing growth of air commerce in and out of the Capital.

Civil Aeronautics Board

No major changes in organization or policy were experienced by the Civil Aeronautics Board during 1954. The five-member group marked its 16th year by noting several significant developments in U. S. civil aviation.

Passenger helicopter service, inaugurated in 1953 with flights by New York Airways between LaGuardia and Newark airports, expanded into inter-city operations with the initiation of scheduled passenger helicopter flights by National and Mohawk airlines using seven- and eight-passenger Sikorskys.

The experiment initiated late in '53 to carry first-class and other preferential mail (other than air mail and air parcel post) by air on a space-available basis and at a nonpriority rate was expanded to include mail shipments between numerous points on the routes of seven domestic trunk lines and 14 local service air carriers.

CAB reported that passenger traffic also continued to expand in 1954. Revenue passenger-miles of scheduled domestic operations for the year ended June 30th increased 13 percent.

Federal subsidy of the airlines for the year ended June 30th was approximately $80.4-million. Under Reorganization Plan No. 10 (reported in the 1953 Aircraft Year Book), the Board performs the function of paying to the air carriers that portion of compensation under provisions of the Civil Aeronautics Act representing subsidy.

An important decision affecting subsidy payments to air carriers was made by the Supreme Court early in 1954 when it ruled that any excess earnings of an airline's domestic operations must be offset against the subsidy need of its international operations. Prior to this decision, domestic and international operations had been considered separately by the CAB for mail rate purposes.

National Advisory Committee for Aeronautics

The researches of the National Advisory Committee for Aeronautics in 1954 were largely concentrated upon problems requiring solution to enable design and construction of airplanes and missiles with performance substantially improved over the best of today's production. In recent years great advances have been made in aeronautics, and yet there is no sign that the end of the period of spectacular accomplishment is near.

Results of research conducted over a ten-year period on the problems of developing aircraft which would possess both the vertical rising capabilities of the helicopter and the high speeds of conventional airplanes were reflected in 1954 in the successful full-scale VTO prototypes constructed by Lockheed and Convair under Navy contract. Much of the basic research by NACA has been focused on stability and control problems which are most serious during hovering and transition flight of VTO aircraft.

Because of the very large amounts of thrust required to reach higher supersonic flight speeds and provide greater range, the need for improved power plants has become critical. For its part, the NACA's Lewis Flight 'ropulsion Laboratory has been investigating the potentialities of various engine types, with greatest effort being focused on the jet engine. As a result, break-throughs have appeared at several points, and new and more powerful means of increasing greatly the performance of military aircraft have been uncovered. Some of the improvements represented forward steps in the progress of supersonic aircraft which are revolutionary rather than evolutionary.

The speed required to propel an airplane at supersonic speeds is very large, as much as five times that needed to sustain the same airplane at subsonic speeds. It has become increasingly apparent that if supersonic aircraft are to possess the long-range capabilities required a way must be found to breach the fundamental limits inherent in engines using chemical fuels.

One obvious way to extend the range of supersonic aircraft would be to utilize nuclear energy for propulsion. Fission of a single pound of uranium would produce as much heat as burning 2,000,000 pounds of gasoline. Stated another way, the total energy which can be obtained from the "burn-up" of a single pound of uranium equals the energy in 3,500,000 pounds of coal, yet the uranium would be a 1½-inch cube against 32 railroad cars of coal.

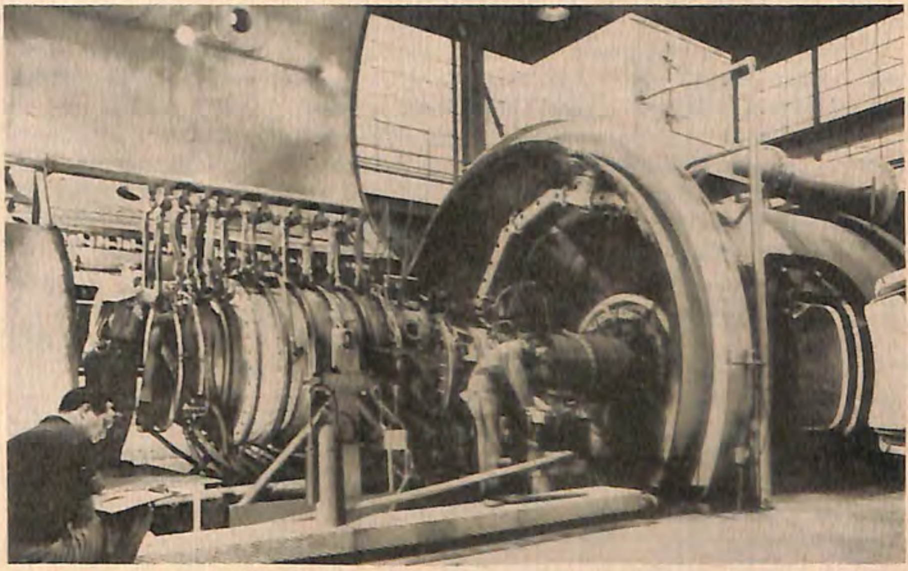
There are many ways in which the heat generated in a nuclear reactor can be converted into power or thrust. One of the simplest is to use the reactor to do the air-heating job in a turbojet engine in place of the usual combustion chambers where chemical fuel is burned. Unfortunately, the rate of heat-transfer to air is relatively low, and the amount of power required for supersonic flight forces use of larger and heavier reactors. Shielding problems for a small reactor in an airplane themselves are serious; they are greatly intensified by the need to utilize a larger reactor.

Both experimental and analytical investigations of the many problems of nuclear aircraft engines are necessary. Often problems are so complex as to require development of novel facilities which can be used to split them into their several parts for piecemeal study and solution.

The performance capabilities to be realized from harnessing nuclear energy for aircraft propulsion would be nonstop supersonic flight to any point on the face of the earth, and return. With so large a gain the goal, industry, the Atomic Energy Commission, the Military Services, and the NACA are participating in vigorous, sustained attacks on the formidable problems that must be solved.

In the search for ways to provide improved power plants for supersonic missiles, the ram-jet and rocket engines offer much promise. The ram-jet has no moving air compressor and has been called a flying stovepipe. It depends upon forward velocity to compress, or ram, air into the engine. Heat is added to the compressed air by burning fuel in a combustion chamber, and the heated air discharges from the exit nozzle in a steady, high velocity stream, giving thrust. The ram-jet must be traveling at high speed to produce useful thrust, but its simplicity encourages further development.

In its research work with ram-jet engines, the NACA has used several techniques. Some models tested are ground-launched, with booster rockets



Interior view of new facility at NACA Lewis Flight Propulsion laboratory

being used to attain initial speed. Other models are launched from an airplane at high altitudes. Sometimes, the two techniques have been combined, and models incorporating booster rockets have been air launched. In these latter cases, the booster accelerates the model to a Mach number of about 2.2, after which it drops off, and the ram-jet engines take over. Both gasoline and experimental fuels have been studied for use in ram-jets. The speed range of ram-jet engines being investigated under flight conditions has been extended from subsonic, in 1946, to a Mach number of about 3.5 (2310 mph) at the present time.

Continuing research is bringing a realization that, at even the relatively low supersonic speeds contemplated for tomorrow's airplanes, the effects of aerodynamic heating will profoundly aggravate already difficult design problems. The high temperatures reached by the airplane parts reduce their strength and stiffness. The rapidity with which the temperature rises is perhaps as important as the temperature level: thermal stresses may develop which can cause structural difficulties, like buckling, or aero-elastic troubles, like flutter, of great severity.

At the extremely high speeds considered for some long-range missiles (above a Mach number of 10, or 6600 mph) the temperatures reached would be enough to melt any presently-known materials., A missile of this type would follow a ballistic trajectory, climbing rapidly above the earth's atmosphere. Aerodynamic heating would not be too troublesome during the climb or level flight. But when it made its descending re-entry into the atmosphere, heat would be poured into the missile at an extremely high rate, with temperatures being reached sufficient to vaporize diamonds.

Preliminary studies have been conducted at the NACA's Langley Aeronautical Laboratory with small models made of low-melting-point metal. By this means, it has been possible to observe the probable behavior of full-scale missiles at high supersonic speeds. The model tests showed clearly that the structural material of the model will melt unless means are employed to prevent this from occurring. Various expedients to preserve the structure from disintegrating have been suggested, such as the use of high-melting-point ceramic and metallic materials, water cooling, and insulation.

On November 20, 1953, the NACA's Scott Crossfield became the first man ever to exceed a Mach number of 2 (in the Douglas D-558-II Skyrocket); two weeks later, Major Charles E. Yeager, USAF, flew the Bell X-1-A to a Mach number of 2.5. But because these speeds were held for only a matter of seconds on both flights, aerodynamic heating did not become serious. If, however, Yeager's speed had been maintained, even for a few minutes, surface temperature of the airplane would have been close to 400° F. If a fighter airplane cruising in the stratosphere at high subsonic speed were to accelerate to a Mach number of 3 (1980 mph), heat would be developed at a rate sufficient to melt a ton of ice per minute. Sustained speed at a Mach number of 4 would increase the temperature to 1000° F.

Analytical comparisons made at the NACA's Ames and Langley Laboratories have been made of materials available for use in the skins of aircraft structures designed to operate in various speed ranges. They show that aluminum is superior as a plate material up to a Mach number of about 2; that titanium is best for the Mach number range between 2 and 3, while steel is best for still higher speeds.

In experimental studies of heating rates, it has been necessary to employ radiant-heat sources, which can provide large quantities of heat very quickly. Temperatures above 4000° F. have been reached within seconds. In addition to such means of simulating aerodynamic heat, supersonic jets are used to produce actual aerodynamic heating comparable to that which would be experienced in actual flight.

Stopping a high-speed turbojet airplane, during landing, within the runway limits of today's airports has become a problem of increasing concern as the size and landing speed of such aircraft have continued to grow. Providing wheel brakes of sufficient size to do the job alone imposes too great a weight penalty. Other devices, such as parachute brakes, have been used but their high cost and other disadvantages have served to spur the search for a better way of obtaining the rate of deceleration desired.

Both in this country and in Europe the idea of obtaining the necessary braking power by turning the rearward turbojet blast to a forward direction has been explored. Much work has been done on the problem, and several ways of obtaining satisfactory thrust reversal have been studied.

Basic requirements for a practicable thrust-reversal device, in addition to effectiveness and reliability, include light weight and minimum penalty on flight performance. Also, the jet stream must be reversed in such fashion that it will not strike parts of the airplane which would be damaged by intense heat.

Thrust-reversal devices which have been investigated most thoroughly fall into three general categories. Perhaps most intensively developed to date has been the so-called target type, which obtains flow reversal by positioning a cup or dish squarely across the path of the rearward jet. When not in use, the cup elements are retracted into the engine nacelle or other airplane structure. The cup must be large enough to cause sufficient flow reversal; it cannot on the other hand be so large as to impose an excessive weight or drag penalty when not in use. It must be located close enough to the tailpipe to obtain good thrust reversal, but not so close as to reduce jet flow.

A second type employs a series of thin metal rings which, when not in use, are retracted into the engine tailpipe. To obtain thrust reversal, the jet stream is deflected against the rings by an upstream air blast piped from the engine's compressor, or by action of the jet stream on adjustable swirl vanes attached to the tailcone. As the amount of the air blast or the angular setting of the vanes is increased, more of the jet stream moves outward against the rings, which are so curved in cross section as to cause flow reversal. In this type, "cost" must be measured in terms of thrust losses during flight, caused by presence of the swirl vanes or of the blast tube in the jet stream.

In a third type, which the NACA has been studying, a double set of blades located inside the tailpipe causes thrust reversal. When not in use, the blades are closed in such fashion as to impose minimum drag. Although these blades impose some thrust loss during flight, this type is of interest because of its relative simplicity and also because it is possible to direct the reversed jet flow so as to avoid hitting airplane parts.

Aeromedical research has established that man can withstand very high impact loads providing their duration is short. Analysis of non-fire, crash-landing airplane accidents showed the lowest percentage of severe and fatal accidents among personnel who remained seated. This information suggested the possibility of learning how to reduce the frequency and severity of injuries in this type of accident.

By installing special instrumentation in the arcraft used in the crash-fire program which the Lewis Laboratory has been conducting, detailed information was gained about the forces transmitted through the airplane structure to that part of the fuselage where passengers would be located. In one test it was found that loads exceeding 12 g's (1 g equals the force of gravity) were imposed. Under these conditions a 200-pound passenger would exert a force of more than 2400 pounds on his seat belt. Such loads might tear the passenger from his seat or the seat from the airplane structure. In either event the passenger would be likely to suffer serious injury as he was hurled about the cabin.

Other tests were conducted, using light airplanes and dummies supplied by the Military Services. The dummies are constructed in such fashion that bone stiffness, joint action and tissue texture like man's are simulated.

In these tests, slow-motion picture records of the dummy's reactions during a crash, together with information about the loads imposed during a crash, were obtained.

Findings from this research program led to formulation of design requirements for an aircraft passenger seat which could absorb safely loads imposed during a crash landing. Among the seat specifications were the following: (1) It should be strong enough to hold the passenger in place; (2) it should be capable of enough elastic deformation to absorb the shock of peak loads, but with considerable frictional damping to prevent elastic rebound; (3) it should be able to withstand shocks from any direction, since a crash-landed airplane may swing around and hit objects while moving sideways or rearward, and (4) it should be constructed of such materials that if breakage occurs, no sharp or pointed objects will endanger the passenger.

To determine whether such space requirements could be met within the space and weight limitations present in aircraft construction, an experimental seat was built for study under crash conditions. Unsuited for commercial production, the seat incorporates construction features necessary for research, that interfere with passenger comfort.

The seat back, side arms, and seat pan are air-inflated members without metal parts. A body or head striking these parts would be well cushioned. Rubber linkages between the structural members afford necessary elasticity and ability to support a blow from any direction, while friction surfaces prevent elastic rebound.

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. The members of the Committee are as follows: Robert B. Murray, Jr., Under Secretary of Commerce for Transportation, Chairman; Chan Gurney, Chairman of the Civil Aeronautics Board, Vice Chairman; Samuel C. Waugh, Assistant Secretary of State for Economic Affairs; George H. Roderick, Assistant Secretary of the Army; James H. Smith, Jr., Assistant Secretary of the Navy for Air; Roger Lewis, Assistant Secretary of the Air Force; H. Chapman Rose, Assistant Secretary of the Treasury; E. George Siedle, Assistant Postmaster General; 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.

The Committee completed and transmitted to the President a comprehensive survey of Civil Aviation Policy. This report was accepted as a guide for the Administration and was released for information of the public on May 26, 1954.

In the economic field the Committee has completed a report covering the development (civil-military potential) of convertible aircraft. The report concludes that the convertiplane appears to have a significant potential utility for military, civil defense and commercial operations. Among other things, it recommends that activities of the military services and other organizations in developing technical experience with the convertiplane be accelerated to the extent practicable; that civil agencies be given maximum possible access to the results of military development programs; and that transport convertiplanes developed by the military services, unless required to perform special military missions, be designed to meet basic civil airworthiness standards. It points out, however, that basic responsibility for development of commercial convertiplane design rests with the private aircraft manufacturing industry. 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. Internationally, and through ICAO, it has continued work toward greater facilitation of passenger and cargo movements in international traffic; on international airport charges; toward a multilateral agreement for the exchange of commercial rights in international air transport; on joint financing of air navigation facilities and services, and the eliminaton of important deficiencies in such facilities and services. The United States has also reconsidered its position regarding the need for the North Atlantic ocean weather stations and agreed that it would participate in a modified ICAO program, effective July 1, 1954. In the legal field, the Committee's work has included preparation of the U. S. position for the Tenth Session of the ICAO Legal Committee, which was devoted primarily to the drafting of a Convention on aerial collisions.

The Committee approved and promulgated national standards for aeronautical beacons, lead-in lights, obstruction lighting and marking and runway marking. U. S. proposals for the revision of the international airworthiness code (Annex 8), and the international phonetic alphabet are being submitted for consideration by ICAO. The Committee prepared U. S. positions for nine (9) international technical conferences, including those for Divisional meetings on Communications and Meteorology, as well as one each for the Fourth North Atlantic Ocean Station Conference and the Third North Atlantic Regional Air Navigation Meeting. An over-all national plan for the coordination of all search and rescue facilities has been drafted. Based upon requirements developed within the Committee, high-speed jet navigation charts for the continental United States are being produced.

A high-level operational policy group established by the Air Traffic Control & Navigation Panel and known as Special Working Group No. 13 (SWG-13) is engaged in a complete review of the Common Civil/Military System of Air Traffic Control and Navigation, with particular emphasis on extension of radar's use. This group consists of the best operational and technical people from both government and industry, and expects to recommend major improvements to the system. Another NAV Panel working group, under the chairmanship of the Coast Guard, is developing a new implementation program in regard to the world-wide long distance nagivation system. Complete operational requirements for a domestic short distance navigation system, which encompasses the needs of all aircraft operations, has been developed and transmitted to the Air Navigation Development Board for their future guidance, particularly in relationship to the Board's evaluation of the VOR/DME system and military TACAN system. The Air Coordinating Committee is also studying pilot education recommendations involving flight operations in areas of high density air traffic. A study is also going forward, which is expected to bring up-to-date mobilization recommendations as they relate to the Federal Airways System. ACC has coordinated criteria covering the installation of Federal aids to navigation and traffic control, e. g., radar, ILS, control towers, etc. A similar criteria has also been produced which relates to the operation of non-federal navigation aids. Inauguration of a one year trial of special VFR procedures for high density air traffic zones where mid-air collisions are a hazard is planned for the Washington, D. C. area. At the request of the Under Secretary of the Air Force, the ACC is considering evaluation of the VOLSCAN approach computer system for use in the Common System.

The Committee approved the revision of the terms of reference for the Airport Use Panel, with chairmanship contributed by the Department of Commerce; also, a provision is made for a separate non-government advisory committee to consist of industry representatives who will meet periodically with the members of the Panel. Of particular importance, the revised terms of reference assure that the airport use and construction programs of the various member agencies of the Panel will be brought before the Panel for coordination before presentation to the Bureau of the Budget and the Congress. This procedure is designed to avoid conflicts between the users of the nation's airports before they become public controversies.

The Committee continued to effect the coordination required between all users of the airspace, settling about 2,000 cases per year. Radio and Television broadcasters' proposals to construct tall antenna towers have quite frequently presented the aviation interests with serious problems, but proposed tower heights have been lowered or alternate sites selected to decrease these hazards to an acceptable degree. There are approximately 460 restricted areas in the country, used by the military for practice firing and bombing. There are more than 165,000 miles of civil airways in existence today and these two opposing types of activities must be continually coordinated within the Committee.

Agricultural Research Service

Agricultural Research Service's Aircraft and Special Equipment Center was moved during 1954 from Oklahoma City, Okla., to USDA's Agricultural Research Center at Beltsville, Md. This move integrated more closely aerial research within the Service and the Department. As commercial operators become better equipped to handle agricultural aircraft work, the trend in ARS is to contract for as many of its services as possible, using its own planes for experimental, survey, supervisory and reconnaissance work. As a result, ARS' Plant Pest Control Branch, which in 1950 owned 26 planes, now owns 5. These planes flew 1,173 hours in 34 States during 1954, largely in supervising 53 commercial aircraft engaged in insect control work.

The second Agriculture Department-sponsored Agricultural Aviation Research Conference was held December 3-4 in Chicago.

During 1954, airplanes were used to spray 825,000 acres of land in 6 States to control grasshoppers, 156,500 acres in 5 States to control Mormon crickets, and 1,371,000 acres of forests in 6 States to control gypsy moths.

The new and growing use of aircraft to disperse seed, pelleted fertilizers and granular insecticides is prompting research into better ways of distributing heavier-than-dust dry material. Granular insecticides are less affected by wind than are dust or spray, and penetrate foliage to soil insects, or marsh grasses to sandfly or mosquito larvae. Some 900 acres in the Southeast were treated by plane with granular materials, mostly dieldrin, to control white-fringed beetles. Ordinary dusting equipment was used with agitator tied off. Last spring airplanes followed plows along some 1,500 acres of Illinois land dispersing granular dieldrin and obtained excellent control of Japanese beetles in an isolated infestation.

A metering device and distributor for granular material was developed to the flight study stage in Ohio; a series of flight tests were made in Texas in developing another distributor for such material. Spray dispersal equipment was modified on two of ARS' Aircraft and Special Equipment Center planes so that they can now apply both granulated materials and sprays.

ARS' Entomology Research Branch has developed an automatic insect-riddance system in which a time clock triggers automatic aerosol valves that spray an entire plane with insecticides at one time. The Navy is further testing this system, particularly on its hospital ships.

A fluidizer for dry bulk materials that makes them behave like liquids was developed and is being improved by ARS agricultural engineers.

The Ohio Project, planned in 1951 and first flown this past February, is an applicator plane designed around the configuration of an existing light plane fuselage and wings. Research results from ARS' Toledo laboratory and the Ohio Agricultural Experiment Station, as well as data from other sources, on distribution equipment were used in its distributor designs. Developers want to make plans available so that any qualified mechanic can modify existing planes in the average agricultural engineering shop.

The steadily mounting number of planes arriving in this country from abroad presents a growing danger of entry of foreign plant diseases and insect pests. In 1954 ARS' plant quarantine personnel examined nearly 76,000 planes arriving in this country from abroad; a third of these carried prohibited or restricted plant materials.

Federal Communications Commission

During fiscal 1954 the Federal Communications Commission met with various coordinating and policy groups, both on a domestic and international scale, to solve the many new problems which occurred as a result of telecommunications developments. The most important of these groups were the Air Coordinating Committee (ACC), The Radio Technical Commission for Aeronautics (RTCA), and the International Civil Aviation Organization (ICAO).

The latest statistics for aviation radio stations (as of Sept. 30, 1954) show a total of 39,900, divided as follows: carrier aircraft 2,314; private aircraft 25,186; public service aircraft 273; aeronautical and fixed stations 1,397; Civil Air Patrol 9,704; airdrome control 467; aeronautical navigational 276; flight test 134; flying school 12; and aeronautical utility mobile 137.

Aeronautical and fixed stations furnish a non-Government radio communication service necessary for the safe, expeditious, and economical operation of aircraft. Aeronautical land stations are used to communicate with aircraft, whereas aeronautical fixed stations are employed for point-to-point communications.

Civil Air Patrol stations are used in connection with Civil Air Patrol activities and emergencies pertaining to the protection of life and property. Air shows, missing aircraft search missions, training missions, and communication systems at encampments; bases and meetings are examples of their services.

Airdrome Central stations are used for transmitting necessary control instructions to aircraft arriving at and departing from airports. Such control is necessary so as to maintain safe separation of aircraft to prevent collision and to govern the flow of air traffic into and out of airports.

Fish and Wildlife Service

The Fish and Wildlife Service, in carrying out certain phases of its conservation programs, owned and operated 54 aircraft during fiscal year 1954. The fleet was composed of: 25 Pipers (Supercubs, Pacers, J 3 C's and J 5 C's); 10 Grumman Geese; 8 Grumman Widgeons; 4 Boeing Y L 15 observation planes; 2 Stinson V 77's; 2 Cessna 170's; 1 Flying Station Wagon; 1 Aeronca Chief; and 1 Twin Beechcraft.

These aircraft were used in a variety of field activities, such as surveying waterfowl, planting waterfowl feed, controlling noxious vegetation, protecting agricultural crops from depredation, hunting predatory animals, conducting wildlife censuses, and patrolling in connection with the enforcement of game and fishery laws.

Fifty-six personnel held letters of flight authority during the fiscal year. These pilots flew more than 12,000 hours and the territory covered included Alaska, Canada, Mexico, Cuba, Puerto Rico, Haiti and the Dominican Republic, as well as the United States.

The maintenance and repair of Service aircraft operating in the United States are handled through commercial shops. In the Territory of Alaska, however, where 37 Service aircraft were used during the fiscal year, the Service maintains overhaul and repair shops of its own.

Forest Service

A new Forest Service Aerial Fire Depot was completed and placed in operation at Missoula, Montana, in 1954. President Eisenhower spoke at the dedication program September 22, declaring that he had "long wanted to join in a salute to the Forest Service and particularly the 'Smokejumpers,' who have saved priceless assets of the Nation." The new $700,000 depot was constructed under a special authorization from Congress.

The Forest Service uses aircraft in connection with the protection and management of 150 National Forests, located in 40 States and Alaska. 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, surveying and spraying for insect control, and search and rescue. In 1954, the Forest Service owned and operated 21 fixed-wing aircraft. These included 13 single-engine airplanes previously owned, and 3 single engine and 5 twin-engine 'planes acquired for replacement of worn-out planes during the year by transfer from other governmental agencies. These planes have all been equipped for transporting personnel, cargo parachuting, and smokejumper work. Some single-engine planes and one DC-3 are equipped for seeding and spraying.

Use of fixed-wing aircraft by the Forest Service in 1953 totaled 16,839 hours. This included 2,675 flights, totaling 3,711 hours, by Forest Service airplanes; 7,079 flights, 12,827 hours, by commercial planes under charter contract; and 152 flights for 301 hours by aircraft of the Armed Services. Use of helicopters (commercially operated under contract) amounted to 2,368 flights for 978 hours. (Not included in the above figures is certain contract flying for aerial photography and insect contract work.)

A total of 23,371 fire-fighters and other passengers were transported during 1953. Cargo transported totaled 1,400,600 pounds, of which 408,219 was air freight (delivered at nearest airport), and 1,013,031 pounds was para-cargo 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 269. During the year, the smokejumpers made 1,754 jumps to 489 fires. They worked a total of 6,563 man-days on fires. Estimated savings due to smoke-jumper use amounted to $972,155.

In the fiscal year ended June 30, 1954, aerial photography for national-forest mapping and resource inventory covered 4,411 square miles. Most of this was done under contract.

Effective January 1, 1954, the research and control work on forest insects and diseases formerly conducted by the Agricultural Research Administration was assigned to the Forest Service, as part of a reorganization of the Department of Agriculture ordered by the Secretary. Field programs of the transferred units, including aerial surveys of forest insect conditions and aerial spraying projects, were integrated with other Forest Service activities. During the year, some 200,000 acres of valuable ponderosa pine timber in Idaho was sprayed from the air to control an outbreak of pine butterfly, an insect causing rapid defoliation of infested trees. All told, the Forest Service used planes for the aerial spraying of more than 325,000 acres of forest to combat insect infestations during the year. Almost 1,500 hours of flying time was devoted to surveys of insect conditions in forest areas in various parts of the country. The insect surveys covered an estimated 50,000 square miles of forested land.

Over 250 hours were flown in surveying a forested area of about 10,000 square miles for detection of oak wilt disease. This survey covered parts of northern Arkansas, Tennessee, and Kentucky, and the Appalachion section of western North Carolina and Virginia. Most of this insect and disease survey work was carried out under contract, and was in addition to that tabulated above.

Research looking to improvement of aerial surveys and of aerial spraying methods for the control of forest insects require about 200 hours of flying time annually.

The year 1955 will mark the Fiftieth Anniversary of the establishment of the Forest Service in the U. S. Department of Agriculture.

National Air Museum

The 50th anniversary of powered flight greatly increased the Museum's activities through the anniversary year. Having custody of the Kitty Hawk, Wright 1909 military airplane, Wright EX Vin Fiz, components of original Wright aircraft, and an extensive collection of data and photographs pertinent to the Wright Brothers, the Museum was called upon constantly to supply material for numerous programs and projects. Much of the material had been gathered in the previous year in anticipation of the anniversary activities. The Museum was thus in a position to supply photographs, transcripts, and monographs to correspondents and visitors. This work became one of the chief functions of the Museum as the nation marked the half century of powered flight.

A commemorative exhibit was installed under the wings of the Kitty Hawk featuring the Wright Brothers' accomplishments. The exhibit consisted of 16 scale models of aircraft, including gliders, produced by the Wright Brothers and the Wright Company, 3 Wright engines, portrait busts of Orville and Wilbur Wright, a model of the Wright Memorial at Kitty Hawk, N. C., a reproduction of the Wright wind tunnel, and enlarged photographs of their aircraft. This exhibit remained on display during the month of December.

Progress was made on the preliminary plans for the proposed National Air Museum building, to exhibit the national aeronautical collection. Most of the effort was concentrated on the selection of a suitable site and architectural studies. Storage facilities in the Washington area were improved and expanded to preserve the collection in the interim period.

A bequest was received from George H. Stephenson several years ago to provide for a statue of the renowned air leader General William Mitchell.

Mr. Bruce Moore, sculptor, was commissioned and started his initial studies. A grant was received from the Link Foundation to be used for a booklet describing 12 of the Famous aircraft in the national collection. This booklet, *Masters of the Air*, will be used by the Museum for informational purposes.

Aggressive action was taken throughout the year to complete the ready reference library of major aviation magazines. This library contributed to two major research projects, conducted by the staff, on the Kettering Aerial Torpedo of 1918 and a pictorial history of the Wright Brothers. Both projects resulted in new and authentic material for the collection. More than 3,000 photographs have been assembled on the Wright Brothers.

Three hundred sixty new specimens from forty-eight sources were received and recorded by the Museum. Outstanding among them was the Boeing 247-D transport airplane, Adaptable Annie, flown by Roscoe Turner and Clyde Pangborn in the MacRobertson Race, 1934. America's first jet-propelled bomber, the Douglas XB-43, was flown to the Washington area for storage. A German rotary wing kite, piloted, for use with submarines during the World War II, was received along with the Prewitt Rotorchute, an interesting development used for dropping equipment under extreme conditions. The Museum received an early Link Trainer, 1929, embodying the initial developments of Edward Link for simulating flight conditions. Excellent models, which came from Douglas Aircraft Company and North American Aviation, Inc., were placed on display. The supercharger and automatic pilot for Wiley Post's Winnie Mae along with a parachute which was made in 1917 and used by Post in 1924, when he made exhibition jumps, were placed in the collection.

Post Office Department

The fiscal year ending June 30, 1954, showed a continued increase in the use of air services. Over 1,451,000,000 pieces of domestic letter mail, including free air mail letters from armed forces overseas, were transported, an increase of approximately 39,000,000 pieces, while there were over 19,500,000 pieces of air parcel post carried, an increase of approximately 1,600,000 pieces.

The total net weight of air mail including air parcel post was approxi-81,700,000 pounds, an increase of about 4,800,000 pounds over the previous year.

During the fiscal year 1954, a total of over 9,500,000 pounds of United States mail, including about 2,300,000 pounds of air parcel post and other articles, was transported by air to foreign countries, showing an increase of over 600,000 pounds. These figures do not include the mail exchanged with U. S. possessions and military installations overseas.

Foreign air parcel post service and air service for other articles, that is, prints, samples, newspapers, etc., is now available to over one hundred countries.

Weather Bureau

The first phase of the Weather Bureau's in-service pilot briefing training program for its aviation personnel was completed in 1954 with more than 700 employees successfully completing the course. Phase two, which consists of extending this training to all employees entering into this type of work, continued.

Weather Bureau reports and forecasts received wider and faster distribution as a result of CAA's action during the year to speed up its teletypewriter communications systems from 60 to 75 words per minute.

A new book, intended especially to help pilots with their weather problems, was completed and submitted to CAA for publication as one of their technical series. Entitled *Pilots' Weather Handbook,* the new book replaces the earlier Manual No. 25, Meteorology for Pilots, and is available from the Government Printing Office.

An experimental continuous broadcast of recorded weather and Notices to Airmen information was begun as a joint Weather Bureau and CAA project. The broadcasts, made over CAA's L/MF air navigation air at Arcola, Viriginia, contain a summary of the present and forcast weather conditions within approximately 250 miles of Washington, plus radar weather reports, pilots' reports of in-flight conditions, and hourly surface reports.

A total of 28 weather detection radar sets have now been commissioned, mostly in the central United States and along the Gulf and Atlantic coasts. GMD-1 radio direction finding sets are in operation at 13 stations for determining wind directions and speeds of stratospheric levels. Completion of a fully automatic weather reporting station was realized in 1954 and two of these stations are now in continuous, unattended operation at field locations, automatically entering their reports on the teletypewriter circuits. Work is progressing on the development of supplemental equipment that will permit the automatic stations to report regularly cloud height and visibility conditions in addition to pressure, temperature, relative humidity and wind, which are currently being reported.

Following development of practical remote reading equipment for automatically measuring cloud height and visibility conditions in the approach path to the instrument runway and testing of the equipment at Washington National Airport (reported in 1954 YEAR BOOK) the Weather Bureau has completed installation of automatic end-of-runway observation equipment at New York (La Guardia and Idlewild airports), and at Newark, New Jersey, during 1954. Installation of similar equipment is in progress at 13 other major airports in the United States and is scheduled for completion in 1955.

One phase of a research program conducted by the Weather Bureau and the Sperry Gyroscope Company for the Air Navigation Development Board dealing with problems connected with reporting weather during periods of low ceiling and visibility was completed. Plans were being made for a field test of the results of the research program.

The Weather Bureau continued its program of in-flight and on-station checking of the aviation weather service and is using a Cessna 190 in this work.

CHAPTER FIVE

The Airlines

DURING 1954, THE SCHEDULED AIRLINES continued their efforts to bring the best possible service to the public with four notable achievements:

Implementing the Post Office Department's experiment of flying non-local first-class mail between certain major U. S. cities, the airlines enabled (and are enabling) hundreds of millions of letters to reach destination an average of 11½ hours sooner than if they had moved by surface means. During the first year of the experiment, ending October 1, 1954, the scheduled airlines cooperating in the program flew 9,600,000 ton miles of first-class mail, thereby saving letter writers nearly ten billion hours. For this service the Post Office Department received from the public $29,500,000. The Department paid the airlines $1,830,000 for flying the mail. Thus, the Post Office Department was able to retain $27,670,000 or 94 percent for its own services.

The original tests are still being conducted between New York and Chicago; Washington and Chicago; New York and Jacksonville-Tampa-Miami; and between Chicago and those Florida points. On November 22 the experiment was expanded to include 19 West Coast cities.

Today, certificated helicopter carriers are bringing expedited passenger, mail and cargo service to 34 points in the Chicago area, 23 points in the New York area and 22 points in the Los Angeles area. In addition, the Civil Aeronautics Board, during 1954, authorized one of the local carriers in New York State to operate a segment of its route system with helicopter equipment and granted one of the scheduled air carriers the authority to supplement its trunk line operation in Florida with helicopter service.

The year 1954 saw plans crystalize for the introduction of turboprop aircraft into the scheduled airlines route system. The time table for beginning U. S. scheduled service with this type of aircraft is the early spring of 1955, when one of the domestic trunk carriers will take delivery on three of a total order of 60 turboprop aircraft. Turboprops promise to bring increased comfort and speed between certain pairs of cities to the flying public. For example, the type of turboprop which will enter the service of the U. S. public in 1955 will cut the average flying time from New York to Cleveland from approximately two hours to about 1 hour 30 minutes.

The major U. S. scheduled airlines accelerated their cargo (express and freight) sales merchandising programs during 1954. At the present time, there are 56 aircraft certificated for "cargo only" in service, three of which are DC-6A's. The others are C-54's and C-46's. However, two of the larger trunk lines are planning to add 12 DC-6A's to their all-cargo fleet in the near future. These planes have total cargo space equivalent to two railway boxcars.

Realizing the business that can be developed through lower packaging costs, the scheduled airlines, through their Air Traffic Conference, have established a subcommittee to explore thoroughly this subject. Apropos of this, Brigadier General John P. Doyle, Director of Transportation for the Air Force, has said that the time has come for planes to be designed specifically to carry cargo packed in modern low-cost containers susceptible to the most modern material-handling methods.

There follows a comparative table showing traffic and revenue statistics for the U. S. scheduled airlines during 1953 and 1954 (partially estimated):

U. S. DOMESTIC TRUNK LINE STATISTICS

	1953	1954	Percent Change
Revenue Passengers	26,135,794	28,869,000	+10.56
Revenue Passenger Miles (000)	14,297,909	15,950,000	+11.55
Mail Ton-Miles	71,725,595	81,300,000	+13.35
Express Ton-Miles	42,526,761	38,750,000	− 8.88
Freight Ton-Miles	131,779,675	142,000,000	+ 7.76
Total Operating Expenses	791,416,000	885,000,000	+11.82.
LOCAL SERVICE			
Revenue Passengers	2,031,508	2,450,000	+20.60
Revenue Passenger Miles	390,854,000	453,000,000	+15.90
Mail Ton-Miles	1,000,758	1,220,000	+21.91
Express Ton-Miles	955,128	1,100,000	+15.17
Freight Ton-Miles	1,178,793	1,175,000	− 0.32
Totals	49,358,000	54,000,000	
INTERNATIONAL			
Revenue Passengers	2,682,219	2,812,000	+ 4.84
Revenue Passenger Miles (000)	3,381,124	3,700,000	+ 9.43
Mail Ton-Miles	30,838,373	40,833,000	?
Cargo Ton-Miles (Express and Freight)	74,643,683	82,300,000	+10.26
Operating Revenues	337,286,000	358,789,000	+ 6.38

Sources: For 1953 from CAB recurrent reports. For 1954 monthly traffic reports for 10 months of 1954. For revenues and expenses, three quarterly reports for the first three quarters of 1954—last quarter estimated.

Allegheny Airlines

The outstanding events during 1954 for Allegheny Airlines was the 35 percent increase in business over 1953 and inauguration of first class mail services by Allegheny and other local service airlines.

During the 12 month period ending September 30, 1954, Allegheny carried 207,435 passengers for an increase of 13 percent over the corresponding period the previous year. In August, Allegheny boarded its millionth passenger since the inauguration of passenger service in 1949.

During the year the airline increased its passenger miles flown approximately 35 percent over last year. In 1953 Allegheny again received the National Safety Council's Aviation Safety Award and maintained an unbroken safety record in its passenger operations.

At year-end, Allegheny reported its equipment modification program under way which will expand the seating capacity from 24 to 27 passengers and will permit carry-on baggage by passengers. The modification will increase the tail weight capacity of the airplane and reduce the over-all gross.

Because of the weather problem characteristic of the Middle Atlantic Area during the winter, Allegheny developed a passenger advisory system which gained favorable customer reaction. The program is predicated on a forecast system beginning approximately three hours before flight time enabling Allegheny to contact passengers at home or in their offices prior to leaving for the airport advising them of the status of their flight and whether or not it will operate in a routine manner.

American Airlines

American Airlines held two birthday parties in 1954—both of them milestones in the history of commercial air transportation.

On November 29, American celebrated the first anniversary of its history-making non-stop transcontinental flights in both directions. Using the 365 mile-an-hour Douglas DC-7, American pioneered non-stop service between New York and Los Angeles with a single round-trip flight, adding two more round-trips during 1954.

A record on the non-stop was made one day, broken unofficially the next. On Monday, March 29, 1954, a DC-7 carrying 60 passengers and a crew of five flew from Los Angeles to Idlewild Airport in 6 hours and 10 minutes, breaking the previous official record by ten minutes. But the very next day, on the same flight, 54 passengers and five crewmen made it—unofficially—in five hours and 51 minutes.

American took delivery on the last of its 25 DC-7s in the summer of this year, bringing its total Flagship fleet of Convairs, DC-6's, DC-6B's, DC-6A Air-freighters to 188.

The second birthday observance was the tenth anniversary of regularly scheduled airfreight, introduced to the air transportation industry by American on October 15, 1944.

Counting 1945 as the first full year of operation, American carried a little under 2-million ton miles of airfreight in 1945, 36 and a half million ton miles five years later, 54,660,000 ton miles last year, and nearly 28,-000,000 ton miles in the first six months of 1954.

Revenue from airfreight showed a similar increase, rising from $827,000 for all of 1945, to $7,241,000 in 1950, $11,658,000 in 1953, and $6,055,000 for the first six months of 1954. Last year's airfreight revenue represented 12% of all of American's revenue. This year's six-month airfreight revenue represented almost a 17% increase over revenue for the same period a year ago.

The tenth anniversary of airfreight coincided with American's announced decision to buy seven more DC-6A Airfreighters from Douglas Aircraft at a total cost of $10.4-million including spare parts.

For the first nine months of 1954, meanwhile, American reported a net profit, after taxes, of $5,465,000. Totals on passenger service for the first nine months were 4,258,000 passengers carried 2,517,000,000 passenger miles.

In May and June of this year, American broke and set industry records for airline passenger traffic with 325,065,000 passenger revenue miles flown in May and 366,640,000 passenger miles in June.

In July, a new service for America's passengers was introduced. Applying the techniques of low-cost installment-plan buying to air travel, American developed a new type of "Go-Now, Pay-Later" credit plan, featuring no down payment, up to 24 months to pay, and the lowest local interest rates available for any travel loan.

In May, American announced that it will build an $8-million maintenance base at New York International Airport, with construction expected to be completed by the early summer of 1956.

Braniff Airways

The year 1954, for Braniff Airways, was one of changes and progress under new administration. When the airline's founder and president Thomas E. Braniff, was killed in a private airplane accident on January 10, management was turned over to his veteran associates.

Fred Jones of Oklahoma City, a director of Braniff Airways for more than ten years was elected Chairman of the Board of Directors. Charles E. Beard, an officer in the company since 1935, and executive vice-president since January, 1947, became president.

During 1954, Braniff completed one of its most successful years in both domestic and international operations, flying 26,500,000 revenue miles, carrying 1,640,000 passengers.

Combination DC-6 tourist and first-class service over the airline's South American routes between Miami and Buenos Aires proved very successful.

Experiments were begun in April with airborne radar equipment in co-operation with the U. S. Navy. Braniff was the first commercial air carrier using airborne radar equipment in scheduled passenger flights to South America.

On October 14, 1954, the Civil Aeronautics Board approved the operation by Braniff and TWA of through interchange service between Houston and San Francisco via Dallas-Fort Worth, Amarillo and Los Angeles.

In November, the company introduced a "Time-Payment Travel Plan" for both domestic and Latin American services.

During July, of the 123,193 revenue passengers carried by Braniff, 112,845 were carried to their destination on time (within 15 minutes of published schedule time).

Capital Airlines

One of the most significant aircraft purchases occurred on June 3, 1954 when J. H. Carmichael, president of Capital Airlines announced that his company had bought from Vickers-Armstrong three Viscount airliners powered by Rolls-Royce turbo propeller engines. At the same time he announced that Capital had taken an option on thirty-seven additional Viscounts. This option was exercised on August 11 and a further option was taken on twenty more Viscounts. Thus, Capital's purchase totaled forty airplanes and involved $45-million.

Capital's exercise of its option on the additional thirty-seven aircraft tended to speed up delivery of the Viscounts thus enabling the company to inaugurate service with the new turboprop planes early in 1955. Delivery date for the last of the forty airplanes was set for August, 1956. Should the option on the additional twenty planes be taken up, bringing Capital's Viscount fleet to sixty, delivery on the balance will be completed between September, 1956 and February, 1957.

In the first nine months of 1954 Capital carried 1,813,518 passengers as compared to 1,699,548 passengers in the same period in 1953. Not only did Capital carry most of the major league baseball teams last year but they also signed an exclusive contract with the Pittsburgh Pirates to carry the team to all its "away" games. It was the first time a major league baseball team depended solely on air transportation to fulfill its yearly schedule.

Early in January Capital broke at least four records when it chalked up the biggest single day of travel in its 26-year history. Total revenue for the day of January 3 was $206,944 when approximately 10,871 passengers flew 3,426,759 revenue passenger miles. Capitaliners flew 100,286 miles for another new all-time record. It was the first time the company topped the $200,000 mark for one day's revenue.

Again last year Capital Airlines received an award for its contribution to safe air transportation from the National Safety Council. Up to November, 1954 the airline had flown over three billion passenger miles without a single passenger or crew fatality.

Capital's mail revenue and poundage dipped slightly during 1954 as compared to the previous year. In the first nine months of 1954, 8,337,632 pounds of mail were flown 1,544,904 ton miles for a revenue of $711,695. While in the first nine months of 1953, 8,922,222 pounds were flown 1,658,172 ton miles for a $778,585 revenue.

Due to an air express strike early in the year the shipping of express by air was somewhat less in the first nine months of 1954 than in the first nine months of 1953. The figures show that 10,612,343 pounds were flown 1,717,473 ton miles for a revenue of $682,153 at the three-quarter mark this year while for the same period last year 13,794,898 pounds were flown 2,124,358 ton miles with a resulting revenue of $886,872.

Air freight poundage and revenue was up for the first nine months of 1954 over the like period in 1953. As of September 30, 1954 Capital had flown 12,949,173 pounds of air freight 3,141,237 ton miles. Revenue was $851,828. For the first nine months of 1953, 11,454,923 pounds were flown 3,141,237 ton miles for a revenue of $693,901. In mid-summer Capital established an express air cargo service at lower air freight rates to virtually every major city area in the world from the 77 Capital-served cities in the United States.

Capital was the first company to adopt radiant heat for precise preheating of engine cylinders on a conveyorized basis. Two mechanics designed an infra-red oven to pre-heat the cylinders. Previously the cylinders were heated by a gas torch method but with the new infra-red treatment there is a 30 percent increase in assembly production, a saving of 25 man-hours a week and cleaner, cooler working conditions.

On October 1 Capital marked the first year of its income retirement plan when Captain Harry Smith, 63 years old, announced his retirement. On his last flight from Minneapolis/St. Paul in a Lockheed Constellation his son, Harry, Jr. flew co-pilot on this sentimental journey. Captain Smith is the first commercial pilot to turn the controls of his airplane over to his son.

Capital reported a net profit for the first nine months of 1954 of $1,010,647 and an operating profit of $1,504,639. The total operating revenue amounted to $35,901,275. Earnings per share of common stock for the nine-month period were $1.28.

Continental Air Lines

Continental Airlines engaged in an all-out long range program to strengthen and increase its interchange service in 1954. The newly inaugurated air coach with American Airlines to the West Coast began on September 26 and showed marked increases in passengers and revenue.

Envisioned for the future by Continental is the first direct service between the Pacific Northwest and Florida with interchange agreements linking United's Seattle to Denver route, Continental's Denver to Kansas City mileage and Delta-Chicago and Southern's Kansas City to Miami routes into a unified, one plane service.

It was announced in November by Continental's president that the spring of 1955 will bring the introduction of airborne C-Band radar equipment to the airline's fleet. Plans for the installation of several hundred thousand dollars of radar equipment were completed and by the fall of 1955 the entire fleet of the company's planes will be equipped. Continental was the second major air carrier in the country to announce a C-Band radar program, an additional step towards assuring continued safety in operation and comfort in passenger travel.

The view of the radar screen permits the pilot to avoid turbulent areas by circumventing the known, but visible storm condition, to evade portions of the flying route which are known to harbor icing conditions dangerous to safety, and to maintain adequate clearance of mountainous terrain areas in flight.

In its twenty years of operation, Continental has had a fatality-free record. This is attributed to careful pilot and crew instruction, favorable working conditions, and a thorough inspection of all equipment before departure and during lay-overs.

Program entitled "Design for Executive Development" was announced at the annual sales traffic, flight service and station managers meetings held in Denver in October.

The new program is a step towards instituting an over-all plan to provide opportunities for greater promotion with the company and establishing analyses and specifications for all job catagories.

The airline had carried 303,065 passengers through September. A successful advertising campaign, "12 cents a mile car-6 cents a mile air" was carried out to aid passenger revenue. The campaign pointed out the difference in air and automobile travel, which helped convert motorists miles to air miles.

Mail, too, showed a 13.8 percent increase over the same period the previous year, and express and freight showed a 19 percent increase.

Delta-C. & S. Air Lines

Delta-C&S Air Lines, which celebrated the first anniversary of the merger of Delta and Chicago & Southern Air Lines on May 1, was seeking in 1954 to provide competitive service from 26 cities of the South and Southwest to Washington, Baltimore, Philadelphia, and New York, and to close gaps in the company's present routes between Birmingham and Memphis and between New Orleans and Houston. A decision was not expected until the latter part of 1955.

Certification of this extension would create a new airline route for 29 cities with a total population of 26,116,411.

The airline presently serves 58 cities, 16 states, and 7 countries, with a total route system of 9,508 miles.

August was the heaviest month in the history of the company with 176,273 revenue passengers carried and 74,227,944 revenue passenger miles flown.

For the eighth straight summer Delta-C&S offered all-expense packaged vacations to Miami Beach, with the package period opening April 25 and continuing through December 15. Also, for the first time this year Delta-C&S offered a week's holiday family package at Fort Lauderdale, Florida.

The airline also offered low-cost packaged Aircruises to Havana and Varadero Beach, Cuba; Kingston, Montego Bay, and resorts on the north shore of Jamaica; Port au Prince, Haiti; Ciudad Trujillo, The Dominican Republic; and San Juan, Puerto Rico.

Summer excursion fares and low-cost air coach rates boosted Florida travel among those not buying packaged vacations.

What to see and do in South Florida and the Caribbean, 1954 version, was described in the fourth edition of Delta-C&S's illustrated guide to

Greater Miami entitled "Planning Your Holiday in Miami and Miami Beach."

Delta-C&S operated more air coach service in 1954 than ever before, featuring service from Chicago-Houston, Chicago-New Orleans, Detroit-Dallas, Atlanta-Dallas, and Chicago-Miami.

For the third summer, Delta-C&S continued its non-stop aircoach Chicago-Miami service during the summer months, and it operated with an average of 78-80 percent of its seats occupied.

The Delta-C&S DC-6 fleet is now undergoing a modification program which, when completed, will provide the number of seats necessary to meet CAB requirements for daylight DC-6 coach operation. Day coach service was estimated to start by December 1 on the Chicago-Miami route. Also, transcontinental day coach service was scheduled to start on the same date on the American-Delta-C&S-National interchange flights between Los Angeles and Miami.

Delta-C&S's first DC-7 was christened at the Douglas factory in California on February 22. The giant plane, carrying 50 passengers and piloted by Charles H. Dolson, vice president of operations, and T. P. Ball, superintendent of flight operations, flew from Santa Monica to Jacksonville on February 24 in six hours at an average speed of 371 miles per hour. This plane represents the first in a fleet of ten of these luxury planes which Delta-C&S has ordered at a total cost of $17.5-million. Six more were scheduled for delivery before the end of the year.

Scheduled DC-7 service was inaugurated April 1 between Chicago and Miami, and the luxury planes now serve Chicago, St. Louis, Houston, Cincinnati, Atlanta, and Miami.

Delta-C&S has designated its DC-7's the *Golden Crown Fleet* and decorated the distinctive giant tail of each of the 69-passenger aircraft with a crown, symbol of supremacy. The flights are named The Royal Biscayne, The Royal Poinciana, The Royal Ranger, and the Royala Merchant.

Delta-C&S has supplemented visual inspection of aircraft parts with a portable X-Ray machine to examine interior structures. Delta-C&S is the first airline to buy such equipment, which is resulting in greater safety and efficiency of operation and eliminates costly inspection disassemblings now necessary for routine checks of concealed parts.

Delta-C&S is installing Bendix Ignition Analyzers on the DC-7's for use in flight by the flight engineer and for Maintenance's use on the ground. Purpose of the ignition analyzer is to detect, locate, and identify any ignition malfunction occurring during engine operation, and information obtained from the analyzer during flight is reported to maintenance to aid mechanics in locating and correcting the trouble many times faster than the previous methods.

At the annual meeting of directors, Delta-C&S reported an operating income of $732,000 for the quarter ended September 30, and a net profit after taxes of $171,000—equivalent to 29 cents a share.

In a report to the annual stockholders meeting which preceded the directors' meeting, C. E. Woolman, president and general manager, listed operating revenues of $13,158,000 and operating expenses of $12,526,000 for the quarter.

Eastern Air Lines

In March of 1954, Eastern Air Lines completed the semi-final stage of its $155-million re-equipment program when it received it's 16th and final turbine-compound powered Super-C Constellation. This fleet represented a total cost of $25-million, including spare parts.

The final stage in the airline's re-equipment program leading up to the commercial jet era, will be the delivery of 12 Douglas DC-7B airliners in the spring of 1955. Representing still another $25-million investment, more than $2-million per airplane, these aircraft will be equipped with long-range wings new high-performance flaps and engines still more powerful than the 13,000 horsepower turbine-compounds now in service.

In May, Captain Eddie Rickenbacker, Chairman of the Eastern Air Lines Board, announced that Eastern Air Lines would convert more than 50 percent of its trunkline services into lower fare Aircoach operations.

With its new service, Eastern is able to provide a capacity for approximately 1.5-million Aircoach passengers annually. (This compares with a total of about 3.5-million Aircoach passengers carried by the entire industry in 1953.)

The sweeping change in policy means that Eastern, one of the so-called big four domestic trunkline carriers, is able to provide daily Aircoach capacity for 4,072 (plus extra sections), with 5.25-million Aircoach seat miles scheduled every twenty-four hours.

Eastern reported a record breaking 1,497,299 passengers boarded during the months of June, July and August, representing a 9 percent increase over the 1,373,373 passengers flown during the first quarter of 1954.

In October Eastern announced plans to double its passenger facilities at its Miami terminal by constructing two new wings that now makes it the largest air terminal in the world. The terminal has a capacity to handle 2-million passengers annually.

The airline has added two new 550 foot wings on the 36th Street side of the airport which now provides over one-half mile of passenger-handling facilities, and allowing the enlarged terminal to load and unload 19 of Eastern's huge 88-passenger Super Constellations at one time.

Eastern Air Lines reported a net profit, after taxes and all charges, of $1,789,824 or 72¢ a share for the first nine months of 1954 as compared with $2,795,911 or $1.13 a share for the same period of 1953.

The reduction in net earnings compared with a year ago, is largely accounted for by a 39 percent increase in depreciation charges on the company's two new fleets of aircraft, these charges for the current nine months totaling $18,482,430, an increase of $5,229,435 over the $13,252,995 for depreciation in the first three quarters of 1953.

Gross operating revenues totaled $127,915,987, a gain of 16 percent over the $110,633,221 reported a year ago.

Total operating expenses, including the increase in depreciation, were $116,755,000 or 18 percent higher than the $98,819,000 for the same months last year. Compared with a nine months' operating ratio of 89.3 in 1953, the ratio of expense to revenue, including depreciation, but before taxes, was 91.3 for the same period this year.

With 16 new 88-passenger Super-C turbine-compound Constellations added to the fleet, seat miles operated were increased 27 percent 3,185 million in 1953 to 4,052 million this year. Revenue passengers carried totaled 4,306,768, a 19 percent gain over the 3,604,797 for the first nine months of last year and revenue passenger miles were up 20 percent from 1,973 million in the comparable period of 1953 to 2,370 million this year. The greatly increased carrying capacity of the new fleet is also reflected in the load factor of 58.49 percent so far this year compared with 61.95 percent a year ago before the new Super-C Constellations were put into service.

Hawaiian Airlines

On November 11, Hawaiian Airlines celebrated its 25th Anniversary of scheduled flight in Hawaii. The airline continued to hold America's all-time Safety Record of no passenger or crew fatality in its history.

Hawaiian Airlines serves all ten of the Territory's commercial airports: Lihue, island of Kauai; Honolulu, island of Oahu; Lanai City, Lanai; Kahului and Hana, island of Maui; Hoolehua, island of Molokai; Upolu, Kamuela, Kona and Hilo, island of Hawaii, over 402 unduplicated route miles.

The line's flight equipment includes: five 44-passenger Convair 340's, seven 24-passenger Douglas DC-3's, and three Douglas DC-3 cargoliners.

National Airlines

Revenue passenger miles flown over routes of National Airlines during the fiscal year, ended June 30, 1954, increased more than 20 percent over the previous year. Much of this increase can be attributed to addition of four Douglas DC-7 aircraft to National's fleet, and 12 new Convair 340 aircraft, plus increased sales effort on National's all-expense summer package vacations to Florida.

Also during the fiscal year installation of radar on NAL's trunk fleet was begun, a selling point which should prove to be as attractive as the speed advantage and comfort-of-the DC-7 aircraft fleet.

The sales department at National also was streamlined. During the fiscal year the department was reorganized into two categories—sales and customer service. The direct sales approaches have been separated from the service functions.

On November 22nd, 1953 National's first DC-7 set an official transcontinental speed record between Santa Monica, California and Miami in nonstop time of 5 hours, 50 minutes and 12 seconds. This flight of 2300 miles was accomplished at an average speed of 407 miles per hour.

Also during the fiscal year a Sikorsky S-55 seven-passenger helicopter was purchased and integrated into National's fleet. The Civil Aeronautics Board extended a temporary one-year extension to operate this aircraft in passenger service within a 150-mile radius of Miami International airport. On February 1, 1954, National placed the seven-passenger helicopter in service between Miami and West Palm Beach, Fla. Five other communities between these two cities are now connected on NAL's helicopter schedules. In inaugurating this operation National became the first scheduled domestic airline to begin a regular helicopter operation.

During the fiscal year NAL reported operating revenues of $39-million. This was an increase of 18 percent over operating revenues reported during the previous year. Net earnings for the fiscal year totaled $4,465,000, or $4.42 per share.

A $25-million re-equipment and expansion program was completed during fiscal 1954 with the addition of 12 Convair 340 and four Douglas DC-7's (as previously mentioned) to National's aircraft fleet. A new multi-million dollar engine overhaul base was placed in operation in October 1953 and a new six-bay hangar at New York Idlewild airport was also opened.

On February 22, 1954 NAL was selected by the United States Post Office to carry the first 3¢ mail by air between Washington and Miami. This important service continues between New York, Washington and Florida.

On October 15, 1954 National celebrated its 20th anniversary.

National's routes now cover 3000 unduplicated miles, serving 33 cities. Employees total nearly 3000 and the aircraft fleet numbers 35, with 80 percent of the trunk line fleet in service less than two years.

Northeast Airlines

Northeast Airlines had its biggest year in 1954 and consistently each month broke previous passenger records. In August Northeast carried 80,926 passengers, an increase of nearly 21 percent above August 1953. The number of passengers carried in July and August exceeded the total of passengers for the first 12 years of service for this 21 year old carrier.

On January 25, 1954 Northeast Airlines doubled its' Convair fleet. In May the airline opened a Washington Sales office.

Northeast operated a unique Merry-Go-Round service during the peak holiday week-ends of July 4th and Labor Day to accommodate the unprecedented demand. On July 2nd 45 extra flights were flown over and above the regular schedule—which was a new high with a total of 19 aircraft.

In August, the Civil Aeronautics Board set the prehearing date for the New York-Florida Proceedings which got underway on September 24th.

Passenger handling procedures were streamlined to eliminate unnecessary waits by the passenger both at the ticket counter and in the aircraft while still at the gate. Excess baggage collections were modified to certain points to assist passenger to save time and render the process more painless.

Northeast overhauled or converted every aircraft it owned during the past year. The twelve DC-3's, aside from the above, have had the latest type seat, new flood boards, new heating systems and new electrical systems installed. All instrument panels have been standardized.

Northwest Orient Airlines

Donald W. Nyrop, attorney and former government aviation official, became president of Northwest Orient Airlines October 16, 1954.

For the second year in succession, the airline broke the million-passenger mark on its domestic system. The total was 1,094,000, an increase of 7.4 percent over the 1,018,707 during 1953, the first year in the carrier's history that it passed the million-passenger mark. Revenue passenger miles flown totaled 745,135,000, an increase of 3.6 percent over 1953's total of 719,-510,061.

On the plus side, also was the total of freight ton miles, 4,080,000, up 10.2 percent over the previous year's 3,701,009. Small decreases during 1954 were recorded in mail ton miles, 3,253,486, a drop of 2.6 percent from the previous year's 3,341,012; and in express ton miles, 1,683,000, a drop of 2.6 percent from the 1953 total, 1,728,952.

On its international system—which extends through Alaska, Tokyo, Pusan, Seoul, Okinawa and Taipei to Manila (also including service to Hong Kong in conjunction with Hong Kong Airways)—Northwest carried 85,400 passengers, compared with 79,986 the previous year, an increase of 6.8 percent.

The revenue passenger miles flown on the international route were 155,010,000 compared with 131,664,693, an increase of 17.7 percent.

Freight ton miles were 5,858,000, compared with 7,611,158, down 23 percent; mail ton milees, 3,049,000, compared with 1,661,593, up 81 percent; express ton miles, 169,900, compared with 185,457, down 8.4 percent.

(The 1954 figures are estimates, based on actual figures up to September, projected to the end of the year. The 1954 ratios used in the estimates are the same as those which proved out in 1953 and other years. The 1953 figures are complete audited figures.)

During the year, Northwest inaugurated tourist service to Honolulu through the northwest gateway of Seattle-Tacoma-Portland, using Douglas DC-6B aircraft. Tourist service was inaugurated, also, to Alaska and the Orient.

Northwest adopted a "Fly Now—Pay Later" plan, offering the public a wide choice of air travel on a credit basis. The plan covered domestic and international flights, both on-line and off-line.

The airline started overnight daily cargo service between the Atlantic seaboard and the midwest, with both westbound and eastbound flights between New York and Minneapolis-St. Paul via Milwaukee.

An aircraft interchange arrangement was worked out with Eastern Air Lines, Seattle-Chicago-Miami.

The National Safety Council awarded Northwest the Award of Honor, for its outstanding employee safety record in the line maintenance and base repair units. The Council also presented the airline with the Award of Merit, for its flight crew safety record.

Most dramatic among the year's flights was one on June 30, the morning the sun went into total eclipse. Aboard a Northwest Stratocruiser was a group of noted scientists who were making a special study of the phenomenon. Their attention was centered in the Minneapolis-St. Paul area, from which the flight took off, because this was directly in the path of the eclipse. Data gathered in the Minnesota field were sent by short-wave to Stockholm, where Swedish scientists were waiting to view the eclipse.

The half-fare family plan continued to prove popular throughout the year. Of the 745,135,000 revenue passenger miles flown, on the domestic system, 32,262,400 were credited to the family plan.

Several all-time records for the airline were set during August. During the month, 127,542 passengers were carried 101,320,000 revenue passenger miles.

Various speed records, both domestic and international, were set during the year.

Pacific Northern Airlines

The outstanding event for Pacific Northern Airlines in 1954 was the recommendation of the Bureau Council and the Chief Examiner of the Civil Aeronautics Board that PNA retain its present routes between the States and points in Alaska. These recommendations are now before the CAB and a decision was expected early in 1955.

Passenger traffic in the first eight months of 1954 was 5.5 percent over that of 1953. During these months PNA carried 46,162 passengers between the U. S. and Alaska and within the Territory of Alaska.

PNA again received the National Safety Council Award, marking 23 years of service without a passenger fatality.

There was an increase of 12 percent in mail carried in 1954 over 1953 and a 14.6 percent increase in cargo carried in the first eight months of 1954 as compared to 1953.

Pan American Grace Airways

As Panagra marked its 26th anniversary of service on September 13, company operations were at an all-time high along a 8,800 mile network extending through the countries of Panama, Colombia, Ecuador, Peru, Bolivia, Chile and Argentina. It appeared certain by the year's end that 1953's record figure of 137,619,000 revenue passenger miles would be greatly exceeded.

In February a DC-6 El Interamericano logged the airline's 20,000th crossing of the high Andes mountains between Chile and Argentina. Panagra has been flying this route on its regular transcontinental run between Santiago, Chile and Buenos Aires since it inaugurated service between these two points in 1929 with tri-motored Fords.

Early in 1954 Panagra carried out the installation of tourist information booths in key cities along its route.

Panagra continued its interest in the field of education by offering travel fellowships to students of Latin America interested in pursuing graduate studies at universities in the United States. The airline joined with Pan American World Airways in flying to this country about 50 students recommended by the Institute of International Education and approved by the State Department.

The company in March added another tourist flight between Panama, Colombia, Ecuador and Peru to handle the increase in passenger and cargo traffic to these countries. The new flight, serving Panama City, Cali, Quito, Guayaquil, Talara, Chiclayo and Lima, brought to five the number of tourist flights operated over this route per week.

During the same month a new tourist service to Argentina was inaugurated, whereby the flight time between Miami and Buenos Aires was cut to 22 hours and 40 minutes by means of a non-stop operation from La Paz to the Argentine capital.

In April, Panagra became a pioneer in the commercial use of airborne radar by placing a Bendix Radio unit aboard a DC-6B for regularly scheduled operations from Miami to Buenos Aires. The radar, installed in a special plastic nose, went on trial in a test of its effectiveness in detecting storm centers and areas of turbulence under actual weather conditions.

The first six months of operations in 1954 showed an increase of approximately 7 percent in traffic over the same period the previous year. As of June 30, the airline had flown 72,063,000 revenue passenger miles and carried 65,308 passengers, as compared to 67,416,000 revenue passenger miles flown and 61,606 passengers carried during the first six months of 1953.

In a major decision announced in August Panagra ordered airborne radar to be placed aboard its DC-7 equipment, scheduled for delivery in the spring of 1955. Five DC-7's were slated to be equipped with an RDR-1 unit of Bendix Radio, which is a lighter, more practical set than the radar used so successfully by the military.

Pan American World Airways

Pan American World Airways made two important advances in the engineering field during 1954, the Boeing Stratocruiser conversion program and the installation of radar for evaluation on DC-6Bs.

The Stratocruiser program included modification of the General Electric turbo-superchargers on the Pratt & Whitney engines and installation of six extra gas tanks at the ends of the wings to hold an additional 410 gallons of fuel. This improvement will insure non-stop transatlantic operation of the B-377 under any but the most adverse weather conditions.

Radar was installed in one of Pan American's DC-6Bs for a round-the-world evaluation program which permitted testing of the Bendix RDR-1 under all weather conditions. The set will enable the pilot to see the weather 150 miles ahead through the radar scope mounted on the flight deck. Thus he will be able to find holes in cloud formations far ahead of the plane and use smoother lanes.

In the field of passenger traffic the greatest advance was the introduction of the Pan Am Pay Later Plan. This plan made possible installment plan paying for air travel.

For the first eight months of 1954, Pan American had flown 1,219,281 passengers on its worldwide routes, an increase of 5.6 percent over the

1,155,003 passengers that had been carried for the same period of 1953. One notable development in the passenger field was the increase in longhaul traffic as indicated by the fact that passenger miles for the first eight months of 1954 increased from 1,355,719,000 to 1,511,689,000, a gain of 11.5 percent as compared with the overall gain in passengers carried of 5.6 percent.

Although the Pay Later Plan was in effect only since May, it has already brought in two million dollars in new business, almost all of it from people who would not have travelled had the plan not been in effect.

To increase passenger comfort Pan American has introduced on daily transatlantic flights staterooms styled by Henry Dreyfus. The President Staterooms, as they are called were introduced in response to a demand for complete privacy by celebrities, businessmen who use travel time for conferences and families travelling with children.

During 1954, Pan American was awarded from the National Safety Council, an Aviation Safety Award for 1953 in recognition of having flown 2,889,332,000 passenger miles without passenger or crew fatality. The award was given by the National Safety Council.

Also in 1954 Pan American received the Frye Airline Performance Trophy for 1953 for pioneering in the use of the upper air "jet stream" in regularly scheduled commercial flight.

Cargo as well as passenger business increased during 1954 with Pan American having flown 37,017,000 ton miles in the first eight months of the year as compared with 31,561,000 ton miles in the same period of 1953, or an increase of 17.3 percent.

Addition of two DC-6A Clippers to the all cargo fleet meant a considerable increase in transatlantic cargo since the DC-6As are pressurized and for this reason better adapted to carrying livestock and persishable goods.

Besides the DC-6As which joined the fleet in 1954 Pan American completed its fleet of DC-6Bs making a total of 45 of this type of aircraft. Orders were also placed for seven DC-7Bs for delivery in 1955 and for 15 DC-7Cs to be delivered early in 1956. The DC-7Cs will enable Pan American to fly to Pacific non-stop in both directions. Also on order are three Comet III type jet airliners.

In addition to the Stratocruiser conversion program and the weather radar project Pan American introduced a new method of qualifying pilots into airports into which they have never flown before by means of a widescope film.

In the Spring Pan American extended its services for the first time into the midwestern United States, opening operations between Chicago and Detroit and Europe. Direct service between Berlin and the United States was also inaugurated.

One flight on the new service from the midwest set a record of 11 hours and seven minutes from Detroit to Prestwick, Scotland on October 5.

Other records made during the year were Mexico City to Caracas, 2,400 miles in seven hours, 54 minutes by Captain Armin Elsaesser in a Constellation on February 27; Mexico City to Miami, 1,332 miles in three hours and 49 minutes by Captain David G. Desmond in a DC-6B on February 28; Miami to San Juan, 1,060 miles in three hours, eight minutes by Captain Marius Lodessen in a DC-6B on January 28; New York to Caracas, 2,250 miles in six hours, 58 minutes by Captain Robert T. Born in a DC-6B on April 13; New York to San Juan, 1,612 miles, in four hours and 52 minutes by Captain Fred E. Muhl in a DC-6B on April 13.

Piedmont Airlines

During the month of June, 1954 Piedmont Airlines carried 30,173 passengers; the passenger miles were 6,047,679. This is the largest number of passengers and passenger miles flown by Piedmont in the history of the company and the largest ever achieved by a local service carrier.

In April, Piedmont carried its one-millionth passenger. Through June 30, Piedmont had flown 244,376,000 passenger miles without passenger or crew fatality, thus establishing the record having had no fatalities since the beginning of operations.

During this year, Piedmont has introduced an air travel discount plan know as PEP (Piedmont Economy Plan) which offers to the public a discount of 75 percent or more on return fares. This Plan is applicable to certain segments of Piedmont's system and does not apply to segments which would cause competition to other air carriers. To make use of this discount, it is necessary that the return portion of the trip is made within 48 hours of the origination of the flight and has been found to be most benefiical to businessmen and shoppers.

Riddle Airlines

Riddle Airlines, which operates an all-cargo route between New York, Miami and Puerto Rico, in 1954 elected a new president and a new board of directors. John Paul Riddle, aviation pioneer who founded the airline in 1945, is again president of the company.

Riddle Airlines during the year continued to contribute to the agricultural and industrial growth of Florida and Puerto Rico. The company flies the raw material to the island for such industries as the needle work trade and the fountain pen business. Skilled, abundant labor is used to assemble the pens and hand-sewn handkerchiefs, scarves and lingerie, and the finished products are flown to New York for distribution.

Air freight also provided the answer to getting Florida's fruits, garden vegetables and flowers in bloom directly to the northern markets while they were still fresh from the fields.

For the comparative 12 months through Oct. 1, Riddle was running 3,463,528 pounds ahead of the same period the previous year.

The company is now operating eight C-46s. During the first nine months of 1954 they flew 11,535 hours, covering 2,203,275 miles.

Riddle is modifying its C-46 engines to the R-2800-51 MI configuration developed by Air Carrier Engine Service, Inc. Changes include later type cam and valve mechanism; larger capacity oil pump; modification of blower section for more even mixture distribution, and use of forged alumimun cylinder heads. The modifications have produced reductions in cylinder head and oil temperatures, and made it possible to secure METD power for prolonged periods on single engine operation.

Grimes rim lights have been installed on all flight instruments. The planes have omnirange, ILS, dual ADF and RTAI-B high frequency transceiver for long range communications and a 50-channel ARC-I receiver.

Riddle's net operating profit (before military operations) during the fiscal year ended June 30, 1954, was $132,847.

Southern Airways

Southern Airways, Inc. has just completed the celebration of its fifth anniversary of scheduled airline service to the Southeast.

The year 1954 was the best in the history of the airline, with an estimated 133,000 passengers flown. This record was 18 percent above that of 1953. Record passenger day was July 2, 1954, when 605 passengers boarded Southern flights.

Since beginning operations, Southern has flown more than 95-million passenger miles without passenger or crew fatality, and has been awarded the National Safety Council Safety Award four years in succession.

Southern Airways was the first scheduled airline to install rotating safety beacon lights on the tail of all DC-3 aircraft in its fleet. Also, in 1954, passenger service was improved with the installation of Janitrol heating equipment with summer blowers in all aircraft.

As of September 30, 1954, the company had shown a profit of $57,000, compared to a profit of only $12,000 for the entire of 1953. Commercial revenues had increased by 14 percent over the like period of the preceding year.

Also, in 1954, Southern Airways was one of the local service carriers to participate in the First Class Mail by Air experiment, speeding mail service to thosuands of residents of the Southeast at regular first class mail rates.

Trans-Canada Air Lines

The most outstanding highlight for Trans Canada in 1954 was the introduction of two-class Super Constellation service on its North Atlantic route. This service began on May 14th, and marked the first time that a North American carrier offered both first class and tourist service in the same aircraft.

On August 26th the Company announced the purchase of three more Vickers Viscount aircraft, the first propeller-turbine aircraft to make its appearance on North American routes. These aircraft will go into service in mid-February, and the order for three more was added to a previous order of fifteen and a Letter of Intent to purchase an additional four was announced.

The National Safety Council Award for safety of operation of ground personnel was presented to the Company on October 26th.

On October 18th an unofficial speed record between Montreal and

Prestwick was established on a regular Super Constellation flight, when the distance was covered in eight hours and eight minutes.

Trans World Airlines

The year 1954 was marked with significant new strides and progress in almost every phase of Trans World Airlines' global operations, and the airline looked ahead to 1955, the year which will highlight TWA's thirty years of public service.

Record increases in air traffic well beyond the best of 1953 were recorded in all TWA departments.

An estimated total of three billion, 162 million passenger miles were flown over TWA's United States and international routes—an increase of 9.8 percent over 1953.

In the United States, TWA's coast-to-coast routes accounted for almost two billion, six hundred million passenger mles—9.4 percent above the 1953 figure. International passenger miles flown were estimated at 570 million—an increase of 11.8 percent over last year.

Striking increases were recorded in TWA's low-cost Sky Tourist type of service. Preliminary figures showed a 44.3 percent increase in the number of passenger miles flown in this type of service on TWA's trans-Atlantic routes to Europe and the Middle East over 1953 figures. Domestic Sky Tourist service gained 31.6 percent for the same period.

All other phases of the airline's operations showed healthy gains during the year. Mail ton miles were up an estimated 21.5 percent over 1953; express and freight ton miles, 5.8 percent.

TWA inaugurated on August 1 a new service, the Time Pay Plan, which can be applied to all-inclusive tour travel, providing TWA's one-carrier service on routes serving both the U. S. and overseas points. Credit can also be applied for travel over routes of connecting carriers as well. As the year ended, TWA's Time Pay Plan program was extended to U. S. citizens residing abroad for travel in the U. S. and overseas.

Still another milestone in TWA's development and encouragement of low-cost air travel were the TWA Thrift-Season Travel Bargains, inaugurated in November.

Strides in airline technology were taken in 1954 as well.

Highlight in this field was the breaking of ground for the new $20-million overhaul base at Kansas City. TWA will dedicate the first unit of the base in mid-1955.

TWA and Lockheed Aircraft Corporation announced aerodynamic refinements in the engineering of TWA's twenty upcoming Model 1049G Super Constellations, which will increase the speed and long-range reliability of this aircraft.

Powered by turbo-compound engines and equipped with the most advanced devices including Sperry engine analyzers and weather surveillance radar, the new aircraft will be placed in TWA's transcontinental luxury service in 1955.

In October, TWA's meteorology department revealed a new weather forecasting concept related to daily changes in the sun's corona. Already proven useful in the airline's daily flight forecasting, the concept is expected to prove of great value to agriculture and other fields dependent upon weather.

Several honors came to TWA during 1954. The National Safety Council in June, announced its list of aviation safety awards in which TWA led 39 U. S. airlines with a record 8 billion safe passengers miles flown over its 33,000 miles of air routes.

In September, special honors of the Italian government were bestowed upon Warren Lee Pierson, Board Chairman of TWA, when he received the decoration of Grand Officer of the Order of the Republic from the Prime Minister of Italy, in recognition for his contribution to the rebirth of civil aviation in Italy.

Dr. John H. Furbay, TWA's director of Air World Education, received the Brewer Trophy as "Aviation's Man of the Year for Aviation Education". The award was made at the annual Wright Brothers Memorial Dinner, December 17, in Washington, D. C., by the National Aeronautics Association.

United Air Lines

Record-breaking passenger and cargo volumes, together with technological advances highlighted 1954 for United Air Lines.

According to company estimates, United will have flown 3.3-billion revenue passenger miles in the year, an increase of 21 percent from 1953, and carried some 4,735,000 passengers, an all-time record and a gain of 20 percent from the previous year. In carrying such traffic the company's fleet of almost 200 twin-engined and four-engined aircraft will have chalked up approximately 100-million revenue airplane miles.

Estimates on cargo volume show that in 1954, as compared with 1953, United will have flown 23,300,000 mail ton miles, up 11½ percent, and 44,200,000 cargo ton miles, an increase of about 14 percent.

In September, United sold $20-million in 20-year 3¾% Series C debentures to two insurance companies. At the same time, the $45-million stand-by credit available from a group of 38 banks was reduced to $30-milion, and the period of availability extended one year.

During the first nine months of the year, the company's gross operating revenue rose to a record $148,166,395, as compared to $131,141,489 in the first nine months of 1953. Net earnings, after taxes, for the first three quarters of 1954 totaled $8,433,683 as compared with $8,024,115 in the year earlier period.

In August the company's Board of Directors authorized installation of airborne radar in the company's fleet.

During the year, United received almost all its initial order for 25 Douglas DC-7s, as well as the last of its order for 55 twin-engined Mainliner Convairs. Use of the new planes enabled United to begin non-stop coast-to-coast flights and expand its schedules to the greatest level in its history. By the end of the year, 365-mile-an-hour DC-7 service had been inaugurated at New York, Newark, Boston, Hartford-Springfield, Philadelphia, Washington, Cleveland, Detroit, Chicago, Denver, Los Angeles, San Francisco and Seattle-Tacoma; Mainliner Convair service had been expanded to 65 cities and four-engined air coach service to 22 communities on the company's coast-to-coast, Pacific Coast and California-to-Hawaii system.

To meet future demands, the Board of Directors in August authorized purchase of an additional 17 aircraft, costing $22.3-million. The planes, which will be delivered during the first eight months of 1956, include two 58-passenger DC-7s, ten 58-passenger DC-6Bs and five four-engined all cargo DC-6As. The 15-ton-capacity DC-6s are the first 300-mile-a-hour aircraft to join the company's growing all-cargo fleet.

Late 1954 the company sold its six Boeing Stratocruisers to British Overseas Airways Corporation.

During the year United became the first domestic airline to use electronic flight simulators. Four Curtiss Wright Dehmel simulators, purchased by United for more than $3-million, electronically duplicate the performance of aircraft without leaving the ground. In addition to standard types of pilot training such as upgrading and transition, they permit training of crews as a coordinated unit and enable instructors to set up flight problems rarely undertaken in actual aircraft. DC-6B and Convair 340 simulators were installed in the company's Chicago Flight Training Center, while simliar units were placed in operation at Denver.

Other technological advances made by the company in the year included installation of PB-10A autopilot couplers on 64 DC-6s. These devices automatically place aircraft "on the beam" during an ILS approach. Automatic telephone answering devices were put in service at smaller stations. The equipment handles incoming reservations and information calls while personnel are busy on the ramp or during periods when the station is closed for the night.

The company also announced plans to install Selcal on its Mainliner fleet. Selcal enables ground radio operators to communicate with en route flights on a selective basis. United's order for 286 Bendix glide slope receivers was placed in July as largest of its kind in the air transport industry. The receivers are used in instrument landing operations.

In 1954 United's new DC-7s set many new commercial speed records including the mark of 16 hours, 51 minutes on a special one-stop Dawn-to-Dusk press flight from New York to Honolulu.

Western Airlines

Western Airlines in 1954 completed 28 years of continuous operation, and was serving 44 cities in 12 states and Canada on its 5,525-mile system.

In September, it was announced that non-stop service between Los Angeles and Seattle would be operated by Western with a $5-million additional fleet of Douglas DS-6B airliners. The new flight augmented the airline's existing DC-6B schedules and aircoach services to all major Pacific Coast cities.

Western Airlines is based at Los Angeles.

CHAPTER SIX

Utility Airplanes and Helicopters

NOT SINCE THE BOOM-OR-BUST days of 1946-1947 has general aviation reveled in such comfortable optimism as it did during 1954. The sharp difference lay in the fact that the '54 boom was substantial and real, based on a healthy economic growth of the utility of the aircraft. Business and industry claimed the aircraft as its own, with private, pleasure or sport flying practically non-existent.

The aircraft has taken its place in agriculture as a farm tool; in industry, as a tool for cargo hauling, patroling and surveying; and in the business world as a convenient and non-expendable means of transportation. The company-owned airplane has put the fixed-base operator, the overhaul/-maintenance base, the equipment manufacturer, and the airport back into business. And from all indications back into business to stay.

Predictions that the end of the excess profits tax would be the end of the company-owned and operated fleets proved untrue. Instead of dumping the planes, companies increased their utility. Where at the beginning the aircraft were executive in practice as well as name, they are now business planes, no longer reserved for the top cream of industry.

The plane is credited to a great extent with the growing trend toward decentralization of industry. Companies no longer are restricted to plant and office sites near commercial transportation.

In 1954, the approximately 6000 companies operating aircraft spent close to a half billion dollars on equipment, accessories, and services. Aircraft Industries Association reported a fleet of 21,500 aircraft in the corporate fleet in 1953. Of the total 2437 were multi-engine and 19,063 were single engine lightplanes. This compares to the estimated 17,500 planes under company ownership in 1952 of which 1750 were multi-engine. The business aircraft fleet is estimated to be 17 times larger than the domestic airlines.

Although the oil industry is by far the greatest user of the business aircraft, all forms of business have adopted it as a business necessity—retail firms, banks, lumber companies, paper mills, chemical firms, and publishing houses, among others.

The least regulated of the air transportation field, business flying is proud of its safety record. In 1954 the overall average was estimated at 0.04% fatality per million plane miles. The National Business Aircraft Association, which represents a group of the larger business fleet operators, awarded safety certificates to 21 member companies for flying a total of 37,927,538 miles without accident or injury. Sixty-eight company pilots were granted safety awards for flying 500,000 accident and injury free miles individually.

The airlines, which at first viewed the growth of business flying with a jaundiced eye, are now claiming that this medium actually increases airline travel. Robert Ramspeck, vice president of Eastern Air Lines, told the 1954 NBAA convention that business flying forces the use of airlines. Competitors who do not operate aircraft must use the airlines to compete with companies that do. Fleet operators, completely accustomed to air transportation, send their employees off on airlines when it is not economically sound to use their own planes.

The growing utility of the aircraft has seen the decline in production of two-place aircraft and the growth of four- to six-place equipment. The major lightplane manufacturers were expected to ship between 3500 to 4000 aircraft of under 12,500 airframe weight by the end of 1954. While the actual number of shipments is comparable to other years, the dollar value of $50 million is higher because of the larger, more complex equipment being manufactured to meet the needs of the business world.

The big equipment news for 1954 in the utility field was the production of the small twin-engine transport. Joining Aero Design & Engineering Co., which introduced the twin Aero Commander six-place business liner first in 1950, was Piper with its four-place twin-engine Apache; Cessna with its clean-line Model 310; and Beech with its Twin Bonanza. The four new twins provide customers with a price range of from $32,000 to $70,000, depending on speed and range. The small twins satisfied a long need for twin-engine reliability so needed in long range coast-to-coast flights, which are a feature of the new busines flying needs.

More powerful engines have been added to single-engine planes to meet the needs of the business user who can fulfill his aircraft needs in small ranges, but still desires speed within economic bounds.

Helicopters are being prepared for the business group to meet the needs of short range plant hopping. Bell Aircraft announced plans for 1955 production on two models. One a three-place passenger ship fitted with a custom interior, the other a four-place utility copter that can be quickly converted from passenger to cargo carrying, expected to be within the $40,000 price category.

The biggest business, however, lies in the large multi-engine types. The users of these airline-type aircraft feel the need for a plane designed for their own needs. Long dependent on surplus and used aircraft such as the DC-3, Lodestar, A-26 and other World War II bomber types converted to executive transports, members of NBAA spearheaded a drive in 1952 to encourage manufacturers to design a 300 mph, pressurized, twin-engine, eight to ten passenger plane designed to their specifications.

Not until two years later did Cessna Aircraft take the first plunge. It announced the design of the Model 620—four engines, eight to ten place, pressurized, with a possible price of under $300,000. A prototype was expected to fly in the spring of 1955.

But even with accelerated progress, full production is still two years away. The corporate group must continue to depend on the old workhorses. Biggest problem is expensive operation and shortage of spares on out of

New Taylorcraft model features fibreglas reinforced plastic exterior

production aircraft. Expense seems to be secondary. In order to get the increased speed and range companies are going as far as to buy Convair 340's. Approximately 17 were pressed into business service during 1954. Aircraft converted to executive interiors and requirements are going for as high as $800,000.

To date, overhaul and conversion bases throughout the country have cornered the big executive market. With competition stiff, the conversion designs are elaborate. DC-3's and Lodestars are brought up to modern standards with more powerful engines. Interiors are designed for maximum comfort, beauty and utility.

Prices on these conversions with engines and navigation aids range from $200,000 to $500,000 and sometimes higher. It is often the sole or major project of the base.

Lear, Incorporated, has set up a subsidiary to produce the Learstar, Lodestar conversion designed by William P. Lear. The old "clunker" has been redesigned beyond recognition. Speeded up to near 300 mph, it is an example of what is being done to keep business flying until the manufacturers come forth with an original design.

Navigation and radio equipment manufacturers are also reaping the harvest of business flying. With safety a prime factor among the business users and operators, every new, proven navigation aid is a must. The new Distance Measuring Equipment so far is found only on business planes, both large and small. Omni has come to be standard equipment as much on the single-engine planes as on the larger transport types. One company alone reports more than 500 Omni receivers sold in one year's time.

The advent of clean, light, fast planes resulted in a rash of weather accidents caused by pilots getting into situations in an airplane a little too hot to handle. To prevent the deadly spiral dive, designers turned their attention to creating automatic stabilizers. Lear in 1954 marketed the Arcon stabilizer based on magnetic amplifiers; Javelin Aviation of Wichita designed a simpler, cheaper single-axis autopilot; and Summers Gyroscope attempted to build stabilization into the faster planes. All these products are aimed at the utility aircraft.

Automatic pilot manufacturers found a new outlet for their product with the majority of the larger transport types so equipped.

Aircraft Owners and Pilots Association, which represents the lightplane pilot, took the lead in the life saving campaign by commissioning the University of Illinois to work out a simple instrument training curriculum for the single engine plane owner. Called the 180 degree turn rating, it provides the pilot with sufficient training to get out of weather before he gets into trouble.

Single-engine equipment was not neglected by the manufacturer during the year. Developments in light single planes ranged from an all-Fiberglas design by Taylorcraft to a trend toward fast (200 mph) all-metal tricycle gear equipment. Piper announced it was discontinuing production on its tail-wheel geared Pacer. No demand. The end of the fabric covered plane is approaching. Piper is reportedly readying an all-metal design. Beech and Cessna modernized, souped-up their single-engine models.

The special needs of the aerial dusters and sprayers were being met by the design of farm machinery. A company in Yakima, Wash., Lamson Aircraft, announced it was going back 20 years in the design of its Air Tractor—a slow, maneuverable, stable biplane.

With business-flying taking its place with the military and airline segments of the industry, its prosperity is rubbing off on the airports and fixed base operators. An estimated $150-million is spent annually for fuel, maintenance, tie-down, landing fees, hangaring and other services.

The airports in most cases leave the responsibility of servicing the group to the fixed base operators at the field, under lease arrangements which usually carry a percentage of fuel sales reverting back to the airport and city. Very much aware of this revenue potential, municipalities are expanding airports and providing more airports to grab off the trade.

Fast, long-range, twin-engine Learstar

New airports are being planned to provide comparable facilities for the business fliers to that of the airlines. In congested airport areas, cities are planning new airports for the new business. Need for secondary airports in large population areas is felt.

The agressive fixed-base operators have been brought back to life. Those that can provide the service demanded by the group are in good financial condition. For the first time in history, more than fifteen FBO's reported sales in excess of $1-million each with about half of them nearing the $5-million market.

Greatest source of income is in the sale of accessories; second is fuel and oil. Maintenance and overhaul is sandwiched in between. Those that have aircraft and accessory distributorships and provide modern salesmanship methods are in excellent condition.

Recognition of this vast fleet's value to the nation is reflected in civil defense mobilization plans. Single engine aircraft figure strongly in state defense planning. The Defense Air Transport Administration in Washington is working with the large multi-engine aircraft owners in developing a secondary emergency fleet, somewhat similar to the CRAF plan for the airlines.

Helicopters

Military procurement continued to dominate the helicopter industry during 1954, although the civil world was getting down to business in planning for future helicopter transport activities. The Army appeared to be the largest customer for helicopters and expected to spend $1-billion over the next five years for rotorcraft. Long-range Army plans reportedly called for operating more than 1000 helicopters, including cargo, utility, ambulance, liaison and training models.

At the beginning of 1954, 84 communities were being served by the three certified helicopter airlines in Los Angeles, New York and Chicago with the Civil Aeronautics Board having approved service to an additional 46 communities within the three areas. In addition, Mohawk Airlines undertook the experimental helicopter operation during the summer months along some of its routes and National Airlines has been testing helicopter shuttle service in the Miami area.

With analyses made during the year pointing to mass use of helicopters in scheduled service five to ten years off, efforts of the air carriers and manufacturers were directed toward organized planning for that time. The Air Transport Association's Rotorcraft Committee began an intensive study of direct operating cost and preparation of a detailed list of design recommendations for transport helicopter types. It was generally agreed that twin engine rotorcraft were essential for public transportation.

The Air Coordinating Committee's Air Policy Review set the pace for government participation. It stated that the U. S. should continue encouraging and supporting development and use of commercial helicpoters and support a program of rotary wing research through the National Advisory Committee for Aeronautics, which is spending about a million dollars a year on rotary wing research. The Government should also encourage use of 'copters experimentally, with CAA and CAB forming basic civil air regulations for helicopters quickly. CAA should also speed up development of heliport design criteria, while the Air Navigation Development Board and Radio Technical Commission for Aeronautics programs on helicopter airway aids should also be pushed. CAB should view requests for helicopter subsidies by airlines sympathetically.

Favorable reaction was evidenced toward an Army proposal that Army helicopters be flown over air routes under airline supervision. The Army expressed willingness to turn over 15 rotorcraft for this purpose. The Sikorsky S-55 was the first to be used, if the plan was approved, followed by later types such as the Piasecki H-21, Sikorsky S-58 and S-56. Only CAA certified helicopters were to be involved. CAB, CAA, ATA, AIA, and the Army are trying to accelerate the development of Civil Air Regulations for transport category helicopters in order that the Army may utilize civil requirements in its purchasing plan. Recommendations were made during the annual airworthiness review.

The local service airlines were most interested in acceleration of civil helicopter potential. The short-haul market, it is generally agreed, is where the helicopter has the most important job to do. Authorities almost unanimously stated that the helicopter is the most logical replacement for the DC-3.

Heliport planning was stressed. Several heliport studies caution against municipalities beginning construction of heliports at once. It recommends that careful traffic analyses and potentials be first determined; that sites be selected and land optioned. Investigation of eventual heliport requirements should be made. Particular attention should be given to local legislation to take into consideration helicopter flight characteristics, zoning requirements, building regulations, etc.

Major atttention should be focused on centrally-located downtown sites for development as needs, located close to traffic sources in order for the helicopter to perform the most useful public service. Ground-level heliports are generally preferable to structural types on economic grounds. Heliports at airports with large traffic volume should be structurally incorporated to perform the most useful public service.

Although CAA has issued no regulations as yet, clear approaches have been expressed as mandatory on inter-city helicopter operations.

While the air transport industry made its plans, the helicopter manufacturers concentrated on improving the product. Gas turbine powered helicopters came under test by several manufacturers, with at least three making first flights during 1954. Two companies rolled out the first multi-engine 30 to 40 passenger designs—slated for the military first.

Two major problems plague the industry—high maintenance and high operating costs. Two Hiller engineers stated before a Helicopter Society meeting that minimum direct costs would result from a hypothetical 35-passenger design with higher utilization driving costs down rapidly. Costs would be lower, they said, when operated at design ranges.

It was generally felt that increased experience with helicopters will bring down maintenance times and costs. Los Angeles Airways has reported reductions in direct maintenance costs for 1954 to be well under the $30.79 per S-55 flight hour experienced in 1953.

While the air transport industry concentrated on getting its helicopter services lined up, the military was sponsoring competitions for (1) a one-man helicopter for the Marine Corps for combat work and (2) a cargo helicopter for the Army. It appeared that the military would absorb the attention of the rotary wing aircraft for at least two more years. Although nine helicopter types carry CAA certificates, only four are currently being turned out for civil use.

Outside of transport uses, the helicopter is finding use in general aviation for patrol, surveying and agricultural purposes. Small helicopter models are available for these civil uses.

The helicopter manufacturers are trying to get engine manufacturers to design an engine specifically for helicopter use. Greater reliability and engine life, they believe, can be insured by an engine designed for the

Fairchild enters helicopter market with former American helicopter design

helicopter's particular flight characteristics. Although speed is not considered an essential of helicopter performance, gas turbines are expected to provide greater reliability along with increased speeds.

AIA's Helicopter Council is considering recommendations for a 50,000 pound vehicle, although one similar to the 35,000 pound Sikorsky S-56 may prove adequate. Biggest problem to the largest machine is that it would require between 4000 and 5000 hp., which means four engines producing more horsepower than any other powerplant currently being developed.

CHAPTER SEVEN

Planes in Production

AIRCRAFT PRODUCTION continued to make history (See Outstanding Events) and at the same time pointed sharply toward future trends, especially in the jet field, during 1954.

First of the American jet transports, the Boeing 707, with a cruising speed of 550, figured in the news throughout the year under its Air Force tanker designation, KC-135. With a service ceiling of over 42,000 feet, it performed up to or beyond expectations during test flights following its maiden trial on July 15, 1954. Tanker versions went into production on September 1.

Jet production burgeoned in the defense field, notably the North American F-100 Super Sabre, first of the supersonics to go into mass production (in 1953), and the Douglas carrier-based F4D. In 1953, both planes set world speed records, still standing as this edition goes to press.

Both the Douglas DC-7 and the Lockheed Super Constellation continued on heavy production schedules in the reciprocal field.

Notable also was increased production in executive-type lightplanes, which reached a post-war high.

Complete details of all planes coming off the lines during the year appear on the following pages.

CIVIL

AERO DESIGN AND ENGINEERING CO.

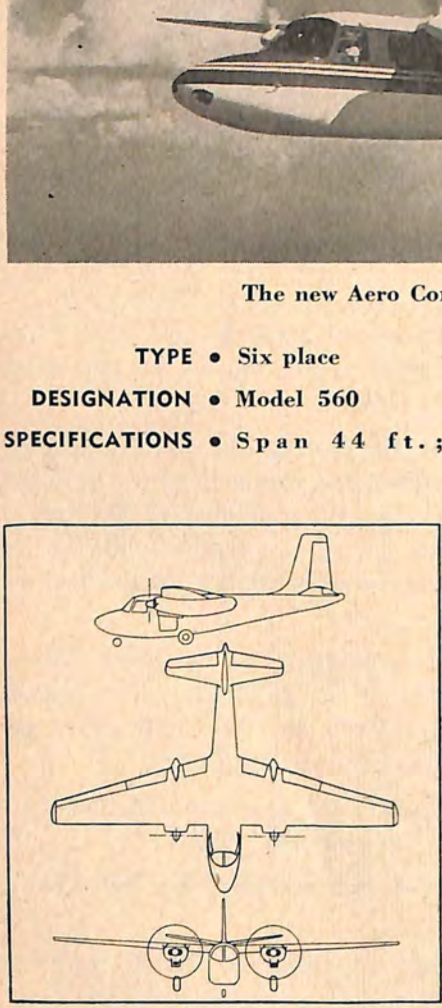
Oklahoma City, Okla.

The new Aero Commander Model 560

TYPE • Six place

DESIGNATION • Model 560

SPECIFICATIONS • Span 44 ft.; Length 34 ft. 2½ in.; Height 14 ft. 9 in.; Empty Weight 3900 lb.; Gross Weight 6000 lb.; Wing Loading 24.6 lb. per sq. ft.; Power Loading 11.10 lb. per bhp; Engine (2) Lycoming GO-480-B, 520 hp normal rated; Fuel Capacity 150 gal.; Propeller Hartzell 3 blade; Main Tire 850x10; Nose Tire 600x6.



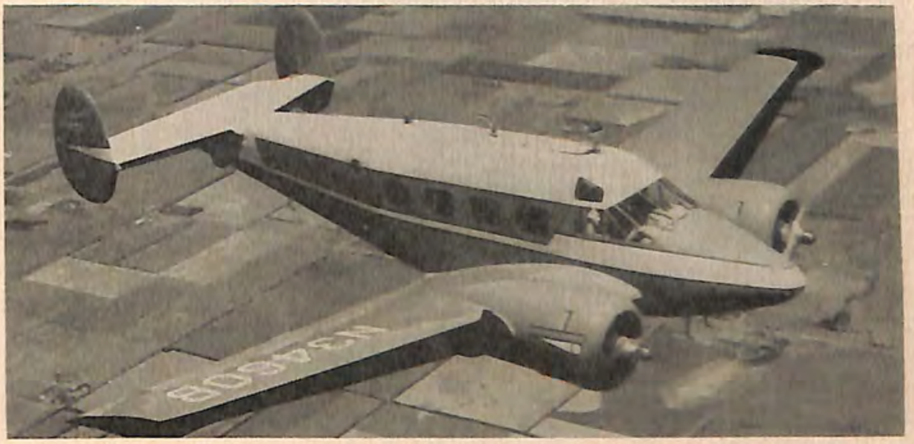
PERFORMANCE • Maximum Speed 179 kn 540 hp at 3400 rpm at S. L.; Cruise Speed 171 kn at 378 hp at 2800 rpm at 10,000 ft.; Landing Speed 52 kn; Rate of Climb 1400 fpm at S. L.; Service Ceiling 20,000 ft.; Absolute Ceiling 22,000 ft.; Range with Maximum Payload 910 nmi.; Range with Maximum Fuel Load 910 nmi.

REMARKS

This new twin-engine model was announced in June and superseded the first production model, the 520. 150 of the 520 models came off the assembly line before the start of production of the 560 model.

BEECH AIRCRAFT CORP.

Wichita, Kans.



Beechcraft Super 18

TYPE • Eight place

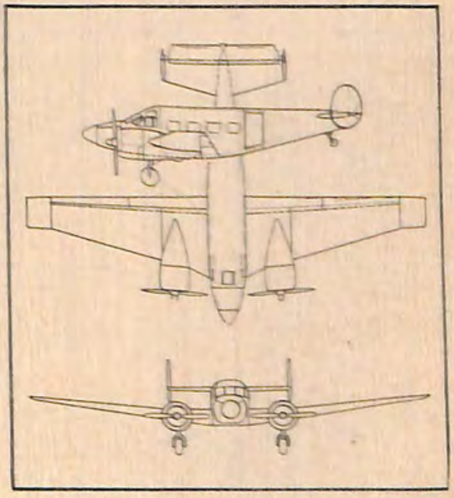
DESIGNATION • Super 18 (Model E18S)

SPECIFICATIONS • Span 49 ft. 8 in.; Length 35 ft. 2½ in.; Height 9 ft. 6 in.; Empty Weight 5970 lb.; Gross Weight 9300 lb.; Wing Loading 25.76 lb. per sq. ft.; Power Loading 10.33 lb. per bhp; Engines (2) Pratt and Whitney 450 hp at 2300 rpm takeoff; Fuel Capacity 286 gal.; Propeller Hamilton Standard hydromatic; Gear conventional; Wing Area 361 sq. ft.; Aileron Area 17.48 sq. ft.; Flap Area 28.12 sq. ft.; Fin Area 20.08 sq. ft.; Rudder Area 13.50 sq. ft.; Stabilizer Area 49.58 sq. ft.; Elevator Area 22 sq. ft.

PERFORMANCE • Maximum Speed 233 mph at 450 hp at 2300 rpm at 3300 ft.; Cruise Speed 216 mph at 337 hp at 2000 rpm at 10,000 ft.; Landing Speed 86 mph; Rate of Climb 1490 fpm at S. L. at 8750 lb. gross; Range with Maximum Payload 1461 mi. at 10,000 ft., 50 percent power, 45 min. reserve.

REMARKS

The Super 18 is a bigger version of the standard Model 18 which has been a commercial and military model since it was first put on the market in 1937. Over 7000 of the military version were built as transports and trainers. The current model features external drag reduction plus many interior improvements.

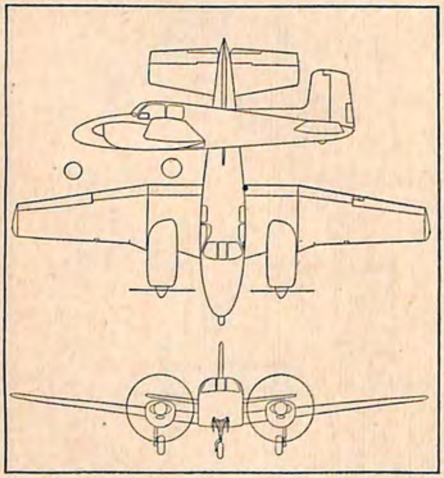


Beechcraft Model B50 Twin Bonanza

TYPE • Six place

DESIGNATION • B50

SPECIFICATIONS • Span 45 ft. 3⅜ in.; Length 31 ft. 6½ in.; Height 11 ft. 4 in.; Empty Weight 3940 lb.; Gross Weight 6000 lb.; Wing Loading 21.66 lb. per sq. ft.; Power Loading 12.25 lb. per bhp; Engine (2) Lycoming GO-435-C2, 245 hp at 3100 rpm at S. L.; Fuel Capacity 134 gal.; Propeller Beech full electrical feathering, hydraulically controlled, continuously variable pitch; Gear tricycle; Wing Area 277.06 sq. ft.; Aileron Area 13.89 sq. ft.; Flap Area 37.80 sq. ft.; Fin Area 14.25 sq. ft.; Rudder Area 12.77 sq. ft.; Stabilizer Area 47.25 sq. ft.; Elevator Area 17.49 sq. ft.



PERFORMANCE • Maximum Speed 205 mph at 245 hp at 3100 rpm at 2500 ft.; Cruise Speed 193 mph at 159 hp at 2800 rpm at 10,000 ft.; Landing Speed 69 mph; Rate of Climb 1450 fpm at S. L.; Service Ceiling 20,000 ft.; Range with Maximum Payload 1087 mi.

REMARKS

First flown on Nov. 15, 1949, the B50 executive transport is the commercial version of the U. S. Army L-23. Engineering reports show the structural and operational standards to which the Twin-Bonanza has been tested are far in excess of those required by governmental agencies.

Beechcraft E35 Bonanza

TYPE • Four place

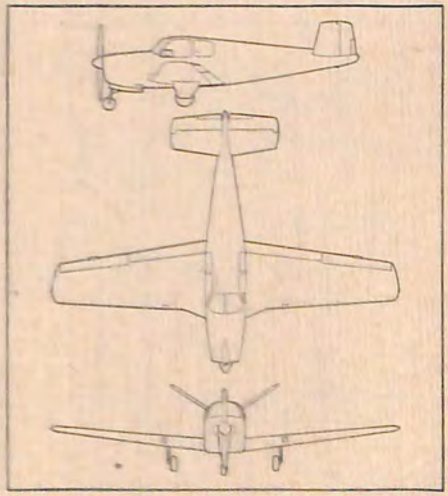
DESIGNATION • E35

SPECIFICATIONS • Span 32 ft. 10 in.; Length 25 ft. 2 in.; Height 6 ft. 6½ in.; Empty Weight 1675 lb.; Gross Weight 2725 lb.; Wing Loading 15.34 lb. per sq. ft.; Power Loading 14.73 lb. per bhp; Engine (standard) Continental E-185-11, 205 hp takeoff —(optional) Continental E-225-8, 225 hp takeoff; Fuel Capacity 39 gal. (59 gal. with auxiliary tank); Propeller Beech electrically controlled; Gear tricycle; Wing Area 177.6 sq. ft.; Fin-Stabilizer Area 23.8 sq. ft.; Rudder-Elevator Area 12 sq. ft.

PERFORMANCE • Maximum Speed (standard engine) 190 mph at 185 hp at 2300 rpm at S. L.—(optional engine) 194 mph at 185 hp at 2300 rpm at 3000 ft.; Cruise Speed (standard engine) 179 mph at 139 hp at 2150 rpm at 6000 ft.—(optional engine) 184 mph at 146 hp at 2300 rpm at 8000 ft.; Landing Speed 55 mph; Rate of Climb (standard engine) 1100 fpm at S. L.—(optional engine) 1300 fpm at S. L.; Service Ceiling (standard engine) 18,000 ft.—(optional engine) 19,000 ft.; Range with Maximum Payload 1179 mi. at 10,000 ft. at 165 mph.

REMARKS

The Bonanza was first flown Dec. 22, 1945. It holds the lightplane non-stop world's distance record of 4,957.240 mi. (see RECORDS). Popular with the business executive, the Bonanza has also had a successful feederline operational history. By the 1954 year-end, 4000 had been manufactured.



BELL AIRCRAFT CORP.

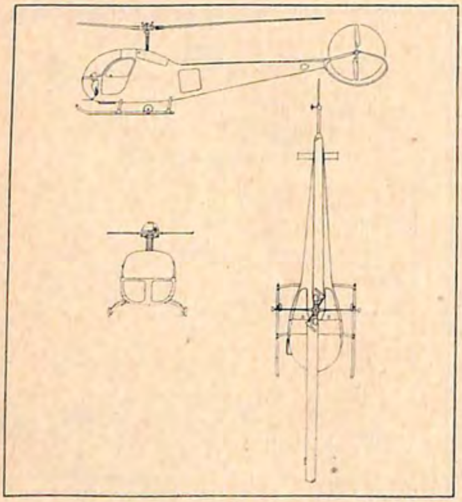
HELICOPTER DIVISION

Fort Worth, Tex.

Bell Model 47H

TYPE • Three place

DESIGNATION • 47H



SPECIFICATIONS • Main Rotor Diameter 35 ft. 1½ in.; Anti-Torque Rotor Diameter 5 ft. 8 in.; Length 31 ft. 4 in.; Height 9 ft. 3 in.; Empty Weight 1480 lb.; Gross Weight 2350 lb.; Engine Franklin 6V4200-C32, 200 hp; Fuel Capacity 435 gal.

PERFORMANCE • Cruise Speed 100 mph; Rate of Climb 900 fpm at S. L.; Range over 265 mi.

REMARKS

Streamlined fuselage including semi-monocoque tail boom, arched skid gear, faired gas tanks and other refinements give this new model a substantial range and cruise advantage over previous models. Cockpit comfort has been increased through wider automotive type seat (60 in.) and soundproofing.

CESSNA AIRCRAFT CO.

Wichita, Kans.

New Cessna Model 180

TYPE • Four place

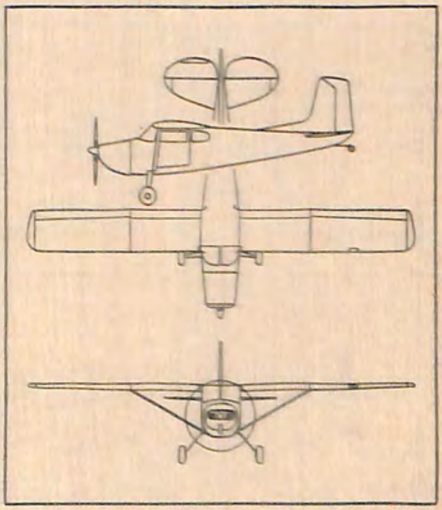
DESIGNATION • 180

SPECIFICATIONS • Span 36 ft.; Length 26 ft.; Height 7 ft. 6 in.; Empty Weight 1480 lb.; Gross Weight 2550 lb.; Wing Loading 14.6 lb. per sq. ft.; Power Loading 11.3 lb. per bhp; Engine Continental 0470, 225 hp at 2600 rpm; Fuel Capacity 60 gal.; Propeller Hartzell constant speed; Wing Area 175 sq. ft.

PERFORMANCE • Maximum Speed 165 mph; Cruise Speed 150 mph; Stalling Speed 64 mph; Rate of Climb 1150 ft. at S. L.; Service Ceiling 19,-800 ft.

REMARKS

New model 180 features added sound proofing and engine changes reducing noise, new outside baggage compartment, adjustable horizontal stabilizer and numerous internal refinements. This model first introduced in 1953, is equipped with para flaps positioned at 20-30-40 deg. Trim operates full horizontal stabilizer. This model has been popular as a float plane.

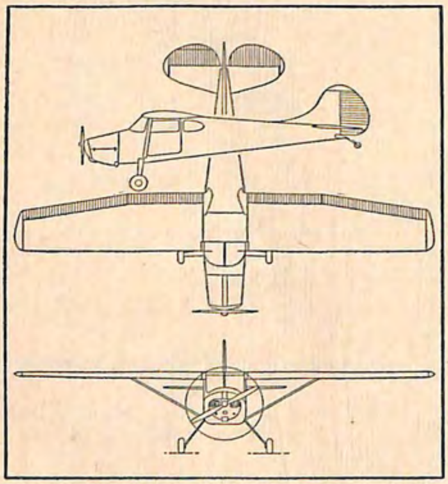


Cessna Model 170

TYPE • **Four place**

DESIGNATION • **170**

SPECIFICATIONS • **Span 36 ft.; Length 25 ft.; Height 6 ft. 7 in.; Empty Weight 1205 lb.; Gross Weight 2200 lb.; Wing Loading 12.6 lb. per sq. ft.; Power Loading 15.2 lb. per bhp; Engine Continental C-145, 145 hp at 2700 rpm at takeoff; Fuel Capacity 42 gal.; Propeller Sensenich fixed pitch; Wing Area 175 sq. ft.**



PERFORMANCE • **Maximum Speed 140 mph; Cruise Speed 120 mph; Stalling Speed 53 mph; Rate of Climb 690 ft at S. L.; Service Ceiling 15,500 ft.; Range 640 mi.**

REMARKS

Current model features three position (20-30-40 deg.) para flaps. Rear seat is easily removed for converting space to cargo. There is a wide range of optional equipment including skis, floats, cross wind gear, stretcher racks for ambulance use, blind flying hood, spraying equipment and provisions for vertical or oblique aerial photography and mapping.

Cessna all-metal Model 195

TYPE • **Five place**

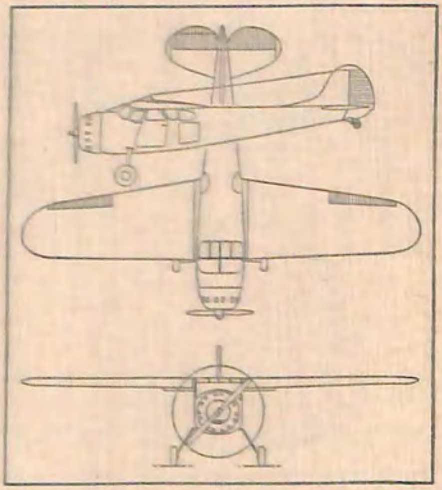
DESIGNATION • **195**

SPECIFICATIONS • **Span 36 ft. 2 in.; Length 27 ft. 4 in.; Height 8 ft.; Empty Weight 2030 lb.; Gross Weight 3350 lb.; Wing Loading 15.3 lb. per sq. ft.; Power Loading 12.2 lb. per hp; Engine Jacobs R-755Az, 300 hp at 2200 rpm; Fuel Capacity 80 gal.; Propeller Hamilton Standard constant speed.**

PERFORMANCE • **Maximum Speed 180 mph; Cruise Speed 165 mph; Rate of Climb 1200 fpm; Service Ceiling 18,300 ft.**

REMARKS

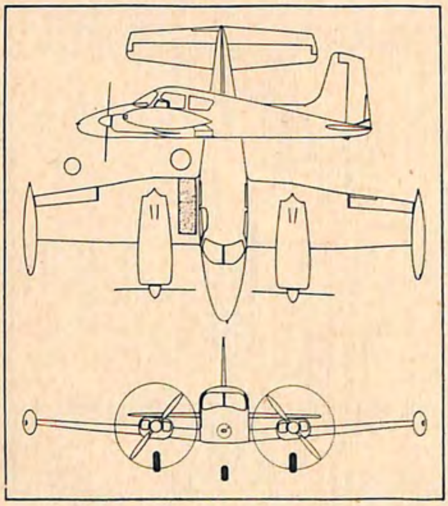
The 195 is the only five-place all-metal airplane offered by an American manufacturer. The Armed Services counterpart is designated the LC-126. The civil model is certificated for floats and skis and is equipped with hinged engine mount and throw-over control. Model 195 seats two in front and either two or three in the rear seat. The rear seats are removed by four bolts to provide an 85 cu. ft. cargo space.



Cessna Model 310

TYPE • **Five place**

DESIGNATION • **310**



SPECIFICATIONS • **Span 36 ft.; Length 27 ft.; Height 10.5 ft.; Empty Weight 2850 lb.; Gross Weight 4600 lb.; Wing Loading 26.2 lb. per sq. ft.; Power Loading 9.6 lb. per bhp; Engine (2) Continental O-470-B, 240 hp normal rated at 2600 rpm; Fuel Capacity 100 gal.; Propeller constant speed full feathering; Gear tricycle; Wing Area 175 sq. ft.**

PERFORMANCE • **Maximum Speed 220 mph; Cruise Speed 205 mph; Rate of Climb 1700 fpm; Service Ceiling 20,000 ft.; Range with Maximum Payload 875 mi.**

REMARKS

New twin Cessna features wing tip tanks, exhaust augmenter tubes, fully-enclosed retractable gear and completely internal antennae.

DOUGLAS AIRCRAFT CO.

Santa Monica, Calif.

Douglas DC-6B

TYPE • Passenger

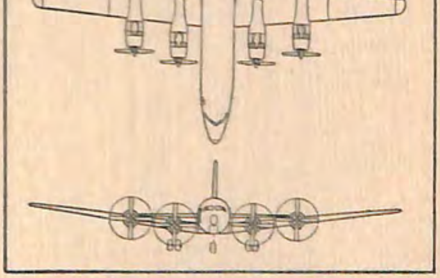
DESIGNATION • DC-6B

SPECIFICATIONS • Span 117 ft. 6 in.; Length 106 ft. 6 in.; Height 28 ft. 8 in.; Empty Weight 58,340 lb.; Gross Weight 107,000 lb.; Wing Loading 73.1 lb. per sq. ft.; Power Loading 10.7 lb. per bhp; Engine (4) Pratt and Whitney R-2800-CB17, 2500 hp normal rated; Fuel Capacity 5512 gal.; Propeller Hamilton Standard full feathering reversible pitch; Gear tricycle, two sets of dual-type main wheels; Wing Area 1463 sq. ft.; Aileron Area 89 sq. ft.; Flap Area 229.4 sq. ft.; Fin Area 93.4 sq. ft.; Rudder Area 49 sq. ft.; Stabilizer Area 210.9 sq. ft.; Elevator Area 108.9 sq. ft.

PERFORMANCE • Maximum Speed 360 mph at 1750 hp at 2300 rpm at 18,700 ft.; Cruise Speed 315 mph at 1200 hp at 2300 rpm at 22,400 ft.; Landing Speed 106 mph; Rate of Climb 1100 fpm at S. L.; Service Ceiling 21,900 ft.; Range with Maximum Payload 3393 mi.; Range with Maximum Fuel Load 4968 mi.

REMARKS

The DC-6A and DC-6B transports are enlarged versions of the DC-6s which first flew Feb. 15, 1946. First step in the evolution was the DC-6A Liftmaster first flown on Sept. 29, 1949. This was followed by the DC-6B, first flown Feb. 10, 1951. Twenty-three of the world's leading airlines have purchased 202 airplanes of the DC-6B configuration and ten commercial airlines have ordered more than 40 of the DC-6A cargo carriers. Commercial sales of the DC-6 are past the 500 mark. The military has ordered the DC-6A series, designated C-118 by the Air Force and R6D-1 by the Navy. These can be converted to troop transports or hospital planes. 54 to 89 passengers.

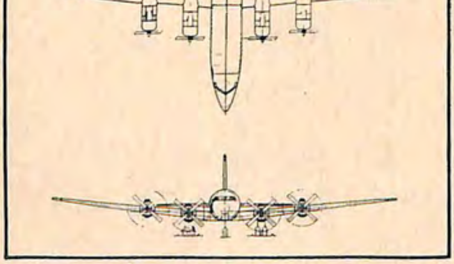


Douglas DC-7 transport

TYPE • **Passenger**

DESIGNATION • **DC-7**

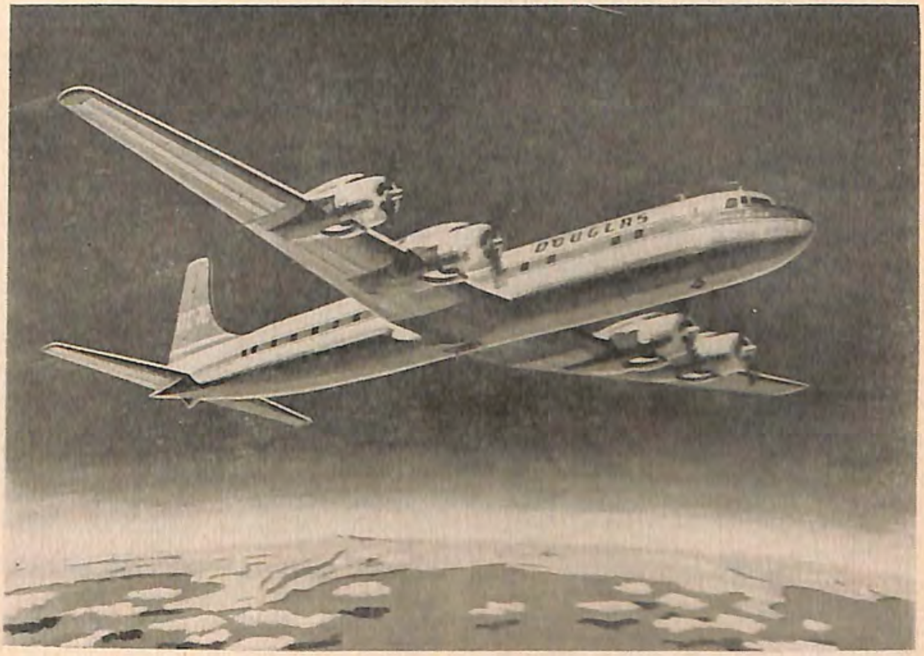
SPECIFICATIONS • **Span 117 ft. 6 in.; Length 108 ft. 11 in.; Height 28 ft. 7 in.; Gross Weight 126,000 lb.; Wing Loading 86.2 lb. per sq. ft.; Power Loading 9.7 lb. per bhp; Engine (4) Wright R-3350 turbo compound, 3250 hp at takeoff; Fuel Capacity 6490 gal.; Propeller Hamilton Standard, eight blade; Gear tricycle, two sets of dual main wheels; Wing Area 1463 sq. ft.; Aileron Area 85 sq. ft.; Flap Area 229 sq. ft.; Fin Area 101 sq. ft.; Rudder Area 67 sq. ft.; Stabilizer Area 156 sq. ft.; Elevator Area 155 sq. ft.**



PERFORMANCE • **Maximum Speed 405 mph at 2450 hp at 2600 rpm at 22,700 ft.; Cruise Speed 359 mph at 1800 hp at 2400 rpm at 24,300 ft.; Landing Speed 122 mph; Rate of Climb 1673 fpm at S. L.; Service Ceiling 28,400 ft.; Absolute Ceiling 29,400 ft.; Range with Maximum Payload 3565 mi.; Range with Maximum Fuel Load 5164 mi.**

REMARKS

The DC-7 is a development of the DC-6 series. The DC-7 is eight feet longer and has several technical improvements. First DC-7 flight was on May 18, 1953. It entered airline service six months later and made possible non-stop transcontinental flights. The DC-7B is equipped with saddle tanks for greater range. Third model is the DC-7C with a ten ft. greater wing span, 40 in. longer fuselage. Added fuel carried in the extended wing root increases operating range to 5000 mi. with reserves. Engine modifications provide a total of 400 greater climb hp. Carries 64 to 95 passengers.



Douglas DC-7C Seven Seas

TYPE • Transport

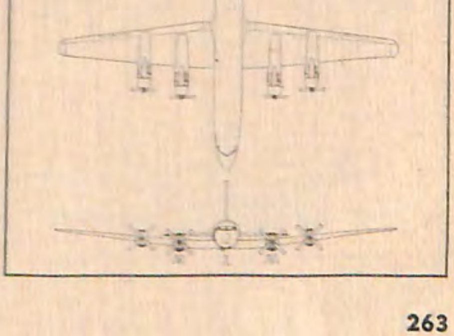
DESIGNATION • DC-7C

SPECIFICATIONS • Span 127 ft. 6 in.; Length 112 ft. 3 in.; Height 30 ft. 9 in.; Wing area including aileron 1637 sq. ft. Empty weight 72,150 lb.; Gross weight 140,000 lb.; Wheel base 39 ft. 6 in. Powerplant Wright R-3350 compound-type EAI; Takeoff 3400 BHP each; Propeller Hamilton Standard 4-bladed.

PERFORMANCE • Maximum speed 406 mph with rated power; Cruise speed 359 mph; Landing speed 99 mph at S.L.; Rate of Climb 845 fpm at 20,000 ft.; Service ceiling 28,000 ft.

REMARKS

Success of earlier DC-7 models in domestic U.S. operations led to development of a larger version especially designed for long-range, intercontinental airline service. This version is capable of flying non-stop between most cities of Europe and the U.S. Production of the newest Douglas commercial transport is concurrent with preceding DC-7 models and airliners of the DC-6 series.



LOCKHEED AIRCRAFT CORP.

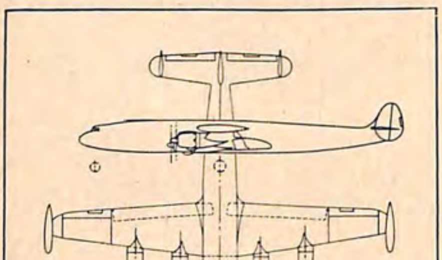
Burbank, Calif.

Lockheed 1049G Super Constellation

TYPE • **Transport**

DESIGNATION • **1049G**

SPECIFICATIONS • **Span 123 ft.; Length 113.7 ft.; Height 24.7 ft.; Empty Weight 73,016 lb.; Gross Weight 137,500 lb.; Wing Loading 83 lb. per sq. ft.; Power Loading 10.56 lb. per bhp; Engine (4) Wright 3250 hp (DA3) turbo-compound, 3250 hp takeoff; Fuel Capacity 7750 gal. with provisions for two 600 gal. tip tanks; Propellers Hamilton Standard three blade; Gear tricycle; Wing Area 1654 sq. ft.; Aileron Area 99.6 sq. ft.; Flap Area 295.4 sq. ft.; Fin Area 211.6 sq. ft.; Rudder Area 91.2 sq. ft.; Stabilizer Area 356.8 sq. ft.; Elevator Area 106.8 sq. ft.**



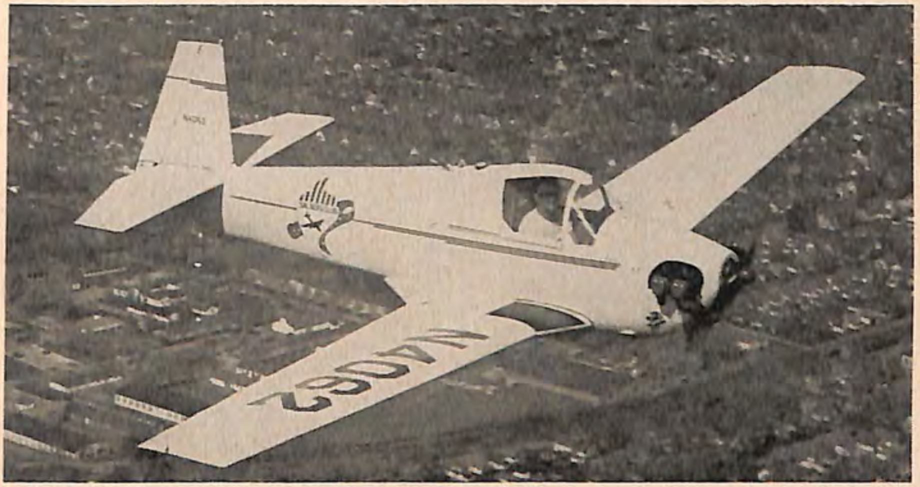
PERFORMANCE • **Maximum Speed 370 mph; Cruise Speed 335 mph; Landing Speed 106 mph; Rate of Climb 1600 fpm; Service Ceiling 30,100 ft.; Absolute Ceiling 31,200 ft.; Range with Maximum Payload 4630 mi.; Range with Maximum Fuel Load (absolute) 5840 mi.**

REMARKS

Introduced in the fall of 1954, the Super Constellation 1049G is the first transport to use Wright turbo-compound engines. Military versions of the new model will carry 106 passengers and a crew of four. Model 1049D Constellations are freight models with a trans-Atlantic load capacity of 18 tons. The main cargo compartment is 83 ft. long and the aircraft's total cargo volume is 5568 cu. ft. It has a double door aft and a single door forward for loading. The 1049Gs have provisions for surveillance radar. 47 to 99 passengers.

MOONEY AIRCRAFT, INC.

Kerrville, Tex.



Mooney Mite M-18L

TYPE • Single seat

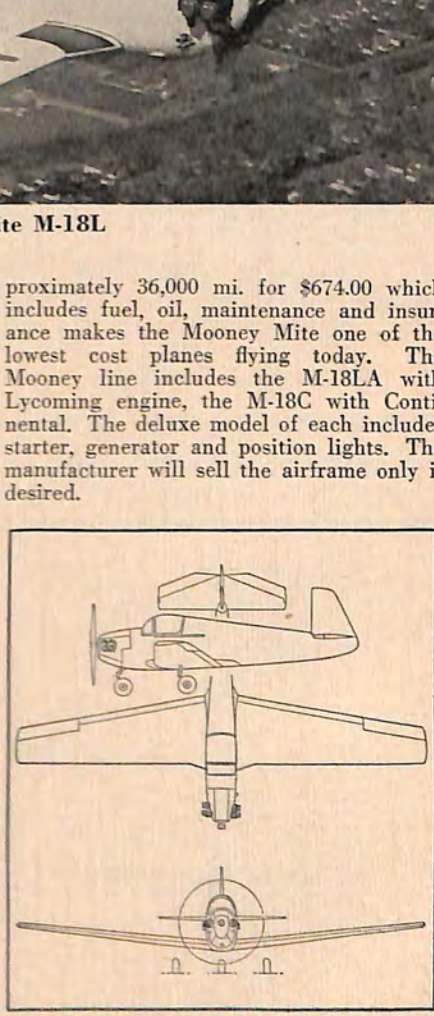
DESIGNATION • M-18L

SPECIFICATIONS • Span 26 ft. 10½ in.; Length 17 ft. 8 in.; Height 6 ft. 3¼ in.; Empty Weight 540 lb.; Gross Weight 850 lb.; Wing Loading 8.9 lb. per sq. ft.; Power Loading 13.1 lb. per bhp; Engine Continental A65-8, 65 hp; Fuel Capacity 16 gal.; Propeller Flottorp; Wing Area 95.05 sq. ft.; Aileron Area 6.62 sq. ft.; Flap Area 10.54 sq. ft.; Fin Area 4.87 sq ft.; Rudder Area 2.26 sq. ft.; Stabilizer Area 12.15 sq. ft.; Elevator Area 5.94 sq. ft.

PERFORMANCE • Maximum Speed 142 mph at 2450 rpm at S. L.; Cruise Speed 130 mph at 2400 rpm at 10,000 ft.; Landing Speed 45 mph; Rate of Climb 1000 fpm at S. L.; Service Ceiling 21,000 ft.; Absolute Ceiling 22,500 ft.; Range with Maximum Payload 420 mi.; Range with Maximum Fuel Load 610 mi.

REMARKS

Three hundred flying hours covering approximately 36,000 mi. for $674.00 which includes fuel, oil, maintenance and insurance makes the Mooney Mite one of the lowest cost planes flying today. The Mooney line includes the M-18LA with Lycoming engine, the M-18C with Continental. The deluxe model of each includes starter, generator and position lights. The manufacturer will sell the airframe only if desired.



PIPER AIRCRAFT CORP.

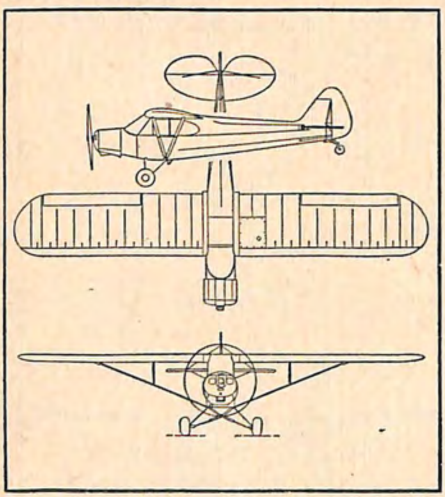
Lock Haven, Pa.

Piper PA-18 Super Cub

TYPE • Two-place

DESIGNATION • PA-18

SPECIFICATIONS • Span 35.3 ft.; Length 22 ft. 6 in.; Height 6 ft. 8 in.; Empty Weight 895 lb.; Gross Weight 1,500 lb.; Wing Loading 8.4 lb. per sq. ft.; Power Loading 12.0 lb. per bhp; Engine Lycoming O-290-D2, 135 hp at 2,600 rpm at S. L.; Fuel Capacity 36 gal.; Propeller Sensenich; Gear conventional.



PERFORMANCE • Maximum Speed 127 mph; Cruise Speed 112 mph at 75 percent power at 7,000 ft.; Landing Speed 38 mph; Rate of Climb 1,050 fpm at S. L.; Service Ceiling 20,500 ft.; Range 500 mi.

REMARKS

This series also comes as an agriculture model with a gross of 1,070 lb. equipped with a 110 gal. chemical tank. Another version is the PA-18T with a 108 hp Lycoming used by the Air Force in some of its civilian training programs. This model has a 90 hp Continental.

Piper PA-22 Tri-Pacer

TYPE • **Four-place**

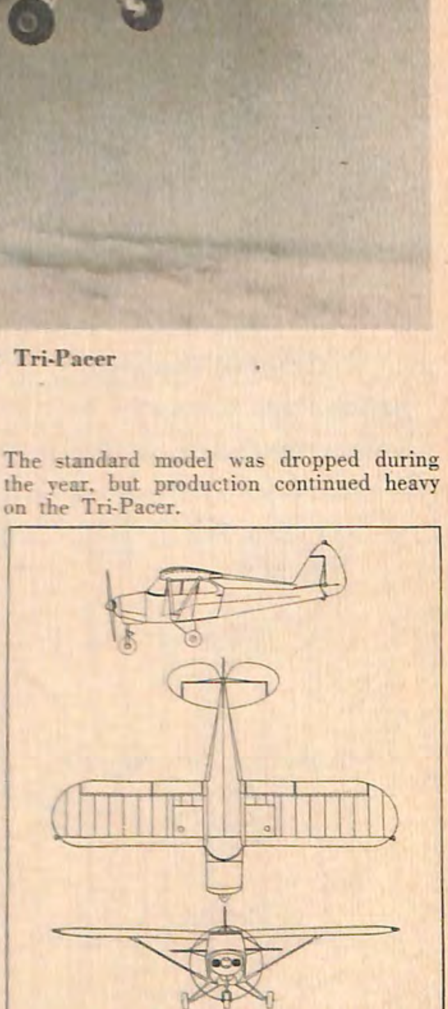
DESIGNATION • **PA-22**

SPECIFICATIONS • **Span 29.3 ft.; Length 20.4 ft.; Height 6.2 ft.; Empty Weight 1,005 lb.; Gross Weight 1,950 lb.; Wing Loading 13.2 lb. per sq. ft.; Power Loading 14.4 lb. per bhp; Engine Lycoming O-290-D2, 135 hp at 2,600 rpm takeoff; Fuel Capacity 36 gal.; Propeller Aeromatic or Sensenich controllable pitch; Gear tricycle.**

PERFORMANCE • **Maximum Speed 137 mph; Cruise Speed 123 mph at 75 percent power at 7,000 ft.; Landing Speed 48 mph; Rate of Climb 800 fpm at S. L.; Service Ceiling 15,500 ft.**

REMARKS

Standard Pacer with tricycle gear costs only 2 mph in speed with no appreciable difference in other performance factors. The standard model was dropped during the year, but production continued heavy on the Tri-Pacer.

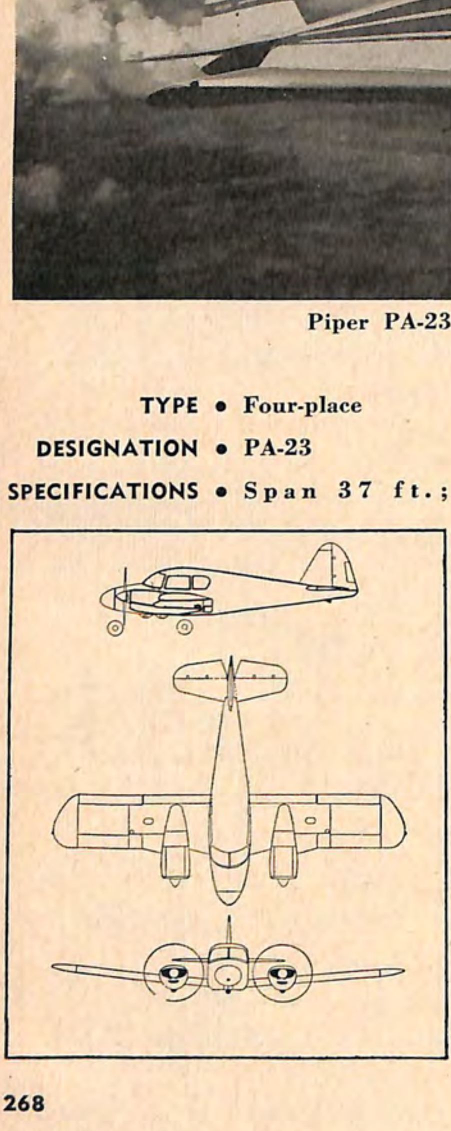


Piper PA-23 Twin Apache

TYPE • **Four-place**

DESIGNATION • **PA-23**

SPECIFICATIONS • **Span 37 ft.; Length 27.1 ft.; Height 9.5 ft.; Engine (2) Lycoming O-320, 150 hp at 2700 rpm; Gross Weight 3500 lb.; Empty Weight 2180 lb.; Useful Load 1320 lb.; Wing Loading 17.2 lb. per sq. ft.; Power Loading 11.6 lb. per hp; Wing Area 204 sq. ft.; Baggage 196 lb.**



PERFORMANCE • **Cruise Speed more than 150 mph.**

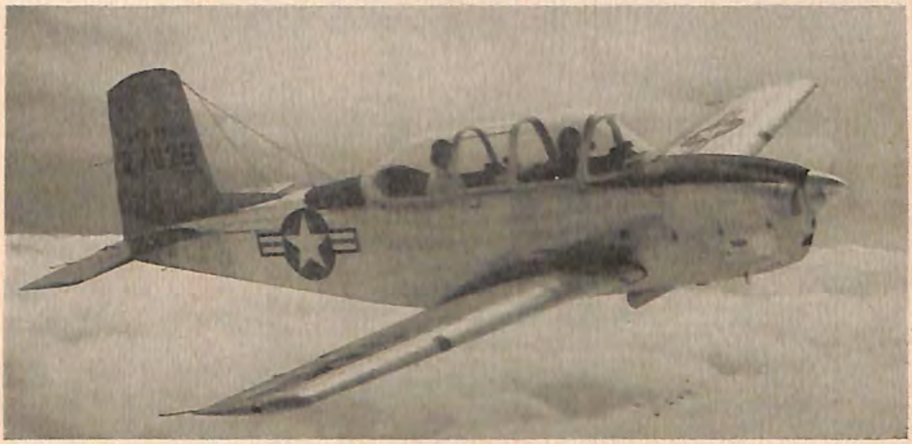
REMARKS

This new Piper twin Apache is all-metal design with short takeoff characteristics and slow landing speed for short field operations. It is capable of maintaining altitude at full gross weight on one engine. The rear seat can be removed in less than two minutes to provide 80 cu. ft. of unobstructed stowage space. The model can be converted into an ambulance plane with room for one stretcher and attendant in the rear seat. The cabin has been built so that a hatch can be cut in the floor for camera installation. Flap and landing gear controls are shaped as an airfoil and wheel respectively for positive identification.

MILITARY

BEECH AIRCRAFT CORP.

Wichita, Kans.



Beech T-34 Mentor

TYPE • Trainer

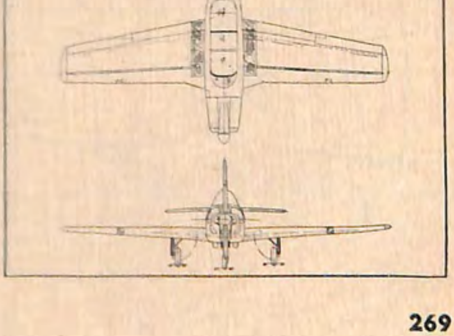
DESIGNATION • T-34A (Air Force)

SPECIFICATIONS • **Span 32 ft. 10 in.; Length 25 ft. 11 in.; Height 9 ft. 7 in.; Empty Weight 2170 lb.; Gross Weight 2900 lb.; Wing Loading 16.33 lb. per sq. ft.; Power Loading 12.89 lb. per bhp; Engine Continental O-470-13, 225 hp at 2600 rpm; Fuel Capacity 50 gal.; Propeller Beech constant speed; Gear tricycle; Wing Area 177.6 sq. ft.; Aileron Area 11.5 sq. ft.; Flap Area 23.3 sq. ft.; Fin Area 10.39 sq. ft.; Rudder Area 6.54 sq. ft.; Stabilizer Area 22.25 sq ft.; Elevator Area 15 sq. ft.**

PERFORMANCE • **Maximum Speed 189 mph at 225 hp at 2600 rpm at S. L.; Cruise Speed 173 mph at 135 hp at 2300 rpm at 10,000 ft.; Landing Speed 54 mph; Rate of Climb 1230 fpm at S. L.; Service Ceiling 20,000 ft.; Range with Maximum Payload 736 mi. at 10,000 ft. 60 percent power.**

REMARKS

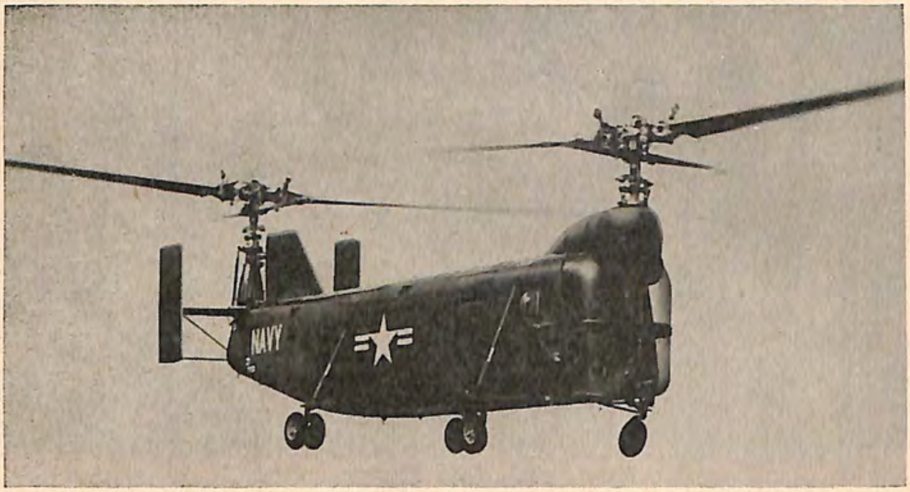
The T-34 Mentor, developed by Beech as a private venture, has now been adopted as the official primary trainer for the U. S. Air Force, U. S. Navy, and the air services of Canada, Chile, Colombia, El Salvador and Japan. It has won every evaluation contest in which it has participated since the first prototype flight, Dec. 2, 1948.



BELL AIRCRAFT CORP.

HELICOPTER DIVISION

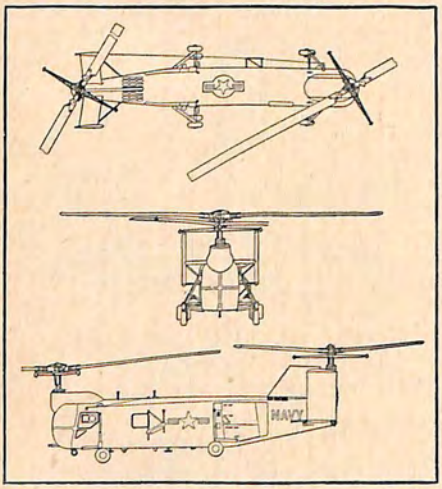
Fort Worth, Tex.



Bell HSL twin tandem

TYPE • Anti - Submarine Combat

DESIGNATION • HSL-1 (Navy)



SPECIFICATIONS • Main Rotor Diameter 51 ft. 6 in.; Length 40 ft.; Height 14 ft. 6 in.; Engine Pratt and Whitney R-2800, 1900 hp normal rated; Fuel Capacity 425 gal.

PERFORMANCE • All data are classified.

REMARKS

This is the first helicopter specifically designed for anti-submarine warfare, and marks Bell's first departure from the single main rotor configuration. The HSL-1 rotor system has the standard Bell rigid two-blade rotor and automatic stabilizer system. The engine is mounted in conventional position in the aft section of the fuselage. The rotors can be folded rearward, the rear blades folding forward for compact carrier stowage. Stabilizing fins are provided for directional stability in high speed flight.

BOEING AIRPLANE CO.

Seattle, Wash.

Boeing B-52 Stratofortress

TYPE • Heavy bomber

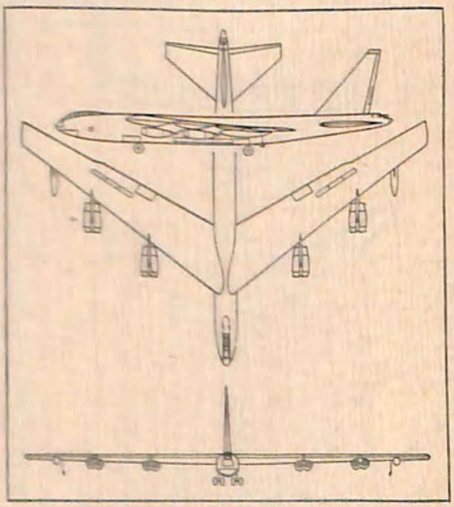
DESIGNATION • B-52 (Air Force)

SPECIFICATIONS • Span 185 ft.; Sweepback 35 deg.; Length 156 ft.; Height 48 ft.; Gross weight more than 350,000 lb.; Engine (8) Pratt and Whitney J57 turbojet, 10,000 lb. thrust class; Gear eight main wheels in tandem with single outrigger wheels near wing tips.

PERFORMANCE • Can be described only as "a very-high speed, long-range heavy bomber with a service ceiling over 45,000 ft."

REMARKS

Two experimental prototypes of this airplane continued to undergo Boeing and Air Force test programs at year end. First Stratofortress to fly, the YB-52 made its initial flight April 15, 1952 reversing the usual order. It was ordered into quantity production before the first flight. Boeing is building production B-52s at Seattle, Wash., and the company's Wichita, Kans. Division was tooling up at year end for second source production. Prototypes have tandem seating; production models side-by-side. The B-52 is the largest and heaviest jet airplane ever built.

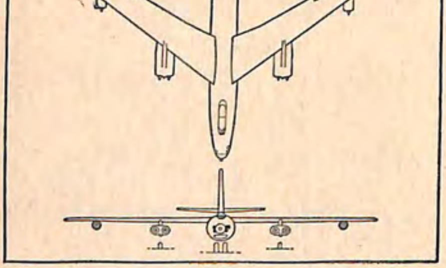


Boeing RB-47E (foreground) and B-47E

TYPE • Medium Bomber

DESIGNATION • B-47E (Air Force)

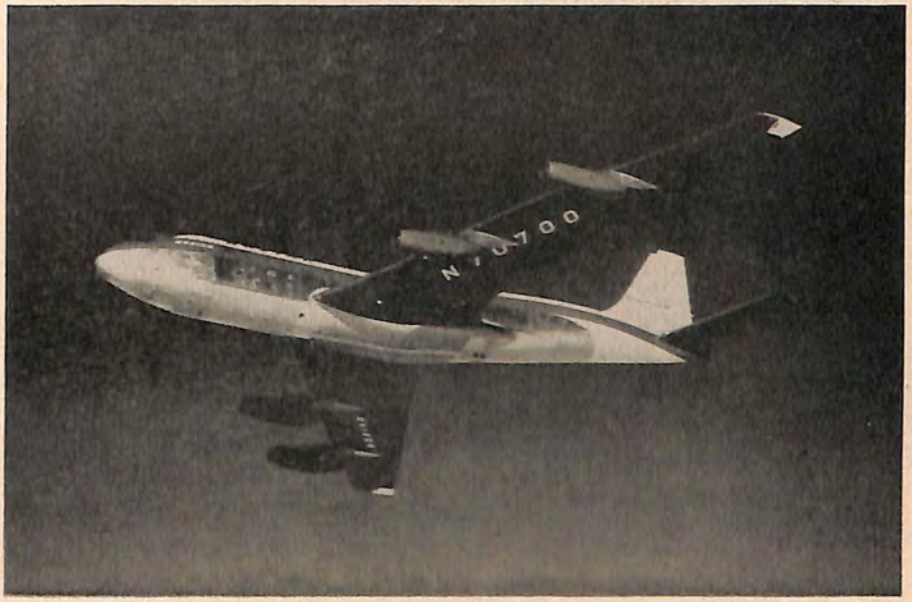
SPECIFICATIONS • Span 116 ft.; Sweepback 35 deg.; Length 106 ft.; Height 28 ft.; Gross Weight more than 200,000 lb.; Normal Bomb Load more than 20,000 lb.; Engine (6) General Electric J47, 6000 lb. thrust normal rated; provisions for 33 external ATO units, 1000 lb. each and water injection systems providing 17 percent power increase; Gear dual main wheels in tandem with a single outrigger under each inboard pod.



PERFORMANCE • Maximum Speed more than 600 mph; Service Ceiling over 40,000 ft.; Range more than 3000 mi.

REMARKS

The B-47 is the fastest operational bomber in the world. The first XB-47 flight took place Dec., 1947 and more than 1000 have been built since. Another model, the RB-47E, differs from the standard model in having longer nose, more windows and air-conditioned camera compartment in place of bomb bay. Crew for this model is pilot, co-pilot riding in tandem and observer-photographer. Among the features of the B-47 are the thin flexible wings which have a drooped appearance on the ground changing to a slight dihedral in flight. A B-47 set a new jet endurance record during 1954 with a 17,000 mi. flight in 35 hours with the aid of aerial refueling. Crew: 3.



Boeing 707 tanker-transport

TYPE • **Tanker Transport**

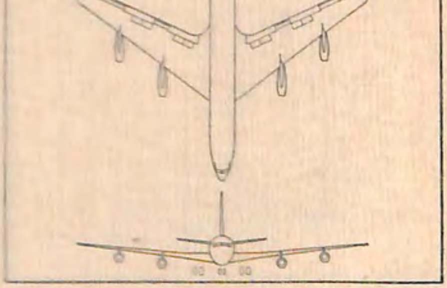
DESIGNATION • **KC-135 (Air Force) this is the advanced version of the 707 transport, details of which are not released.**

SPECIFICATIONS • **Span 130 ft.; Sweepback 35 deg.; Length 128 ft.; Height 38 ft. 3 in.; Gross Weight 190,000 lb.; Engine (4) Pratt and Whitney J-57 turbojet, 10,000 lb. thrust class; Gear tricycle, main undercarriage units, four-wheel trucks, dual nose wheels.**

PERFORMANCE • **Cruising Speed 550 mph; Service Ceiling over 42,000 ft.**

REMARKS

America's first jet tanker-transport was rolled from Renton, Wash. plant May 14, 1954, and made its maiden flight July 15, 1954. It was flown at altitudes of more than 42,000 ft. and speeds of over 550 mph in early flight tests. It was ordered into production Sept. 1, 1954. Three-view drawing below is 707.

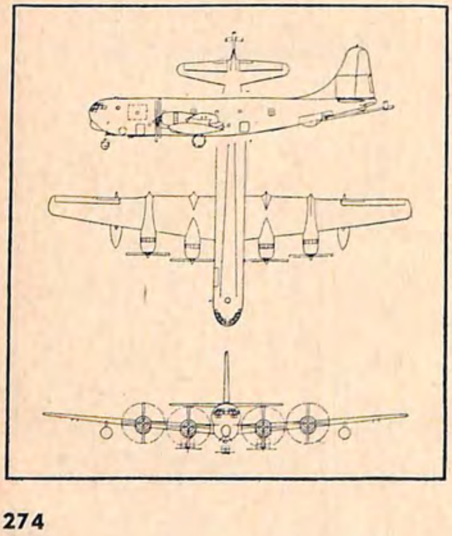


Boeing KC-97G Stratofreighter

TYPE • Tanker transport

DESIGNATION • KC-97G (Air Force)

SPECIFICATIONS • Span 141 ft. 3 in.; Length 110 ft. 4 in.; Height 38 ft. 3 in. (foldable tail); Gross Weight 153,000 lb.; Maximum Weight 175,000 lb.; Engine (4) Pratt and Whitney R-4360-59 Wasp Major, 3500 hp at takeoff; Propellers Hamilton Standard, four blade, full feathering and fully reversible.



PERFORMANCE • Maximum Speed 375 mph; Cruising Speed over 300 mph; Service Ceiling over 35,000 ft.

REMARKS

Flying boom controls and boom operator's station are mounted as a single unit which can be easily removed. Internal fuel tanks are located so that the airplane may also carry cargo while in the tanker configuration. By removing the pod and installing cargo doors in its place, the airplane can serve as a cargo, troop or hospital transport. Chief difference between G and earlier models is the provision for two droppable wing tanks and the relocation of internal fuel tanks. Cargo version carries a maximum of 68,500 lb. of heavy cargo such as jeeps, trucks and artillery. Passenger version carries 130 men, ambulance model up to 79 litter patients and attendants.

CESSNA AIRCRAFT CO.

Wichita, Kans.

Cessna L-19A Bird Dog

TYPE • **Liaison**

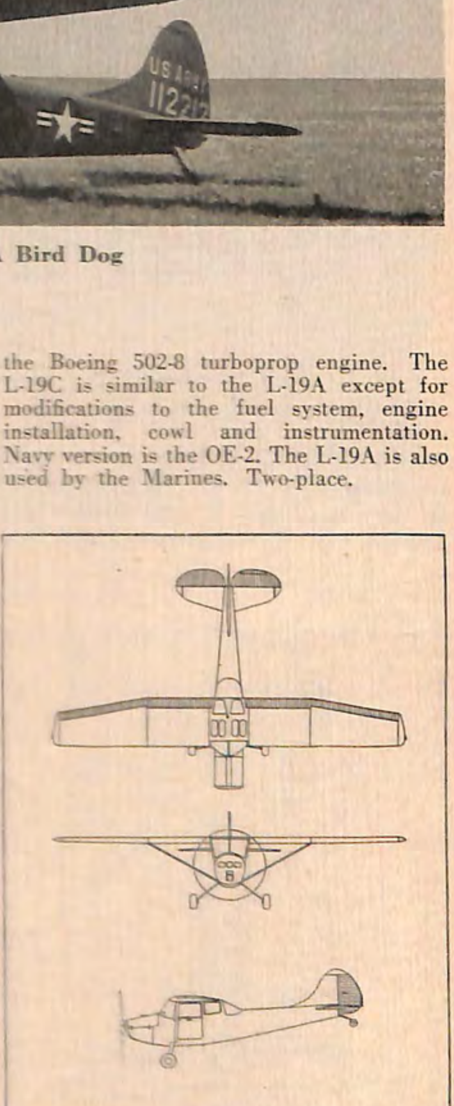
DESIGNATION • **L-19A (Army)**

SPECIFICATIONS • **Span 36 ft.; Length 25 ft.; Height 7 ft. 6 in.; Empty Weight 1448 lb.; Gross Weight 2100 lb.; Engine Continental O-470-11, 213 hp takeoff; Gear Cessna spring type; Propeller McCauley for cruising speeds up to 145 mph, Koppers Aeromatic and Hartzell controllable propellers can also be installed.**

PERFORMANCE • **Maximum Speed 146 mph at 5000 ft.; Cruise Speed 104 mph; Observation Speed 46 mph; Rate of Cimb 1290 fpm at S. L.; Service Ceiling 22,900 ft.; Range at Cruising Speed 306 mph.**

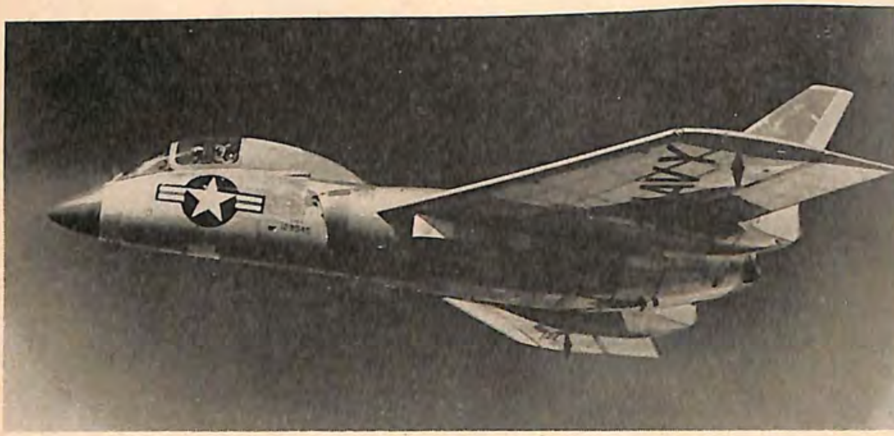
REMARKS

The L-19A is all-metal, has a wide door opening and ample rear cockpit and baggage space that can be converted to stretcher installation. Flaps are the high lift type and extend rearward as they are lowered. Flap travel is 60 deg. An experimental development of this model was the XL-19B, essentially the same airplane as the L-19A except for the substitution of the Boeing 502-8 turboprop engine. The L-19C is similar to the L-19A except for modifications to the fuel system, engine installation, cowl and instrumentation. Navy version is the OE-2. The L-19A is also used by the Marines. Two-place.



CHANCE VOUGHT AIRCRAFT, INC.

Dallas, Tex.



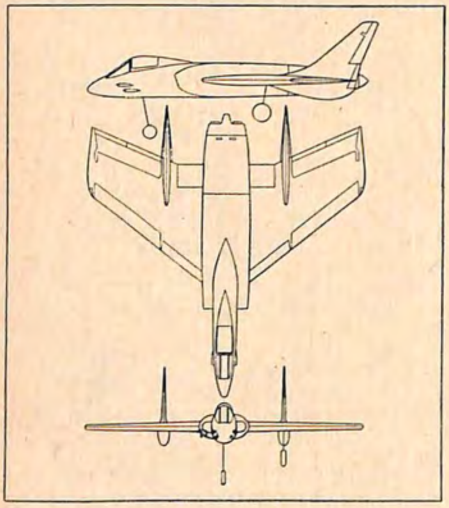
Chance Vought F7U-3 Cutlass

TYPE • Fighter

DESIGNATION • F7U-3 (Navy)

SPECIFICATIONS • Span 39 ft. 8½ in.; Length 44 ft. 3½ in.; Height 14 ft. 7.44 in.; Gross Weight 23,300 lb.; Engine (2) Westinghouse J46-WE-2, 4800 lb. thrust unaugmented, 8200 lb. thrust with afterburners; Gear tricycle; Wing Area 540 sq. ft.; Alivator Area 74.4 sq. ft.; Speed Brake Area 36.1 sq. ft.; Fin Area 131.5 sq. ft.; Rudder Area 12.9 sq. ft.

PERFORMANCE • Maximum Speed over 650 mph; Rate of Climb over 13,000 fpm; Service Ceiling combat approved 45,000 ft.



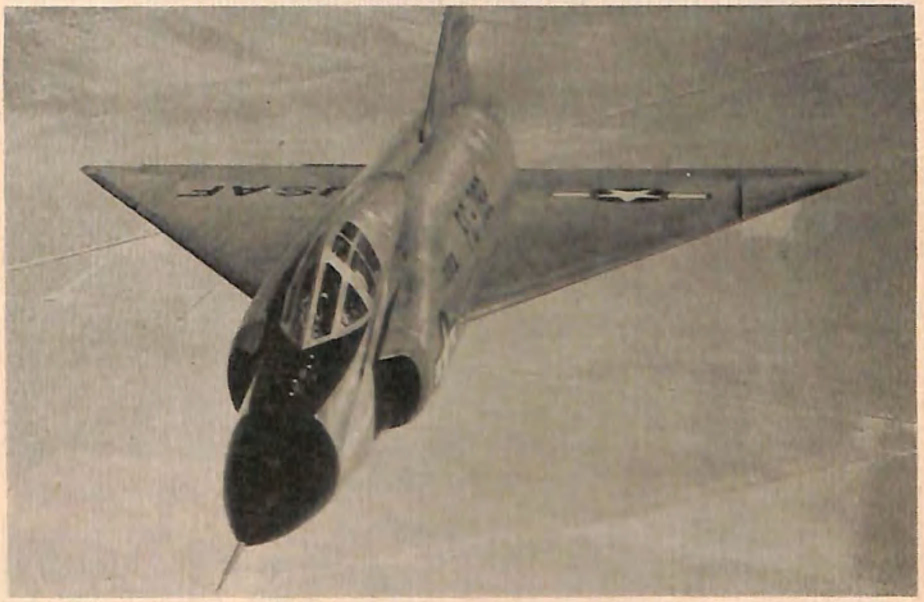
REMARKS

An attack version of the F7U-3, the A2U-1, started into production late in 1954 but was subsequently halted. Future of the project was uncertain as we went to press. It is basically the same airframe as the F7U-3 but has added range and armament protection changes and provisions for carrying a more varied bomb load. The F7U-3 continued in production during the year with large numbers going to the Fleet. The Cutlass has a dual power control hydraulic system rather than a single system with a separate manual control system. Each system is completely independent of the other. Ailovators combine ailerons and elevators and provide longitudinal and lateral control. Leading edge wing slats replace conventional landing flaps for low stalling speeds.

CONVAIR

A DIVISION OF THE GENERAL DYNAMICS CORP.

San Diego, Calif.



Convair F-102 delta wing interceptor

TYPE • Fighter

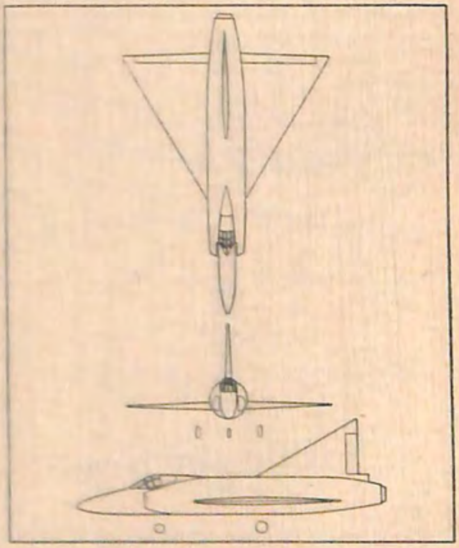
DESIGNATION • F-102 (Air Force)

SPECIFICATIONS • Span 37 ft.; Length 52 ft.; Height 18 ft.; Gross Weight 25,600 lb.; Engine Pratt & Whitney J-57.

PERFORMANCE • All data are classified.

REMARKS

The F-102 is a large delta wing interceptor designed for either piloted or pilotless flight. It uses the Hughes guidance equipment and mounts the Hughes Falcon missile. The first production model was completed in March, 1954. First all-weather supersonic interceptor for the Air Force, the F-102's electronic and armament improvements make it a lethal weapon in any kind of weather.

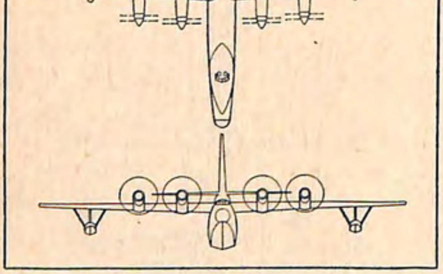


Convair R3Y-1 Tradewind

TYPE • **Transport**

DESIGNATION • **R3Y-1 (Navy)**

SPECIFICATIONS • **Span 145 ft. 9 in.; Length 139 ft. 8 in.; Height 51 ft. 5 in.; Empty Weight 80,000 lb.; Gross Weight 150,000 lb.; Overload Gross Weight 160,000 lb.; Engine (4) Allison T40A-10, 5500 hp takeoff; Propeller Aero Products three blade.**



PERFORMANCE • **Maximum Speed 386 mph at 25,000 ft.; Cruise Speed 300 mph; Rate of Climb 2500 fpm; Range with Maximum Payload 2300 mi.**

REMARKS

The new production version of the XP5Y-1 features extensive redesign with completely refaired bow, new high aspect ratio vertical tail, new engine installations, modified float support structure. The R3Y-2 loads from the bow and is the assault transport version. The original model was the first multi-engine turboprop airplane. It made its initial flight April, 1950. Design features high length-beam ratio hull for low drag in flight and improved water handling characteristisics. Cargo flying boat.

Convair B-36J—last of the series

TYPE • **Heavy bomber**

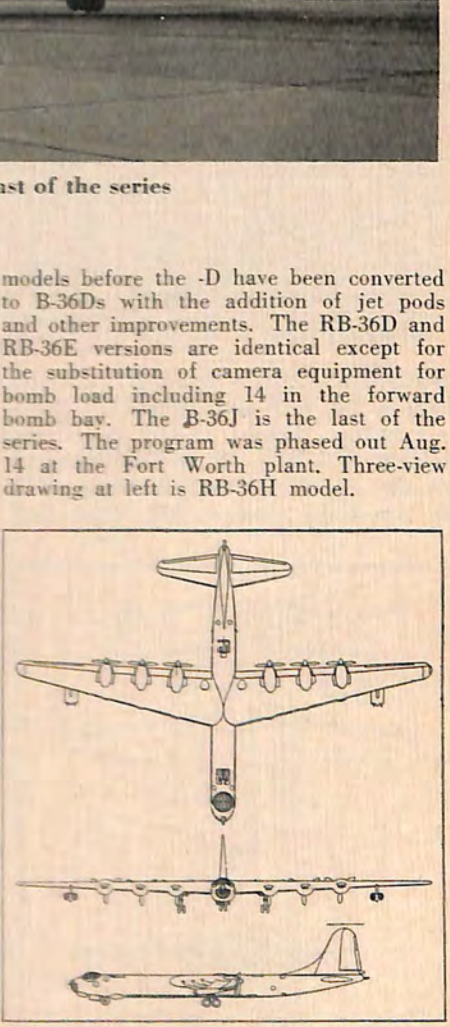
DESIGNATION • **B-36J (Air Force)**

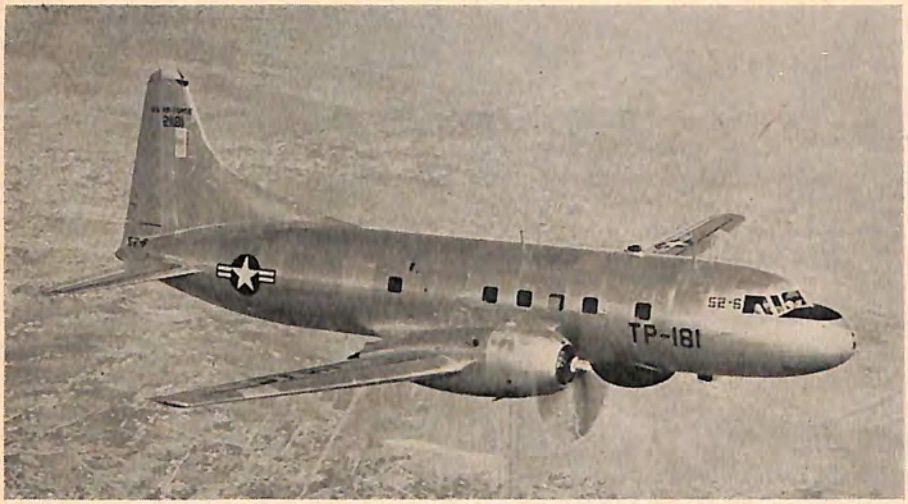
SPECIFICATIONS • **Span 230 ft.; Length 162 ft. 1 in.; Height 46 ft. 9 in.; Gross Weight over 400,000 lb.; Wing Loading 85 lb. per sq. ft.; Engine (6) Pratt and Whitney R-4360, 3800 hp (4) General Electric J47 turbojet, 5200 lb. thrust; Propeller Curtiss Electric three blade; Gear tricycle, dual nose wheel, four wheel truck main; Wing Area 4772 sq. ft.; Aileron Area 247.8 sq. ft.; Flap Area 517.7 sq. ft.; Fin Area 325.2 sq. ft.; Rudder Area 217.3 sq. ft.; Stabilizer Area 505.9 sq. ft.; Elevator Area 472.9 sq. ft.**

PERFORMANCE • **Maximum Speed over 435 mph; Landing Speed 100 mph; Service Ceiling over 45,000 ft.; Range with Maximum Fuel Load 10,000 mi.**

REMARKS

The B-36 is one of the largest combat aircraft in the world and is the standard Strategic Air Command heavy bomber. All models before the -D have been converted to B-36Ds with the addition of jet pods and other improvements. The RB-36D and RB-36E versions are identical except for the substitution of camera equipment for bomb load including 14 in the forward bomb bay. The B-36J is the last of the series. The program was phased out Aug. 14 at the Fort Worth plant. Three-view drawing at left is RB-36H model.



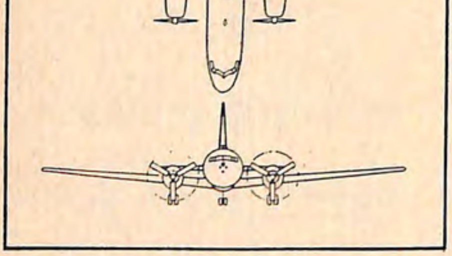


Convair T-29D Flying Classroom

TYPE • **Trainer**

DESIGNATION • **T-29D (Air Force)**

SPECIFICATIONS • **Span 91 ft. 9 in.; Length 74 ft. 8 in.; Height 27 ft. 3 in.; Empty Weight 30,481 lb.; Gross Weight 43,575 lb.; Wing Loading 53.3 lb. per sq. ft.; Power Loading 8.72 lb. per bhp; Engine (2) Pratt and Whitney R-2800-99W, 2500 hp; Fuel Capacity 1550 gal.; Propeller Hamilton Standard three blade; Gear tricycle; Wing Area 817 sq. ft.; Aileron Area 24.52 sq. ft.; Flap Area 140 sq. ft.; Fin Area 86.2 sq. ft.; Rudder Area 41 sq. ft.; Stabilizer Area 175.44 sq. ft.; Elevator Area 58.62 sq. ft.**



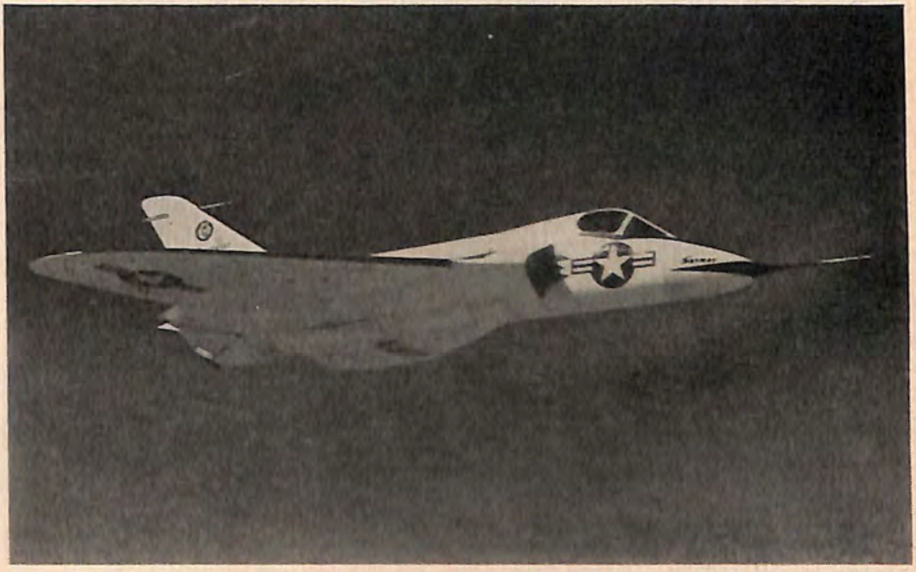
PERFORMANCE • **Maximum Speed 314 mph at 1700 rpm at 15,800 ft.; Cruise Speed 239 mph at 5000 ft.; Landing Speed 93 mph; Rate of Climb 1415 fpm at S. L.; Service Ceiling 25,100 ft.; Absolute Ceiling 26,200 ft.; Range with Maximum Fuel Load 2222 mi.**

REMARKS

The T-29 series is built as a trainer for bombardiers and navigators, the -D model for bombardiers, the -C for navigators. The T-29D accommodates seven students and instructors. The T-29C version is equipped with 14 stations, each with table, instrument panel and other essential navigational training aids. Radar training equipment provides for three students with instructors.

DOUGLAS AIRCRAFT CO., INC.

Santa Monica, Calif.



Douglas F4D-1 Skyray

TYPE • Fighter

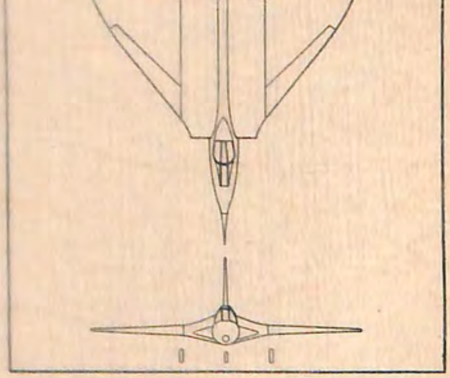
DESIGNATION • F4D-1 (Navy)

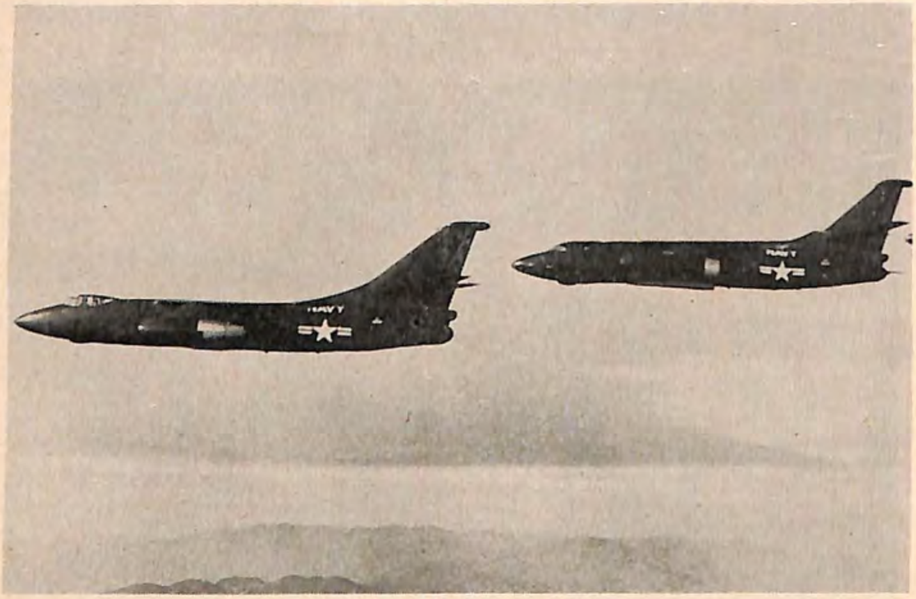
SPECIFICATIONS • Span 27 ft. 6 in.; Length 37 ft. 7 in.; Height 12 ft. 10 in.; Gross Weight about 16,000 lb.; Engine Pratt and Whitney J57-P2.

PERFORMANCE • All data are classified.

REMARKS

Named the Skyray because of its resemblance to the ocean dwelling manta ray, the F4D is a supersonic fighter interceptor. Its delta-like wing provides a low aspect ratio, maximum sweep and minimum thickness. Air scoops are located at either side of the fuselage and elevons on the trailing edges of the wings combine aileron and elevator functions. It is the first carrier-based airplane ever to hold the world's speed record. On Oct. 3, 1953, the F4D set the world's official speed record over a three kilometer (1.863 mi.) course averaging 753.4 mph in four passes. On Oct. 16, 1953, the same plane averaged 728.110 mph for a 100 kilometer (62.1 mi.) course record.



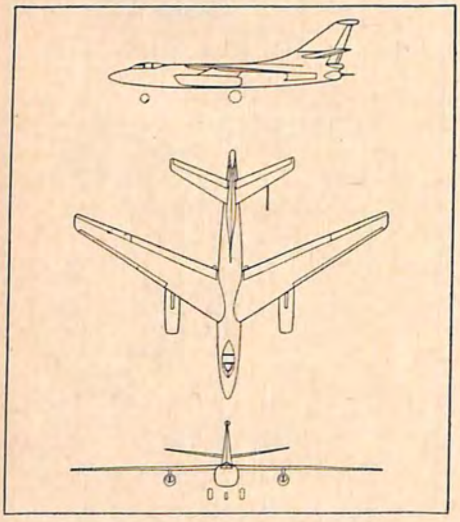


Douglas A3D Skywarriors

TYPE • **Attack**

DESIGNATION • **A3D (Navy)**

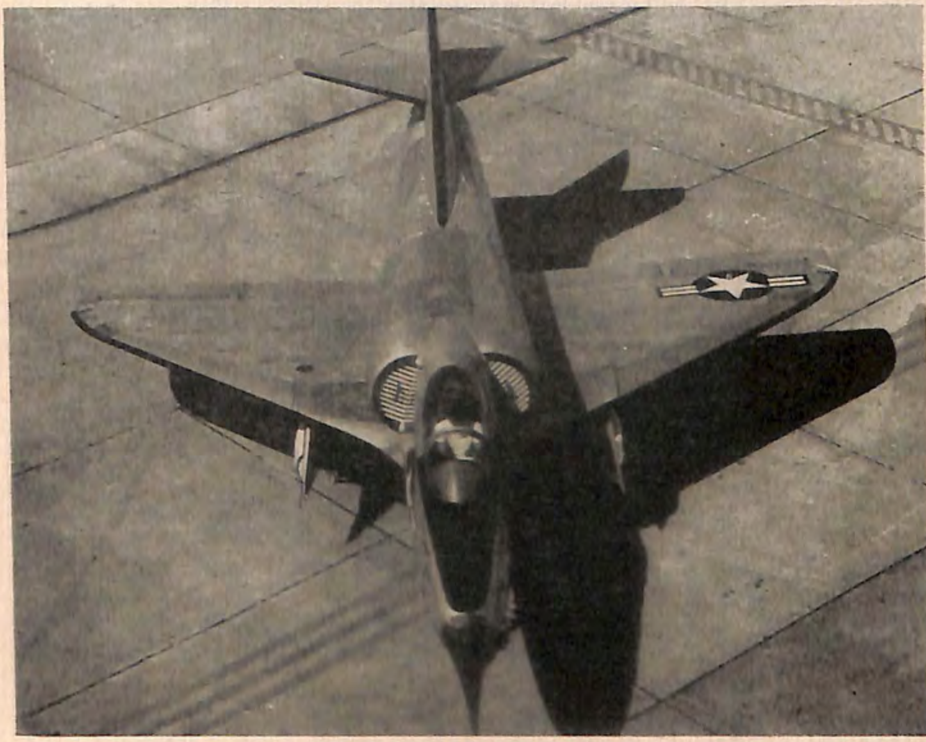
SPECIFICATIONS • **Span 72 ft. 6 in.; Length 75 ft. 10 in.; Height 23 ft. 9 in.; Wing Loading 90 lb. per sq. ft.; Thrust Loading 3.7 lb. per lb. of thrust; Engine (2) Pratt and Whitney J57 turbojet, 9500 lb. thrust; Gear tricycle.**



PERFORMANCE • **(Estimated) Maximum Speed more than 650 mph; Service Ceiling over 45,000 ft.; Range more than 1500 mi.**

REMARKS

The XA3D-1 was equipped with Westinghouse J-40 engines, the production model with J57s. This model first flew Sept. 16, 1953. It can be used at altitude for combat missions, 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 carriers. Pressurized cabin has a crew of three—pilot, pilot-bombardier and gunner-navigator. The A3D has a simple slide-type escape chute and an upper ditching hatch. It also has hydraulic dive brakes in the side of the fuselage. It entered production in Jan., 1953.



Douglas A4D-1 Skyhawk

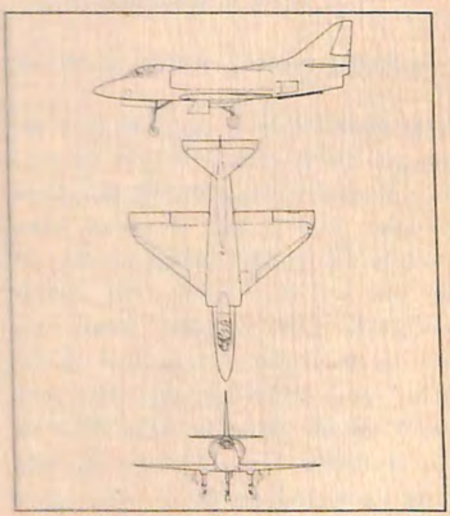
TYPE • Bomber

DESIGNATION • A4D (Navy)

SPECIFICATIONS • Gross Weight 14,400 lb.; Engine J65-W-4 Wright Sapphire. All other specifications classified.

REMARKS

The A4D Skyhawk, smallest and lightest U. S. jet combat plane ever built, was developed by the Douglas El Segundo Division. It required only 18 months to design and build the first model, and the first flight on June 22, 1954, took place two weeks after the tiny plane came off the production line. Although designed for carrier operations, the Skyhawk is small enough to omit the traditional folding wings of that type. The A4D is less than half the size of many current operational jet fighters but has a performance superior to many of them and a combat radius greater than many current propeller driven attack planes. All other data are classified.



Douglas RB-66 sweptwing twin-jet bomber

TYPE • **Reconnaissance**

DESIGNATION • **RB-66 (Air Force)**

SPECIFICATIONS • **Span 72 ft. 6 in.; Length 75 ft. 2 in.; Height 23 ft. 7 in.; Empty Weight 39,735 lb.; Gross Weight 70,000 lb.; Overload Gross Weight 79,000 lb.; Wing Loading 90 lb. per sq. ft.; Engine (2) Allison yJ71-A-9; Gear tricycle; Wing Area 780 sq. ft.; Aileron Area 32.6 sq. ft.; Flap Area 108.8 sq. ft.; Fin Area 129.9 sq. ft.; Rudder Area 32.5 sq. ft.; Stabilizer Area 114.8 sq. ft.; Elevator Area 52.2 sq. ft.**

PERFORMANCE • **All data are classified.**

REMARKS

The RB-66 is a swept-wing, twin-jet bomber re-engineered from the basic design of the Douglas A3D. Its two Allison J-71 engines are slung in pods beneath its high wings. First flight, June 28, 1954. This model was designed specifically for photo reconnaissance and is a running mate for the B-66, the bomber version also in production at the Douglas Long Beach plant. The XA3D-1 was first flown Oct. 28, 1952 and at that time was the most powerful carrier based design to go into production. This model had two Pratt and Whitney J57s and was designed for carriers of all classes.

Douglas AD-5 Skyraider

TYPE • Attack bomber

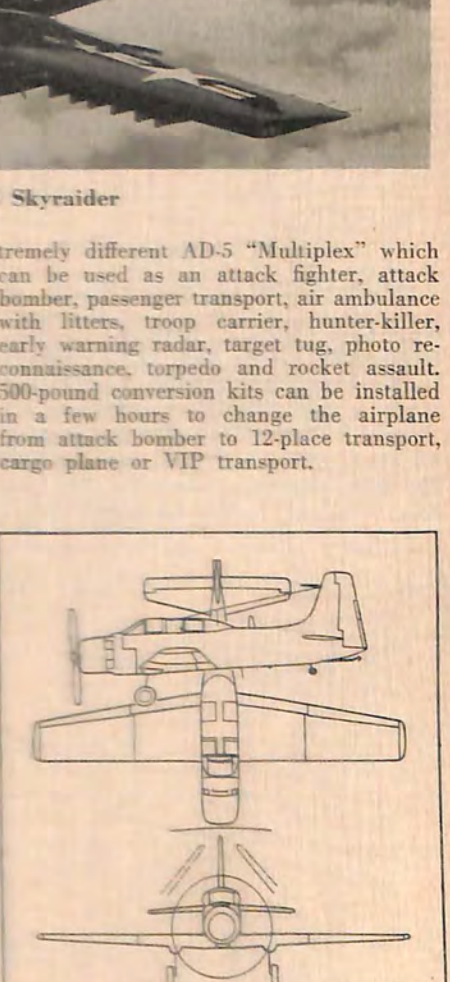
DESIGNATION • AD-5 (Navy)

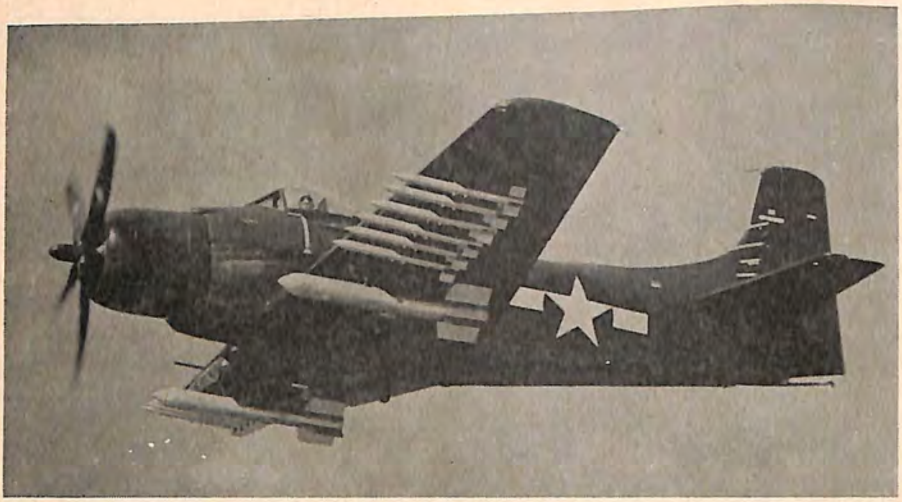
SPECIFICATIONS • Span 50 ft. ¼ in.; Length 40 ft. ⅝ in.; Height 15 ft. 9⅝ in.; Empty Weight 12,313 lb.; Gross Weight 18,799 lb.; Overload Gross Weight 25,000 lb.; Wing Loading 47 lb. per sq. ft.; Power Loading 9.9 lb. per bhp; Engine Wright R-3350, 2700 hp normal rated; Fuel Capacity 380 gal.; Propeller Aeroprop four blade; Gear conventional; Wing Area 400 sq. ft.; Aileron Area 52 sq. ft.; Flap Area 32 sq. ft.; Fin Area 33 sq. ft.; Rudder Area 22 sq. ft.; Stabilizer Area 43 sq. ft.; Elevator Area 44 sq. ft.

PERFORMANCE • (Estimated) Maximum Speed 365 mph; Cruising Speed 300 mph; Combat Radius 500 mi.

REMARKS

AD Skyraiders have been produced in quantity including AD-1s, -2s, -3s, -4s, -5s and -6s since late 1945. Numerous versions have been turned out ranging from attack-dive bombers, night attack, radar countermeasures, airborne early warning, anti-submarine and target towing to the extremely different AD-5 "Multiplex" which can be used as an attack fighter, attack bomber, passenger transport, air ambulance with litters, troop carrier, hunter-killer, early warning radar, target tug, photo reconnaissance, torpedo and rocket assault. 500-pound conversion kits can be installed in a few hours to change the airplane from attack bomber to 12-place transport, cargo plane or VIP transport.



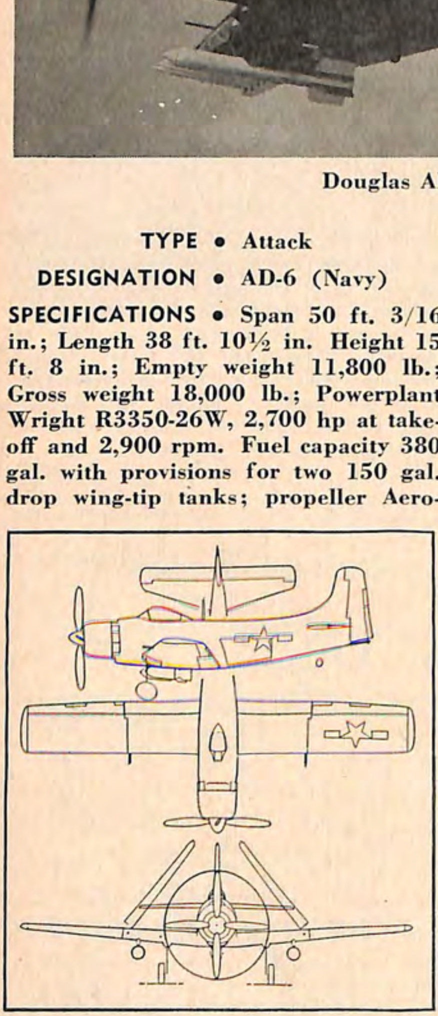


Douglas AD-6 Skyraider

TYPE • **Attack**

DESIGNATION • **AD-6 (Navy)**

SPECIFICATIONS • **Span 50 ft. 3/16 in.; Length 38 ft. 10½ in. Height 15 ft. 8 in.; Empty weight 11,800 lb.; Gross weight 18,000 lb.; Powerplant Wright R3350-26W, 2,700 hp at take-off and 2,900 rpm. Fuel capacity 380 gal. with provisions for two 150 gal. drop wing-tip tanks; propeller Aero-products; Gear conventional retractable.**



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 (counter-measure) 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 regular 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.

Douglas C-124 Globemaster

TYPE • Transport

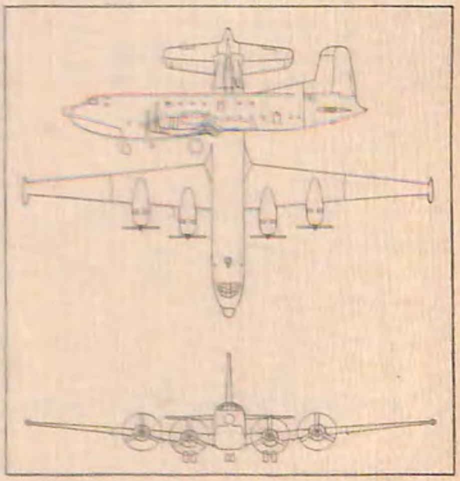
DESIGNATION • C-124C (Air Force)

SPECIFICATIONS • **Span 174 ft. 1.58 in.; Length 130 ft. .05 in.; Height 48 ft. 3.62 in.; Empty Weight 101.052 lb.; Gross Weight 185,000 lb.; Overload Gross Weight 194,500 lb.; Wing Loading 74 lb. per sq. ft.; Power Loading 12.2 lb. per bhp; Engine (4) Pratt and Whitney R-4360-63A, 3800 hp (wet), 3400 hp (dry); Fuel Capacity 11,000 gal.; Propeller Curtis three-blade reversible; Gear tricycle, dual main and nose wheel; Wing Area 2506 sq. ft.; Aileron Area 66.2 sq. ft.; Flap Area 521.4 sq. ft.; Fin Area 280.3 sq. ft.; Rudder Area 185.1 sq. ft.; Stabilizer Area 394.7 sq. ft.; Elevator Area 285.8 sq. ft.**

PERFORMANCE • **(Estimated) Maximum Speed 298 mph at 20,800 ft.; Cruising Speed 264 mph at 13,600 ft.; Rate of Climb 800 fpm; Service Ceiling full gross 22,050 ft.; Range 6280 mi.**

REMARKS

The C-124C is the newest in the C-124 series and is being produced at the Long Beach Div. It is the largest heavy cargo and troop transport in production today. It was developed from the C-74 by addition of bulge under the fuselage and many minor refinements. A hydraulically operated nose loading ramp can take cargo items up to 130 in. wide and 140 in. high. An amidships loading door can handle cargo items measuring 89 in. wide, 155 in. long and 85 in. high. This hold is stressed for 16,000 lb. As a troop carrier, it can carry 200 troops and their equipment, or as a hospital plane, 127 litter patients and their attendants.



FAIRCHILD AIRCRAFT DIVISION

FAIRCHILD ENGINE & AIRCRAFT CORP.

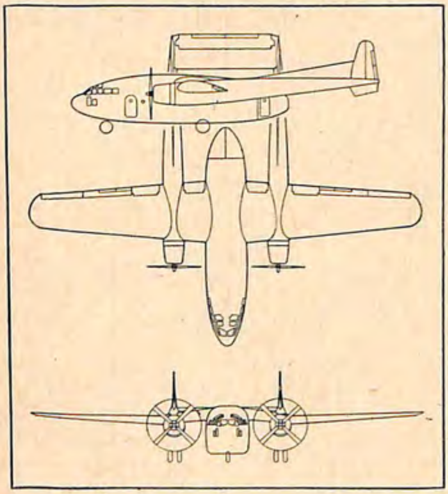
Hagerstown, Md.

Fairchild C-119G Flying Boxcar

TYPE • **Transport**

DESIGNATION • **C-119G (Air Force), R4Q-2 (Navy)**

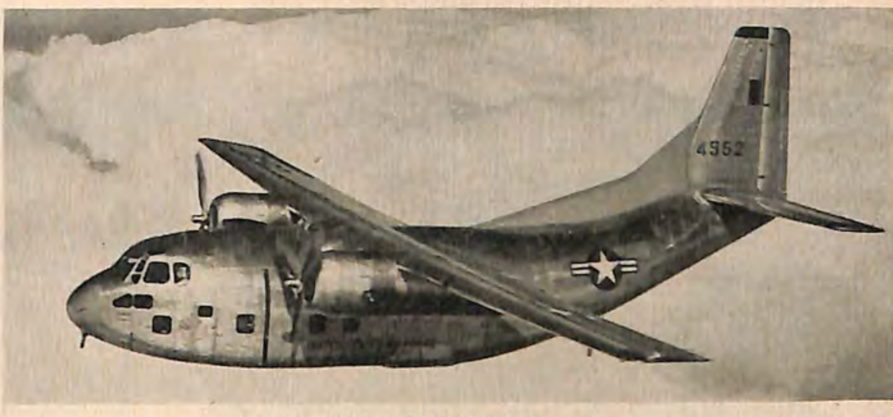
SPECIFICATIONS • **Span 109 ft. 3 in.; Length 86 ft. 6 in.; Height 26 ft. 3 in.; Empty Weight 39,920 lb.; Gross Weight 64,000 lb.; Overload Gross Weight 77,000 lb.; Wing Loading 44.2 lb. per sq. ft.; Power Loading 9.1 lb. per bhp; Engine (2) Wright R-3350, 2650 hp normal rated, 3500 hp takeoff; Fuel Capacity 2624 gal.; Propeller Aeroproducts four blade; Gear tricycle dual main gear; Wing Area 1447 sq. ft.; Aileron Area 33.7 sq. ft.; Flap Area 60 sq. ft.; Fin Area 357 sq. ft.; Rudder Area 55.6 sq. ft.; Stabilizer Area 172.34 sq. ft.; Elevator Area 113.86 sq. ft.**



PERFORMANCE • **Maximum Speed 294 mph at 2250 hp at 2600 rpm at 15,500 ft.; Cruise Speed 230 mph at 1800 hp at 2300 rpm at 10,000 ft.; Landing Speed 92 mph; Rate of Climb 1600 fpm at S. L.; Service Ceiling 28,000 ft.; Absolute Ceiling 29,000 ft.; Range with Maximum Payload 2000 mi. (with 18,000 lb. cargo — maximum cargo is 29,400 lb.); Range with Maximum Fuel Load 3048 mi.**

REMARKS

The Flying Boxcar is also used by the U. S. Marine Corps as R4Q-2, and by the Royal Canadian Air Force. It was developed from the wartime C-82A. Versatility is available in the box car fuselage, equipped with an electrically-operated monorail for rapid aerial delivery of cargo packs, light artillery, jeeps or 42 paratroops. In 20 minutes the cabin can be converted to carry 38 litter patients with four attendants. The C-119G model made its appearance in 1953 and is also in use with the Belgian, Italian and Indian air forces. Flying Boxcars have been in continuous production since 1944 when the first C-82 flew. Crew: 5.



Fairchild C-123B

TYPE • **Transport**

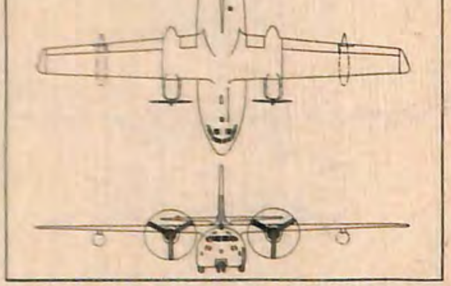
DESIGNATION • **C-123B (Air Force)**

SPECIFICATIONS • **Span 110 ft.; Length 76 ft. 3 in.; Height 34 ft. 1 in.; Empty Weight 30,388 lb.; Gross Weight 54,000 lb.; Overload Gross Weight 60,000 lb. (estimate); Wing Loading 44 lb. per sq. ft.; Power Loading 10.8 lb. per bhp; Engine (2) Pratt and Whitney R-2800, 1900 hp normal rated 2500 hp takeoff; Fuel Capacity 2414 gal. (includes auxiliary wing tanks); Propeller Hamilton Standard three blade; Gear tricycle dual wheels; Wing Area 1223.2 sq. ft.; Aileron Area 83.3 sq. ft.; Flap Area 128 sq. ft.; Fin Area 186.7 sq. ft.; Rudder Area 59.2 sq. ft.; Stabilizer Area 217.7 sq. ft.; Rudder Area 59.2 sq. ft.; Elevator Area 127.9 sq. ft.**

PERFORMANCE • **Maximum Speed 253 mi. at 1800 hp at 2600 rpm at 13,000 ft.; Cruise Speed 186 mi. at 1150 hp at 2150 rpm at S. L.; Landing Speed 85 mi.; Rate of Climb 1100 fpm at S. L.; Service Ceiling 24,000 ft.; Absolute Ceiling 25,000 ft.; Range with 1800 lb. Payload 1470 mi.; Range with Maximum Fuel Load 2990 mi.**

REMARKS

Normal cargo load of the C-123B is 16,000 lb. It is equipped with integral hydraulically operated ramp and cargo door. Loading demonstrations have shown that a 155 mm howitzer and ¾ ton truck can be completely loaded and tied down in less than two minutes. The same cargo can be unloaded in one minute. Tie down fittings are stressed for 10,000 lb. in any direction and are spaced on the cargo compartment floor on a 20-in. grid pattern. The C-123B was designed specifically as a cargo plane and can carry 60 fully-equipped troops, 50 litter patients, tow a glider weighing up to 30,000 lb. or be towed in an emergency.



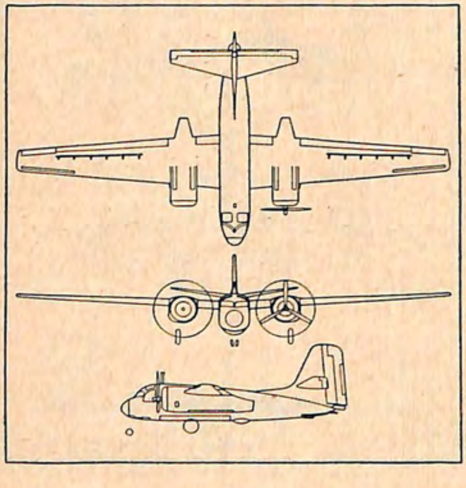
GRUMMAN AIRCRAFT ENGINEERING CORP.

Bethpage, L. I., N. Y.

Grumman S2F-1 sub-killer

TYPE • Anti-submarine

DESIGNATION • S2F-1 (Navy)



SPECIFICATIONS • Span 69 ft. 8 in.; Length 42 ft. 3 in.; Height 16 ft. 3 in.; Engine (2) Wright R-1820-82, 1525 hp takeoff.

PERFORMANCE • All data are classified.

REMARKS

New twin-engine craft is designed to integrate both hunter and killer functions of AF-2 single-engine anti-submarine types. As with the AF-2S and AF-2W Guardian models, speed and high performance have been exchanged for endurance to permit hours of sea patrol seeking the enemy snorkel. Full combat version will mount huge search radar dome, carry torpedoes, depth charges, mines, sonobuoys and cannon.

Grumman F9F-8 Cougar

TYPE • Fighter

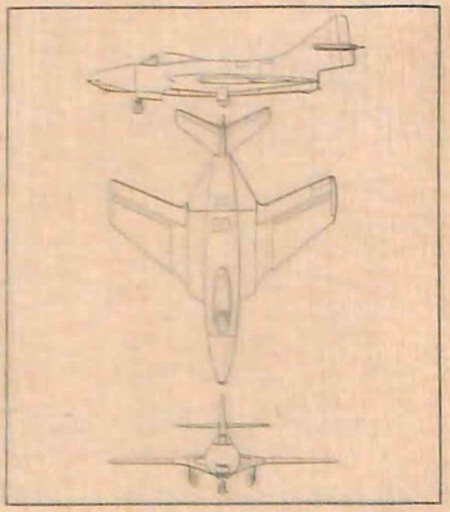
DESIGNATION • F9F-8 (Navy)

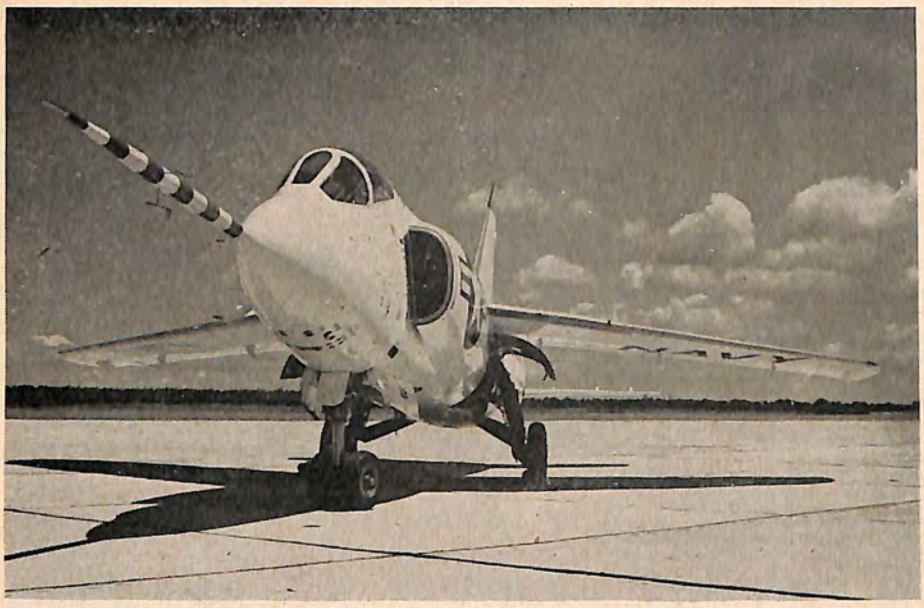
SPECIFICATIONS • Span 34 ft. 6 in.; Length 41 ft. 7 in.; Height 12 ft. 3 in.; Engine Pratt and Whitney J48-P-8, 7250 lb. thrust.

PERFORMANCE • All data are classified.

REMARKS

The F9F-8 Cougar has replaced the F9F-6 on the production line. The -8 is faster, more maneuverable and has greater range. Changes include replacing the movable wing slats with fixed cambered leading edges and extending the trailing edges. These modifications improved the Cougar's speed, maneuverability and low speed handling characteristics. Elimination of the hydraulic system in the wings and lengthening the fuselage by eight inches provided additional space for fuel. The Cougar was the Navy's first operational sweptwing fighter. It has four 20 mm cannons mounted in its nose and can carry a wide variety of external stores.





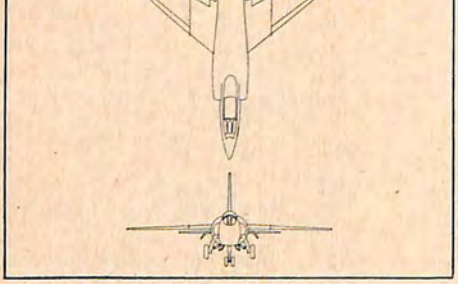
Grumman F9F-9 Tiger

TYPE • Fighter

DESIGNATION • F9F-9 (Navy)

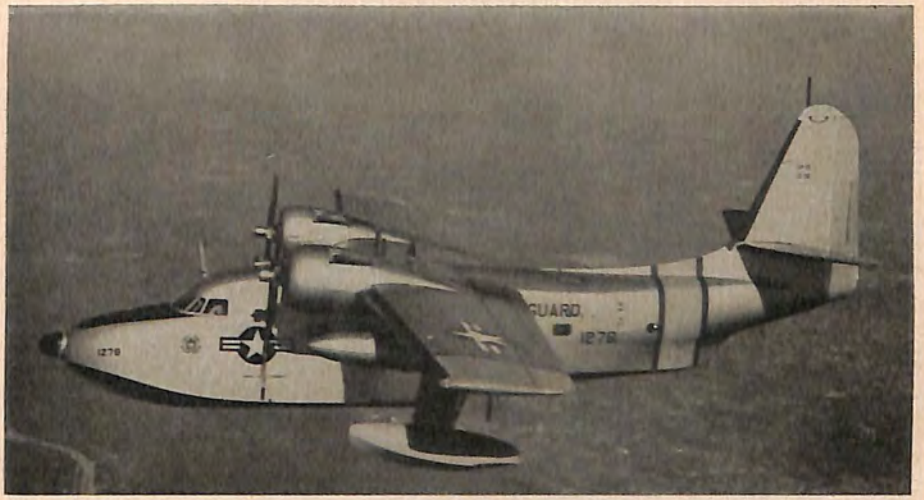
SPECIFICATIONS • Span 31 ft. 7 in.; Length 40 ft. 10 in.; Height 12 ft. 8 in.; Engine Wright J65-W-6 with afterburner.

PERFORMANCE • All data are classified.



REMARKS

The Tiger, although bearing an F9F designation, is a completely new design, and one of the world's few military aircraft capable of supersonic speeds in level flight. Its indented fuselage, nicknamed "coke bottle" was designed to reduce drag characteristics at transonic speeds. Wings, swept to same degree as Cougars, are extremely thin. The entire upper and lower skins are machined from single sheets of aluminum alloy. A small portion of the wing near the tip folds down manually for carrier storage. This simplicity of design is characteristic throughout. The Tiger's first flight was made July 30, 1954. Year end contracts amounted to over $190-million. The Tiger was in production at year end. It will carry the most modern armament designed for fighters, including air-to-air and air-to-ground missiles.



Grumman SA-16A Albatross

TYPE • **Utility**

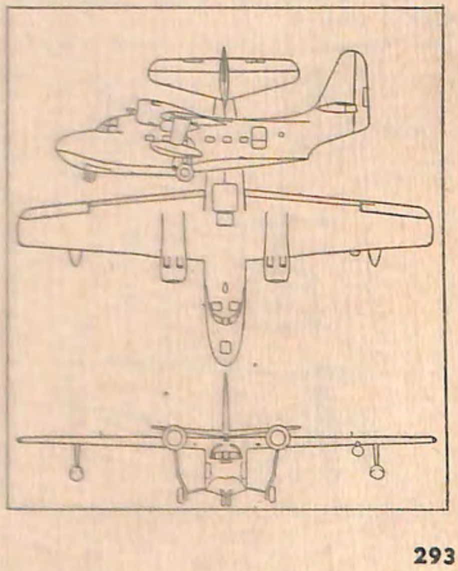
DESIGNATION • **SA-16A (Air Force), UF-1 (Navy), UF-1G (Coast Guard)**

SPECIFICATIONS • **Span 80 ft.; Length 61 ft. 4 in.; Height 24 ft. 5 in.; Engine (2) Wright R-1820-76, 1425 hp takeoff.**

PERFORMANCE • **Maximum Speed 277 mph; Cruise Speed 230 mph.**

REMARKS

The Albatross, Grumman's largest amphibian, was the first aircraft adopted by the unified Naval-Air Force command. It is used by the Air Force, Navy and Coast Guard as a general utility aircraft capable of performing as a hospital plane or for air-sea rescue, cargo, transport or photographic duty. It carries the widest variety of communication and navigation equipment found in the air today. On active service with every Air Force, Air Rescue Squadron throughout the world, the Albatross has participated in many dramatic rescues, including a single Arctic mission requiring separate landings on water, ice, on water again and finally on land. Crew: 6.



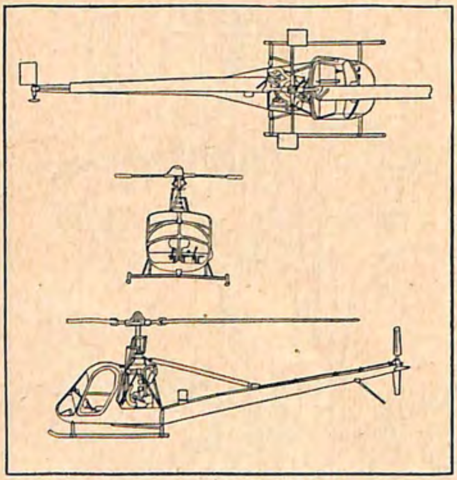
HILLER HELICOPTERS

Palo Alto, Calif.

Hiller H-23B (Army) HTE-2 (Navy)

TYPE • Utility

DESIGNATION • H-23B (Army); HTE-2 (Navy)



SPECIFICATIONS • **Main Rotor Diameter 35 ft.; Anti-Torque Rotor Diameter 5.5 ft.; Length 38.7 ft.; Height 9.8 ft.; Empty Weight 1705 (H-23B), 1754 (HTE-2); Useful Load 795 lb. (H-23B), 746 lb. (HTE-2).**

PERFORMANCE • **Maximum Speed 84 mph at S. L.; Cruise Speed 70 mph at S. L.; Rate of Climb 770 fpm at S. L.; Service Ceiling 9400 ft.; Range 135 mi.**

REMARKS

The 12-B is the three-place commercial version of this model. Accessories are available for agricultural spraying and dusting, evacuation work, night flying and executive use. The H-23B and HTE-2 are both used as helicopter trainers. A number are also in service with foreign governments including the British.

KAMAN AIRCRAFT CORP.

Windsor Locks, Conn.

Kaman HOK-1

TYPE • **Utility**

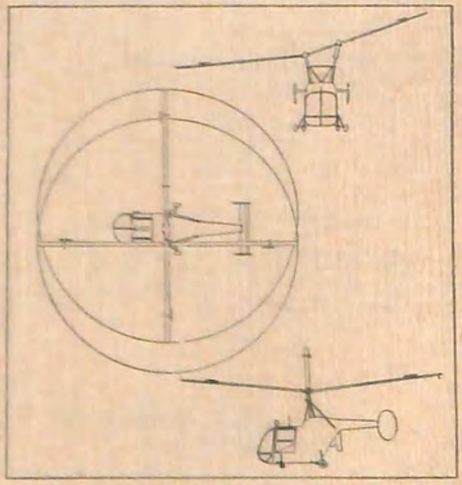
DESIGNATION • **HOK-1 (Navy)**

SPECIFICATIONS • **Rotor Diameter 47 ft.; Length 22 ft. 7 in.; Height 12 ft. 6 in.; Engine Continental R-975-40, 525 hp at 2600 rpm.**

PERFORMANCE • **All data are classified.**

REMARKS

General utility design can be readily converted to ambulance version carrying two litter patients and one medical attendant or an additional ambulatory patient, in addition to the pilot. The HOK-1 uses the patented Kaman servo-flap for blade control. The twin vertical fins provide directional stability in high speed flight. Stabilizer controllable from collective pitch control.



LOCKHEED AIRCRAFT CORP.

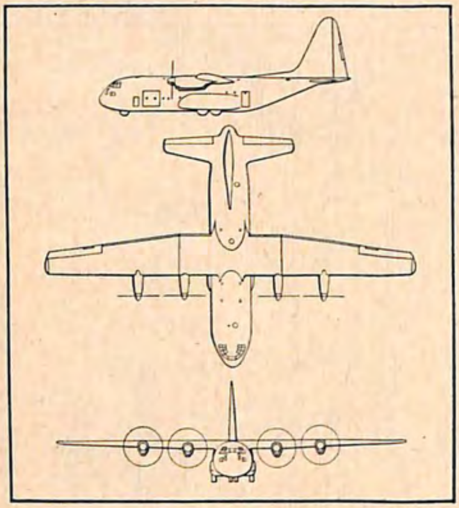
Burbank, Calif.

Lockheed C-130

TYPE • **Transport**

DESIGNATION • **C-130A (Air Force)**

SPECIFICATIONS • **Span 132 ft.; Length 95 ft.; Height 38 ft.; Engine (4) Allison T-56 turboprop, 3750 hp takeoff; Propeller Curtiss-Wright Turboelectric three blade.**



PERFORMANCE • **All data are classified.**

REMARKS

Two development models of this new turboprop were built at Lockheed's Burbank facility and at year end the YC-130 was undergoing flight test at Palmdale and Edwards Air Force bases. Production contracts for the C-130 were assigned to GAP-6, operated by Lockheed at Marietta, Ga. The C-130A has a high, widespread wing; a low-to-the ground fuselage, an upswept high tail which permits loading at truck-bed height from the rear. In regular Air Force operation the plane is designed to fly the following missions: (1) Long-range personnel movement and logistic support operations in air evacuation, troop carrier and cargo. (2) Assault and support missions right to the front lines, carrying troops and materiel for forward airstrip delivery or parachute drop. (3) Ambulance missions.

Lockheed P2V-7 Neptune

TYPE • Patrol

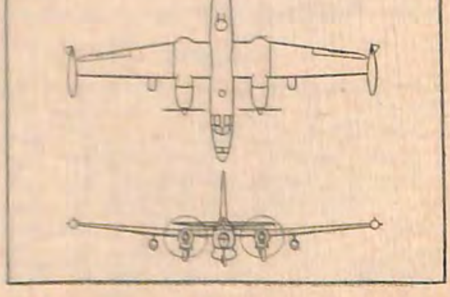
DESIGNATION • P2V-7 (Navy)

SPECIFICATIONS • Span 103 ft. (includes tip tanks); Length 91 ft. 5 in.; Height 29 ft. 4 in.; Empty Weight 43,950, with jet pod engines 47,450 lb.; Gross Weight 72,000 lb., with jet pod engines 75,500 lb.; Engine (2) Wright R3350-32W turbo-compound, 3250 hp and (2) Westinghouse J-34 engines in pods, 3400 lb. thrust; Propeller Hamilton Standard three blade; Wing Area 1000 sq. ft.

PERFORMANCE • Maximum Speed 300 mph (without pods); Service Ceiling 22,000 ft. (without pods).

REMARKS

The P2V-7 is the latest in the Neptune anti-submarine warfare series. Identifying features are double-bubble pilot canopy, jet pod engines supplementing its turbo-compound powerplants and elongated tail housing MAD gear (magnetic airborne detector) for locating underwater submarines. Like previous Neptunes, the P2V-7 is a versatile plane which can be converted for patrol, mine laying or torpedo bomber duty. The J-34 pod installations can be cut in for extra power in over-target maneuvers and takeoffs from short runways. The Westinghouse J-34s require only three bolts to hold them in place under the wing's leading edge. Lockheed is modifying the P2V-5 and P2V-6 by installing jet pod engines on all aircraft of these series. Crew: 7.



Lockheed RC-121

TYPE • Reconnaissance

DESIGNATION • RC-121 (Air Force) WV-2 (Navy)

SPECIFICATIONS • Span 123 ft.; Length 116 ft.; Height 26 ft.; Empty Weight 81,000 lbs.; Gross Weight 145,000 lbs. (based on claim with two wing tip tanks); Wing Loading 87 lb. per sq. ft.; Engine (4) Wright R3350-34; 3250 hp takeoff, 2600 hp cruise; Fuel Capacity 8,000 plus gal.; Propeller Hamilton Standard 6903A three-bladed 15 ft.; Wing Area 1650 sq. ft.

PERFORMANCE • Maximum Speed 270 plus mph; Cruising Speed 200 plus mph; Landing Speed 105 mph; Rate of Climb 800 fpm; Service Ceiling 20,000 plus ft.; Range with Maximum Fuel Load 3500 plus nautical mi.

REMARKS

Late in the year, Lockheed announced the RC-121D, new series which added two 600-gallon wingtip fuel tanks and a 1000-gallon fuselage tank for extra hours aloft. Fuel capacity on the RC-121D totals 8750 gallons, 2200 gallons more than previous models. These new altitude reconnaissance aircraft bulging with electronic detection apparatus, were first announced as being in production in August. The craft are designed to carry the military services' most powerful search radar to high altitudes where radar beams (which cannot bend over the horizon) attain their maximum effectiveness in spotting either surface or air targets. Exact effective range of the radar was not revealed. RC-121's are special versions of Lockheed's Super Constellation. The Air Force version will be used to give air-defense forces extra-early warning of approaching targets. The WV-2's will be used by the Navy primarily to screen U. S. fleets. Two complete flight crews plus a group of electronics specialists, a total of 31 men in all, make up the flying ship's complement. No three-view drawings of the plane were available when the Year Book went to press.

TYPE • Fighter

DESIGNATION • F-104

REMARKS

Design details and performance characteristics are classified information. The only facts which have been cleared for release to date include: (1) The airplane is a supersonic fighter; (2) It is a specialized type of plane which trades weight and complexity for greater speed and maneuverability; (3) It has a Curtiss-Wright J-65 engine plus afterburner. No photographs have been released on the airplane.

Lockheed R7V-2 turboprop Super Constellation

TYPE • Transport

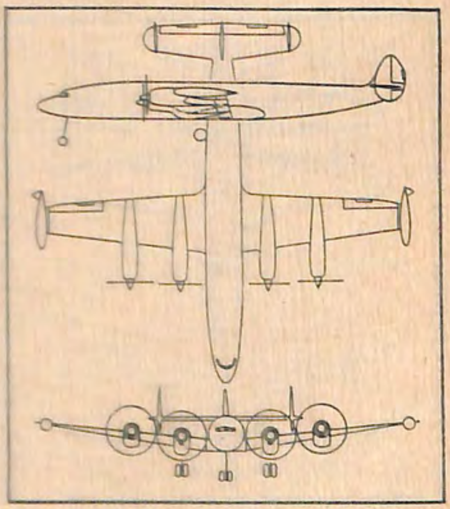
DESIGNATION • R7V-2 (Navy)

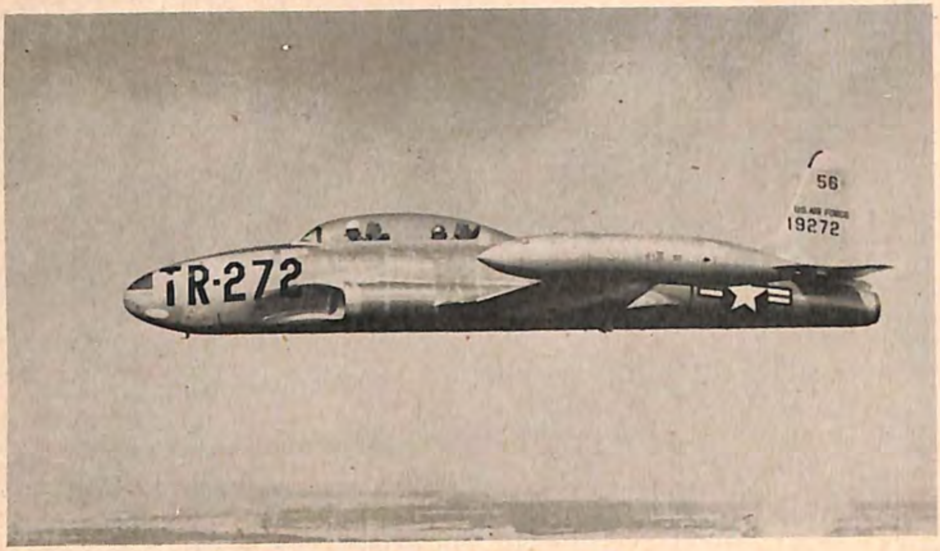
SPECIFICATIONS • Span 117 ft.; Length 116 ft. 2 in.; Height 24.5 ft.; Gross Weight 150,000 lb.; Engine (4) Pratt and Whitney T-34 turboprop, 5550 hp; Fuel Capacity 8750 gal. including two 600 gal. tip tanks; Propeller Hamilton Standard three blade.

PERFORMANCE • Cruise Speed 440 mph; Service Ceiling 35,800 ft.

REMARKS

The R7V-2 carries 36,000 lb. in 5400 cu. ft. of storage space. In over-water configuration it can carry 97 passengers and overland, 106. As a mercy plane, it can carry 73 patients in litter beds and four attendants. Normal cruising altitude is 25,000 ft. It can fly 16-ton loads across the continent in less than six hours. The ordinary cabin supercharger system has been eliminated in this model. Each engine is an air compressor, developing 70 psi; cabin pressurization lines require only 27 psi for full actuation. Lockheed at year end had a contract for two R7V-2 prototypes with the Navy and was building an additional two (YC-121F) for the Air Force.



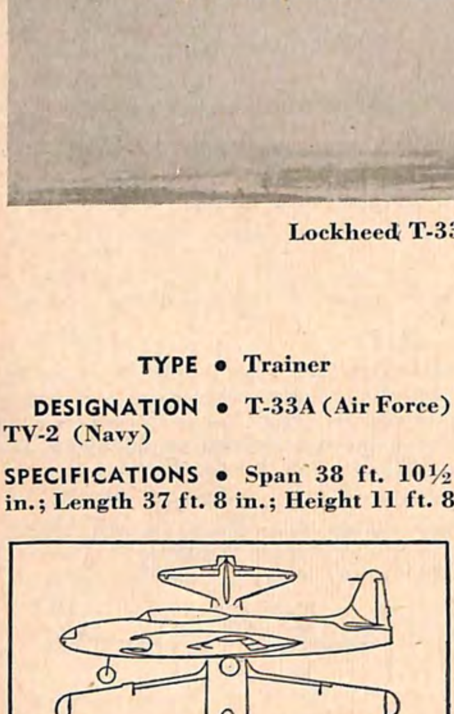


Lockheed T-33A Shooting Star

TYPE • Trainer

DESIGNATION • T-33A (Air Force) TV-2 (Navy)

SPECIFICATIONS • Span 38 ft. 10½ in.; Length 37 ft. 8 in.; Height 11 ft. 8 in.; Empty Weight 8400 lb.; Gross Weight 15,000 lb.; Wing Loading 60.8 lb. per sq. ft.; Engine Allison J-33-35, 5200 lb. thrust at 11,750 rpm at S. L.; Fuel Capacity 683 gal. including tip tanks.



PERFORMANCE • Maximum Speed 580 mph; Rate of Climb 5525 fpm; Service Ceiling 45,000 ft.; Range 1345 mi.

REMARKS

The T-33 is a development of the F-80 Shooting Star, first standard jet plane in the military services. It has been in service since 1948 and is now being built for both the Air Force and Navy and also several foreign powers through the Mutual Defense Assistance Pact. T-33s are also being produced by Canadair Ltd., Montreal for the Royal Canadian Air Force. In addition to being the standard jet trainer in this country, T-33s have been used to train pilots from Holland, France, Belgium, Turkey, Greece, Denmark, Norway, Italy and Portugal, all NATO countries. Crew: 2.

Lockheed F-94C Starfire

TYPE • **Fighter**

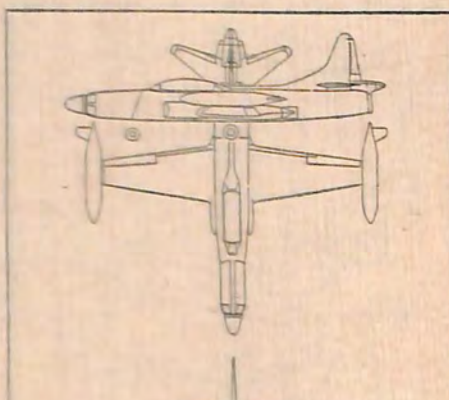
DESIGNATION • **F-94C (Air Force)**

SPECIFICATIONS • **Span 37 ft. 3 in.; Length 44 ft. 6 in.; Height 14 ft. 10 in.; Engine Pratt and Whitney J48-P-5,; Gear tricycle. All other specifications classified.**

PERFORMANCE • **All performance data classified.**

REMARKS

The F-94C Starfire has many changes over earlier F-94A and -B models including improved electronic equipment, thinner wing and swept tail. The plane does not carry guns, but mounts 24 2.75 in. rockets in barrel launcher in nose plus 24 more in special wing pods. The F-94C is the first production fighter equipped with a deceleration parachute. It is a development of the original mass-produced F-80 Shooting Star. The wing uses special Lockheed machine-tapered and ribbed skin plating. Production on this model was completed in Feb., 1954. All-weather interceptor; crew: 2.



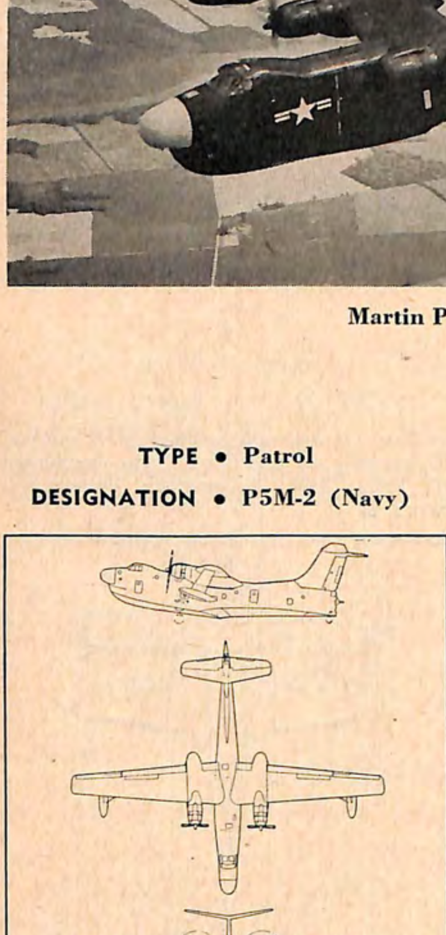
THE GLENN L. MARTIN CO.

Baltimore, Md.

Martin P5M-2 Marlin

TYPE • Patrol

DESIGNATION • P5M-2 (Navy)

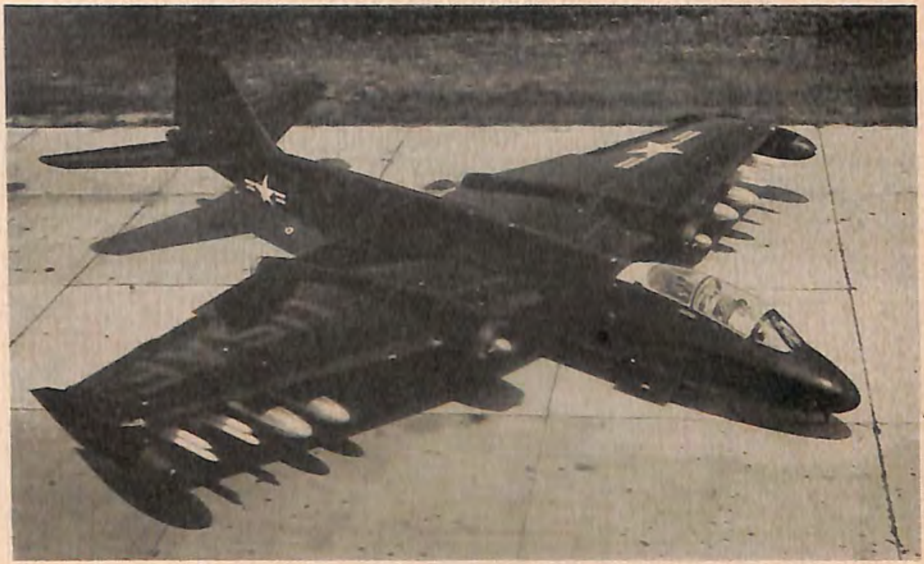


SPECIFICATIONS • Span 118 ft.; Length 102 ft.; Height 30 ft. 11 in.; Gross Weight over 70,000 lb.; Engine (2) Wright R-3350-32W; Propeller Hamilton Standard four blade.

PERFORMANCE • All data are classified.

REMARKS

Developed from the PBM flying boat, the P5M features a long afterbody designed to improve takeoff characteristics and reduce bouncing and instability during landing. To assist water maneuvering, a pair of hydroflaps are mounted on the aft hull and act as water rudders. The big flying boat is heavily equipped with radar and special devices for submarine detection. It also carries a substantial load of depth charges, bombs, torpedoes, rockets and/or mines. There is a gun turret in the tail. Crew: 7.



Martin B-57B

TYPE • Bomber

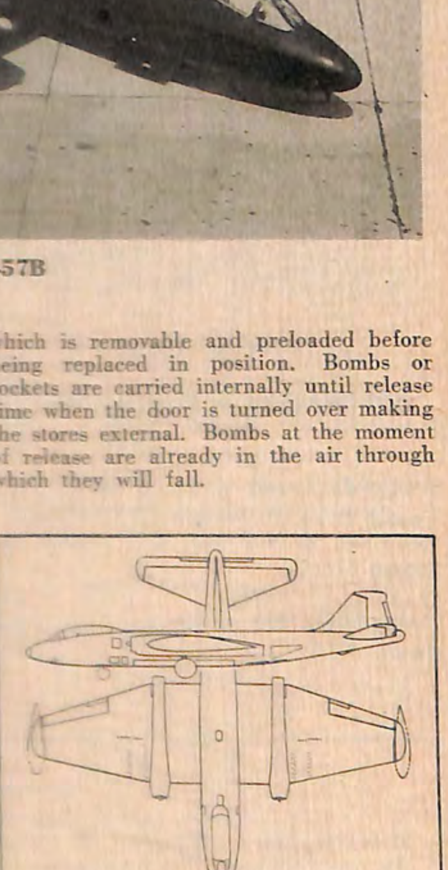
DESIGNATION • B-57B (Air Force)

SPECIFICATIONS • Span 64 ft.; Length 65 ft. 5 in.; Height 14 ft. 8 in.; Empty Weight 26,000 lb.; Gross Weight more than 50,000 lb.; Engine (2) Wright J65-W-1, 7220 lb. thrust.

PERFORMANCE • Maximum Speed more than 500 knots; Service Ceiling more than 45,000 ft.; Range more than 2,000 nautical mi.

REMARKS

The B-57B differs from earlier versions in that it has a completely redesigned cockpit and canopy and has speed brakes on both sides of the fuselage. Primary advantage of the new cockpit is greatly improved visibility for the two crew members. Seating is a tandem arrangement, with the second officer directly behind and slightly higher than the pilot. The speed brakes give more control during low altitude operations and landing approaches. Included in the armament is a rotary bomb door which is removable and preloaded before being replaced in position. Bombs or rockets are carried internally until release time when the door is turned over making the stores external. Bombs at the moment of release are already in the air through which they will fall.



McDONNELL AIRCRAFT COMPANY

St. Louis, Mo.

McDonnell F-101A Voodoo

TYPE • Fighter

DESIGNATION • F-101A (Air Force)

SPECIFICATIONS • Span 39.7 ft.; Length 67.4 ft.; Height 18 ft.; Engine (2) Pratt & Whitney J57, 10,000 lb. thrust.

PERFORMANCE • All data are classified.

REMARKS

The F-101A announced late in the year is a long range, strategic fighter. Designed to have versatile combat capabilities enabling it to perform a variety of missions, the Voodoo is in the supersonic class and is capable of carrying atomic weapons. The twin jet is scheduled for assignment to the Strategic Air Command. Wings are swept 35 deg. A photo reconnaissance version, the RF-101A, is under development for the Air Force. The F-101 is an aerdynamic evolution of an earlier Voodoo model, the XF-88A Voodoo.

McDonnell F-101

The Pratt & Whitney engines (model J57-P-13) that power the F-101 have afterburners shorter by about two feet than other J57 afterburner types produced by Pratt & Whitney. The power of these J57 engines which are in the 10,000 pound thrust class, is increased tremendously by the afterburner device in which additional fuel is burned as the pilot calls for boost in jet thrust. Most of the unusually large fuel load needed for these powerful engines is contained in the fuselage with additional provisions made for carrying extra fuel externally. The "short" afterburner for the F-101 configuration was developed by P&WA at East Hartford, Conn., under an Air Force contract.

McDonnell F3H-1N

TYPE • Fighter

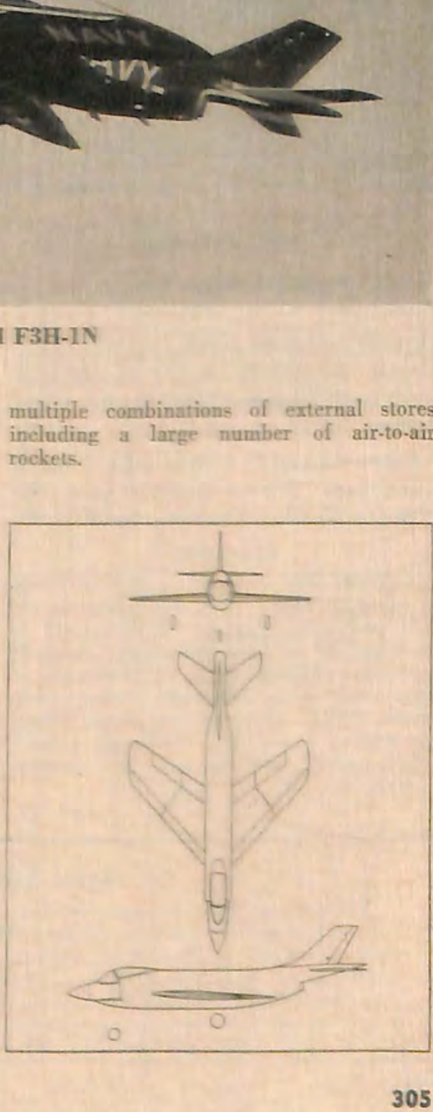
DESIGNATION • F3H-1N (Navy)

SPECIFICATIONS • Span 35 ft. 4 in.; Length 59 ft.; Height 14 ft.

PERFORMANCE • All data are classified.

REMARKS

The single-jet F3H-1N is an all-weather, general purpose, carrier fighter adaptable to a wide variety of missions. It combines interceptor speed and fighter maneuverability with the payload of an attack bomber. Thin wings and tail surfaces are swept back 45 deg. enabling the Demon to combine high speeds and good control in the supersonic range with the low speed characteristics required for carrier-based operations. All-weather operations are made possible by a new type radar and the latest developments in computing and fire control equipment. Armament consists of fast firing, high velocity 20 mm cannon and multiple combinations of external stores including a large number of air-to-air rockets.



NORTH AMERICAN AVIATION, INC.

Los Angeles, Calif.

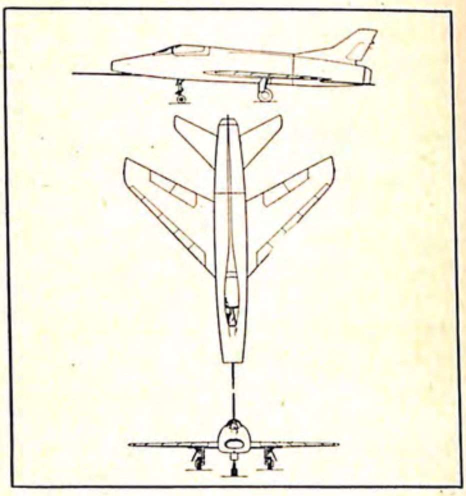
North American F-100 Super Sabre

TYPE • Fighter

DESIGNATION • F-100A (Air Force)

SPECIFICATIONS • Span 36 ft.; Length 46 ft.; Height 13 ft.; Engine Pratt and Whitney J57-P7, plus afterburner.

PERFORMANCE • Maximum Speed supersonic. Service Ceiling over 50,000 ft.; Tactical Radius over 575 mi.

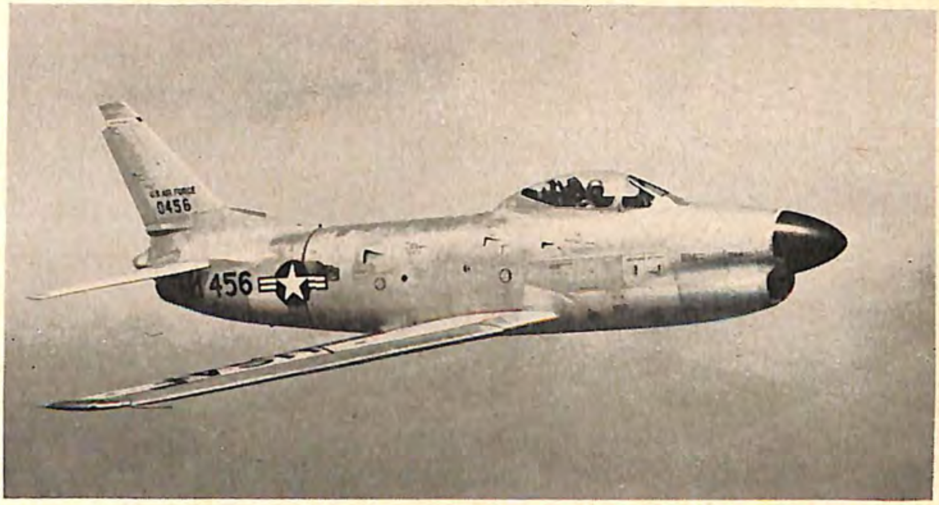


REMARKS

The F-100 was designed as the successor to the F-86 Sabre. The new fighter is the first production airplane in the world to fly regularly at supersonic speed in both level and climbing flight. It features a 45 deg. swept wing, uses tail braking parachute, "solid" stabilizer and large ventral air brake. The F-100A holds the world's speed record and is now in squadron service.

North American F-100

The country's first supersonic fighting unit was formed in September, 1954, when the 436th Day Fighter Squadron at George AFB, California, was equipped with F-100's. The 479th Fighter Wing, of which the 436th Squadron is a part, was thus equipped with the world's fastest production airplane—the FAI announced earlier in the year that the Super Sabre's mark of 755.149 mph was now recognized as the official world speed record. An F-100 attained this average speed in two passes over a 15-km course in October, 1953.



North American F-86D Sabre

TYPE • Fighter

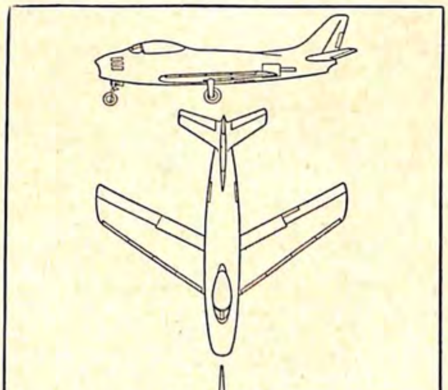
DESIGNATION • F-86D (Air Force)

SPECIFICATIONS • Span 37 ft. 1 in.; Length 41 ft. 8 in.; Height 15 ft.; Gross Weight 18,000 lb.; Engine General Electric J47-17, 5200 lb. thrust takeoff plus afterburner.

PERFORMANCE • Maximum Speed 680 mph; Tactical Radius over 500 mi.; Service Ceiling over 45,000 ft.

REMARKS

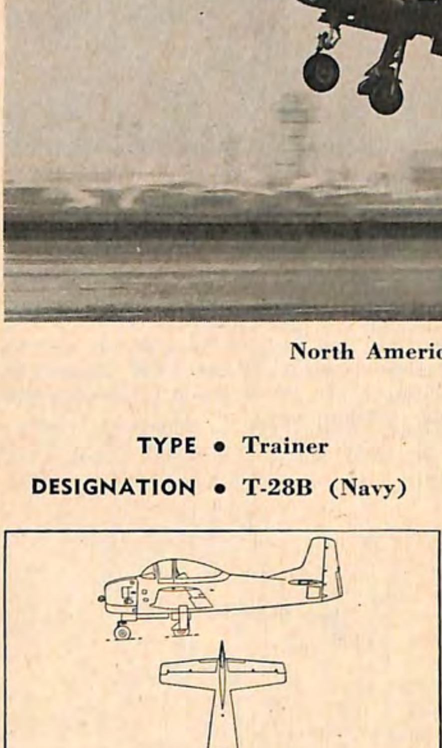
The F-86D Sabre interceptor was virtually a new design over previous models coming equipped with afterburner and search radar in the nose. The -F model was designed for use as either a fighter or low-level fighter bomber. The F-86H, put into production in 1953, has the dual role of fighter-bomber and day fighter. The -H is slightly larger than previous models featuring a GE J-73 engine, stronger landing gear and improved suspension and release mechanisms for carrying droppable wing tip tanks. Navy version of this model is the FJ-2 Fury which is a carrier based, folding wing fighter assigned to the Marines. The FJ-3 is similar to the -2 except for the installation of a Wright J-65 Sapphire engine. The FJ-4 was announced late in the year. Latest in the F-86 series is the -K model which flew for the first time Sept. 10, 1954. All F-86 and FJ models have the all-flying tail in which the elevator and stabilizer are a single controllable surface. Trainer version, TF-86F, was created by adding a five ft. extension to the fuselage plus training aids.



North American T-28B trainer

TYPE • Trainer

DESIGNATION • T-28B (Navy)



SPECIFICATIONS • Span 40.6 in.; Length 32.9 ft.; Height 12.6 ft.; Gross Weight 8,038 lb.; Engine Wright R-1820, 1425 hp; Gear tricycle.

PERFORMANCE • Maximum Speed 346 mph; Cruise Speed 190 mph; Stalling Speed 72 mph; Rate of Climb 2060 fpm; Service Ceiling 37,000 ft.; Range 1038 mi.

REMARKS

The T-28 replaces the previous primary, basic and advanced type trainers and combines these separate stages into a single airplane. It was the first tricycle gear trainer in the Air Force. Servicing the trainer is facilitated by an access port behind the engine. Armament, gun sight, radio and other gear are easily removed for various training missions. The T-28B is the second model in this series and is in production for the Navy. Three-view drawing at left is T-28A.

NORTHROP AIRCRAFT, INC.

Hawthorne, Calif.

Northrop F-89D Scorpion

TYPE • Interceptor Fighter

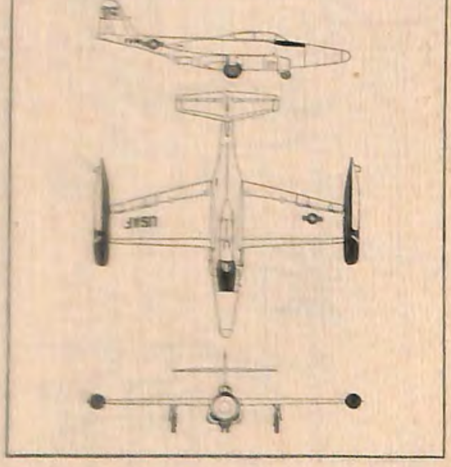
DESIGNATION • F-89D (Air Force)

SPECIFICATIONS • Span 56 ft. 2 in.; Length 53 ft. 4 in.; Height 17 ft. 7 in.; Gross Weight over 40,000 lb.; Engine (2) Allison J35-A-35 with afterburners; Wing Area over 600 sq. ft.

PERFORMANCE • Maximum Speed more than 600 mph; Service Ceiling over 45,000 ft.

REMARKS

The F-89D is America's most heavily armed fighter type airplane. It carries 104 2.75 in. folding air-to-air rockets in permanently mounted wing tip pods. Placement of the rockets in wing tip pods instead of in conventional fuselage or under wing locations provides additional combat advantages. Not only can large number of rockets be carried, but firing does not interfere with vision of the crew, nor are the engine air intakes exposed to smoke and debris produced by the firing. The rockets can be fired in a single, giant volley, or can be fired in groups. This enables the Scorpion to make as many as three passes at a single target. The Scorpion uses decelerous combining the functions of ailerons and air brakes in the split, lateral control surfaces. F-89Ds are on asignment with fighter interceptor squadrons of the Air Defense Command and Alaskan Air Command .Crew: 2.



PIASECKI HELICOPTER CORP.

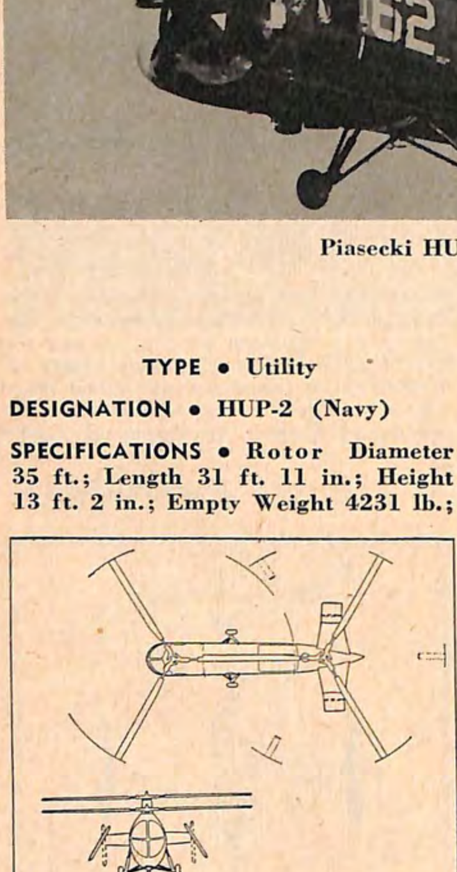
Morton, Pa.

Piasecki HUP-2 Retriever

TYPE • Utility

DESIGNATION • HUP-2 (Navy)

SPECIFICATIONS • Rotor Diameter 35 ft.; Length 31 ft. 11 in.; Height 13 ft. 2 in.; Empty Weight 4231 lb.; Gross Weight 5700 lb.; Overload Gross Weight 6100 lb.; Engine Continental R-975-46, 525 hp normal rated 550 hp takeoff; Fuel Capacity 150 gal.; Gear fixed tricycle.



PERFORMANCE • Maximum Speed 115 mph at S. L.; Cruise Speed 92 mph; Rate of Climb 1200 fpm; Range 260 mi.

REMARKS

The HUP-2 is a tandem rotored, three- to six-place search and rescue helicopter. The fuselage is all metal, stressed skin, semi-monocoque construction. An overlapping tandem rotor design, the HUP-2 is compact enough to go down any aircraft elevator without blade folding and down cruiser elevators with blades folded. Side-by-side seating of pilot and co-pilot, dual controls and an autopilot are provided. The insulated and sound proofed cabin extends 8 ft. 3 in. to the aft of the pilot's compartment and contains approximately 160 cu. ft. of space. A 48 in. x 26 in. rescue hatch is located on the starboard side at the forward end of the cabin.

Piasecki H-21C Workhorse

TYPE • **Assault Transport**

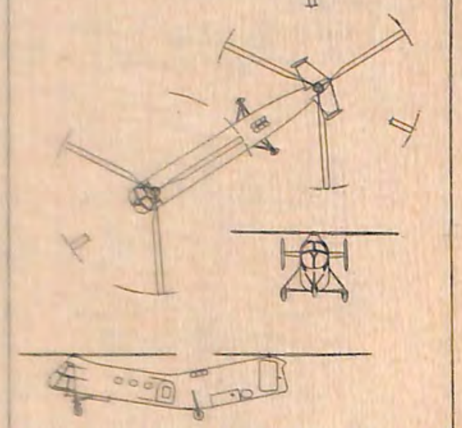
DESIGNATION • **H-21C (Army)**
H-21B (Air Force)

SPECIFICATIONS • **Rotor Diameter 44 ft.; Length 52 ft. 6 in.; Height 16 ft.; Empty Weight 8500 lb.; Gross Weight 13,300 lb.; Overload Gross Weight 15,000 lb.; Engine Wright R-1820-103, 1425 hp takeoff; Fuel Capacity 300 gal.; Gear fixed tricycle.**

PERFORMANCE • **Maximum Speed 135 mph at S. L.; Cruise Speed 98 mph at S. L.; Rate of Climb 960 fpm; Service Ceiling 10,000 ft.; Range over 450 mi.**

REMARKS

The H-21B is the Air Force model in this series, and is similar to the H-21C. The fuselage is of all metal stressed skin, semi-monocoque construction. The cockpit has side-by-side seating with the pilot on the right and complete hydraulic controls. In addition, the H-21B has an autopilot. The main entrance door is located on the left side at the rear of the cabin. On the right side at the forward end of the cabin is a second door, slightly smaller, where a 400 lb. capacity boom type rescue or loading hoist can be installed. Both cabin doors slide open and shut along the sides of the fuselage and each door has a plexiglas knockout panel for emergency exit. There are two additional escape hatches above the cabin in the crown of the fuselage. Both the H-21B and C models have a 4500 lb. capacity external cargo sling.

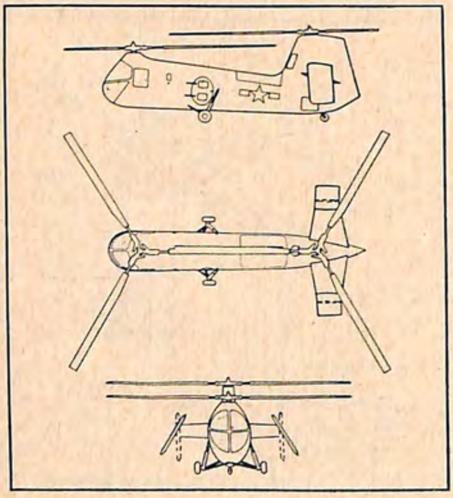


Piasecki H-25 Army Mule

TYPE • Utility

DESIGNATION • H-25A (Army)

SPECIFICATIONS • Rotor Diameter 35 ft.; Length 31 ft. 11 in.; Height 12 ft. 6 in.; Empty Weight 3963 lb.; Gross Weight 5750 lb.; Overload Gross Weight 6100 lb.; Engine Continental R-975-46, 525 hp normal rated 550 hp takeoff; Fuel Capacity 150 gal.; Gear fixed tricycle.



PERFORMANCE • Maximum Speed 104 mph at S. L.; Cruise Speed 80 mph; Rate of Climb 650 fpm; Service Ceiling 10,000 ft.; Range 253 mi.

REMARKS

The H-25A has an overlapped tandem rotor design with dual hydraulic controls, side-by-side seating and a contoured plastic nose for maximum visibility. A 48 in. x 26 in. rescue hatch is located at the forward end of the cabin in the right side of the floor adjacent to the pilot's seat. A hydraulic hoist is included for aerial hoisting. The engine is fan cooled and easily removable as a complete power package, including accessories and lubricating system. Engine power is transmitted through a drive shaft and rpm reduction transmissions to the two 35 ft. three-bladed rotors which are counter-rotating.

REPUBLIC AVIATION CORP.

Farmingdale, L. I., N. Y.

Republic F-84F Thunderstreak

TYPE • Bomber

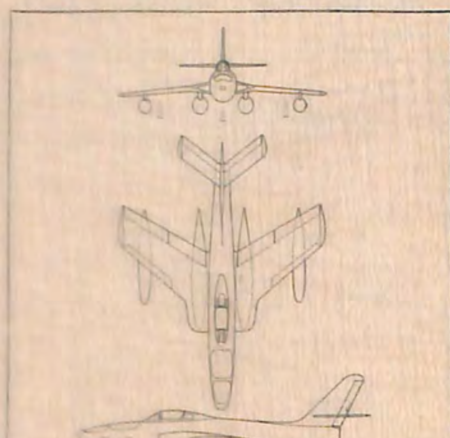
DESIGNATION • F-84F (Air Force)

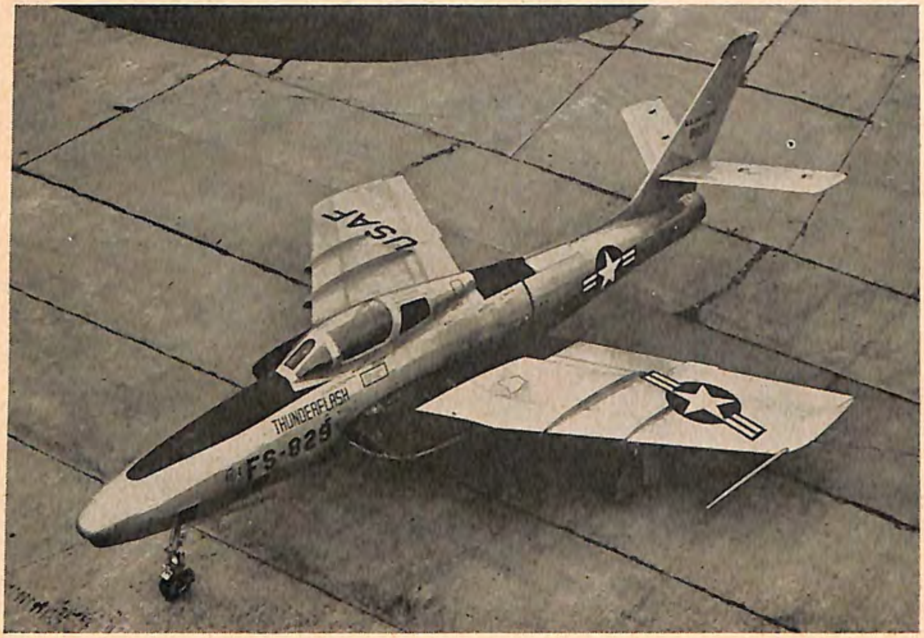
SPECIFICATIONS • Span 33 ft. 6 in.; Length 43 ft. 4 in.; Height 14 ft. 4 in.; Gross Weight 25,000 lb.; Engine Wright J65-W-3, 7200 lb. thrust.

PERFORMANCE • Maximum Speed more than 650 mph; Service Ceiling 45,000 ft.; Range with Maximum Payload over 2000 mi.

REMARKS

The F84-F has a primary mission as fighter-bomber, but its performance and versatility make it adaptable for interception and escort missions. It is armed with six .50 caliber machine guns and can carry more than 6000 lb. of bombs, rockets and napalm. In addition, it is listed as capable of carrying the atomic bomb. It is in service with six USAF commands and is also slated for delivery to nine NATO nations. Among the more noticeable differences between this and earlier models are the swept wing, fattened fuselage for larger J65 engine, and faired aft canopy structure. Structure uses heavy forge press parts. The F-84F Thunderstreak, the Air Force's first swept-wing fiighter-bomber, far exceeds performance of previous F-84 models. Equipped for in-flight refueling.

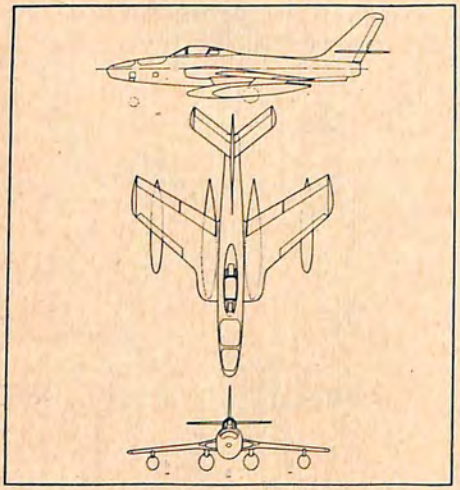




Republic RF-84F Thunderflash

TYPE • **Reconnaissance**

DESIGNATION • **RF-84F (Air Force)**



SPECIFICATIONS • **Span 33 ft. 6 in.; Length 47 ft. 6½ in.; Height 15 ft.; Engine Wright J65, 7200 lb. thrust.**

PERFORMANCE • **Maximum Speed more than 650 mph; Service Ceiling over 45,000 ft.; Range with Maximum Fuel Load over 2000 mi.**

REMARKS

The RF-84F Thunderflash is a combat twin of the Thunderstreak. It was designed to meet requirements for a high speed, high or low altitude, day or night photo plane capable of getting pictures and, if necessary, fighting its way back to base. The Thunderflash mounts four .50 caliber machine guns, two in each wing. Wing root air intakes permit installation of aerial cameras and radar in the nose of the plane. Teamed with the Convair B-36 carrier plane in the composite known as FICON, it combines the 10,000 mi. range of the bomber with its own 2000 mi. range. It can take off and land on the mother plane.

SIKORSKY AIRCRAFT DIVISION

UNITED AIRCRAFT CORP.

Bridgeport, Conn.

Sikorsky XH-39

TYPE • Helicopter

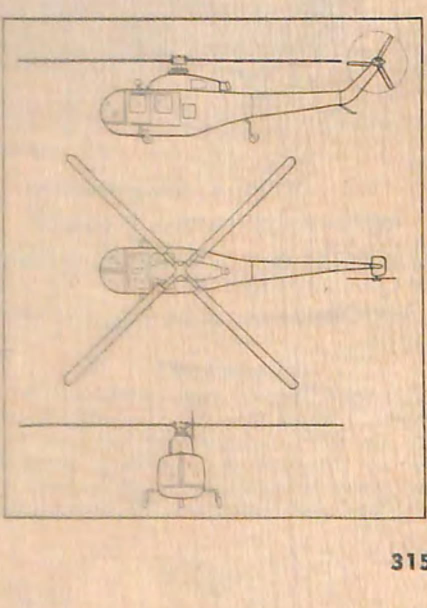
DESIGNATION • XH-39 (Army)

SPECIFICATIONS • Main Rotor Diameter 35 ft.; Tail Rotor Diameter 6 ft. 4 in.; Length 30 ft. 3 in.; Height 9 ft. 8 in.; Empty Weight 2,200 lb.; Gross Weight 3,560 lb.; Engine Turbomeca Artouste II with maximum power rating 400 hp at 35,000 rpm, continous power rating 323 hp at 35,000 rpm.

PERFORMANCE • High speed at sea level 127 knots, cruising 120 knots; Maximum rate of climb 750 fpm; Cruising range 220 miles.

REMARKS

The XH-39 set the world's speed record for helicopters when it flew at 156.005 mph over the 3 kilometer course at Windsor Locks, Conn. The world's helicopter altitude record of 24,500 feet was estabished on October 17, 1954 with the XH-39. The 81 feet of payload space offers adequate accommodation for three passengers and 200 lbs of baggage, or two litter patients and a medical attendant, or 800 lbs of cargo.



Sikorsky HR2S

TYPE • Transport

DESIGNATION • HR2S-1 (Navy)

SPECIFICATIONS • Rotor diameter 90 ft.; Length 60 ft.; Gross Weight 28,500 lb.; Engine (2) Pratt and Whitney R-2800, derated to 1900 hp.

PERFORMANCE • All data are classified.

REMARKS

This new Sikorsky model is S-56 commercial model and H-37A Army model. The HR2S-1 carries two Marine squads (26 men) or three jeeps plus crew. Commercial version, projected for 1956, will carry 34 passengers in airline service. Rotor and tail fold for carrier stowage. Autopilot and anti-icing equipment are standard. Clamshell nose doors permit cargo and troop loading with greater ease than in preivous side door loading models. Retractable main landing gear is the first on a production helicopter. Five bladed main rotor and four bladed tail rotor are all-metal and fold mechanically for stowage.

Sikorsky HSS

TYPE • Anti-submarine

DESIGNATION • HSS-1 (Navy)

SPECIFICATIONS • Engine Wright R-1820, 1425 hp.

PERFORMANCE • All data are classified.

REMARKS

This single engine, single main rotor helicopter is larger than the Navy's HO4S and Marine HRS. Equipped for extensive submarine detection work, its main piece of equipment is sonar gear which includes an electrical device that may be lowered into the ocean while the helicopter hovers at low altitude. The engine is installed in the nose of the aircraft with clamshell doors which open to give the same ease of maintenance found on the HO4S. Gear is tricycle with the main gear forward. The four all-metal main rotor blades and four-bladed tail rotor can be folded manually for shipboard stowage. The pilot and co-pilot fly from a position above and slightly back of the engine, while the passenger-cargo area is directly below the main rotor head. The HSS-1 is equipped with a Sikorsky developed autopilot.

Sikorsky S-55

TYPE • **Helicopter**

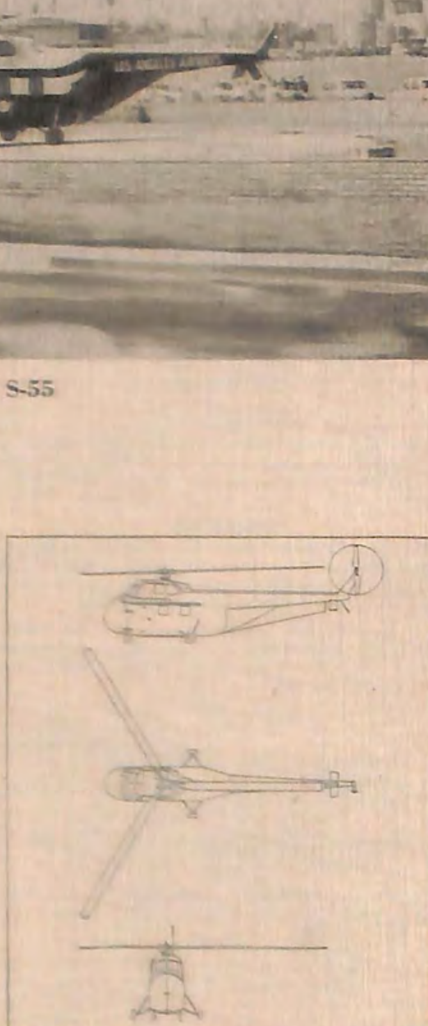
DESIGNATION • **S-55 (Army)**

SPECIFICATIONS • **Main Rotor Diameter 53 ft.; Tail Rotor Diameter 8 ft. 9 in.; Length 42 ft. 2 in; Height 13 ft. 4 in. Empty Weight 4,795 lb.; Gross Weight 7,200 lb.; Engine Pratt & Whitney Wasp S1H2 with 550 bhp; Fuel Capacity 185 gal.**

PERFORMANCE • **Maximum Speed 101 mph; Cruise Speed 85 mph; Maximum Rate of Climb at Sea Level 700 fpm; Range 405 st.mi.**

REMARKS

The S-55 has a seating capacity of crew (pilot and copilot) passengers (military—10 (commercial)—7, with alternate cargo capacity of 340 cubic feet. Military models have Wright R1300 engine.



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 C-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. New model is 5KS-4500 rated at 4500 lb. thrust for five seconds.

MODEL: AJ10-24 Liquid rocket engine.

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 in. 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 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 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.

MODEL: Franklin 6A4-150-B3.

DATA

TYPE: 6 cylinder, air-cooled, horizontally opposed. CAA TYPE CERTIFICATE: 238.

SPECS

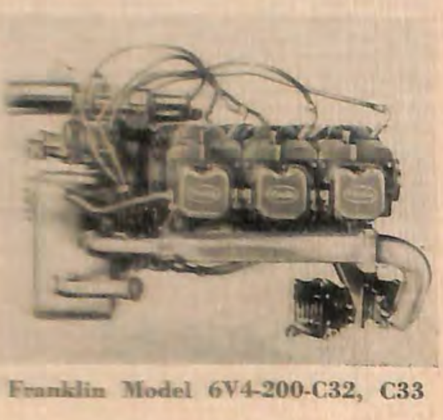
LENGTH: 37⅝ in. FUEL GRADE: 80 octane. BORE: 4.5 in. STROKE: 3.5 in. DISPLACEMENT: 335 cu. in. COMPRESSION RATIO: 7:1. DRY WEIGHT: 321 lb. with hub and accessories. WEIGHT PER HP: 2.14 lb.

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.

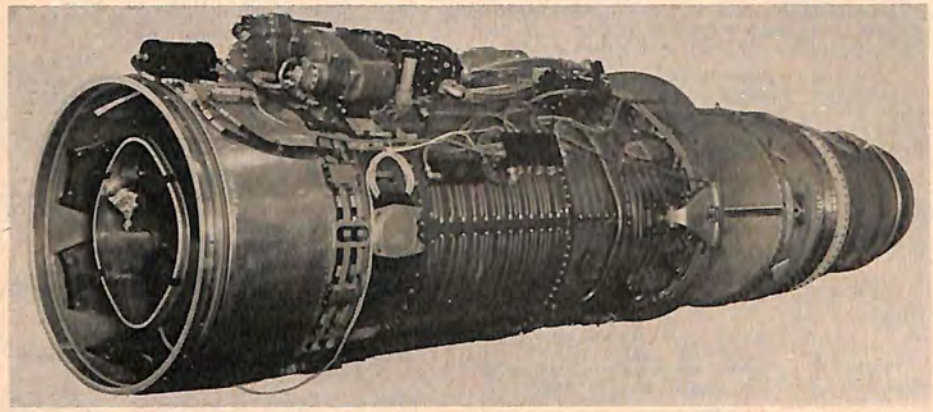
EQUIPMENT

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.



Franklin Model 6V4-200-C32, C33

ALLISON DIVISION
GENERAL MOTORS CORP.
Indianapolis, Ind.



Allison J-71 turbojet

MODEL: J71.

DATA

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. The 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. Latest model is -9 installed in Douglas RB-66.

MODEL: J33-A-35.

DATA

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.

DATA

TYPE: Axial-flow turbojet.

SPECS

DIAMETER: 40-9/16 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: J-33-A-37.

DATA

TYPE: Centrifugal-flow turbojet.

SPECS

LENGTH: 159.50 in. WIDTH: 49.83 in. TOTAL WEIGHT: 1750 lb. COMPRESSOR STAGES: One. TURBINE STAGES: One. STARTER: Electric starter generator.

PERFORMANCE

STATIC THRUST: 4600 lb. at 11,750 rpm; IDLE: 1010 lb. at 7000 rpm.

REMARKS

Current production installation is in Martin B-61 Matador.

MODEL: T40-A-6, -10.

DATA

TYPE: Axial-flow turboprop.

SPECS

LENGTH: 181.6 in. WIDTH: 38.5 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 CORP.

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: 19.7 in. LENGTH: 41.8 in. COMPRESSOR: single-sided, centrifugal. TUR-

BINE: two-stage, solid disc, axial flow. COMBUSTOR: Annular, straight-through flow. AIR DELIVERY: 2.3 lb sec. at 50 psi, std. day. WEIGHT: 210 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: 352 (J69-T-9)

DATA

TYPE: Centrifugal-flow turbojet.

SPECS

DIAMETER: 22.3 in. LENGTH: 50.5 in. COMPRESSOR: single-sided, centrifugal flow. TURBINE: single-stage, solid disc, axial flow. COMBUSTOR: annular, straight-through flow. WEIGHT: 333 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 22,700 rpm sea level.

REMARKS

The other models are available as target drone power plant and booster units.

Other small gas turbines either in partial production, development or experimental stages include Model 420 (Aspin II) with a takeoff thrust of 790 lb. at 34,500 rpm; Model 210-1 (Artouste I) with a takeoff shaft hp of 280 plus 40 lb. thrust at 34,000 rpm—this model was used on the Cessna XL-19C; Model 220-2 (Artouste II) with a takeoff shaft hp of 425 at 33,000 rpm—used in the Sikorsky XH-39 helicopter; Model 260, 400 hp at takeoff at 34,800 rpm; Model 354 with 1,000 lb. thrust at 20,350 rpm—is scheduled for the Ryan Q-2 drone; Model 352 with a takeoff thrust of 920 lb. at 22,700 rpm is scheduled for the production Cessna XT-37 trainer.

FAIRCHILD ENGINE DIVISION
FAIRCHILD ENGINE & AIRPLANE CORP.

Farmingdale, N. Y.

MODEL: J44

DATA

TYPE: Turbojet.

PERFORMANCE

STATIC THRUST: 1000 lb. at 15,780 rpm. NORMAL RATED THRUST: 1000 lb. at 15,780 rpm. AFTERBURNER THRUST: None.

SPECS

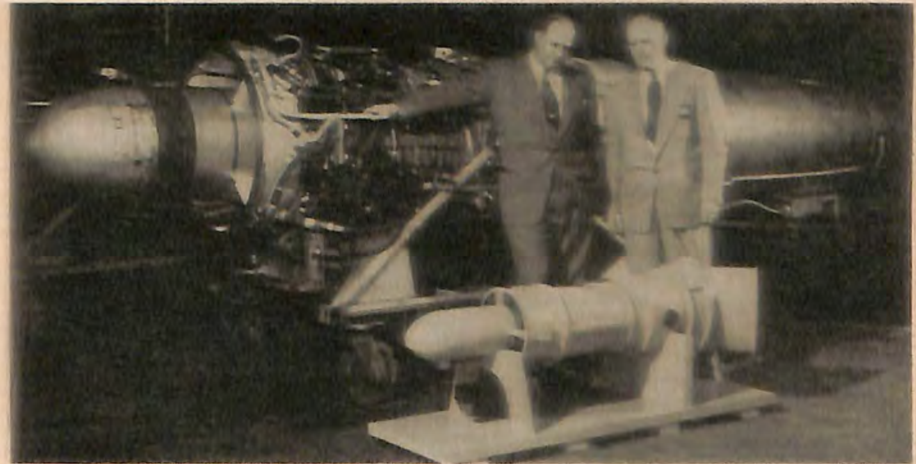
LENGTH: 32 in. WIDTH: 22 in. TOTAL WEIGHT: 335 lb. COMPRESSOR STAGES: 1. TURBINE STAGES: 1.

EQUIPMENT

STARTER: Comp. Air or Electric.

GENERAL ELECTRIC CO.

Cincinnati, Ohio



G.E. XT-58 helicopter engine mock-up in front of G.E. J47-17 with afterburner

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 6,000 lb.

MODEL: J73.

DATA

TYPE: Axial-flow turbojet.

SPECS

DIAMETER: 36.75 in. LENGTH: 146 in.

PERFORMANCE

STATIC THRUST: In excess of 9,000 lb. dry. Afterburner thrust has been estimated at 14,000 lb. by some experts not in on the development or production of this model.

MODEL: XT 58-GE-2

DATA

TYPE: Axial Flow Turboshaft.

REMARKS

All specifications and data on the XT-58 are classified other than to say its size is comparable to the conventional piston power plant in the family automobile but is several times as powerful. It is designed for the Navy's Bureau of Aeronautics primarily to power helicopters; however, with some modifications, it can be adapted as a power plant for fixed wing aircraft either as a turbo-prop or a turbo-jet.

JACOBS AIRCRAFT ENGINE CO.

Pottstown, Pa.

MODEL: R-755A.

DATA

TYPE: Radial 7 cyl. air cooled.

PERFORMANCE

TAKEOFF HP: 300 at 2200 rpm. CRUISING HP: 225 at 1900 rpm. FUEL CONSUMPTION: .450 per hp hr. @ cruising.

SPECS

DISPLACEMENT: 757 cu. in. BORE: 5.25 in. STROKE: 5.00 in. COMPRESSION RATIO: 6:1. FUEL GRADE: 80 min. DRY WEIGHT: 505 lb. DIA.: 44 in. LENGTH: 40.2 in. CARBURETOR: Stromberg NA-R7A. MAGNETOS: 1 Scintilla model VMN7-DF5, 1 Scintilla distributor (battery and coil). STARTER AND GENERATOR: Provision for Eclipse type 397 starter, Eclipse 25 amp generator.

CURRENT PRODUCTION INSTALLATIONS: Cessna 195.

MODEL: R-755B.

DATA

TYPE: 7 cyl. radial A.C.

PERFORMANCE

TAKEOFF HP: 275 at 2200 rpm. CRUISING HP: 205 at 1900 rpm. FUEL CONSUMPTION: .450 per hp hr.

SPECS

DISPLACEMENT: 757 cu. in. BORE: 5.25 in. STROKE: 5.00 in. COMPRESSION RATIO: 6:1. FUEL GRADE: 80 min. DRY WEIGHT: 500 lb. WIDTH: 44 in. LENGTH: 40.2 in. CARBURETOR: Strom NA-R7A. MAGNETOS: 1 Scintilla VMN7-DF5, 1 Scintilla battery timer. STARTER AND GENERATOR: Provision for Eclipse type 397 starter, Eclipse 25A generator.

CURRENT PRODUCTION INSTALLATIONS: Cessna 195.

MODEL: R-755EH.

DATA

TYPE: Air cooled 7 cyl. radial geared for rotor 8.5:1.

PERFORMANCE

TAKEOFF HP: 350 at 2500 rpm. CRUISING HP: 262 at 2500 rpm. FUEL CONSUMPTION: .500 per hp hr.

SPECS

DISPLACEMENT: 757 cu. in. BORE: 5.25 in. STROKE: 5.00 in. COMPRESSION RATIO: 6.5:1. FUEL GRADE: 92 min. DRY WEIGHT: 600 lb. DIA: 44.0 in. LENGTH: 42.37 in. CARBURETOR: Simmonds S.U. fuel injection pump. MAGNETOS: 1 Scintilla VMN7-DF5, 1 Scintilla battery timer. STARTER AND GENERATOR: Provision for Eclipse type 397 starter, Eclipse 25A generator.

CURRENT PRODUCTION INSTALLATIONS: (Experimental) Jacobs 104 helicopter.

LYCOMING DIVISION
AVCO MFG. CORP.
Williamsport, Pa.

MODEL: O-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.

MODEL: O-435-A.

DATA

TYPE: 6 cylinder, air-cooled, horizontally opposed. CAA TYPE CERTIFICATE: 228.

SPECS

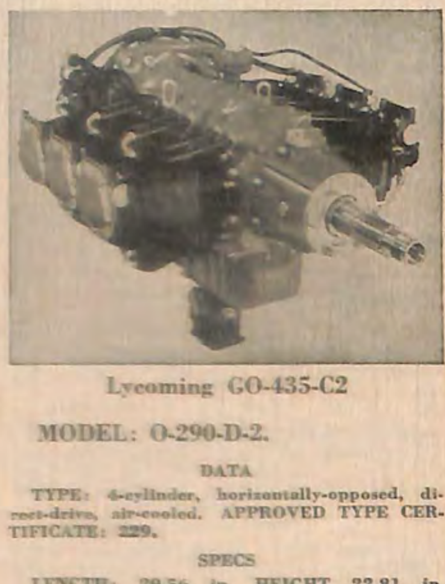
LENGTH: 38.10 in. FUEL GRADE: 80 octane. BORE: 4.875 in. STROKE: 3.875 in. DISPLACEMENT: 434 cu. in. COMPRESSION RATIO: 6.5:1. DRY WEIGHT: 392 lb. with hub and accessories. WEIGHT PER HP: 2.06 lb.

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.



Lycoming GO-435-C2

MODEL: O-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: 7.0:1. WEIGHT: 255 lb. FUEL GRADE: 80 octane.

PERFORMANCE

TAKE-OFF POWER: 140 hp at 2,800 rpm. RATED POWER: 125 hp at 2,600 rpm. FUEL CONSUMPTION: 0.46 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: 543 lb.

PERFORMANCE

TAKE-OFF POWER: 400 hp. FUEL CONSUMPTION: .57 lb. per hr.

EQUIPMENT

CARBURETOR: Bendix. IGNITION: Scintilla. FUEL PUMP: Pesco.

MODEL: O-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: .53 lb. per hr.

EQUIPMENT

CARBURETOR: Marvel-Schebler. IGNITION: Delco-Remy. FUEL PUMP: AC.

MODEL: VO-434AIA.

DATA

TYPE: 6 cylinder, opposed, aircooled for vertical installation. CAA type certificate No. 279.

SPECS

DISPLACEMENT: 434.0 cu. in. BORE: 4.875 in. STROKE: 3.875 in. COMPRESSION RATIO: 7.3:1. FUEL GRADE: 80/87. DRY WEIGHT: 394 lb. WIDTH: 33.12 in. LENGTH: 35.21 in.

PERFORMANCE

CONTINUOUS HP 250 at 3200 rpm. FUEL CONSUMPTION: 80 percent power, 3200 rpm, 20 gal. per hr.

EQUIPMENT

CARBURETOR: MA45. MAGNETOS: Scintilla S6RN20,21.

MODEL: O-340.

DATA

TYPE: 4 cylinder, horizontally opposed, aircooled engine. CAA type certificate 277.

SPECS

DISPLACEMENT: 340.4 cu. in. BORE: 5.125 in. STROKE: 4.125 in. COMPRESSION RATIO: 7.15:1. FUEL GRADE: 80/87. DRY WEIGHT: 275 lb. WIDTH: 32.55 in. LENGTH: 24.68 in.

PERFORMANCE

TAKEOFF hp 160 at 2700 rpm. CRUISING HP 120 at 2450 rpm. FUEL CONSUMPTION: 9 gal. per hour.

EQUIPMENT

CARBURETOR: Marvel Schebler MA4*. MAGNETOS: Scintilla S4LN20, 21. STARTER AND GENERATOR: Delco Remy.

MODEL: SO-480.

DATA

TYPE: 6 cylinder, aircooled, supercharged, helicopter engine for horizontal or vertical installation.

SPECS

DISPLACEMENT: 479.7 cu. in. BORE: 5.125 in. STROKE: 3.875 in. COMPRESSION RATIO: 7.3:1. FUEL GRADE: 100/130. DRY WEIGHT: 444 lb. WIDTH: 33.12 in. LENGTH: 38.53 in.

PERFORMANCE

CONTINUOUS HP 325 at 3200 rpm. FUEL CONSUMPTION: 25 gals./hr. at 80 percent normal, 3200 rpm.

EQUIPMENT

CARBURETOR: Bendix PS7BD. MAGNETOS: Scintilla S6RN20, 21.

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, 1,585 lb.; two speed, 1,605 lb.

PERFORMANCE

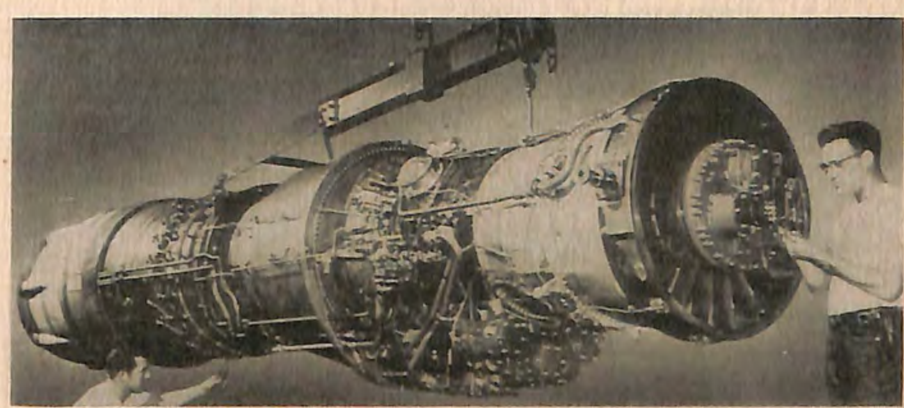
TAKE-OFF: 1,450 at 2,700 rpm and 2,800 ft. NORMAL RATED POWER: 1,200 hp at 2,550 rpm and 6,400 ft.

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.



Pratt & Whitney Aircraft J-57 with afterburner

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 1,700 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 at 3500 ft.

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 produced more than 4,000 hp.

MODEL: Turbo-Wasp J48 (JT-7)

DATA

TYPE: Centrifugal-flow turbojet.

SPECS

DIAMETER: 50.50 in. LENGTH: 109.75 in. COMPRESSOR: double-entry, single-stage, centerifugal-flow. TURBINE: axial-flow, single-stage. WEIGHT: 2,080 lb. FUEL: Kerosene, gasoline or special jet fuel.

PERFORMANCE

TAKE-OFF POWER: 7,250 lb. thrust. MILITARY RATING: 7,250 lb. thrust. NORMAL RATING: 5,600 lb. thrust. CRUISE RATING: 3,750 lb. or 3,100 lb. thrust.

REMARKS

The J48 powers the Navy's Grumman F9F-5 Panther and the swept-wing F9F-6 and F9F-8 and the Lockheed F-94C all-weather interceptor for the Air Force.

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 exclusivly throughout the engine structure. This model is no longer offered commercially.

MODEL: Turbo-Wasp J57 (JT-3)

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 Air Force's Boeing B-52 long-range bomber, the North American F-100, McDonnell F-101, Convair F-102, and the Navy's Douglas F4D fighter and A3D bomber. The J-57 also powers the Boeing 707. The fighter aircraft are powered by afterburner versions of the J-57 engine.

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

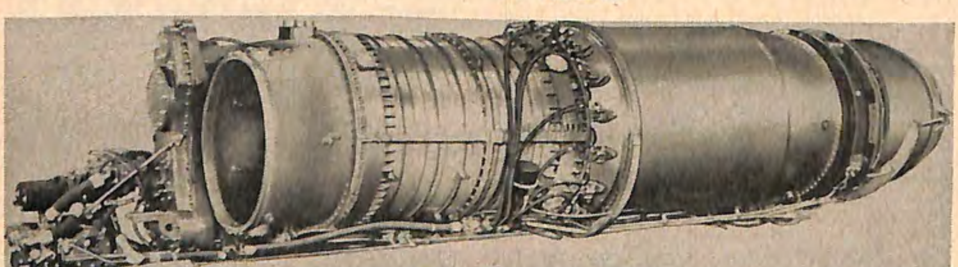
TYPE: Axial-flow turbojet

SPECS

DIAMETER: Approx. 3 ft. 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 DIVISION
CURTISS WRIGHT CORP.

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-1300-2.

DATA

Type: 7 cylinder air cooled.

SPECS

DIAMETER: 50.45 in. **BORE:** 6.125 in. **STROKE:** 6.312 in. **DISPLACEMENT:** 1,300 cu.-in. **COMPRESSION RATIO:** 6.21 to 1. **GROSS WEIGHT, DRY,** 1,056 lb.

PERFORMANCE

TAKE-OFF POWER: 800 hp at 2.600 rpm at S. L. **FUEL CONSUMPTION:** 0.451 lb. per hp per hr.

REMARKS

This engine was designed for blimp and helicopter installations; also the R-1300-3.

MODEL: R-1300-4.

DATA

TYPE: 7 cylinder radial reciprocating, air-cooled.

SPECS

DISPLACEMENT: 1300 cu. in. **BORE:** 6.125 in. **STROKE:** 6.312 in. **COMPRESSION RATIO:** 6.2:1. **FUEL GRADE:** 91/96. **DRY WEIGHT:** 1092 lb. **WIDTH:** 50.45 in. **LENGTH:** 48.12 in.

PERFORMANCE

TAKEOFF HP 800 at 2600 rpm. **CRUISING HP** 420 at 2200 rpm. **FUEL CONSUMPTION:** .438 lb. per hp hr. (at 215 hp).

EQUIPMENT

CARBURETOR: Bendix PD9F1. **MAGNETOS:** Am. Bosch S7LU-3.

REMARKS

Current production installation is Goodyear ZP5K blimp.

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-3350-24W.

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: 81.98 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: 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: 972TC18DA-1, -3.

DATA

TYPE: 18 cylinders air cooled.

SPECS

DIAMETER: 56.6 in. BORE: 6.125 in. STROKE: 6.312 in. DISPLACEMENT: 3,350 cu. in. COMPRESSION RATIO: 6.7 to 1. FUEL CONSUMPTION: 0.391 lb. per hp per hr. at 50 percent power.

REMARKS

Model DA-1 is in production for the Lockheed Super Constellation 1049C. Another version, the DA-2, is produced for the Douglas DC-7B.

MODEL: 972TC18DA4.

DATA

TYPE: 18 cylinder radial compound.

SPECS

DISPLACEMENT: 3350 cu. in. BORE: 6.125 in. STROKE: 6.312 in. COMPRESSION RATIO: 6.7:1. FUEL GRADE: 115/145. DRY WEIGHT: 3549±1 percent lb. WIDTH: 56.59 in. LENGTH: 89.53 in.

PERFORMANCE

TAKEOFF HP 3250 at 2900 rpm. CRUISING HP 1910 at 2400 rpm. FUEL CONSUMPTION: .385 lb. per hp hr. (at 1200 hp).

EQUIPMENT

CARBURETOR: Bendix PR58S2. MAGNETOS: Bendix-Scintilla DLN-9.

REMARKS

This model is currently in production for the Douglas DC-7B. Another model, the TC-18DA3, with only slight differences, is in production for the Lockheed 1049E, F and G.

MODEL: 981TC18EA1.

DATA

TYPE: 18 cylinder radial reciprocating.

SPECS

DISPLACEMENT: 3350 cu. in. BORE: 6.125 in. STROKE: 6.312 in. COMPRESSION RATIO: 6.7:1. FUEL GRADE: 115/145. DRY WEIGHT: 3615±1 percent lb. WIDTH: 56.59 in. LENGTH: 89.53 in.

PERFORMANCE

TAKEOFF HP 3700 at 2900 rpm. (1400 lb./hr. water-alcohol flow.) CRUISING HP 1910 at 2400 rpm. FUEL CONSUMPTION: .385 lb. per hp. hr. (at 1200 hp).

EQUIPMENT

CARBURETOR: Bendix PR58S2. MAGNETOS: Bendix-Scintilla DLN-9.

REMARKS

Current production installations are Canadair CL-28 and Douglas DC-7C.

MODEL: J65-W-1.

DATA

TYPE: Axial-flow turbojet.

SPECS

DIAMETER: 37.5 in. LENGTH: 114.83 in. WEIGHT: 2,595 lb. (2,696 with accessories). COMPRESSOR STAGES: 13 of 29.375 in. in diameter. TURBINE STAGES: 2 of 30.5 in. in diameter.

PERFORMANCE

STATIC THRUST: 7,220-7800 lb. at 8,300 rpm. NORMAL RATED THRUST: 6,400 lb. at 8,000 rpm.

REMARKS

Current production installation of various J65 models include Grumman F9F-9, Douglas A4D, Lockheed XF-104, Martin B-57, North American FJ-3 and FJ-4, Republic RF84-F and F84-F. The J65-W-4 is rated at 7,800 lb. thrust.

1954 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. 1

Harmar D. Denny appointed to new six-year term as Civil Aeronautics Board member.

Chance Vought Aircraft, Inc., starts operations as wholly-owned subsidiary of United Aircraft Corp. Frederick O. Detweiler, formerly Division Manager, elected president. Official separation date: July 1, 1954.

Jan. 5

Air National Guard Col. Williard W. Millikan sets New York-to-Washington speed mark of 24 minutes in North American F-86F.

Jan. 6

President Eisenhower names Chan Gurney as new CAB chairman through December 31, 1954.

Post Office Department's experimental tests of flying non-local first-class mail between New York and Chicago enter fourth month. Air Transport Association reports experiments have yielded Post Office an average of $2,000 above payments made to air carriers for each ton of mail flown.

Jan. 8

Navy announces acceptance of first production model of McDonnell F3H-1N, powered by single Westinghouse J40 turbojet. Later models will be powered by Allison J71 of greater thrust.

Jan. 10

Thomas E. Braniff, founder and president of Braniff Airways, killed with 11 others in crash of private plane near Shreveport, La.

Jan. 11

Howard Hughes announces that non-profit foundation, Howard Hughes Medical Institute, will become sole owner of Hughes Aircraft company.

British Overseas Airways Corp. grounds all DeHavilland Comet jet transports following Jan. 10 Comet crash near Island of Elba.

Bell Aircraft Corp. confirms existence of XB-63 Rascal guided missile. No details revealed.

Jan. 13

Navy Secretary Robert B. Anderson says 40 per cent of Navy's aircraft are modern types.

Jan. 14

Braniff Airways directors name Fred Jones, Oklahoma City, as board chairman, and Charles E. Beard, formerly executive vice president, as president.

Jan. 15

Air Force announces that two Martin B-61 pilotless bomber squadrons will be deployed to Germany in 1954 for use in NATO defense.

Jan. 21

President Eisenhower submits fiscal 1955 budget to Congress, calling for steady air power expansion and $4.74-bilion in new money for Navy and Air Force aircraft and related procurement. President says new budget "points toward the creation, maintenance, and full exploitation of modern air power."

Jan. 26

Navy announces delivery of first Bell HSL-1 anti-submarine helicopter.

FEBRUARY

Feb. 1

Earl D. Johnson, former Under Secretary of the Army, becomes president of Air Transport Association, succeeding Emory S. Land. Land will remain as ATA consultant for one year.

For first time in history, Civil Aeronautics Board loses case in Supreme Court. Court rules (9-0) that "excess profits" of an airline's domestic operations must be offset against that airline's international subsidy needs.

Feb. 2

Douglas YC-124B, USAF four-engined turboprop transport, makes first flight. Plane is powered by Pratt & Whitney YT34-P-1 engines.

Feb. 4

Convair announces production is underway on B-36J, with gross weight of more than 400,000 pounds.

Lockheed Aircraft Corp. says P2V-7, newest version of Neptune patrol bomber, is in production. Plane is equipped with two wing-mounted Westinghouse J34 jet pods to supplement its two Wright Turbo Compound piston engines.

Feb. 12

Continental Casualty Co. of Chicago announces 20 per cent reduction in rates for airline trip insurance, resulting from scheduled airlines' safety record and increased efficiency within the company.

Feb. 15

Charles A. Lindbergh nominated by President Eisenhower as brigadier general in Air Force reserve.

Far East Air Forces reveals that a regular U. S. airlift is flying supplies to 250 USAF technicians in Indo-China. Douglas B-26's are being sent to Indo-China to bolster French Air Force.

Feb. 17

Associated Aviation Underwriters and Mutual of Omaha increase coverage provided to scheduled air travelers by 25 per cent, due to "the scheduled airlines' splendid safety records."

Feb. 18

Civil Aeronautics Board reports that U. S. scheduled airlines in 1953 carried a total of 33.8-million passengers 19.6-billion passenger miles.

Feb. 24

Aircraft Industries Association says that 20 U. S. airframe manufacturers now have 53 different models of military aircraft in production for the Air Force, Navy, Army and NATO nations.

Feb. 25

Convair R3Y turboprop (Allison T40's) flying boat makes first flight at San Diego. The 80-ton

seaplane is America's first water-based turbo-prop transport.

MARCH

Mar. 1

New peak reached in number of U. S. airports: 6,760.

Mar. 3

Harold R. Harris resigns as president of Northwest Airlines.

Mar. 11

Army announces orders for 272 helicopters for National Guard units, with about 88 to be delivered within 12 months. ANG units will receive Bell H-13's and Hiller H-23's.

Utility Airplane Council of Aircraft Industries Association reports that utility aircrafts shipments increased in 1953. Seven companies shipped a total of 3,788 one- to 10-place utility planes during the year, compared with shipment of 3,058 such planes during 1952. Dollar value was up to $34,458,000 from 26,159,000.

Mar. 17

Navy announces two vertical take-off fighters: Convair XFY-1 and Lockheed XFV-1. Both planes will be powered by Allison T40 turbo-props turning Curtiss contra-rotating props.

Bell Aircraft Corp. has built more than 1,300 Model 47 helicopters, about 25 per cent for commercial users, with a total value of $55-million.

Mar. 18

Boeing rolls out first production model B-52 Stratofortress at Seattle, Wash.

Gen. Nathan F. Twining, USAF Chief of Staff, says aircraft manufacturers will reach a peak in airframe weight deliveries during 1954.

Mar. 24

Navy takes delivery of Lockheed WV-2 Super Constellation, powered by four Curtiss-Wright R-3350 Turbo Compound engines. Aircraft carries more than six tons of search radar and electronic detection gear. It is designed as a maximum altitude reconnaissance plane.

Mar. 29

American Airlines DC-7 sets official Los Angeles-to-New York commercial speed record: 6 hours, 10 minutes. (Unofficial record is set on following day by another American Airlines DC-7: 5 hours, 51 minutes.)

Mar. 31

Census Bureau reports that exports of aircraft, parts and accessories during 1953 averaged $73.3-million per month.

North American F-51 Mustang piloted by Joe DeBona sets new transcontinental speed mark for piston aircraft, flying from Los Angeles to New York in four hours, 24 minutes, 17 seconds.

APRIL

Apr. 1

President Eisenhower signs legislation to create Air Force Academy.

First tourist service across Pacific, mid-Atlantic to southern Europe and South Africa, and round-the-world starts. Pan American Airways beings flights to Johannesburg, Manila, Tokyo and round-the-world. TWA starts flights on April 2 to Lisbon and Madrid. Northeast Airlines starts Pacific tourist service on April 4.

Apr. 2

Gen. Hoyt S. Vandenberg, 55, second chief of staff of the USAF, dies in Washington, D. C. Vandenberg served as Chief of Staff from 1948 until 1953.

Apr. 5

First production model of Convair F-102 delta-winged interceptor delivered to Edwards AFB.

Apr. 8

De Havilland Comet crashes off Italian Coast on Rome-Cairo leg of London-Johannesburg flight. BOAC grounds Comets again, 2½ weeks after they were returned to service between London and Johannesburg. Comet I's airworthiness certificate later withdrawn by British government.

Apr. 15

Boeing Airplane Co. reveals jet engine reverse thrust design, under development since 1951. Company says device will produce about 45 per cent thrust reversal. It says a jet transport using its normal wheel brakes plus the Boeing jet thrust reverser on each of its engines, could stop in as short a distance on smooth ice as it could on a dry runway with brakes alone.

Apr. 20

USAF begins airlift of French Union personnel from France to Indo China, using Douglas C-124 Globemasters of Tactical Air Command.

Apr. 23

Aircraft Industries Association reports that the 12 largest U. S. airframe manufacturers reinvested in their business 65 per cent of their 1953 net earnings. Of $116.6-million netted, $78.2-million was plowed back in the business and an additional $24.8-million set aside for plant improvement.

Apr. 26

Mohawk Airlines takes delivery on Sikorsky S-55 helicopter. It is first local airline to order a rotary-winged aircraft.

Apr. 28

Aircraft Industries Association reports that U. S. aircraft industry built its 500,000th air plane during April. About half were built during past ten years. Peak production year was 1944, when 96,318 were delivered. AIA also reports that net earnings of 12 leading airframe manufacturers in 1953 totalled $116.6-million. Net return on sales was 2.3 per cent, compared with national average for all manufacturing industries of 5.3 per cent.

Apr. 29

First flight of Martin P5M-2 Marlin, powered by Wright Cyclone Turbo Compound R3350-32W engines.

Apr. 30

Consolidated Vultee Aircraft Corp. merges into General Dynamics Corp., with John Jay Hopkins as board chairman and president of merged corporation. Convair becomes division of General Dynamics. Its president, Joseph T. McNarney, becomes senior vice president of General Dynamics.

MAY

May 1

Navy Secretary Robert B. Anderson replaces Robert M. Kyes, who resigns as Deputy Defense Secretary. Charles S. Thomas becomes Navy Secretary.

Russians display long-range sweptwing jet bomber comparable in size to Boeing B-52, in Soviet Air Force fly-past over Red Square in Moscow. Among other planes shown: nine new medium jet bombers believed comparable to Boeing B-17.

May 4

Cornell-Guggenheim Aviation Safety Center announces intensive long-range program to stimulate development of vertical rising commercial passenger aircraft. First step in new program will be technical study of helicopters, VTO aircraft, convertiplanes, and experimental craft using boundary layer control.

Operation Flashburn, most concentrated tactical support operation in peacetime history, ends. Held from Apr. 26-May 4, about 500 planes of all types, including 260 Fairchild C-119's, took part. Flying Boxcars flew total of 1,131 sorties and 2,043 hours.

May 5

General Precision Equipment Corp. acquires 95 per cent of outstanding stock of Link Aviation, Inc. Link management, including board chairman Edwin A. Link and president Allan Williford, continues unchanged.

May 12

Air Force announces that first of two Republic YF-84J's ordered to evaluate General Electric J73 engine as powerplant for sweptwing Thunderstreak has made first flight at Edwards AFB.

May 15

Maj. Gen. Oliver P. Echols, 62, board chairman and general manager of Northrop Aircraft, Inc., dies in Santa Monica, Calif., after three-week illness. A former president of Aircraft Industries Association, General Echols served as commanding general, Air Material Command, during World War II.

May 16

Eastern Air Lines schedules more than half of its trunk operations as coach flights, in move to counteract increased operating expenses with increased coach traffic. Carrier's new coach services provide 5,250,000 air coach seat miles per 24-hour period.

May 17

Whitley C. Collins named president of Northrop Aircraft, Inc. Collins will also remain as president of Radioplane Co., wholly-owned Northrop subsidiary.

May 20

First of two turboprop Convair 340's ordered by USAF makes initial flight (16-min.) over Fort Worth. YC-131C is powered by two Allison YT56 engines.

May 24

Air Material Command reveals that production orders have been given to Convair Division of General Dynamics (for F-102 supersonic interceptors) and to McDonnell Aircraft Corp. (for F-101 penetration fighters).

Martin Viking II, single stage rocket, sets record altitude record soaring 158 miles high (834,240 feet) at 4300 mph at White Sands Proving Ground, New Mexico.

May 25

Goodyear ZPG-2 non-rigid airship (production version of ZPN-1) sets new record for flight without refuelling, landing at Key West, Fla., after 200 hours, 4 minutes in the air.

May 26

President Eisenhower releases Air Coordinating Committee review of U. S. air policy, which he says will be used as "guide" in future consideration of civil aviation questions.

May 27

North American Aviation builds last F-86F at Los Angeles, and start preparation of vacated production areas for F-100 Super Sabre.

Legislation authorizing $5-million expansion in research facilities of NACA signed by President Eisenhower. New research will include investigations of fuel for inter-continental guided missiles and development of high-speed seaplane fighters.

JUNE

June 1

Paul R. Braniff, 56, co-founder of Braniff Airways, dies.

June 2

Capital Airlines announces purchase of three 48-passenger Vickers-Armstrong turboprop Viscounts, with option on 37 more. First three Viscounts scheduled for delivery in first quarter of 1955.

June 4

First public demonstration of Sikorsky XHSS-1 Navy anti-submarine helicopter (S-58).

June 7

Navy reveals that Douglas A4D lightweight attack bomber, powered by Wright J65 engine, can carry the atomic bomb. Deliveries to fleet units will begin about June, 1955.

June 15

Harry K. Coffey, 59, chairman of board of directors of National Aeronautic Association, killed in private plane crash in Oregon.

June 23

National Safety Council cites 39 U. S. airlines for accident-free operations in 1953.

June 24

Aircraft Industries Association announces that the aircraft industry has become nation's largest manufacturing employer, with more than 800,000 workers.

June 28

Douglas RB-66A flies 36 minutes on initial test flight. An adaptation of Navy's A3D, it is powered by two Allison J71 turbojets suspended in pods under the plane's high sweptback wing.

June 30

New board chairman of Northrop Aircraft, Inc., is William C. McDuffie, replacing the late Gen. Oliver P. Echols. McDuffie has been a member of the Northrop board since 1943.

JULY

July 6

Air Force announces that Lockheed XF-104 has made first flight. Plane is powered by a Wright J65 engine.

July 15

Boeing 707, America's first jet transport, makes initial flight at Renton (Wash.) Municipal Airport. Powered by four Pratt & Whitney J57's, it has maximum gross weight of 190,000 pounds and cruising speed in the 550-m.p.h. class. Wingspan is 130 feet, length 128 feet. Military tanker version is designated Model 717.

July 16

National Safety Council has announced that aircraft manufacturers ranked fourth among all U. S. industries in industrial safety performance during 1953. Aircraft producers had 3.58 disabling accidents per million manhours, compared with average of 7.44 for all U. S. industries.

July 19

Convair Division of General Dynamics Corp. announces Air Force order for Convair C-131B "flying laboratory" versions of Convair 340 twin-engined airliner. USAF will use the plane for testing electronic equipment.

July 22

Goodyear XZS2G-1 airship, designed for Navy anti-submarine warfare, makes first flight.

July 23

Dr. Albert F. Zahm, 92, credited with building a wind tunnel for aeronautical research experiments 20 years before the Wright Brothers' first flight, dies in Indiana.

July 26

Lt. Gen. Hubert Harmon, special assistant for Air Force Academy matters since late 1949, has been approved by President Eisenhower as the school's first superintendent.

July 28

Aircraft Industries Association reports that 33,000 military planes (22,000 for the Air Force) have been delivered since mid-1950.

July 31

Approximately 1,200 pilots strike against American Airlines, demanding retention of ruling limiting pilot flights to eight hours. CAB had authorized transcontinental services which would require exceeding this limit.

AUGUST

Aug. 1

Convair XFY-1 vertical take-off fighter makes first free flight. The Allison T40-powered plane lifted 20 feet on initial hop, later climbed to 150 feet. Reported forward speed is more than 500 m.p.h.

Aug. 3

Denfense Secretary Charles E. Wilson anouces establishment of new Continental Air Defense Command, comprising elements of all military services. CADC will begin operations September 1.

Aug. 5

Air Force says orders have been placed for a "limited number" of Boeing 707 jet transports for use as flying tankers.

First Boeing B-52A production model makes 78-minutes maiden flight at Seattle.

Grumman Aircraft Engineering Corp. publicily unveils supersonic F9F-9 Tiger. Powerplant is Wright J65 engine.

Cessna Aircraft Co. confirms reports of four-engined pressurized business aircraft design. Engineering and mockup phases have been completed, and plane is expected to fly in 1955. Engines are 320-h.p. Continentals, and speed about 250 m.p.h.

Aug. 6

Harold L. Graham, Jr., succeeds Walter Sternberg, who resigned, will continue to handle sales development for the company as a consultant.

Glenn L. Martin Co. announces new version of Canberra—B-57B—capable of carrying four napalm tanks and eight five-inch high velocity rockets under the wings. Plane has redesigned cockpit and canopy, speed brakes on both sides of the fuselage.

Aug. 14

Last Convair B-36 delivered to Air Force by Convair Division of General Dynamics Corp. Experimental model first flew August 8, 1946.

Aug. 18

Senate confirms nomination of Lyle S. Garlock as an Assistant Secretary of the Air Force.

Navy accepts first production Bell HSL-1 anti-submarine helicopter.

Aug. 23

Lockheed YC-130 turboprop cargo plane makes initial flight. It is powered by four 3,750-h.p. Allison T56 engines.

First Piasecki H-21C has been delivered to Army. Range is reported greater than 450 miles, speed more than 130 m.p.h., and service ceiling about 10,000 feet.

Aug. 24

Strike of 1,200 pilots against American Airlines ends at midnight. Pilots fail to gain objective: retention of ruling limiting flight duty to eight hours per day. Walkout resulted from transcontinental services, authorized by CAB, which exceeded this limit. Twenty-five day strike was most expensive in airline history, resulting in estimated $18,750,000 loss of revenue to the company.

Aug. 25

Assistant Defense Secretary Fred A. Seaton says U. S. military aircraft inventory is 34,000 planes, one-third of them jet-powered.

Aug. 26

Convair announces cargo version of Model 340 transport. Convair Freighter will haul up to 7½ tons of cargo over medium ranges at speeds up to 280 m.p.h. Navy has ordered plane, designated R4Y-1.

Army's turbine-powered Sikorsky XH-39 sets new helicopter speed record of 156.005 m.p.h. over three-kilometer course at Winsdor Locks, Conn. Pilot is Warrant Officer Billy I. Wester.

Aug. 27

Adm. DeWitt C. Ramsey, president of Aircraft Industries Association, reports that U. S. aircraft manufacturers are building 900 to 1,000 military planes per month.

Aug. 30

Donald W. Nyrop named president of Northwest Airlines, succeeding Harold R. Harris, who resigned in March. Nyrop, a former CAB chairman, assumes office October 16.

New York Airways starts first scheduled night passenger operation in U. S. Line uses Sikorsky S-55 helicopters.

SEPTEMBER

Sept. 1

Lockheed turboprop Super Constellation (Navy R7V-2) makes first flight. Plane is powered by four 5,700-h.p. Pratt & Whitney T34 engines.

Bertrand B. Acosta, 59, veteran flyer, dies in Denver, Colo. Acosta piloted Rear Adm. Richard E. Byrd and his party on a non-stop Atlantic flight in 1927.

Sept. 5

Harvey H. Dwight, 40, president of Aircraft Engine and Parts Co., and board chairman of Lear, International, Inc., dies in Greenwich, Conn.

Production starts on Douglas DC-7C, new long-range version of DC-7. Douglas officials say airliner's range of more than 5,000 miles will be greater than that of any other commercial transport.

Sept. 17

Juan T. Trippe, president of Pan American World Airways, elected president of International Air Transport Association for 1955-1956.

Sept. 20

Flying Tiger Line and Slick Airways call off intended merger, previously approved by CAB.

Sept. 22

Thomas L. Grace resigns as president of Slick Airways. Pending appointment of new president, Joseph L. Grant, vice president and secretary treasurer, will serve as acting general manager.

Aircraft Industries Association reports that U. S. exported 6,430 civil aircraft and 2,893 civil plane engines to 103 countries between 1947 and 1953.

Sept. 29

Col. Henry G. MacDonald named director of Aircraft Production Resources Agency, succeeding retired Maj. Gen. Kern D. Metzger. MacDonald also heads Air Material Command's Industrial Resources Division at Wright-Patterson AFB.

Sept. 28

Sen. Pat McCarran (D-Nev.) dies in Hawthorne, Nev. McCarran, active in civil aviation matters during his 22-year tenure in the Senate, was the author and sponsor of the Civil Aeronautics Act of 1938. He sponsored the first bill in Congress to create a separate Air Force, was author and sponsor of the Federal Airport Act, and was co-author of the Civilian Pilot Training Act.

OCTOBER

Oct. 4

Lawrence D. Bell relinquishes post as general manager of Bell Aircraft Co. Bell will continue as president. Leston P. Faneuf, who has been assistant general manager, secretary and treasurer, will become general manager.

Glidden S. Doman of Doman Helicopters, Inc., becomes chairman of the board and is succeeded as Doman president by Donald S. B. Waters, formerly financial assistant to the vice president and general manager of Kaiser Metal Products, Inc.

Oct. 12

Air Force's first intermediate jet trainer, Cessna XT-37, makes first test flight at Wichita, Kan. Plane is powered by two Marbore 352 jet engines, built under license by Continental Motors as J69.

Oct. 13

Convair B-58 supersonic bomber and Lockheed F-104 lightweight supersonic air superiority fighter ordered into production, Air Force announces. Air Force Secretary Harold E. Talbott says Boeing 717 jet tanker, also in production, has been given USAF designation KC-135.

Carleton Putnam resigns as board chairman of Delta-C&S Air Lines. He is succeeded by R. W. Freeman, president of the Louisiana Coca Cola Bottling Co., Ltd.

Oct. 17

Unofficial helicopter altitude record (24,500 feet) set by Sikorsky XH-39 at Bridgeport, Conn.

Oct. 19

David S. Smith sworn in as Assistant Air Force Secretary (Manpower and Personnel.)

Oct. 26

McDonnel Aircraft Corp. receives contract to produce advanced Navy all-weather attack aircraft. It is company's first entrance into attack aircraft design field.

Oct. 27

Henry Boggess of Sinclair Refining Co. is elected chairman of National Business Aircraft Association.

NOVEMBER

Nov. 1

Independent Military Air Transport Association and Transport Air Group merge. Combined group will be under direction of IMATA president Ramsey D. Potts, Jr.

Nov. 2

Convair XFY-1 vertical take-off fighter makes first transitional flight.

Nov. 8

John F. Floberg, former Assistant Secretary of the Navy for Air, named chairman of the Conference of Local Airlines. He succeeds Donald W. Nyrop.

Nov. 14

Clarence N. Sayen re-elected president of AFL-Air Line Pilots Association.

Nov. 17

Harmon International Trophies awarded to Jacqueline Cochran, first woman pilot to exceed speed of sound, and Maj. Charles E. Yeager, who established a world speed record of 1,650 m.p.h. in December, 1953. President Eisenhower presents trophies at White House ceremonies.

Nov. 21

Clyde V. Cessna, 74, aviation pioneer and founder of Cessna Aircraft Co., dies.

Nov. 22

McDonnell F-101A Voodoo, supersonic long-range strategic fighter capable of in-flight refueling and carrying atomic weapons, displayed publicly for first time.

Nov. 26

Lockheed Aircraft Corp. reveals it will produce turboprop version of Super Constellation, designated Model 1449. Transport will have a new wing, and will be ready for airline service in 1957, company officials say. It will be powered by four Pratt & Whitney PT2 (T34) engines.

DECEMBER

Dec. 7

President Eisenhower accepts resignation of Under Secretary of Commerce Robert B. Murray, effective January 20. Murray, whose term had been extended three times, will return to private business.

Dec. 9

H. M. Horner, president of United Aircraft Corp., elected chairman of Aircraft Industries Association Board of Governors for first half of 1955. J. C. Garrett, president of the Garrett Corp., named as chairman for latter half of 1955.

Dec. 17

Aviation scientist Dr. Theodore Von Karman receives 1954 Wright Brothers Trophy.

Collier Trophy awarded to J. H. (Dutch) Kindelberger, chairman of the board of North American Aviation, Inc., and Edward H. Heinemann, chief engineer for Douglas Aircraft Co.'s El Segundo Division, for developing the first supersonic fighter planes in service—the North American F-100 Super Sabre and the Douglas F4D Skyray.

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.

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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, Wilford Aircraft Corp., Address: 300 Linden Lane, Merion, Pa.

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; aviation editor-writer, Missiles Systems Div., Lockheed Aircraft Corp. 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.

WILLIS, Charles F., Jr., born in Beaumont, Texas, July 23, 1918; assistant to the assistant to the President of the United States. Address: 3040 P St., N. W., Washington, D. C.

WILSON, Alfred M., business executive born in Minneapolis, Minn., Dec. 31, 1903; executive vice president and director, aeronautical div., Minneapolis Honeywell Regulator Co. Address: 2747 4th Ave., South, Minneapolis, Minn.

WILSON, Charles E., government official, Secretary of Defense. Address: The Pentagon, Washington 25, D. C.

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.

WINTER, John S., aeronautical engineer born in Bradford, Penna., Aug. 8, 1910; chief engineer, powerplants; Marquardt Aircraft Co. Address: Van Nuys, Calif.

WITHINGTON, S. B., corporation official born in Hillsdale, Mich., Feb. 27, 1895; president and general manager, Lycoming Div., AVCO Manufacturing Corp. Address: 550 S. Main St., Stratford, Conn.

WOHL, E. P., aviation executive born in Chicago, Ill., Dec. 7, 1917; executive assistant to the president, Convair division, General Dynamics Corp., Address: 5187 Bedford Dr., San Diego, Calif.

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WOLFE, Thomas, aircraft executive born in David City, Neb., June 12, 1901; president and and chairman of the board, The Aircraft Service Assn. 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.

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: Mu-Atlanta 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: Hq. 12th AF (A-3), APO 12, c/o PM, New York, N. Y.

YEASTING, John O., aircraft executive born in Helena, Ohio, Dec. 1, 1905; vice president-finance, 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, 1892; 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, economist and journalist, editor and publisher, *Payload and The Air Shipper*. Address: GPO Box 775, Brooklyn 1, N. Y.

ZEVELY, J. G., aviation executive born in Morgantown, W. Va., May 16, 1908; director of sales and contracts, Convair Division, General Dynamics Corp. Address: La Jolla, Calif.

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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 J. 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.

We also wish to thank the National Air Museum, Smithsonian Institute for providing the photographs used in this section.

Wright 1911 Glider, Kitty Hawk, N. C.

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 hit 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 is 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 quadreplane.

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

Fokker C-2 Question Mark being refueled by Douglas C-1 Jan. 7, 1929

(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 airchip *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—1835 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, E. M. Griffith, flown by Jack Vilas, in first air forest patrol.

Signal Corps Dirigible #1 in flight at Ft. Myer, Va., 1908

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 radiophone 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 tree 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.

Aerial Torpedo at Dayton Wright Experimental Flying Field, 1918

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. 25-29—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. Kléer, 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 3000 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 F9C-2 engaging hook landing gear on bottom of Airship Macon

Richard Byrd, navigator, and Floyd Bennett, pilot, in Fokker monoplane.

1925, May 21-July 6—Amundsen-Ellsworth bile airship *Norge* crosses Pole in voyage Spitzbergen-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 begun 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 I. 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 organ-

ized 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 Luft-

hansa. (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. 1-4—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 2,806 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.

1954, Jan. 5—Air National Guard Col. Willard W. Millikan sets New York-Washington speed mark of 24 minutes in North American F-86F.

1954, Mar. 1—Peak is reached in number of U.S. airports: 6,760.

1954, Mar. 29—American Airlines DC-7 sets official Los Angeles-New York commercial speed record: 6 hrs. 10 mins.

1954, May 24—Martin Viking II, single stage rocket, sets altitude record soaring 158 miles high (834,240 feet) at 4300 mph. at White Sands Proving Ground, New Mexico.

1954, Aug. 27—Adm. DeWitt C. Ramsey, president of Aircraft Industries Association, reports that U.S. aircraft manufacturers are now building 900 to 1,000 military planes per month.

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 .... 755.149 mph.
Lt. Col. F. K. Everest USAF, Oct. 29, 1953.

MAXIMUM SPEED IN A CLOSED CIRCUIT .... 728.114 mph.
Robert O. Rahn, Oct. 16, 1953.

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.

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.


PRECISE CONTROL
Target Flight Control Systems
Missile Flight Control Systems
Fire Control Systems
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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.

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.

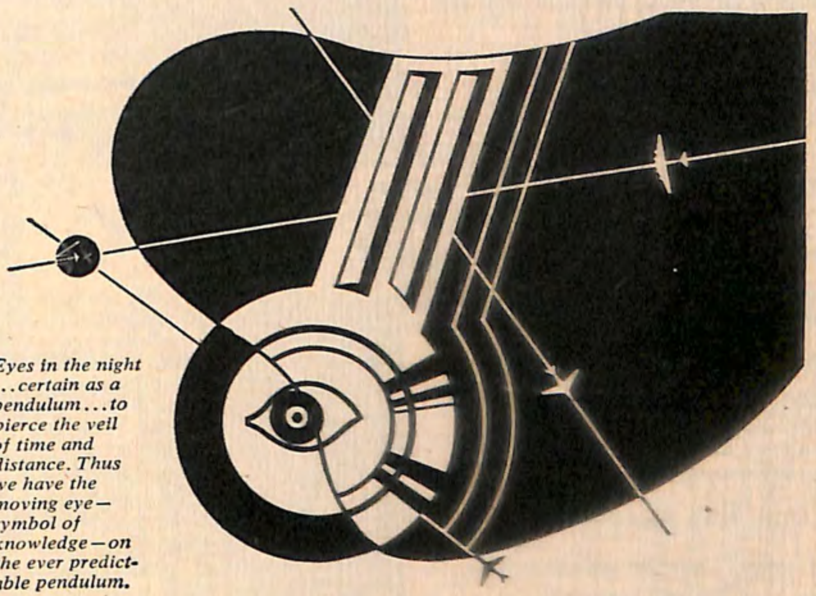
National (U.S.) Record .... Same as above.

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 6,561,660 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 .... 752.943 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.
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.
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.
National (U.S.) Record .... Same as above.

SPEED FOR 310.685 MI. WITHOUT PAYLOAD

World Class Record .... 649.46 mph.
Maj. John L. Armstrong, USAF, United States, North American F-86 H swept wing monoplane, General Electric J-73-GE-3 jet engine, Dayton, Ohio, Sept. 3, 1954. (Pending confirmation by F.A.I. as we went to press.)

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.

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 Clàss 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 .... 158.918 mph.
Iginio Guagnelellini, Italy, Ambrosini G.F.4 Rondone airplane, Continental 90 hp engine, Sesona (Vergiate) Cameri-Seveso S. Pietro course, Dec. 27, 1953.
National (U.S.) Record .... No official record.

SPEED FOR 310.685 MI. IN A CLOSED CIRCUIT

World Class Record .... 154.770 mph.
Ignio Guagnelellini, Italy, Ambrosini G.F.4 Rondome, Continental 90 hp engine, 499.700 kilograms, Sesona (Vergiate) Cameri-Seveso S. Pietro course, December 27, 1953.
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 .... 149.650 mph.

Miss Marie Nicolas, France, Norecrin F. B.E.V.O. airplane, Regnier 4 L 00 engine Marignane-Avignon-Montpellier-Marignane Course, July 7, 1954.

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

World Class Record .... 18,113 feet.

Sergey Zamytchine, U.S.S.R., YAK 18 airplane, M.II.F.R. 160 hp engine, at Klyazma (Moscow), May 8, 1954.

National (U.S.) Record .... No official record.

SPEED FOR 62.137 MI. IN A CLOSED CIRCUIT

World Class Record .... 260.654 mph.

Guido Ferrari, Italy, Super S.7 Ambrosini airplane, Gipsy Queen 330 hp engine, Punto X-Faro di Fiumicino-Faro di Anzio Torre Vaianica Punto X course, Dec. 5, 1953.

National (U.S.) Record .... No official record.

SPEED FOR 310.685 MI. IN A CLOSED CIRCUIT

World Class Record .... 255.819 mph.

Guido Ferrari, Italy, Super S-7 Ambrosini airplane, Gipsy Queen 330 hp engine, Monte Cavo-Villa Odescealchi-Osservatorio Vesuvio-Monte Cavo course, Dec. 5, 1953.

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.

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 1242.739 MI. IN A CLOSED CIRCUIT

World Class Record .... 223.713 mph.
Petre Zakhoudanine, USSR, YAK II Monoplane, ACH-21, 650 hp engine, Touchino-Kalouga-Viazma-Touchino course, Oct. 31, 1953

National (U.S.) Record .... 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 .... 38,560 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.

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.

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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.

SPEED FOR 1,242.739 MI.

World Class Record .... 154.356 mph.
Mario Stoppani and Ing. Antonio Maiorana, pilots; A. Spinelli, S. Forltvesi 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. Spinètti, 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
World Class Record .... 20,523 ft.
Harold E. Mistele, United States, Cessna 180 seaplane, Continental 225 hp engine, Aug. 18, 1954. (Pending confirmation by F. A. I. as we went to press.)
National (U.S.) Record .... Same as above.
SPEED FOR 62.137 MI.
World Class Record .... 131.307 mph.
Harold E. Mistele, United States, Cessna 180 seaplane, Continental 225 hp engine, Aug. 18, 1954.
National (U.S.) Record .... Same as above.
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.

AMPHIBIANS—(CLASS C3)

AIRLINE DISTANCE

World Class Record .... 1,855.610 mi.
Marquise Carina Negrone and Sign. Ada Marchelli, Italy, Piaggio P. 136 L airplane, 2 Lycoming Go 435 C2 240 hp. engines, from Ghedi (Brescia) to Luxor, Egypt, June 18, 1954.

National (U.S.) Record .... 1,429.685 mi.
Maj. Gen. F. M. Andrews, pilot; Maj. John Whiteley, co-pilot; and crew, United States, Douglas YOA5 Amphibian, 2 Wright Cyclone 800 hp engines, from San Juan, Puerto Rico, to Langley Field, Va., June 29, 1936.

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 .... 186.076 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.)

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 .... 24,500 ft. (indicated)
W/O Billy Wester, USA, United States, Sikorsky XH-39 Helicopter, Turbomeca 425 hp engine, Bridgeport, Conn., Oct. 17, 1954. (Pending F.A.I. confirmation as we went to press.)
National (U.S.) Record .... Same as above.
MAXIMUM SPEED WITHOUT PAYLOAD
World Class Record .... 156 mph.
W/O Billy I. Wester, USA, United States, Sikorsky XH-39 Helicopter, Turbomeca Artouste II 425 hp engine, Windsor Locks, Conn., Aug. 26, 1954. (Pending F.A.I. confirmation as we went to press.)
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
World Class Record .... 66.607 mph.
Jean Boulet, France, S.E.3. 120 Helicopter, Salmson 9 NH 200 hp engine, Buc-Etampes-Rambouillet course, July 2, 1952.
National (U.S.) Record .... 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 .... 535.169 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

SPEED FOR 62.137 MI. OVER A TRIANGULAR COURSE
World Class Record .... 59.475 mph.
Jersy Wojnar, Poland, Jaskolka SP 1325 Sailplane, Leszno-Rawicz-Gostyn-Leszno course, May 15, 1954.
National (U.S.) Record .... 52.766 mph.
Richard H. Johnson, Ross-Johnson 5 Sailplane, Grand Prairie-Russell-Don's Airpark-Grand Prairie, Tex. Course, Aug. 28, 1952.

(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 (Moseow) 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 .... 57 hr., 10 min.
Bertrand Dauvin and Henri Couston, France, Franich III Sailplane, Romanin les Alpilles, Apr. 6-8, 1954.
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-Gunter 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—(14,126-21,189 CU. FT.)

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.

Pesco AIRCRAFT ACCESSORIES

ELECTRIC MOTOR-DRIVEN HYDRAULIC PUMPS Models ranging in capacity from 0.1 to 7.0 gpm with pressures up to 3000 psi. DC motors, 6 to 36 volts. AC motors, 400 cycles, 440 volts.

ENGINE-DRIVEN HYDRAULIC PUMPS Pressures up to 3000 psi. Capacities up to 12 gpm. Weights range from 2.5 to 10 lbs.

ELECTRIC MOTORS Designed for maximum power with minimum size and weight. AC Induction, 1 or 3-phase, 400 cycle at various voltages, 0.01 to 9 hp. DC Series, Shunt, or Compound, 6 to 36 volts, 0.01 to 11 hp at various speeds. All types of enclosures, continuous or intermittent duty.

FUEL BOOSTER PUMPS AC or DC, single or two-speed motors. Capacities up to 40,000 pph. Pressures up to 40 psi. Suitable for gasoline or JP4 fuel to 50,000 feet. Tank mounted, submerged or external; or line mounted.

FUEL PUMPS Vane type for reciprocating engines, flow to 700 gph, pressures to 35 psi. Gear type for jet engines, flow to 200 gpm, pressures to 1500 psi, designed to supply main, after-burner, and emergency fuel requirements.

CARTRIDGE® PUMPS Custom built integral components to serve the hydraulic power requirements of original design. They are designed to be installed without fittings or external connections.

engineering Pesco production

PRODUCTS DIVISION

BORG-WARNER CORPORATION
24700 NORTH MILES ROAD • BEDFORD, OHIO

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

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 .... 32,811 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.

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 .... 46,949 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.

Carrier Based Jets to have Radar Guided Missiles

NAVY'S AIR-TO-AIR SPARROW 1 IN PRODUCTION

THE STORY BEHIND THE STORY:

■ On May 12, newspapers from coast to coast carried headlines like the ones above, announcing the Navy's newest weapon of defense—Sparrow I—and the beginning of volume production for operational use in the fleets.

■ Ahead of these headlines were 7 years of intensive cooperative effort shared by the Navy's Bureau of Aeronautics and Sperry.

■ Originally designated project HOT SHOT, Sparrow began back in 1947 when the Bureau of Aeronautics assigned to Sperry the full responsibility of creating an entirely new air-to-air missile system. It had to be light and compact – so multiple units could be carried by fighter-type jets. It had to be deadly accurate – capable of outmanouvering the swiftest bombers an enemy could produce. And it had to be practical—suitable for large-scale production.

■ The rocket-powered, radar-guided Sparrow I, coming off the production lines here and at the new Sperry Farragut plant in Bristol, Tennessee, meets these requirements—and more. It embodies the proved features of more than 100 different missiles designed, constructed and tested during a 7-year period – and the finest brains of an organization that has devoted more than 40 years creating and manufacturing automatic flight control and fire control systems.

SPERRY GYROSCOPE COMPANY

DIVISION OF THE SPERRY CORPORATION • GREAT NECK, N.Y.

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 np 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

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 .... 315.067 mi.

Mrs. M. Choisnet-Gohard, France, Air-100 Sailplane No. 14, from Beynes-Thiverval to Bordeaux-Leognan, Apr. 17, 1954.

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 .... 46.953 mph.

Wanda Szemplinska, Poland, Jaskolka SP-1311 Sailplane, Leszno-Rawicz-Gostyn-Leszno Course, May 15, 1954.

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 .... 38 hr., 41 min.

Mrs. Jacqueline Mathe, pilot; Mrs. M. Garbarino, passenger; France, Castel Mauboussin CM7 No. 02 Biplace Sailplane, Romanin les Alpilles, Jan. 11-12, 1954.

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.

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 — 155.598 mi.
Mrs. Francine Abadie and Mrs. Josiane Charpentier, France, Castel 25 S 138 Sailplane, La Ferte Alais-Blois-LaFerte Alais Course, May 30, 1954.
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.


A NEW CONCEPT—AiRESEARCH COMPLETE
AIR DATA COMPUTER
SYSTEM

THIRD CATEGORY (14,126 TO 21,189 CU. FT.)

DURATION
World Class Record — 22 hr., 40 min.
A. Kondratyeva, U.S.S.R., SSSR BP-31 Balloon, Moscow to Loukino Polie, May 14-15, 1939.
National (U.S.) Record — No official record.

DISTANCE
World Class Record — 318.128 mi.
Mrs. Paulette Weber, France, F-AMAQ Balloon of the Roubaix (Nord) at Villers, May 8-9, 1953.
National (U.S.) Record — No official record.

ALTITUDE
Neither World Class nor National (U.S.) Record has been established.

SIXTH CATEGORY (42.412-56,502 CUBIC FEET)

DURATION
World Class Record — 34 hr., 21 min., 36 sec.
Miss L. Ivanova and Miss S. Tonkova, U.S.S.R., take-off near the Central Aerology Observatory at Dolgoproudnaia, landing at Barachevo, Apr. 22-24, 1948.
National (U.S.) Record — No official record.

DISTANCE
Neither World Class nor National (U.S.) Record has been established.

ALTITUDE
Neither World Class nor National (U.S.) Record has been established.

SEVENTH CATEGORY (56,538-77,691 CU. FT.)

DURATION
International Record — 34 hr., 21 min., 36 sec.
Miss L. Ivanova and Miss S. Tonkova, U.S.S.R., take-off near the Central Aerology Observatory at Dolgoproudnaia, landing at Barachevo, Apr. 22-24, 1948.
National (U.S.) Record — No official record.

DISTANCE
Neither International nor National (U.S.) Record has been established.

ALTITUDE
Neither International nor National (U.S.) Record has been established.

EIGHTH CATEGORY (77,706-105,942 CU. FT.)

DURATION
International Record — 34 hr., 21 min., 36 sec.
Miss L. Ivanova and Miss S. Tonkova, U.S.S.R., takeoff near the Central Aerology Observatory at Dolgoproudnaia, landing at Barachevo, April 22-24, 1948.
National (U.S.) Record — None established.

DISTANCE
Neither International nor National (U.S.) Record has been established.

ALTITUDE
Neither International nor National (U.S.) Record has been established.

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.

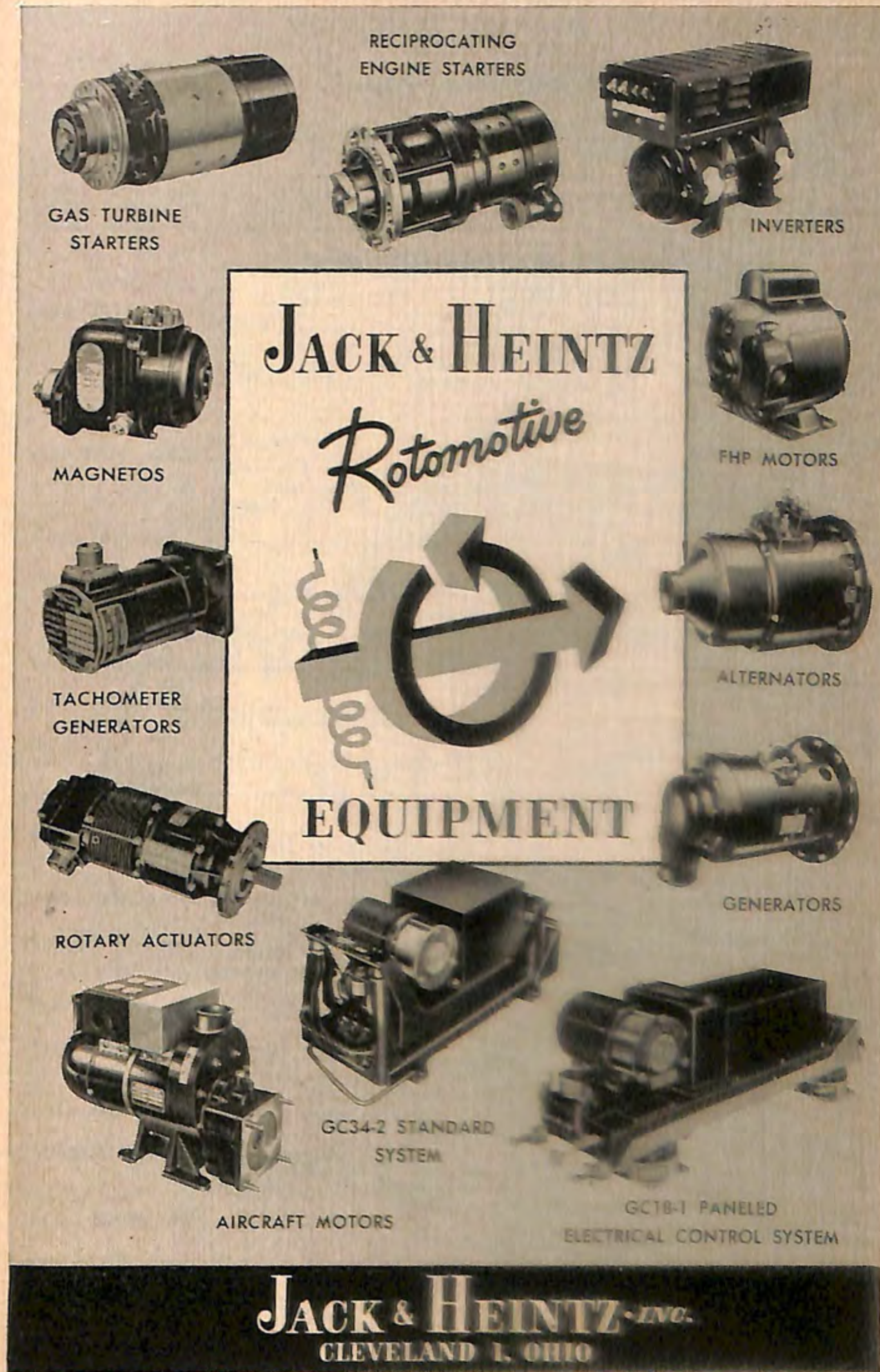
ALTITUDE — No official record.

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.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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 .... 595.910 mph.
Col. W. W. Millikan, ANGUS, United States, North American F-86F-25 swept wing monoplane, General Elecertic J-47-17 jet engine, from International Airport to Floyd Bennett Field, Brooklyn, Jan. 2, 1954. Distance (Center to Center): 2,445.90 statute mi. Elapsed time: (Center to Center); 4 hr., 6 min., 16 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 .... 452.760 mph.
W/C A. H. Humphrey, pilot; Sqdn. Ldr. D. Bower and Sqdn. Ldr. R. F. B. Powell, navigators; Great Britain, English Electric Canberra B. MK II WH 699 aircraft, 2 Rolls Royce Avon R.A.3 jet engines. Dec. 19, 1953. Elapsed time: 13 hr., 16 min., 25.2 sec.
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 .... 293.608 mph.
Capt. W. Baillie, pilot; Great Britain, BEA Vickers Viscount 700 G-AMAV airplane, 4 Rolls Royce Dart 503 RDA3 engines, Oct. 8-10, 1953. Elapsed time: 35 hrs., 46 min., 47.6 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 .... 486.581 mph.
W/C G. G. Petty, pilot; Sqdn. Ldr. T. P. MacGarry and Sqdn. Ldr. J. McDonald Craig, navigators; English Electric Canberra B. MK II, WH 699 aircraft, 2 Rolls Royce Avon R.A.3 jet engines, Dec. 17, 1953. Elapsed time; 12 hr., 21 min., 3.8 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.

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 Sea 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 .... 481.126 mph.
Grp. Capt. John Cunningham, Great Britain, de Havilland Comet, Series 2, G-AMXA, 4 Rolls Royce Avon 503 engines, Jan. 22, 1954. Elapsed time: 6 hr., 22 min., 7.2 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. Hupt, 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.

LONDON, ENGLAND, TO CHRISTCHURCH, NEW ZEALAND
World Class Record .... 493.540 mph.
Flt. Lt. R. L. E. Burton, pilot; Flt. Lt. D. H. Gannon, navigator; Great Britain, English Electric Canberra P.R. MK III WE 139 airplane, 2 Rolls Royce Avon R.A. 3 jet engines, Oct. 8-9, 1953. Elapsed time: 23 hr., 50 min., 42 sec.
National (U.S.) Record .... No official record.

LOS ANGELES, CALIFORNIA, TO PARIS, FRANCE
World Class Record .... 276.311 mph.
Capt. Charles Billet, pilot; Philippe Wertheimer, co-pilot; Robert Girard, radio operator; Pierre Lemaitre, mechanic, France; Douglas DC-6, Pratt & Whitney R-2800 engine on May 28-29,, 1953. Elapsed time: 20 hr., 26 min.
National (U.S.) Record .... No official record.

LONDON, ENGLAND, TO BASRA, IRAQ
World Class Record .... 544.327 mph.
Flight Lieut. R. L. E. Burton, pilot; Flight Lieut. D. H. Gannon, Navigator; Great Britain; English Electric Canberra P.R. MK III aircraft, 2 Rolls Royce Avon R.A. 3 jet engines, Oct. 8, 1953. Elapsed time: 5 hr., 11 min., 5.6 sec.
National (U.S.) Record .... No official record.

LONDON, ENGLAND, TO COLOMBO, CEYLON
World Class Record .... 519.468 mph.
Wing Comdr. L. M. Hodges, pilot; Sqdn. Ldr. R. Currie, Navigator, Great Britain; English Electric Canberra P.R. MK VII, 2 Rolls Royce Avon R.A. 7 jet engines, Oct. 8-9, 1953. Elapsed time: 10 hr., 25 min., 21.5 sec.
National (U.S.) Record .... No official record.

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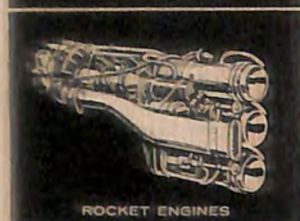

OFFICIAL NATIONAL TRANSCONTINENTAL AND INTER-CITY RECORDS

WEST TO EAST TRANSCONTINENTAL (JET PROPELLED)
Col. W. W. Millikan, ANGUS, United States, North American F-86F-25, General Electric J-47-17 jet engine, from International Airport to Floyd Bennett Field, Brooklyn, N. Y., Jan. 2, 1954. Distance (Center to Center); 2,445.90 mi.; Elapsed time (Center to Center): 4 hr., 06 min., 16 sec. Average speed: 596.910 mph.

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)
Joe DeBona, North American F-51C, N 5528 N, Packard Merlin 1650 engine, from Los Angeles International Airport to Idlewild Airport, Mar. 31, 1954. Distance: 2,469.92 mi. Elapsed time: 4 hr., 24 min., 17 sec. Average speed: 560.744 mph.

WEST TO EAST TRANSCONTINENTAL (COMMERCIAL TRANSPORT AIRCRAFT)
Capt. Joseph B. Glass, pilot; J. W. Hayes, 1st officer; H. W. Hornbach, flight engineer; and 39 passengers; American Airlines' Douglas DC-7, 4 Wright Turbo Compound 3,250 hp. engines, from Los Angeles International Airport to Idlewild, N. Y., Mar. 29, 1954. Distance: 2,469,92 mi. Elapsed time: 5 hr., 10 min. Average speed: 400.528 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. Grubaugh, 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)
Capt. David P. Gannon, pilot; Capt. L. J. Royal, co-pilot; National Airlines, Douglas DC-7, N 82054, 4 Wright Turbo Compound 3250 hp engines, from Clover Field, Santa Monica, to Miami International Airport, Nov. 21, 1953. Elapsed time: 5 hr., 50 min., 12 sec. Distance: 2,341.32 mi. Average speed: 401.140 mph.

LOS ANGELES, CAL. TO JACKSONVILLE, FLA. (TRANSPORT AIRCRAFT)
Capt. Thomas P. Ball and W. Lee McBride, III, pilots; crew of three; Delta-C&S Air Lines, Douglas DC-7, 4 Wright Turbo Compound 3,250 hp engines, from Clover Field, Santa Monica, to Jacksonville Municipal Airport, Mar. 18, 1954. Elapsed time: 5 hr., 29 min., 33 sec. Distance: 2,154.448 mi. Average speed: 392.252 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 H. Dolson and R. W. Tiller, Delta C&S Air Lines' Douglas DC-7, 4 Wright 3,250 hp Turbo Compound engines, from Clover Field, Santa Monica, to Atlanta Municipal Airport, Apr. 9, 1954. Elapsed time: 5 hr., 15 min., 26 sec. Distance: 1,944.01 mi. Average speed: 369.174 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.

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.

LOS ANGELES, CALIFORNIA, TO MEXICO CITY, D. F. (TRANSPORT AIRCRAFT)
Capt. Roberto Pini, pilot; Guillermo S. Prieto, co-pilot; Cia. Mexicana de Aviaçion Douglas DC-6, 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 mi. Average speed: 369.754 mph.

MEXICO CITY, D. F., TO LOS ANGELES, CAL.
A. L. Rodriques, North American P-51-D, NX-33699, Rolls Royce Merlin 68 engine, from Mexico City (Balbuena) Airport to Clover Field, Santa Monica, Cal., Dec. 17, 1946. Elapsed time; 4 hr., 24 min., 30 sec. Distance: 1,557.5 mi. Average speed: 353.308 mph.

LOS ANGELES, CALIFORNIA, TO DENVER, COLO.
Miss Dianna C. Cyrus, Douglas A-26, 2 Pratt and Whitney R-2800 engines, 2000 hp each, from Lockheed Air Terminal, Burbank, to Stapleton Airport, Denver, 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-86-A, 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 miles. Average speed: 617.932 mph.

SAN FRANCISCO, CAL., TO SALT LAKE CITY, UTAH
Frank W. Fuller, Jr., Seversky monoplane, NX-70-Y, Pratt and Whitney Twin Row Wasp 1200 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 NR-70-Y, 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-Bromberg Special, Pratt and Whitney Wasp. Jr. 1195 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 NR-70-Y, 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-70-Y, 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, IDA.
Frank W. Fuller, Jr., Seversky monoplane, NX-70-Y, 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-70-Y, 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 4360 engines, from San Francisco Airport to Washington National Airport, Mar. 3, 1949. Elapsed time: 6 hr., 22 min., 25.4 sec. Distance: 2,436.917 miles. 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, 4 Wright 3350 engines, 2,500 hp each from La Guardia Airport to Atlanta Municipal Airport, Aug. 5, 1947. Elapsed time: 2 hr., 18 min., 06 sec. Distance: 759.707 mi. Average speed: 330.068 mph.

EDWARDS, CAL., TO VANDALIA, OHIO—NONSTOP—(Multi-Jet Engine Aircraft)
John J. Farley, pilot; Sherman Pruitt, Jr., navigator; Northrop F-89A 49-2448, two Allison J-35-A-21B jet engines, Edwards Air Force Base to Cox Municipal Airport, Sept. 7, 1953. Elapsed time; 3 hr., 45 min., 12.5 sec. Distance: 1,868.48 miles. Average speed: 497.800 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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