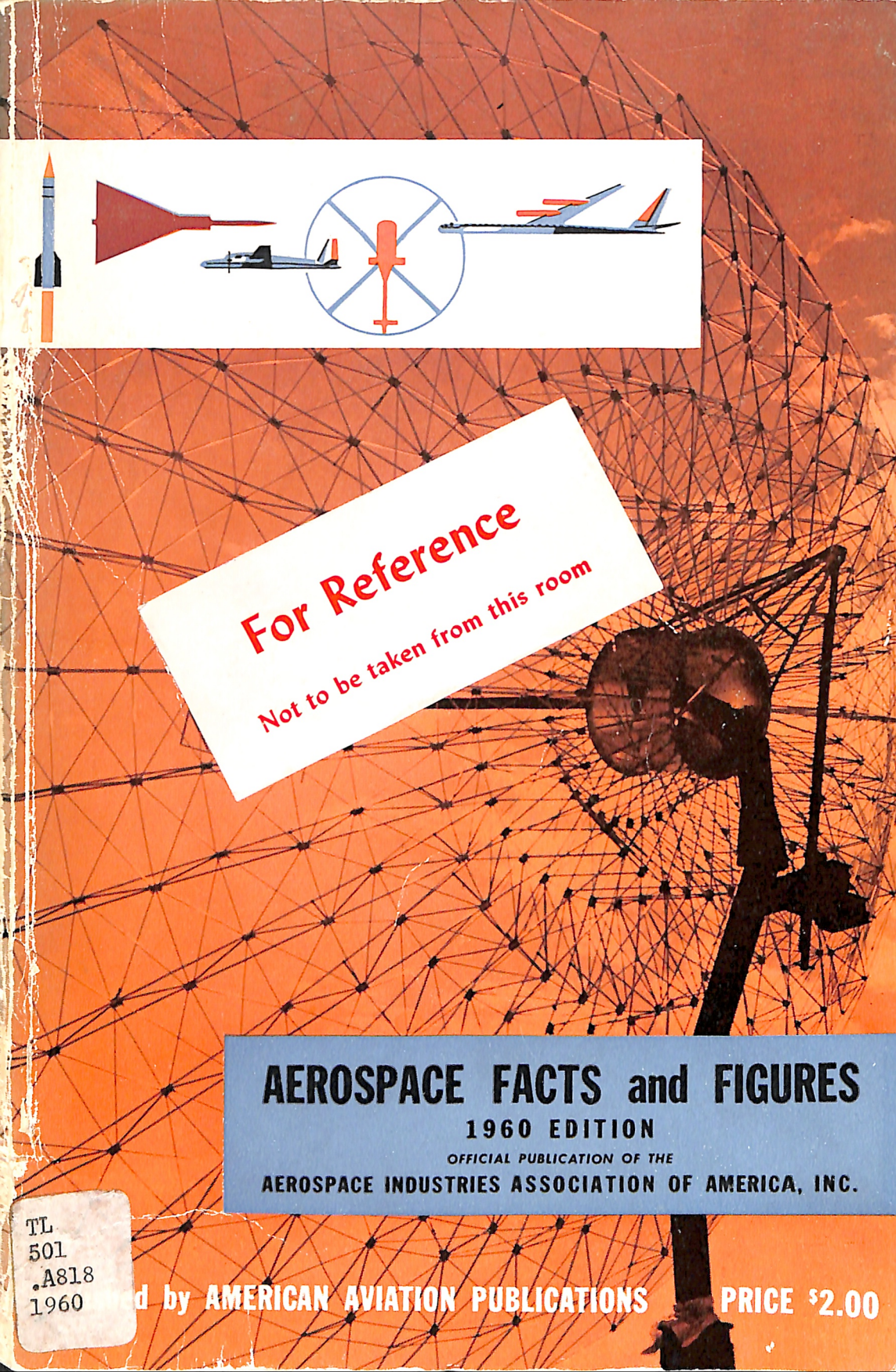


# AEROSPACE FACTS and FIGURES

1960 EDITION

OFFICIAL PUBLICATION OF THE

AEROSPACE INDUSTRIES ASSOCIATION OF AMERICA, INC.

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# AEROSPACE FACTS AND FIGURES—1960

## ERRATA

"Contents" should read:



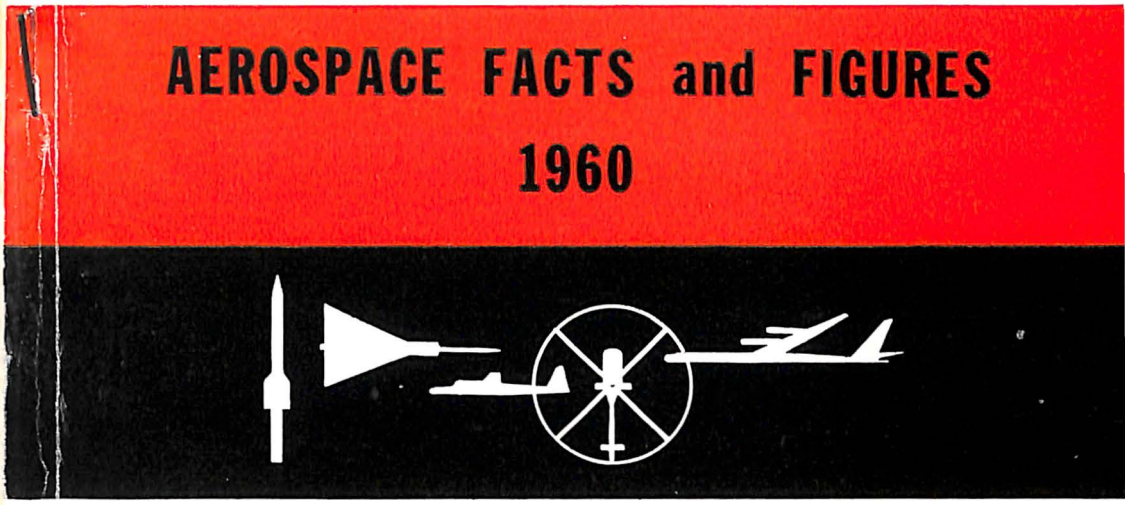
Page 8 In the table "Airframe Weight Production, 1939 to Date" the "Military" should read:

| | |
|---|---|
| 1955 | 114.3 |
| 1956 | 90.9 |
| 1957 | 79.4E |
| 1958 | 60.6E |
| 1959 | 30.0E |

Page 105 The following should be inserted after the first paragraph of the Helicopter chapter: In 1959, more than 35 new commercial helicopter services were organized, bringing the total number of operators in the United States and Canada to 193 at year's end.

AEROSPACE INDUSTRIES ASSOCIATION OF AMERICA, INC.

# AEROSPACE FACTS and FIGURES 1960

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# FOREWORD

The year 1959 was marked by significant changes in the aerospace industry, its structure, composition and field of activity as the result of the continuing progress made in air and space science and technology.

The impact of technological advance has resulted in reduced weapons inventories and has brought a shift from volume production to precision fabrication of very limited quantities. This has caused and will continue to require an extensive realignment of industry labor forces, with an inevitable decline in the number of production workers and a continuing requirement for engineering and technical skills.

Reflecting the changing nature of the organization and the activities of the companies who comprise this Association, the organization name was changed in May 1959 to Aerospace Industries Association. By definition, aerospace embraces research, development and production of manned and unmanned vehicles and their supporting equipment for movement above the earth's surface, whether they move within the layer of atmosphere which surrounds our planet or beyond it.

Sales in the aerospace industry totaled approximately $11 billion in 1959—about the same as in 1958. However, despite the relatively high level of sales, production of military *aircraft* declined from about 3,700 units in 1958 to about 2,400 units in 1959.

Offsetting the decline in aircraft unit production were rising expenditures for guided missiles and space vehicles. Expenditures in these two areas climbed to an estimated $3.5 billion in fiscal 1959.

Increasing deliveries of gas turbine-powered transports—and their enthusiastic endorsement by the traveling public—was perhaps the highlight of 1959 aerospace industry accomplishments. By year's end, approximately 245 of these planes had been delivered to foreign and domestic airlines. Equally promising has been the increasing acceptance of the small aircraft for business and utility purposes, with deliveries during 1959 approximating 7,100 units.

A large part of AEROSPACE FACTS AND FIGURES—1960 is not a work of original research. It represents a compilation of facts gleaned from hundreds of sources in the world of aviation during the past year which have been considered of importance and interest.

It is hoped that this eighth edition, as those in the past, may serve as a standard aviation reference work of value to legislators, administrators and managers in Government and industry, writers and editors, analysts and students.

*Aerospace Industries Association*
May 1960

# CONTENTS

# 1

# PRODUCTION AND FACILITIES

The impact of significant technological advance during the past two years, and during 1959 in particular, has resulted in reduced weapons inventories and has brought a shift from volume production to precision fabrication of very limited quantities. One result has been that more and more companies are competing for fewer and fewer contracts. Another result is that the need for an unprecedented degree of reliability in components has made precision fabrication more essential than ever before. This requires an extensive realignment of our labor force with a decline in the number of production workers and an increased requirement for engineering and technical skills. It also requires construction of new highly specialized facilities and necessitates high-cost machines which quickly could become useless as the result of another newer advance in our technology.

The cost to develop one of our modern weapon systems could easily exceed the cost of producing the limited number of weapons that defense would require. Thus, during this period, we are primarily devoted to

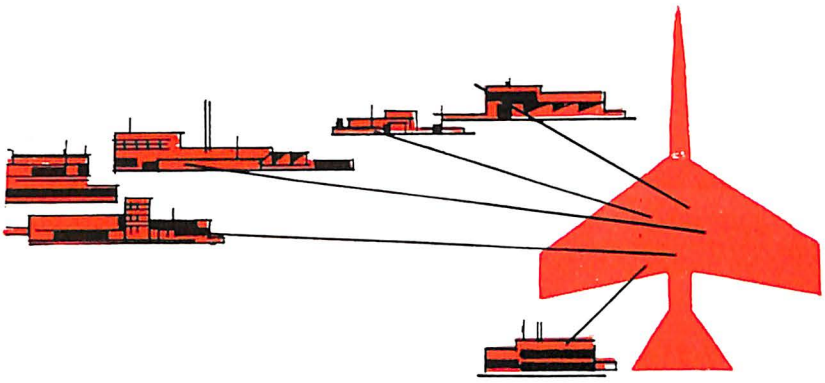
research and development, rather than production effort. To meet and solve these problems, aircraft and missile manufacturers have made and are continuing to make radical changes in their organizations in order to cover the broad scope of aircraft, missiles, spacecraft, their propulsion systems, guidance and related equipments.

Two national policy determinations have been the major factors causing the changing nature of the industry. First is the increasingly prominent role played by high performance guided missiles in our defense weapons inventories with a concurrent reduction in aircraft re-

U. S. AIRCRAFT PRODUCTION
1909 TO DATE
(Number of Aircraft)

| Year | TOTAL | Military | Civil |
|---|---|---|---|
| 1909 | N.A. | 1 | N.A. |
| 1910 | N.A. | — | N.A |
| 1911 | N.A. | 11 | N.A. |
| 1912 | 45 | 16 | 29 |
| 1913 | 43 | 14 | 29 |
| 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 | 743 | 687 | 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 |

(*Continued on next page*)



AIRCRAFT PRODUCTION
1909 TO DATE (cont'd)
(Number of Aircraft)

| Year | TOTAL | Military | Civil |
|---|---|---|---|
| 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 | 12,813 | 6,028 | 6,785 |
| 1941 | 26,289 | 19,445 | 6,844 |
| 1942 | 47,675 | 47,675 | — |
| 1943 | 85,433 | 85,433 | — |
| 1944 | 95,272 | 95,272 | — |
| 1945 | 48,912 | 46,865 | 2,047 |
| 1946 | 36,418 | 1,417 | 35,001 |
| 1947 | 17,739 | 2,122 | 15,617 |
| 1948 | 9,838 | 2,536 | 7,302 |
| 1949 | 6,137 | 2,592 | 3,545 |
| 1950 | 6,293 | 2,773 | 3,520 |
| 1951 | 7,923 | 5,446 | 2,477 |
| 1952 | 12,811 | 9,302 | 3,509 |
| 1953 | 14,760 | 10,626 | 4,134 |
| 1954 | 12,129 | 8,740 | 3,389 |
| 1955 | 12,852 | 8,032 | 4,820 |
| 1956 | 13,319 | 6,114 | 7,205 |
| 1957 | 12,346 | 5,619 | 6,745 |
| 1958 | 10,860[E] | 4,000[E] | 6,860 |
| 1959 | 10,242[E] | 2,000[E] | 8,242 |

N.A.—Not available.
E Estimate.
Sources: 1, 2, 3, 14, 19

quirements. Second has been the determination to provide for these new weapons while maintaining an existing offensive-defensive military organization under a relatively fixed budgetary ceiling.

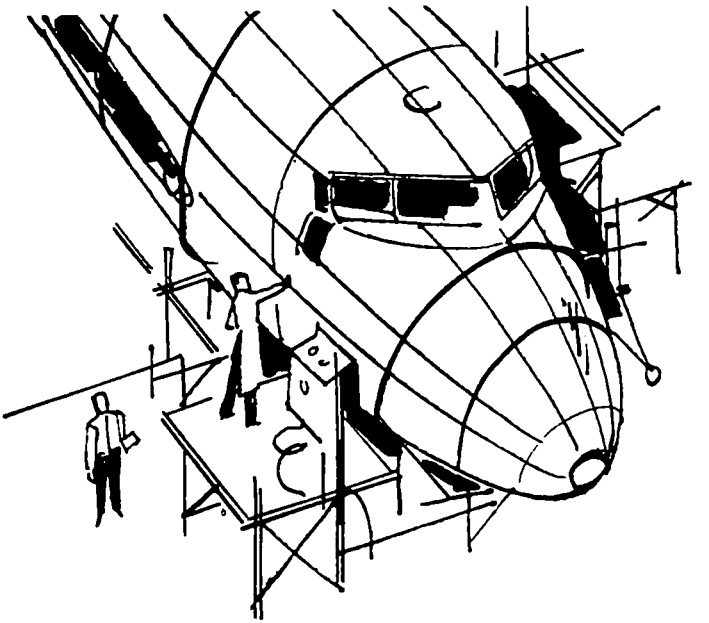
The impact of technological progress on the industry during 1959 has been magnified by the cancellations, cutbacks, and stretch-outs of both development and production programs resulting from Government efforts to operate within a fixed ceiling of defense expenditures.

The production of military aircraft during 1959 continued to drop. An estimated 2,000 units were produced in 1959, compared to 4,000 in 1958. Military aircraft scheduled for procurement have dropped from 1,754 units in fiscal 1959 program to 1,609 in fiscal 1960 program to an estimated 1,510 in fiscal 1961 program. Sales of the manufacturers of military aircraft and parts dropped 22.7% from $5.3 billion in 1958 to $4.1 billion in 1959. Estimated military piston, turbine and ramjet engine production dropped sharply in 1959 to 4,900 units from 8,000

AIRFRAME WEIGHT PRODUCTION, 1939 TO DATE

| Year | Weight in Millions of Pounds (Excluding Spares) | | |
|---|---|---|---|
| | TOTAL | Military | Civil |
| 1939 | 12.5[E] | 10.1 | 2.4[E] |
| 1940 | 27.8[E] | 23.1 | 4.7[E] |
| 1941 | 86.1[E] | 81.4 | 4.7[E] |
| 1942 | 275.8 | 275.8 | — |
| 1943 | 654.2 | 654.2 | — |
| 1944 | 961.1 | 961.1 | — |
| 1945 | 541.1 | 539.4 | 1.7 |
| 1946 | 38.4 | 12.9 | 25.5 |
| 1947 | 29.3 | 11.4 | 17.9 |
| 1948 | 35.2 | 25.1 | 10.1 |
| 1949 | 37.0 | 30.3 | 6.7 |
| 1950 | 41.9 | 35.9 | 6.0 |
| 1951 | 55.2 | 50.2 | 5.0 |
| 1952 | 116.6 | 107.3 | 9.3 |
| 1953 | 148.4 | 138.0 | 10.4 |
| 1954 | 140.9 | 130.4 | 10.5 |
| 1955 | 124.5 | 90.0 | 10.2 |
| 1956 | 106.2 | 79.4[E] | 16.2 |
| 1957 | 100.8[E] | 30.0[E] | 21.4 |
| 1958 | 76.5[E] | 114.3 | 16.5 |
| 1959 | 46.7[E] | 60.0[E] | 16.7 |

[E] Estimate.
Sources: 1, 14, 19



units in 1958. Sales of engines and parts to military customers were $1.3 billion in 1959, compared to $1.9 billion in 1958. There are no complete statistics available on missile engine production or sales.

Civil aircraft production by the aerospace industry in 1959 was highlighted with the ever-increasing deliveries of gas turbine-powered transports—and their enthusiastic endorsement by the traveling public. By year's end, 245 of these transport planes had been delivered to foreign and domestic airlines.

Increasing acceptance of the small aircraft for business and utility purposes was also highlighted during the year. During the five-year period, beginning in 1954, the production and sale of business and personal aircraft more than doubled, reaching 6,414 units valued at approximately $135,000,000 by 1958. This trend continued during 1959 when deliveries approximated 7,100 units having a retail value of $170,000,000.

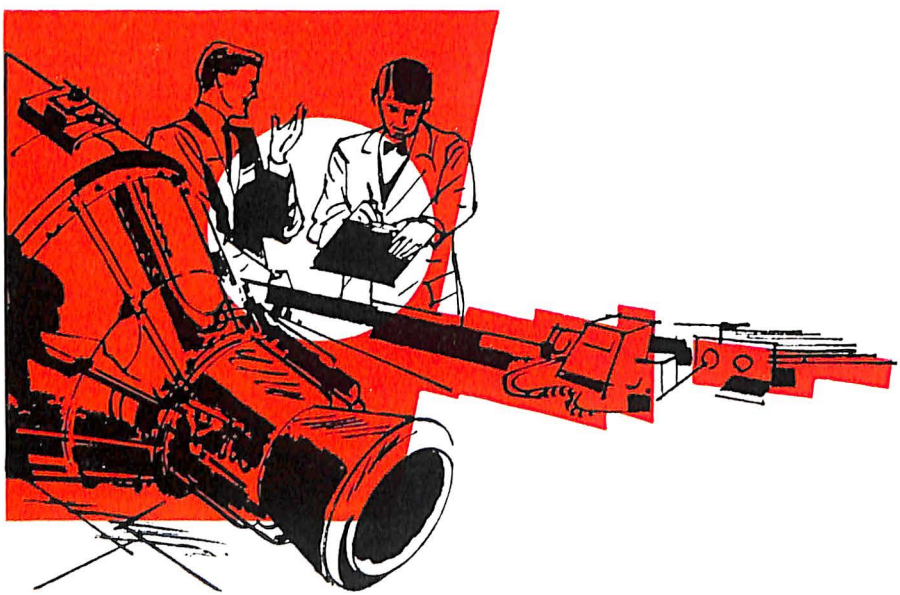
In the production field of guided missiles, six of these new weapon systems progressed from test to operational status, perhaps the most noteworthy being our first intercontinental ballistic missile. At the same time, there was a marked increase in deliveries of all classes of missiles, ranging from the large ICBM's to the relatively small air-to-air missiles, with a consequent increase in the effectiveness of our armed forces.

The helicopter industry is on the threshold of a significant boom because of the adaptation of the turbine engine as the primary power

SALES OF MANUFACTURERS OF COMPLETE AIRCRAFT, AIRCRAFT ENGINES, PROPELLERS AND PARTS 1948 TO DATE
(Millions of Dollars)

| Year | Total | Aircraft and Parts | | | Aircraft Engines and Parts | | | Aircraft Propellers and Parts | | | Other Products and Services[b] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Total | U.S. Military | Other | Total | U.S. Military | Other | Total | U.S. Military | Other | |
| 1948[a] | $1,158 | $ 748 | $ 626 | $122 | $ 265 | $ 222 | $ 43 | $ 48 | $ 36 | $12 | $ 97 |
| 1949 | 1,781 | 1,098 | 927 | 171 | 508 | 461 | 47 | 62 | 50 | 12 | 113 |
| 1950 | 2,274 | 1,416 | 1,255 | 161 | 583 | 519 | 64 | 75 | 62 | 13 | 200 |
| 1951 | 3,456 | 1,883 | 1,657 | 226 | 879 | 779 | 100 | 110 | 89 | 21 | 584 |
| 1952 | 6,497 | 3,897 | 3,442 | 455 | 1,609 | 1,440 | 169 | 148 | 122 | 26 | 843 |
| 1953 | 8,511 | 5,179 | 4,661 | 518 | 2,378 | 2,189 | 189 | 203 | 176 | 27 | 751 |
| 1954 | 8,305 | 5,226 | 4,626 | 600 | 2,062 | 1,872 | 190 | 183 | 151 | 32 | 834 |
| 1955 | 8,470 | 5,164 | 4,605 | 559 | 1,933 | 1,728 | 205 | 134 | 112 | 22 | 1,239 |
| 1956 | 9,496 | 5,554 | 4,740 | 814 | 2,035 | 1,718 | 317 | 136 | 101 | 35 | 1,771 |
| 1957 | 11,765 | 6,772 | 5,607 | 1,165 | 2,527 | 2,137 | 390 | 183 | 140 | 43 | 2,283 |
| 1958 | 11,470 | 6,319 | 5,305 | 1,014 | 2,179 | 1,858 | 321 | 163 | 126 | 37 | 2,809 |
| 1959 | 11,255 | 5,458 | 4,063 | 1,395 | 1,676 | 1,268 | 408 | 102 | 64 | 38 | 4,019 |

[a] Total for last three quarters of 1948 only.
[b] "Other Products and Services" includes missiles, conversions, modifications, and all other products and services not covered under the first three categories as long as they were produced or performed by manufacturers of complete aircraft, aircraft engines, or propellers.
Source: 15



BACKLOG OF ORDERS REPORTED BY MANUFACTURERS OF COMPLETE AIRCRAFT, ENGINES AND PROPELLERS, 1948 TO DATE
(Millions of Dollars)

| December 31 | Total | Aircraft and Parts | Aircraft Engines and Parts | Aircraft Propellers and Parts | Other Products and Services[a] |
|---|---|---|---|---|---|
| 1948 | $3,104 | $2,094 | $ 786 | $103 | $121 |
| 1949 | 3,010 | 2,013 | 749 | 91 | 157 |
| 1950 | 5,039 | 3,102 | 1,470 | 145 | 322 |
| 1951 | 12,665 | 8,126 | 3,531 | 241 | 767 |
| 1952 | 17,653 | 11,222 | 5,172 | 298 | 961 |
| 1953 | 16,753 | 11,604 | 4,080 | 218 | 851 |
| 1954 | 14,852 | 10,639 | 2,929 | 187 | 1,097 |
| 1955 | 15,702 | 10,673 | 3,061 | 130 | 1,841 |
| 1956 | 18,350 | 11,744 | 4,065 | 191 | 2,350 |
| 1957 | 14,531 | 9,236 | 2,969 | 158 | 2,168 |
| 1958 | 13,171 | 8,095 | 2,018 | 69 | 2,989 |
| 1959 | 12,140 | 6,647 | 1,417 | 57 | 4,019 |

[a] "Other Products and Services" includes missiles, conversions, modifications, and all other products and services not covered under the first three categories as long as they were produced or performed by manufacturers of complete aircraft, aircraft engines, or propellers.

Source: 15

plant. The turbine engine offers substantially lower operating and maintenance costs in addition to greater power. The number of commercial helicopter operators in the U. S. and Canada increased from 120 in 1958 to 160 in 1959, and the number of helicopters in service increased from 500 to 640.

Sales of the aerospace industry for 1959 are estimated at about $11.3 billion, approximately the same as in 1958.

Despite the relatively high level of sales, production of military aircraft declined from 4,000 units in 1958, to about 2,000 units in 1959. However, rising expenditures for missiles and space vehicles partially offset this marked decline. Expenditures for the procurement and production of missiles have risen to an estimated $3.49 billion for fiscal year 1959.

Civil aircraft, engines, propellers and parts sales are estimated at about $1.7 billion in 1959, compared to $1.4 billion in 1958.

Total civil aircraft production for 1959, including helicopters, is estimated at 8,242 units, significantly higher than the 1958 output of 6,860 units. The value of the 1959 civil aircraft production is estimated

to be up 38% from 1958. About 260 transports were delivered in 1959, compared to 216 units in 1958. Of these aircraft 242 were turbine-powered transports. At the end of October, U. S. manufacturers had orders for more than 432 turbine transports, valued at about $2 billion.

VALUE OF AIRCRAFT AND PARTS PRODUCED[a]
1914 TO DATE
(Thousands of Dollars)

| Year | TOTAL VALUE OR SALES[b] | Part of Total Which is Added by Manufacture |
|---|---|---|
| 1914 | $ 790 | $ 656 |
| 1919 | 14,373 | 7,246 |
| 1921 | 6,642 | 4,235 |
| 1923 | 12,945 | 9,116 |
| 1925 | 12,525 | 9,655 |
| 1927 | 21,162 | 13,645 |
| 1929 | 71,153 | 43,785 |
| 1931 | 40,278 | 27,177 |
| 1933 | 26,460 | 18,503 |
| 1935 | 45,347 | 30,986 |
| 1937 | 149,700 | 93,144 |
| 1939 | 279,497 | 183,247 |
| 1940 Jul-Dec | 370,000 | N.A. |
| 1941 | 1,804,000 | N.A. |
| 1942 | 5,817,000 | N.A. |
| 1943 | 12,514,000 | N.A. |
| 1944 | 16,047,000 | N.A. |
| 1945 Jan-Aug | 8,279,000 | N.A. |
| 1947 | 1,200,000[E] | 954,575 |
| 1948 Apr-Dec | 1,158,000 | N.A. |
| 1949 | 1,781,000 | 1,344,068 |
| 1950 | 2,274,000 | 1,550,551 |
| 1951 | 3,456,000 | 2,662,993 |
| 1952 | 6,497,000 | 4,450,602 |
| 1953 | 8,511,000 | 5,764,300 |
| 1954 | 8,305,000 | 6,084,000[c] |
| 1955 | 8,470,000 | 5,932,000[c] |
| 1956 | 9,496,000 | 7,035,000[c] |
| 1957 | 11,765,000 | 8,006,000[c] |
| 1958 | 11,470,000 | 7,907,000[c] |
| 1959 | 11,255,000 | 7,878,500[E] |

[a] The figures shown beginning with 1947 include other products and services such as missiles, conversions, modifications, and all other products and services produced and performed by manufacturers of complete aircraft, aircraft engines, and propellers.
[b] 1914-1939: Value of Products
1940-1945: Value of Production at August 1943 Unit Cost.
1947-Date: Sales of Manufacturers of Complete Aircraft, Engines, Propellers, and Parts.
[c] Adjusted for inventory changes.
E Estimate.
N.A.—Not available.
Sources: 3, 12, 15

AIRCRAFT ENGINE PRODUCTION, 1917 TO DATE
(Number of Engines)

| Year | TOTAL | Military | | Civil[a] |
|---|---|---|---|---|
| 1917–1919 | N.A. | 44,453 | | N.A. |
| 1926 | N.A. | 842 | | N.A. |
| 1927 | N.A. | 1,397 | | N.A. |
| 1928 | 3,252 | 2,620 | | 632 |
| 1929 | 7,378 | 1,861 | | 5,517 |
| 1930 | 3,766 | 1,841 | | 1,925 |
| 1931 | 3,776 | 1,800 | | 1,976 |
| 1932 | 1,898 | 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. | | 3,800[E] |
| 1939 | 11,172 | N.A. | | N.A. |
| 1940 | 30,167[E] | 22,667 | | 7,500[E] |
| 1941 | 64,681[E] | 58,181 | | 6,500[E] |
| 1942 | 138,089 | 138,089 | | — |
| 1943 | 227,116 | 227,116 | | — |
| | | Reciprocating | Jet | |
| 1944 | 256,911 | 256,789 | 122 | — |
| 1945 | 111,650[E] | 108,442 | 1,208 | 2,000[E] |
| 1946 | 43,407 | 1,680 | 905 | 40,822 |
| 1947 | 20,912 | 2,683 | 1,878 | 16,351 |
| 1948 | 14,027 | 2,495 | 2,493 | 9,039 |
| 1949 | 11,972 | 2,981 | 5,009 | 3,982 |
| 1950 | 13,675 | 3,122 | 6,239 | 4,314 |
| 1951 | 20,867 | 6,471 | 9,816 | 4,580 |
| 1952 | 31,041 | 8,731 | 16,928 | 5,382 |
| 1953 | 40,263 | 13,365 | 20,251 | 6,647 |
| 1954 | 26,959 | 7,868 | 13,572 | 5,519 |
| 1955 | 21,108 | 3,874 | 9,595 | 7,639 |
| 1956 | 21,869 | 2,982 | 7,388 | 11,499 |
| 1957 | 22,051 | 2,557 | 8,633 | 10,859 |
| 1958 | 18,252 | 1,496 | 6,523 | 10,233 |
| 1959 | 16,052[E] | 600[E] | 4,300[E] | 11,152 |

N.A. Not available.
[E] Estimate.
[a] Reciprocating engines only.
Sources: 1, 3, 14, 19

## Shipments of Civilian Engines
### 1953 to Date

| Company and Engine Designation[a] | 1953 | 1954 | 1955 | 1956 | 1957 | 1958 | 1959 |
|---|---|---|---|---|---|---|---|
| Total | 6,215 | 5,360 | 7,466 | 11,290 | 10,844 | 10,251 | 12,259 |
| Allison Division General Motors | | | | | | | |
| 282 | — | — | — | — | — | 242 | 604 |
| Continental | | | | | | | |
| 205 | 89 | 147 | 163 | 87 | 145 | 77 | 16 |
| 246 | 345 | 78 | 41 | 22 | 24 | 15 | 23 |
| 252 | 367 | 210 | 279 | 629 | 879 | 829 | 1,348 |
| 253 | 715 | 561 | 811 | 1,736 | 811 | 1,734 | 953 |
| 267 | 85 | 423 | 500 | 433 | 31 | 36 | 36 |
| 273 | 760 | 990 | 1,712 | 2,524 | 2,733 | 2,181 | 2,816 |
| 298 | — | — | — | — | — | — | 713 |
| Other | 21 | 17 | 12 | 20 | 24 | 23 | 8 |
| General Electric | | | | | | | |
| 308 | — | — | — | — | — | 18 | 90 |
| Lycoming | | | | | | | |
| 223 | 141 | 2 | 6 | 7 | 8 | 2 | 8 |
| 295 | — | — | — | — | 123 | 561 | 906 |
| 228 | 370 | 217 | 143 | 443 | 315 | 167 | 24 |
| 229 | 1,869 | 969 | 127 | 132 | 44 | 95 | 113 |
| 274 | 94 | 618 | 2,309 | 3,011 | 2,631 | 2,023 | 2,021 |
| 275 | — | 213 | 591 | 909 | 842 | 419 | 308 |
| 286 | — | — | — | 2 | 250 | 768 | 1,044 |
| 284 | — | — | — | — | — | — | 247 |
| Other | — | — | — | — | — | — | 29 |
| Pratt & Whitney Division | | | | | | | |
| 230 | 52 | 44 | 26 | 21 | 5 | 6 | 1 |
| 231, 264 | 847 | 350 | 157 | 316 | 456 | 315 | 3 |
| 290 | — | — | — | — | 35 | 232 | 275 |
| 291 | — | — | — | — | 3 | 23 | 410 |
| Other | 2 | — | — | — | — | — | 5 |
| Wright Aeronautical | | | | | | | |
| 243 | — | 2 | 1 | — | 68 | 51 | 6 |
| 259 | 1 | 1 | 5 | 23 | 157 | 129 | 202 |
| 272 | 455 | 516 | 483 | 315 | 323 | 22 | — |
| 287 | — | — | 32 | 576 | 910 | 283 | 26 |
| 289 | — | — | — | — | — | — | 24 |
| Other | 2 | — | — | — | — | — | — |

[a]Type Certificate number
**Source: 1**

COST VALUE OF FACILITIES IN THE AEROSPACE INDUSTRY[a]
(Millions of Dollars)

| Year | Value | | | Expenditures | | |
|---|---|---|---|---|---|---|
| | TOTAL | Financed by | | TOTAL | Financed by | |
| | | Company | Government | | Company | Government |
| 1955 | $3,932.6 | $2,161.8 | $1,770.8 | $451.1 | $266.9 | $184.2 |
| 1956 | 4,598.2 | 2,532.2 | 2,066.0 | 643.8 | 421.0 | 222.8 |
| 1957 | 5,194.5 | 2,972.2 | 2,222.3 | 780.5 | 514.4 | 266.1 |
| 1958 | 5,843.2 | 3,311.3 | 2,531.9 | 604.4 | 364.0 | 240.4 |
| 1959 | 6,167.2 | 3,449.3 | 2,717.9 | 556.3 | 320.2 | 236.1 |
| TOTAL EXPENDITURES, 1955-1959 | | | | $3,036.1 | $1,886.5 | $1,149.6 |

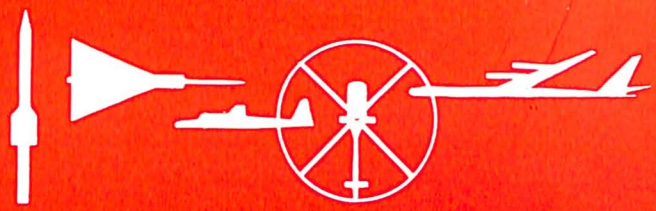
[a] Compilation of data from 46 companies, including major airframe, missile and engine manufacturers.
Source: 1.

FLOOR SPACE OF AIRFRAME, ENGINE AND PROPELLER FACILITIES, 1939 TO DATE
(Millions of Square Feet)

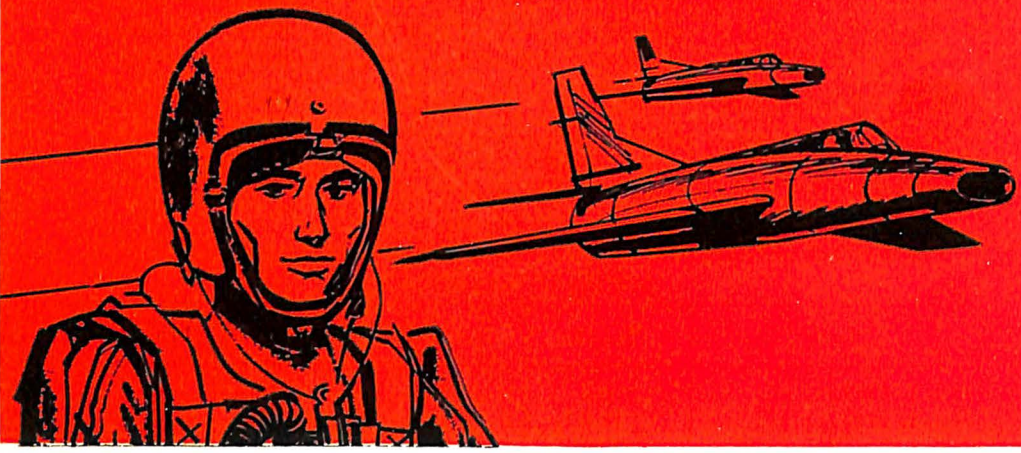
| Date | TOTAL | Airframe | Engine | Propeller |
|---|---|---|---|---|
| Jan. 1, 1939 | 9.5 | 7.5 | 1.7 | .3 |
| Jan. 1, 1940 | 13.1 | 9.6 | 3.0 | .5 |
| Jan. 1, 1941 | 25.5 | 17.9 | 6.5 | 1.1 |
| Jan. 1943 | 117.1 | 77.5 | 31.8 | 5.2 |
| Dec. 1943 | 175.0 | 110.4 | 54.2 | 6.8 |
| Dec. 1944 | 167.4 | 103.0 | 54.9 | 7.9 |
| 1947 (estimate) | 54.1 | 39.0 | 13.5 | 1.6 |
| 1950 (estimate) | 63.5 | 47.5 | 14.0 | 2.0 |
| June 30, 1952 | 122.8 | 82.3 | 38.4 | 2.1 |
| June 30, 1953 | 135.8 | 91.1 | 42.1 | 2.6 |
| Sept. 30, 1954 | 127.5 | 91.0 | 33.7 | 2.8 |
| Dec. 31, 1955 | 131.3 | 96.5 | 32.1 | 2.7 |
| Dec. 31, 1956 | 138.4 | 101.5 | 34.1 | 2.8 |
| Sept. 30, 1957 | 141.5 | 103.5 | 35.2 | 2.8 |
| Dec. 31, 1958 | 137.8 | 103.1 | 31.6 | 3.1 |
| Sept. 30, 1959 | 126.8 | 93.6 | 30.0 | 3.2 |

Sources: 1, 3, 19.

# 2



# MILITARY AVIATION



The building of aerospace power—the provision and maintenance of a force which can continue to guarantee aerospace security for the United States and its allies—is the responsibility of the aerospace industry and the mission of the military aerospace forces.

During the past ten years, this industry-Government task has become increasingly difficult. Rapid technical advances along all flight fronts; advances in propulsion, manufacturing materials, techniques of production, electronics, etc., have made possible weapon performance capabilities considered beyond reach a few years ago. But with these advances have come greatly increased development and manufacturing costs, making, unfortunately, the choice between weapons systems dramatic and difficult.

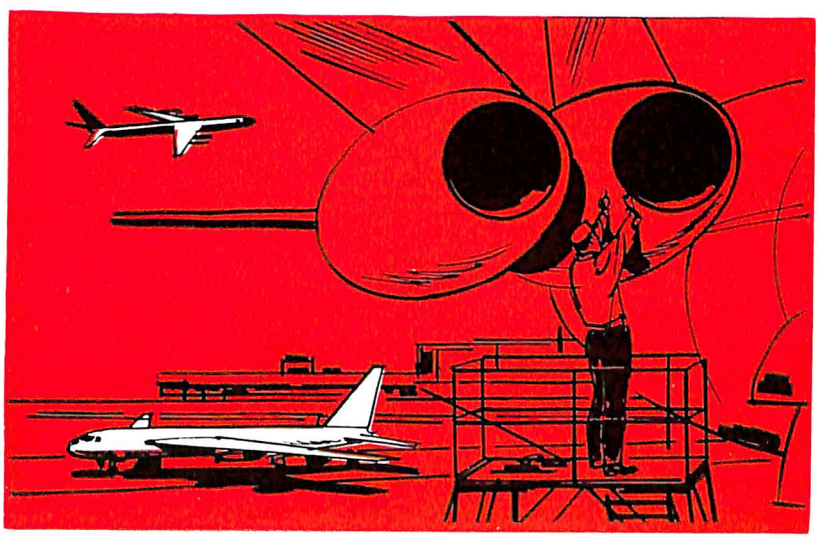
The progress of the industry in the development of ever-more powerful aircraft, missiles and space systems has been outstanding, enabling our military forces to obtain aerospace weapons second to none in minimum quantities ordered for the national defense.

The composition of the military aerospace forces, because of the increasing performance of the weapons, has altered greatly from the

quantity concept of a few years ago. For example, in the opinion of our military leaders, the quantities of aircraft required for our air forces to *maintain* superiority are no longer so high. Our B-17 and B-24 forces of World War II totaled some 30,000 aircraft. The Nation's postwar B-29, B-50 and B-36 force was slightly over 4,000 aircraft. The current strategic bomber force of B-47s and B-52s totals approximately 2,000 aircraft. Contributing, of course, to this changing composition of military aviation are the increasing capabilities of the guided missile. Slowly but surely the missiles are taking over some of the functions, previously the assigned missions of manned aircraft. Ballistic missiles are a typical case. These weapons can destroy an enemy target more than 1,500 miles away within minutes after a decision is made to attack. This is beyond the capability of any manned aircraft now operational or under development.

*Aviation Aspects of Defense Spending*

During the last four years, there have been rapid changes in the product-mix of aeronautical procurement. These changes will continue into fiscal year 1961. The percentage of the procurement dollar devoted to aircraft will continue to decline in 1961, while the percentage going to missiles continues to increase. Whereas aircraft took 59½¢ of every procurement dollar spent in fiscal year 1957, they will take only 44¢ in



COMPOSITION OF MILITARY AIR FORCES
FISCAL YEARS 1959-1961

| | Actual | Planned | |
|---|---|---|---|
| | June 30, 1959 | June 30, 1960 | June 30, 1961 |
| *Department of the Army:* | | | |
| Field artillery missile groups (heavy) (Redstone) | 3 | 3 | 3 |
| Army missile commands | 4 | 4 | 5 |
| Guided missile battalions (equivalents) | 74 | 73¼ | 82¼ |
| Other antiaircraft battalions | 11 | 8 | 5 |
| Separate surface-to-surface missile battalions | 18 | 24 | 26 |
| Active aircraft inventory (total) | 5,199 | 5,663 | 5,791 |
| Helicopters | 2,357 | 2,714 | 2,840 |
| Fixed-wing | 2,842 | 2,949 | 2,951 |
| *Department of the Navy:* | | | |
| Attack carrier air groups | 16 | 16 | 16 |
| Carrier antisubmarine groups[a] | — | 11 | 11 |
| Patrol and warnings squadrons | 42 | 42 | 41 |
| Marine divisions | 3 | 3 | 3 |
| Marine air wings | 3 | 3 | 3 |
| Active aircraft inventory | 9,649 | 8,657 | 8,348 |
| *Department of the Air Force:* | | | |
| USAF combat wings (total) | 105 | 96 | 91 |
| Strategic wings | 43 | 40 | 38 |
| Air defense wings | 27 | 23 | 20 |
| Tactical wings | 35 | 33 | 33 |
| USAF combat support flying forces (total) | 145 | 118 | 115 |
| Air refueling squadrons | 60 | 62 | 66 |
| MATS air transport squadrons | 27 | 22 | 21 |
| Other specialized squadrons | 58 | 34 | 28 |
| Active aircraft inventory | 20.890 | 19,513 | 18,885 |

[a] Prior to 1960 the carrier antisubmarine capability was represented by 22 carrier antisubmarine squadrons which have been reorganized into 11 carrier antisubmarine air groups.
Source: 26

fiscal year 1961 (compared with 47.8 in fiscal 1960). Conversely, missiles took a little over 15¢ of the procurement dollar in 1957 and will take about 26¢ in 1961. The proportion of the procurement dollar going for ships will increase from about 6½¢ in 1957 to over 11¢ in 1961, and electronics and communications equipment will go up from 6½¢ to over 7¢. The proportion of the procurement dollar going for ammunition and for production equipment facilities will continue to decline.

NEW MILITARY AIRCRAFT, BY TYPE[a], ACCEPTED BY THE DEPARTMENT OF DEFENSE
1940 to Date

| Year | TYPE OF AIRCRAFT | | | | | | |
|---|---|---|---|---|---|---|---|
| | TOTAL | Bomber | Fighter | Trans-port | Trainer | Heli-copter | Other |
| 1940 | 6,028 | 1,194 | 1,689 | 290 | 2,731 | — | 124 |
| 1941 | 19,445 | 4,119 | 4,421 | 532 | 9,376 | 7 | 990 |
| 1942 | 47,675 | 12,634 | 10,780 | 1,985 | 17,632 | — | 4,644 |
| 1943 | 85,433 | 29,362 | 24,005 | 7,013 | 19,942 | 22 | 5,089 |
| 1944 | 95,272 | 35,008 | 38,895 | 9,834 | 7,578 | 144 | 3,813 |
| 1945 | 46,865 | 16,502 | 21,578 | 4,613 | 1,309 | 275 | 2,588 |
| 1946 | 1,417 | 132 | 1,017 | 93 | — | 44 | 131 |
| 1947 | 2,122 | 317 | 909 | 98 | 3 | 57 | 738 |
| 1948 | 2,536 | 563 | 1,438 | 61 | 73 | 153 | 248 |
| 1949 | 2,592 | 656 | 1,316 | 68 | 87 | 73 | 392 |
| 1950 | 2,773 | 560 | 1,502 | 176 | 351 | 26 | 158 |
| 1951 | 5,446 | 510 | 2,073 | 271 | 612 | 360 | 1,620 |
| 1952 | 9,302 | 1,226 | 3,739 | 512 | 1,425 | 983 | 1,417 |
| 1953 | 10,626 | 1,243 | 4,665 | 784 | 1,961 | 943 | 1,030 |
| 1954 | 8,740 | 1,807 | 3,518 | 642 | 1,602 | 431 | 740 |
| 1955 | 8,032 | 1,378 | 4,021 | 534 | 1,438 | 444 | 217 |
| 1956 | 6,114 | 1,179 | 2,655 | 362 | 843 | 647 | 428 |
| 1957 | 5,619 | 895 | 2,373 | 229 | 819 | 689 | 614 |
| 1958[E] | 4,000 | N.A. | N.A. | N.A. | N.A. | N.A. | N.A. |
| 1959[E] | 2,000 | N.A. | N.A. | N.A. | N.A. | N.A. | N.A. |

NOTE: This "TOTAL" table includes aircraft bought for delivery to foreign countries and to other federal agencies.

[a] Number of aircraft. Excludes gliders and targets for entire period, airships prior to 1956, and experimental aircraft subsequent to 1949. "Other" includes liaison, observation, utility, search and rescue and basic reconnaissance types. Reconnaissance versions of bombers and fighters are included with bombers and fighters.

E—Estimate
N.A.—Not available.
Source: 20

*Aircraft and Missile Procurement:*

Expenditures for aircraft in 1961 are estimated at $6.02 billion, compared to $6.67 billion in 1960. New obligational authority for aircraft in the 1961 budget is estimated at $4.75 billion, compared to $6.16 billion in 1960. In missiles, expenditures are estimated at $3.47 billion for 1961, compared to $3.50 billion in 1960. The 1961 new missile obligational authority is estimated at $3.82 billion, compared to $3.24 billion in 1960. Total procurement expenditures are set at $13.6 billion in 1961, compared to $13.9 billion in 1960.

*Military Assistance:*

Expenditures for military assistance in 1961 are estimated at $1.75 billion, compared to $1.80 billion in 1960. Requests for new obligational authority for this purpose in 1961 are $2.0 billion, compared to $1.3

NEW MILITARY AIRCRAFT, BY TYPE[a], ACCEPTED BY THE DEPARTMENT OF THE AIR FORCE
1940 to Date

| Year | TYPE OF AIRCRAFT | | | | | | |
|---|---|---|---|---|---|---|---|
| | TOTAL | Bomber | Fighter | Transport | Trainer | Helicopter | Other |
| 1940 | 5,062 | 1,015 | 1,426 | 233 | 2,320 | — | 68 |
| 1941 | 8,723 | 880 | 1,727 | 133 | 5,585 | 7 | 391 |
| 1942 | 26,438 | 5,817 | 5,213 | 1,264 | 11,004 | — | 3,140 |
| 1943 | 45,889 | 15,022 | 11,766 | 5,072 | 11,246 | 19 | 2,764 |
| 1944 | 51,547 | 20,116 | 18,291 | 6,430 | 4,861 | 120 | 1,729 |
| 1945 | 26,231 | 9,490 | 10,591 | 3,043 | 825 | 241 | 2,041 |
| 1946 | 622 | 63 | 321 | 88 | — | 40 | 110 |
| 1947 | 565 | 7 | 301 | 95 | — | 36 | 126 |
| 1948 | 1,153 | 139 | 769 | 61 | 70 | 94 | 20 |
| 1949 | 1,475 | 250 | 921 | 65 | 86 | 24 | 129 |
| 1950 | 1,651 | 219 | 917 | 169 | 303 | 6 | 37 |
| 1951 | 2,149 | 152 | 1,158 | 240 | 517 | 14 | 68 |
| 1952 | 3,625 | 399 | 1,247 | 454 | 1,258 | 49 | 218 |
| 1953 | 5,674 | 489 | 2,862 | 578 | 1,381 | 165 | 199 |
| 1954 | 5,226 | 716 | 2,729 | 603 | 998 | 172 | 8 |
| 1955 | 4,117 | 632 | 2,346 | 466 | 578 | 82 | 13 |
| 1956 | 2,515 | 605 | 1,166 | 326 | 354 | 62 | 2 |
| 1957 | 2,467 | 318[b] | 1,494[c] | 216[d] | 343[e] | 16[f] | 80[g] |

[a] Number of aircraft. Excludes gliders and targets for entire period, airships prior to 1956, and experimental aircraft subsequent to 1949. "Other" includes liaison, observation, utility, search and rescue and basic reconnaissance types. Reconnaissance versions of bombers and fighters are included with bombers and fighters.
[b] Includes YB-47's; RB-52's; RB-57 s; RB-66's; B-58's; P-TV's.
[c] Includes RF-84's; F-100's; RF-101's; F-102's; F-104's; F-105's; F106's.
[d] Includes C-123's; C-130's; C-133's; KC-135's.
[e] Includes T-33's; T-37's.
[f] Includes H-13's; H-21's.
[g] Includes L-27's.
Source: 20

billion in 1960. In this connection, the President pointed out that the major purpose of this increase was to provide for the "new and costly weapons for which the free world still looks for help from the United States." He also noted that the forces of the countries included in MAP possess about five million army troops, 2,200 combatant ships and over 25,000 aircraft, about half of which are jets.

*Aircraft Procurement:*

Aircraft procurement continues to decline, with 1510 aircraft scheduled for the 1961 program—99 fewer than in 1960. Of this total, 633, are for the Air Force, 658 for the Navy and 219 for the Army. Production of B-52H's, B-58's and KC-135's will continue. An increased number of F-105's will be purchased, and procurement of C-130's and jet trainers will continue. For the Navy, the number of Navy attack aircraft to be purchased, including the A3J, will be increased. Procurement of

NEW MILITARY AIRCRAFT, BY TYPE[a], ACCEPTED BY THE DEPARTMENT OF THE NAVY

1940 to Date

| Year | TOTAL | TYPE OF AIRCRAFT | | | | | |
|---|---|---|---|---|---|---|---|
| | | Bomber | Fighter | Transport | Trainer | Helicopter | Other |
| 1940 | 966 | 179 | 263 | 57 | 411 | — | 56 |
| 1941 | 3,514 | 620 | 340 | 155 | 1,899 | — | 500 |
| 1942 | 8,347 | 2,093 | 1,259 | 290 | 3,586 | — | 1,119 |
| 1943 | 20,055 | 7,830 | 5,499 | 535 | 5,845 | 3 | 343 |
| 1944 | 25,579 | 10,236 | 12,090 | 1,215 | 1,787 | 24 | 227 |
| 1945 | 16,847 | 6,923 | 8,381 | 537 | 456 | 34 | 516 |
| 1946 | 795 | 69 | 696 | 5 | — | 4 | 21 |
| 1947 | 955 | 310 | 608 | 3 | 3 | 21 | 10 |
| 1948 | 1,203 | 424 | 669 | — | 3 | 59 | 48 |
| 1949 | 836 | 406 | 382 | 3 | 1 | 43 | 1 |
| 1950 | 977 | 341 | 560 | 7 | 48 | 5 | 16 |
| 1951 | 1,374 | 350 | 779 | 31 | 41 | 143 | 30 |
| 1952 | 2,164 | 794 | 870 | 25 | 105 | 353 | 17 |
| 1953 | 2,315 | 667 | 1,096 | 135 | 129 | 245 | 43 |
| 1954 | 2,367 | 1,090 | 782 | 23 | 405 | 46 | 21 |
| 1955 | 2,260 | 721 | 782 | 49 | 533 | 128 | 47 |
| 1956 | 1,966 | 559 | 750 | 36 | 424 | 152 | 45 |
| 1957 | 1,816 | 555[b] | 579[c] | 8[d] | 476[e] | 193[f] | 5[g] |

[a] Number of aircraft. Excludes gliders and targets for entire period, airships prior to 1956, and experimental aircraft subsequent to 1949. "Other" includes liaison, observation, utility, search and rescue and basic reconnaissance types. Reconnaissance versions of bombers and fighters are included with bombers and fighters.

[b] Includes P2V-7's; P5M-2's; PO-2W's (WV-2); AD-7's; A3D-2's; A4D-2's; FJ-4B's; S2F-1's.

[c] Includes F8U-1's; F4D-1's; F5D-1's; F9F-8's; F11F-1's; F3H-2's; FJ-4's.

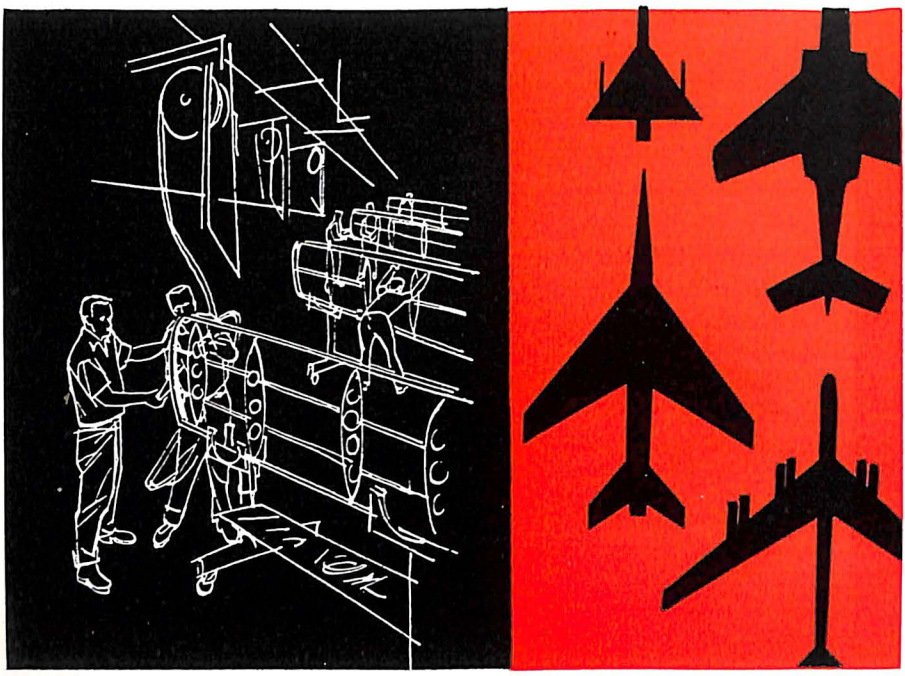
[d] Includes TF-1's; R4Y-2's.

[e] Includes F9F-8T's; TV-2's; T2V-1's; T34B's; T28C's; TT-1's.

[f] Includes HOK's, HRS-3's; HR2A-1's; HHS-1's; HSS-1's; HUS-1's.

[g] Includes ZPG-2W's; ZS2G-1's.

Source: 20



NEW MILITARY AIRCRAFT, BY TYPE[a], ACCEPTED BY THE DEPARTMENT OF THE ARMY

1948 to Date[b]

| Year | TYPE OF AIRCRAFT | | | | | | |
|---|---|---|---|---|---|---|---|
| | TOTAL | Bomber | Fighter | Transport | Trainer | Helicopter | Other |
| 1948 | 180 | — | — | — | — | — | 180 |
| 1949 | 74 | — | — | — | — | 6 | 68 |
| 1950 | 35 | — | — | — | — | 15 | 20 |
| 1951 | 1,532 | — | — | — | — | 192 | 1,340 |
| 1952 | 1,342 | — | — | — | — | 559 | 783 |
| 1953 | 989 | — | — | — | — | 463 | 526 |
| 1954 | 496 | — | — | — | — | 155 | 341 |
| 1955 | 289 | — | — | — | — | 200 | 89 |
| 1956 | 722 | — | — | — | — | 430 | 292 |
| 1957 | 915 | — | — | — | — | 450 | 465 |

[a] Number of aircraft. Excludes gliders and targets for entire period, airships prior to 1956, and experimental aircraft subsequent to 1949. "Other" includes liaison, observation, utility, search and rescue and basic reconnaissance types. Reconnaissance versions of bombers and fighters are included with bombers and fighters.

[b] For the years 1940 through 1947, aircraft for the Army Air Corps are included under Air Force.

[c] Includes H-13's; H-19's; H-21's; H-23's; YH-32's; H-34's; H-37's; YH-41's.

[d] Includes L-19's; L-20's; L-23's; L-26's; U-1's.

Source: 20

AIRFRAME WEIGHT OF MILITARY AIRCRAFT PRODUCED, BY TYPE
1940 TO DATE
(Weight in Millions of Pounds, Excluding Spares)

| Year | Total | Bombers | Fighters | Transports | Trainers | Other[a] |
|---|---|---|---|---|---|---|
| 1940 | 23.1 | 9.2 | 5.5 | 2.5 | 5.6 | .3 |
| 1941 | 81.4 | 40.9 | 16.4 | 3.8 | 18.1 | 2.2 |
| 1942 | 275.8 | 162.5 | 48.8 | 18.2 | 39.3 | 7.0 |
| 1943 | 654.2 | 423.0 | 121.8 | 55.5 | 47.1 | 6.8 |
| 1944 | 961.1 | 609.2 | 215.5 | 113.6 | 19.1 | 3.7 |
| 1945 | 539.4 | 331.1 | 124.7 | 75.5 | 3.4 | 4.7 |
| 1946 | 12.9 | 3.9 | 5.6 | 2.4 | — | 1.0 |
| 1947 | 11.4 | 3.3 | 4.5 | 2.5 | — | 1.1 |
| 1948 | 25.1 | 13.2 | 9.2 | 1.6 | .4 | .7 |
| 1949 | 30.3 | 18.0 | 8.7 | 2.4 | .5 | .7 |
| 1950 | 35.9 | 16.4 | 10.2 | 6.7 | 1.9 | .7 |
| 1951 | 50.2 | 17.0 | 15.7 | 11.5 | 3.1 | 2.9 |
| 1952 | 107.3 | 36.7 | 31.7 | 24.6 | 9.5 | 4.8 |
| 1953 | 138.0 | 44.1 | 40.7 | 36.5 | 11.3 | 5.4 |
| 1954 | 130.4 | 51.8 | 35.4 | 31.1 | 9.6 | 2.5 |
| 1955 | 114.3 | 39.9 | 43.2 | 20.9 | 7.4 | 2.9 |
| 1956 | 90.0 | N.A. | N.A. | N.A. | N.A. | N.A. |
| 1957 | 79.4 | N.A. | N.A. | N.A. | N.A. | N.A. |
| 1958[E] | 60.0 | N.A. | N.A. | N.A. | N.A. | N.A. |
| 1959[E] | 30.0 | N.A. | N.A. | N.A. | N.A. | N.A. |

NOTE: Data exclude gliders and targets for entire period and experimental aircraft subsequent to 1949.
[E] Estimate.
[a] "Other" includes helicopter, liaison, observation, utility, search and rescue and basic reconnaissance types; however, reconnaissance versions of bombers and fighters are included with bombers and fighters.
Source: 19

the F8U-2N and F4H will remain at about the same level. An increased number of GV1's and S2F's will be procured. Army aircraft procurement will increase more than 35 per cent over 1960, including the Mohawk, the Caribou, the Iroquois, and first production quantities of the Chinook.

*Guided Missiles Procurement:*

The 1961 budget requests funds for procurement and production of the four main strategic deterrent missiles—Atlas, Titan, Minuteman and Polaris. No new money for Jupiter and Thor. Hound Dog and Quail will continue at a high level. Procurement of Talos, Terrier and Tartar will continue. In addition, large numbers of Sparrow, Falcon and Side-

winder will be procured. Bullpup will be increased considerably over 1960. Pershing will continue on a high priority basis. Additional funds for Little John and an improved version of Honest John will be provided, together with Lacrosse and Sergeant missiles. A substantial procurement of Hawk missiles and the first production quantity of Redeye will be made in 1961, also, a sizeable quantity of Davy Crockett.

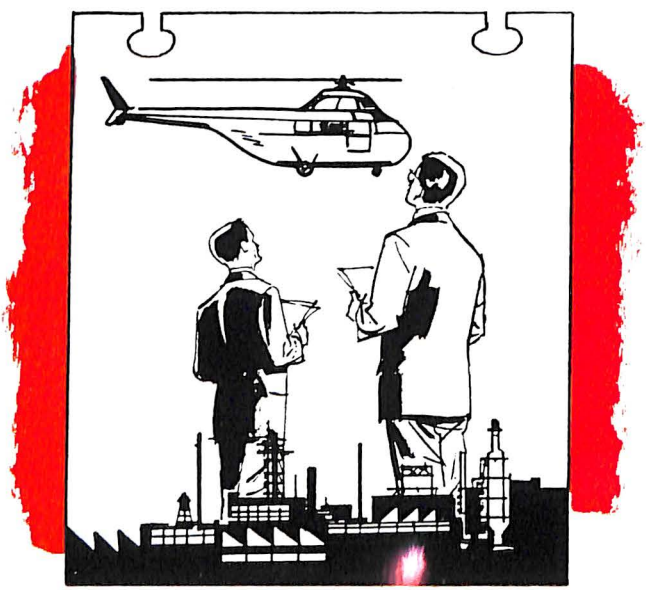
*Distribution of Funds in Department of Defense:*

Of the $40.99 billion expenditure estimated for 1961, the Air Force estimate is $18.61 billion, the Navy $11.68 billion, the Army $9.38 billion, and DOD $1.31 billion. Comparable 1960 figures are $18.82 billion, $11.57 billion, $9.34 billion, and $1.20 billion, respectively. Direct obliga-

HELICOPTER INVENTORY
1955 TO DATE

| June 30 | TOTAL[E] | Army | Navy[a,E] | Air Force[E] |
|---|---|---|---|---|
| 1955 | 2,268 | 1,188 | 650 | 430 |
| 1956 | 2,556 | 1,456 | 700 | 400 |
| 1957 | 3,061 | 1,901 | 800 | 360 |
| 1958 | 3,423 | 2,193 | 900 | 330 |
| 1959 | 3,657 | 2,357 | 1,000 | 300 |
| 1960 | N.A. | 2,714[E] | N.A. | N.A. |
| 1961 | N.A. | 2,840[E] | N.A. | N.A. |

[a] Includes Marine Corps.
[E] Estimate.
N.A.—Not available.
Sources: 19, 26



MILITARY AIRCRAFT IN DEVELOPMENT OR PRODUCTION
(FIXED WING)

| Designation | Name | Type | Service | Manufacturer |
|---|---|---|---|---|
| L-23-F | Seminole | Combat Command | Army | Beech |
| B-52H | Stratofortress | Bomber | USAF | Boeing |
| KC-135A | Stratotanker | Tanker | USAF | Boeing |
| T-37A | — | Trainer | USAF | Cessna |
| F8U-2N | Crusader | Fighter | Navy | Chance Vought |
| F-106A,B | Delta Dart | Fighter | USAF | Convair |
| B-58A | Hustler | Bomber | USAF | Convair |
| F4D | Skyray | Fighter | Navy | Douglas |
| A3D,-2P, -2Q,-2T | Skywarrior | Attack | Navy | Douglas |
| A4D-2N | Skyhawk | Attack | Navy | Douglas |
| C-133B | — | Cargo | USAF | Douglas |
| A2F-1 | — | Attack | Navy | Grumman |
| S2F-3 | Tracker | Anti-Sub | Navy | Grumman |
| TF-1 | Trader | Cargo/Utility | Navy | Grumman |
| F9F-8, -8P | Cougar | Fighter | Navy | Grumman |
| W2F | — | Patrol | Navy | Grumman |
| F11F-1 | Tiger | Fighter | Navy | Grumman |
| WF2 | Tracer | Patrol | Navy | Grumman |
| AO-1 | Mohawk | Observation Surveillance | Army | Grumman |
| WV-2 | Super Constellation | Anti-Sub | Navy | Lockheed |
| GV-1 | — | Tanker | Navy | Lockheed |
| F-104F | Starfighter | Fighter | USAF | Lockheed |
| C-130B | Hercules | Cargo | USAF | Lockheed |
| SC-130B | — | Recon | USAF | Lockheed |
| P2V-7 | Neptune | Patrol | Navy | Lockheed |
| P3V | — | Patrol | Navy | Lockheed |
| P6M-2 | Seamaster | Minelayer | Navy | Martin |
| P5M-2[a] | Marlin | Patrol | Navy | Martin |
| F3H-2N | Demon | Fighter | Navy | McDonnell |
| F4H-1 | — | Fighter | Navy | McDonnell |
| F101B | Voodoo | Fighter | USAF | McDonnell |
| RF101C | Voodoo | Fighter | USAF | McDonnell |
| A3J-1 | Vigilante | Attack | Navy | North American |
| B-70 | — | Bomber | USAF | North American |
| T-39A,B | Saberliner | Trainer | USAF | North American |
| T2J-1 | — | Trainer | Navy | North American |

(*Continued on next page*)

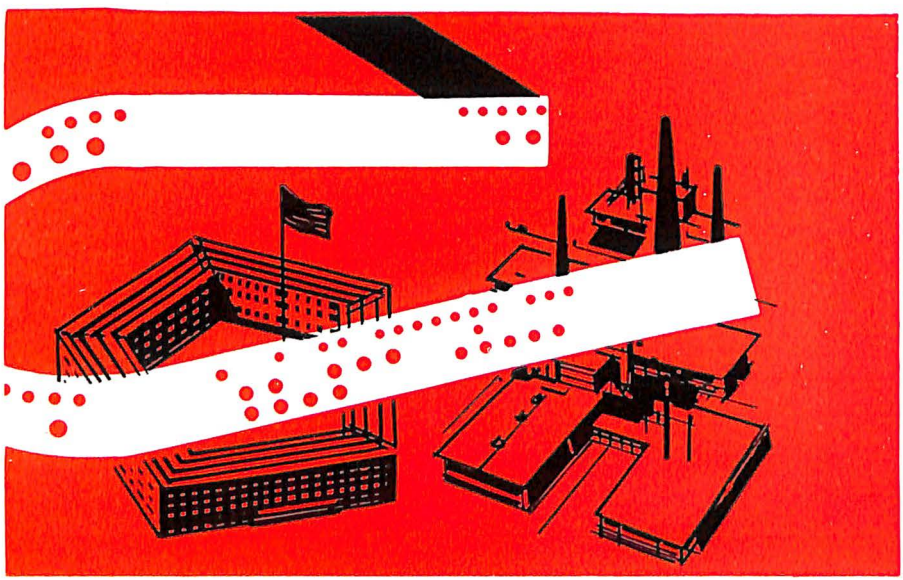
MILITARY AIRCRAFT IN DEVELOPMENT OR PRODUCTION—*Continued*
(FIXED WING)

| Designation | Name | Type | Service | Manufacturer |
|---|---|---|---|---|
| T-38A | — | Trainer | USAF | Northrop |
| F-105D | Thunderchief | Fighter | USAF | Republic |
| AC-1 | Caribou | Tactical Transport | Army | DeHavilland |
| UO1 | Aztec | Liaison | Navy | Piper |

[a] No further production—those in use being modified.
Source: 19

tions, which stem from new obligational authority and carry-over funds, will provide the Air Force with $18.99 billion, the Navy $12.14 billion, the Army $10.01 billion and DOD $1.27 billion.

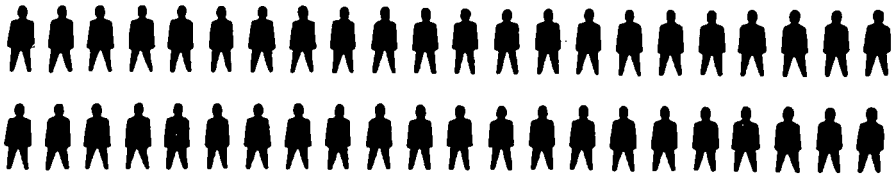
By the end of fiscal 1961, the Air Force is scheduled to have 91 wings, compared to 105 at the end of fiscal 1959. The major reduction during 1960 will be effected in air defense tactical wings. The Navy will operate 16 carrier air groups in 1961, and 3 Marine air wings. Army aviation active aircraft inventory is scheduled to include about 4,800 aircraft. At the present time, within the Strategic and Tactical Air Command structures, there is a combined total of 59 air refueling squadrons. By fiscal year end of 1960 these two commands will be operating 62 refueling squadrons.



PERSONNEL IN THE UNITED STATES AIR FORCE, 1912 TO DATE

| As of June 30 | TOTAL | Officers | Aviation Cadets | Airmen |
|---|---|---|---|---|
| 1912[a] | 51 | 12 | — | 39 |
| 1914 | 122 | 18 | — | 104 |
| 1916 | 311 | 63 | — | 248 |
| 1918[b] | 195,023 | 20,708 | — | 174,315 |
| 1920 | 9,050 | 969 | — | 8,081 |
| 1922 | 9,642 | 958 | 113 | 8,571 |
| 1924 | 10,547 | 884 | 119 | 9,544 |
| 1926 | 9,674 | 954 | 142 | 8,578 |
| 1928 | 10,549 | 1,055 | 280 | 9,214 |
| 1930 | 13,531 | 1,499 | 378 | 11,654 |
| 1932 | 15,028 | 1,659 | 325 | 13,044 |
| 1934 | 15,861 | 1,545 | 318 | 13,998 |
| 1936 | 17,233 | 1,593 | 328 | 15,312 |
| 1938 | 21,089 | 2,179 | 342 | 18,568 |
| 1940 | 51,165 | 3,361 | 1,894 | 45,910 |
| 1941 | 152,125 | 10,611 | 8,627 | 132,887 |
| 1942 | 764,415 | 55,956 | 50,213 | 658,246 |
| 1943 | 2,197,114 | 205,874 | 99,672 | 1,891,568 |
| 1944 | 2,372,292 | 333,401 | 82,647 | 1,956,244 |
| 1945 | 2,282,259 | 381,454 | 16,764 | 1,884,041 |
| 1946 | 455,515 | 81,733 | 7 | 373,775 |
| 1947 | 305,827 | 42,745 | 53 | 263,029 |
| 1948 | 387,730 | 48,957 | 1,338 | 337,435 |
| 1949 | 419,347 | 57,851 | 1,860 | 359,636 |
| 1950 | 411,277 | 57,006 | 2,186 | 352,085 |
| 1951 | 788,381 | 107,099 | 2,476 | 678,806 |
| 1952 | 973,474 | 128,401 | 6,782 | 838,291 |
| 1953 | 977,593 | 130,769 | 9,157 | 837,667 |
| 1954 | 947,918 | 129,752 | 9,072 | 809,094 |
| 1955 | 959,946 | 137,149 | 4,384 | 818,413 |
| 1956 | 909,958 | 142,093 | 3,256[e] | 764,609 |
| 1957 | 919,835 | 140,563 | 2,706[d] | 776,566 |
| 1958 | 871,156 | 132,939 | 2,458[e] | 735,759 |
| 1959 | 840,435 | 131,602 | 4,271[f] | 704,562 |
| 1960[E] | 825,000 | N.A. | N.A. | N.A. |
| 1961[E] | 825,000 | N.A. | N.A. | N.A. |

[E] Estimate.
N.A.—Not available.
[a] As of November 1.
[b] As of November 11.
[f] This category includes 1,614 Air Force Academy Cadets.
[d] This category includes 504 Air Force Academy Cadets.
[e] This category includes 1,169 Air Force Academy Cadets.
[f] This category includes 1,169 Air Force Academy Cadets.
Sources: 3, 6, 26



ARMY AVIATORS[a] ON ACTIVE DUTY, 1950 TO DATE

| As of June 30 | Total Number |
|---|---|
| 1950 | 1,050 |
| 1951 | 1,372 |
| 1952 | 1,933 |
| 1953 | 2,227 |
| 1954 | 2,528 |
| 1955 | 3,097 |
| 1956 | 4,156 |
| 1957 | 5,050 |
| 1958 | 5,611 |
| 1959 | 5,984 |

[a] Enlisted personnel statistics not available prior to November 30, 1959, when the number was 10,993.
Source: 9

NAVAL AVIATION PERSONNEL[a], 1941 TO DATE

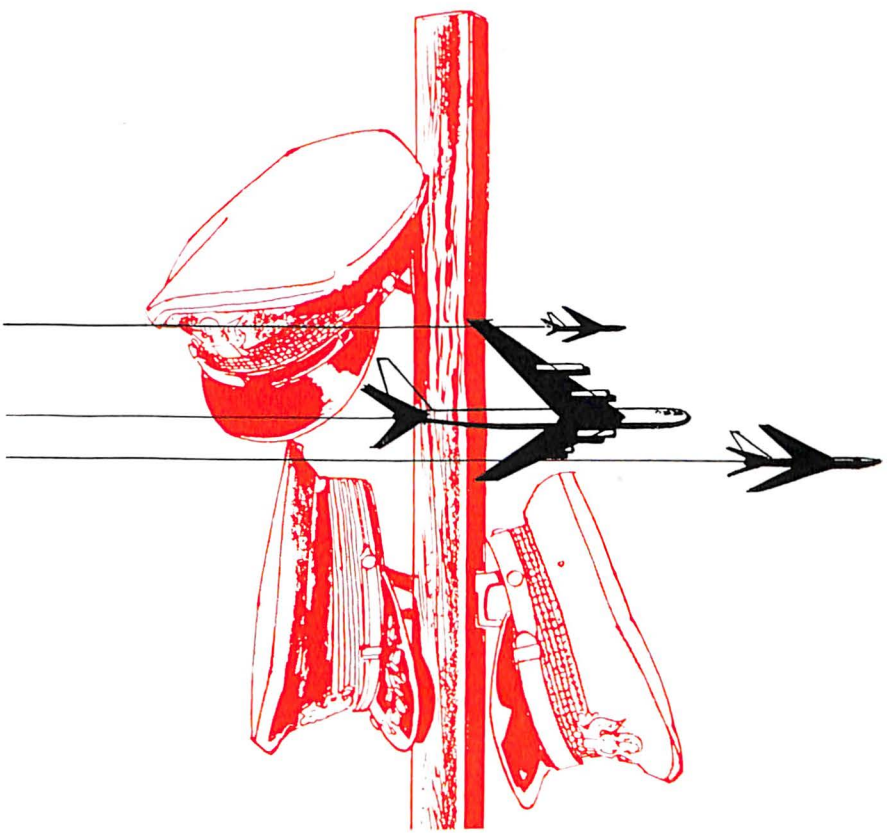
| Year as of June 30 | TOTAL | Pilots | Enlisted Aviation Rates | Aviation Ground Officers |
|---|---|---|---|---|
| 1941 | 23,148 | 6,300 | 14,848 | 2,000 |
| 1944[b] | 299,968 | 47,276 | 228,356 | 24,336 |
| 1950 | 91,298 | 12,978 | 76,349 | 1,971 |
| 1951 | 162,214 | 18,287 | 139,838 | 4,089 |
| 1952 | 194,730 | 20,944 | 168,486 | 5,300 |
| 1953 | 196,813[c] | 22,903 | 163,673 | 4,930 |
| 1954 | 179,783[c] | 21,316 | 147,670 | 4,725 |
| 1955[d] | 165,243[c] | 21,352 | 133,424 | 4,885 |
| 1956[e] | 204,388 | 23,740 | 175,588 | 5,060 |
| 1957 | 212,684 | 23,101 | 181,847 | 7,736 |
| 1958 | 202,884 | 23,214 | 172,777 | 6,893 |
| 1959 | 191,077 | 22,593 | 161,931 | 6,553 |

[a] Navy and Marine.
[b] Pilots as of Aug. 31; others as of October 31.
[c] Includes non-pilots in flying status and formerly designated pilots.
[d] As of January 1.
[e] As of November 30, 1956.
Sources: 3, 41

The Military Air Transport Service currently includes 27 squadrons comprising 9 wings. By fiscal year end 1961, however, MATS will be reduced by six squadrons. There are 34 other specialized squadrons currently within the Air Force structure comprising communications, air rescue, etc. By end of fiscal 1961 these will be reduced to 28.

*Organization of Wings, Air Groups*

Air Force: The basic organization unit of the United States Air Force is the "wing." A wing is comprised of a combat group and necessary administrative and service units. The number of airplanes in a wing depends on its mission; for example, a wing of heavy bombers has 45 planes, a medium bomber wing has 45, a light bomber wing 48, a day fighter wing 75, an all-weather fighter squadron 25. The USAF also operates separate squadrons for rescue, support and in-flight refueling. There are 20 aircraft per in-flight refueling squadron. There are 6 to 10 aircraft per air rescue squadron depending on the mission.



## Appropriations and Expenditures for Military Aviation
### 1899 to Date
(Millions of Dollars)

| Fiscal Year | U. S. Air Force | | Naval Aviation[a] | |
|---|---|---|---|---|
| | Total Cash Appropriations | Expenditures | Total Cash Appropriations | Expenditures |
| 1899 | $ .05 | N.A. | $ — | N.A. |
| 1909 | .03 | N.A. | — | N.A. |
| 1912 | .12 | N.A. | .03 | N.A. |
| 1913 | .10 | N.A. | .01 | N.A. |
| 1914 | .17 | N.A. | .01 | N.A. |
| 1915 | .20 | N.A. | .01 | N.A. |
| 1916 | .80 | N.A. | 1.0 | N.A. |
| 1917 | 18.7 | N.A. | 3.8 | N.A. |
| 1918 | 735.0 | N.A. | 61.5 | N.A. |
| 1919 | 952.3 | N.A. | 220.4 | N.A. |
| 1920 | 28.1 | N.A. | 25.7 | N.A. |
| 1921 | 35.1 | $ 30.9 | 20.0 | N.A. |
| 1922 | 25.6 | 23.1 | 19.1 | $ 14.3 |
| 1923 | 13.1 | 18.1 | 14.8 | 14.2 |
| 1924 | 12.6 | 11.0 | 14.7 | 14.3 |
| 1925 | 13.5 | 11.7 | 15.7 | 15.5 |
| 1926 | 15.9 | 14.9 | 18.2 | 18.1 |
| 1927 | 15.3 | 16.8 | 22.4 | 22.0 |
| 1928 | 21.1 | 19.4 | 20.3 | 19.8 |
| 1929 | 28.9 | 23.3 | 32.3 | 32.1 |
| 1930 | 34.9 | 28.1 | 31.6 | 31.1 |
| 1931 | 38.9 | 38.7 | 32.1 | 31.0 |
| 1932 | 31.9 | 33.0 | 31.2 | 31.7 |
| 1933 | 25.7 | 22.1 | 25.4 | 31.2 |
| 1934 | 31.0 | 17.6 | 29.8 | 15.5 |
| 1935 | 27.9 | 20.5 | 32.1 | 17.2 |
| 1936 | 45.6 | 32.2 | 40.8 | 20.5 |
| 1937 | 59.6 | 41.3 | 38.9 | 27.5 |
| 1938 | 58.9 | 51.1 | 51.6 | 59.8 |
| 1939 | 71.1 | 83.4 | 48.2 | 47.9 |
| 1940 | 186.6 | 108.5 | 111.8 | 50.8 |
| 1941 | 2,173.6 | 605.9 | 453.0 | 193.6 |
| 1942 | 23,049.9 | 2,555.2 | 6,190.0 | 993.1 |
| 1943 | 11,317.4 | 9,392.4 | 5,258.0 | 3,966.4 |

*(Continued top next page)*

APPROPRIATIONS AND EXPENDITURES FOR MILITARY AVIATION
1899 TO DATE—*Continued*
(Millions of Dollars)

| Fiscal Year | U. S. Air Force | | Naval Aviation[a] | |
|---|---|---|---|---|
| | Total Cash Appropriations | Expenditures | Total Cash Appropriations | Expenditures |
| 1944 | 23,656.0 | 13,087.7 | 4,583.7 | 4,490.1 |
| 1945 | 1,610.7 | 11,357.4 | 2,539.6 | 5,166.0 |
| 1946 | .5 | 2,519.4 | 795.0 | 1,065.7 |
| 1947 | 1,200.0 | 854.3 | 770.8 | 749.1 |
| 1948 | 608.1 } [b] 829.8 } | 1,199.1 | 906.0 | 747.9 |
| 1949 | 938.8 | 1,059.2 | 588.3 | 875.1 |
| 1950 | 4,139.4 | 3,599.9 | 1,041.5 | 989.4 |
| 1951 | 15,791.1 | 6,348.6 | 3,815.3 | 1,237.3 |
| 1952 | 22,974.7 | 12,712.4 | 5,266.5 | 2,205.2 |
| 1953[E] | 22,076.2 | 15,089.6 | 4,873.0 | 3,061.3 |
| 1954 | 11,402.4 | 15,668.5 | 2,322.0 | 3,235.6 |
| 1955 | 11,715.8 | 16,406.7 | 2,749.5 | 2,554.8 |
| 1956 | 15,681.3 | 16,748.8 | 1,711.7 | 2,836.1 |
| 1957 | 17,696.5 | 18,362.7 | 2,543.7 | 3,053.3 |
| 1958 | 17,732.0 | 18,435.0 | 2,682.8 | 3,358.6 |
| 1959 | 18,713.0 | 19,084.0 | 2,033.8 | 2,442.0 |
| 1960[E] | 18,475.0 | 18,823.6 | 1,961.6 | 1,979.0 |
| 1961[E] | 17,737.0 | 18,614.0 | 2,113.0 | 1,989.0 |

NOTE: For details on missiles see separate tables in this and the missiles chapter.
N.A.—Not available.
E Estimate.
[a] Includes "Aircraft and Related Procurement" and "Aircraft and Facilities" until 1960. Beginning with 1961 "Procurement of Aircraft and Missiles."
[b] FY 1949 Construction of Aircraft & Related Procurement appropriation enacted in FY 1948.
Sources: 3, 26

Navy: Navy carrier air groups usually are composed of 2 fighter squadrons; 3 attack squadrons; 1 heavy attack squadron or detachment; 4 photo planes; and 6 aircraft early warning (AEW) planes and one detachment of helicopters. Super aircraft carriers of the Forrestal Class (54,600 tons) have up to 80 or 100 aircraft. Large Midway Class (51,000 tons) carriers have slightly less aircraft, while medium sized carriers of the Essex Class (33,000 tons) have a complement of 70 to 80 aircraft. Antisubmarine squadrons attached to ASW support carriers average 40 aircraft, and shore-based patrol squadrons have a complement of 12 planes each. Marine fighter squadrons are assigned 20 aircraft.

Army: An Army detachment currently has 26 to 28 aircraft per division, depending on whether it is infantry or armor and is assigned to a division in liaison, reconnaissance, observation, or courier missions. Helicopter companies are light, medium or heavy, depending upon the type of helicopters used. Each company has 21 helicopters. A fixed-wing group has 21 basic 1½-ton, 11-passenger aircraft and is assigned to field Army level.

TOTAL FEDERAL EXPENDITURES AND EXPENDITURES FOR MILITARY AIRCRAFT AND GUIDED MISSILES
1922 TO DATE
(Dollar Figures in Millions)

| Fiscal Year | Total Federal Expenditures | Total Military Expenditures[a] | Expenditures for Aircraft and Missiles[b] | Percent Aircraft and Missiles of Total Federal | Percent Aircraft and Missiles of Military |
|---|---|---|---|---|---|
| 1922 | $ 3,373 | $ 935 | $ 6 | .2 | .6 |
| 1923 | 3,295 | 730 | 7 | .2 | 1.0 |
| 1924 | 3,049 | 689 | 10 | .3 | 1.5 |
| 1925 | 3,063 | 717 | 10 | .3 | 1.4 |
| 1926 | 3,098 | 677 | 12 | .4 | 1.8 |
| 1927 | 2,974 | 688 | 14 | .5 | 2.0 |
| 1928 | 3,103 | 732 | 22 | .7 | 3.0 |
| 1929 | 3,299 | 791 | 29 | .9 | 3.7 |
| 1930 | 3,440 | 839 | 31 | .9 | 3.7 |
| 1931 | 3,652 | 832 | 31 | .8 | 3.7 |
| 1932 | 4,535 | 834 | 29 | .6 | 3.5 |
| 1933 | 3,864 | 784 | 25 | .6 | 3.2 |
| 1934 | 6,011 | 706 | 13 | .2 | 1.8 |
| 1935 | 7,010 | 924 | 23 | .3 | 2.5 |
| 1936 | 8,666 | 1,147 | 44 | .5 | 3.8 |
| 1937 | 8,177 | 1,185 | 58 | .7 | 4.9 |
| 1938 | 7,239 | 1,240 | 67 | .9 | 5.4 |
| 1939 | 8,707 | 1,368 | 68 | .8 | 5.0 |
| 1940 | 8,998 | 1,799 | 205 | 2.3 | 11.4 |
| 1941 | 12,711 | 6,252 | 587 | 4.6 | 9.4 |
| 1942 | 32,297 | 22,905 | 2,915 | 9.0 | 12.7 |
| 1943 | 76,179 | 63,414 | 10,072 | 13.2 | 15.9 |
| 1944 | 93,744 | 75,976 | 12,828 | 13.7 | 16.9 |
| 1945 | 100,405 | 80,357 | 11,521 | 11.5 | 14.3 |
| 1946 | 60,703 | 43,151 | 1,649 | 2.7 | 3.8 |

(*Continued on next page*)

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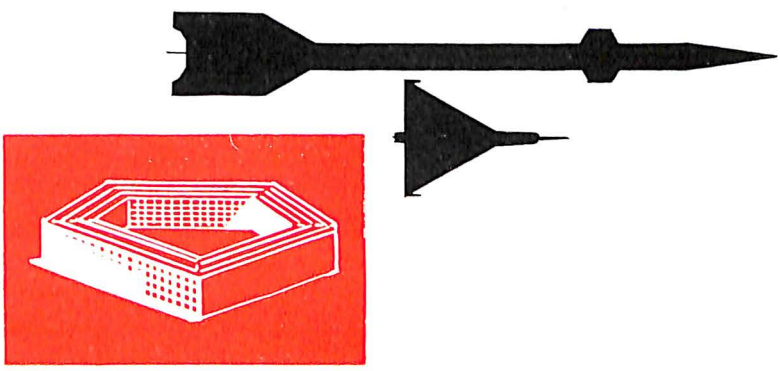
TOTAL FEDERAL EXPENDITURES AND EXPENDITURES FOR MILITARY AIRCRAFT AND GUIDED MISSILES
1922 TO DATE
(Dollar Figures in Millions)

| Fiscal Year | Total Federal Expenditures | Total Military Expenditures[a] | Expenditures for Aircraft and Missiles[b] | Percent Aircraft and Missiles of Total Federal | Percent Aircraft and Missiles of Military |
|---|---|---|---|---|---|
| 1947 | 39,289 | 14,769 | 593 | 1.5 | 4.0 |
| 1948 | 33,791 | 11,983 | 703 | 2.1 | 5.9 |
| 1949 | 40,057 | 13,988 | 1,248 | 3.1 | 8.9 |
| 1950 | 39,617 | 13,009 | 1,705 | 4.3 | 13.1 |
| 1951 | 44,058 | 22,444 | 2,433[c] | 5.5 | 10.8 |
| 1952 | 65,408 | 45,963 | 5,057[c] | 7.7 | 11.0 |
| 1953 | 74,274 | 51,830 | 7,712[c] | 10.4 | 14.9 |
| 1954 | 67,772 | 47,872 | 8,839[c] | 17.6 | 18.5 |
| 1955 | 64,570 | 42,089 | 8,755[c] | 13.6 | 20.8 |
| 1956 | 66,540 | 41,825 | 8,314[c] | 12.5 | 19.9 |
| 1957 | 69,433 | 44,414 | 10,073[c] | 14.5 | 22.7 |
| 1958 | 71,936 | 44,142 | 11,185[c] | 15.5 | 25.3 |
| 1959[d] | 80,697 | 46,425 | 11,152[c] | 13.8 | 24.0 |
| 1960[d,E] | 78,383 | 45,650 | 9,479[c] | 13.0 | 22.3 |
| 1961[d,E] | 79,816 | 45,568 | 9,506[c] | 11.9 | 20.9 |

[d] Data are not directly iomparable to those for earlier years because of changes in title classifications and in funding.
[E] Estimate.
[a] Includes stockpiling Mutual Defense, and Atomic Energy.
[b] Includes related items.
[c] Procurement and Production, military functions only.
[d] Data are not directly comparable to those for earlier years because of changes in title classification: and in funding.
Sources: 3, 18, 20, 26



DEPARTMENT OF DEFENSE
EXPENDITURES FOR PRODUCTION AND PROCUREMENT, TOTAL AND AIRCRAFT
1951 TO DATE
(Millions of Dollars)

| Year Ending June 30 | Total Procurement and Production | Aircraft | Aircraft as Percent of Total |
|---|---|---|---|
| 1951 | $ 3,976 | $2,412 | 60.7 |
| 1952 | 11,478 | 4,888 | 42.2 |
| 1953 | 17,123 | 7,417 | 43.3 |
| 1954 | 15,958 | 8,335 | 52.2 |
| 1955 | 12,997 | 8,037 | 61.8 |
| 1956 | 12,182 | 7,146 | 58.6 |
| 1957 | 13,649 | 7,978 | 59.5 |
| 1958 | 14,677 | 8,448 | 57.6 |
| 1959 | 14,410 | 7,658 | 53.1 |
| 1960[E] | 13,943 | 6,670 | 47.8 |
| 1961[E] | 13,602 | 6,027 | 44.3 |

Sources: 20, 21

DEPARTMENT OF DEFENSE
EXPENDITURES FOR AIRCRAFT PROCUREMENT, BY AGENCY
1951 TO DATE
(Millions of Dollars)

| Year Ending June 30 | Total Defense Department | Air Force | Navy | Army |
|---|---|---|---|---|
| 1951 | $2,412 | $1,812 | $ 594 | $ 7 |
| 1952 | 4,888 | 3,633 | 1,205 | 51 |
| 1953 | 7,417 | 5,586 | 1,735 | 95 |
| 1954 | 8,335 | 6,254 | 1,998 | 83 |
| 1955 | 8,037 | 6,295 | 1,676 | 67 |
| 1956 | 7,146 | 5,181 | 1,831 | 134 |
| 1957 | 7,978 | 5,817 | 1,996 | 166 |
| 1958 | 8,448 | 6,084 | 2,207 | 157 |
| 1959 | 7,658 | 5,393 | 2,152 | 113 |
| 1960[E] | 6,670 | 4,879 | 1,683 | 108 |
| 1961[E] | 6,027 | 4,232 | 1,663 | 132 |

[E] Estimate.
Sources: 20, 21

DEPARTMENT OF DEFENSE
UNOBLIGATED FUNDS AVAILABLE FOR PROCUREMENT, FEBRUARY 29, 1960
TOTAL AND AIRCRAFT
(Millions of Dollars)

| | Total Procurement and Production | Aircraft | Aircraft as Percent of Total |
|---|---|---|---|
| Defense Department .... | $12,611 | $5,750 | 45.6 |
| Air Force ..... | 6,791 | 3,769 | 55.5 |
| Navy ..... | 4,186 | 1,861 | 44.5 |
| Army ..... | 1,634 | 120 | 7.3 |

Source: 20

DEPARTMENT OF DEFENSE
UNPAID OBLIGATIONS, JANUARY 31, 1960
TOTAL AND AIRCRAFT
(Million Dollars)

| | Total Procurement and Production | Aircraft | Aircraft as Percent of Total |
|---|---|---|---|
| Defense Department .... | $15,132 | $6,145 | 40.6 |
| Air Force ..... | 7,732 | 3,889 | 50.3 |
| Navy ..... | 5,393 | 2,140 | 39.7 |
| Army ..... | 2,006 | 115 | 5.7 |
| Office of Secretary of Defense ..... | 1 | — | — |

Source: 23

DEPARTMENT OF DEFENSE
NEW OBLIGATIONAL AVAILABILITY FOR PRODUCTION AND PROCUREMENT, TOTAL AND AIRCRAFT
1951 TO DATE
(Millions of Dollars)

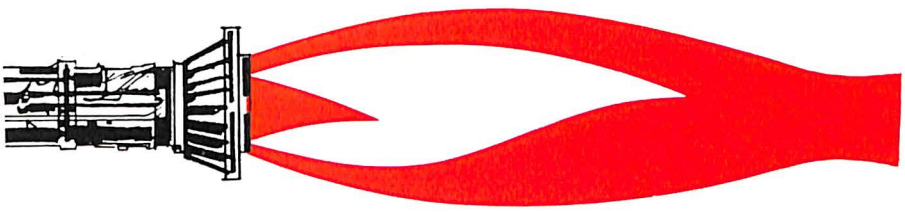
| Year Ending June 30 | Total Procurement and Production | Aircraft | Aircraft as Percent of Total |
|---|---|---|---|
| 1951 | $23,114 | $ 8,686 | 37.6 |
| 1952 | 29,536 | 13,471 | 45.6 |
| 1953 | 19,956 | 13,346 | 66.9 |
| 1954 | 10,432 | 4,470 | 42.8 |
| 1955 | 7,149 | 4,403 | 61.6 |
| 1956 | 9,653 | 6,241 | 64.7 |
| 1957 | 11,737 | 6,303 | 53.7 |
| 1958 | 11,399 | 5,726 | 50.2 |
| 1959[a] | 15,296 | 6,346 | 41.5 |
| 1960[a,E] | 13,261 | 6,160 | 46.5 |
| 1961[a,E] | 13,085 | 4,753 | 36.3 |

[E] Estimate.
[a] Data are not directly comparable to those for earlier years because of changes in title classifications and in funding.
Sources: 20, 24

DEPARTMENT OF DEFENSE
NEW OBLIGATIONAL AVAILABILITY FOR AIRCRAFT PROCUREMENT, BY AGENCY
1951 TO DATE
(Millions of Dollars)

| Year Ending June 30 | Total Defense Department | Air Force | Navy | Army |
|---|---|---|---|---|
| 1951 | $ 8,686 | $ 6,247 | $2,304 | $135 |
| 1952 | 13,471 | 10,091 | 3,335 | 44 |
| 1953 | 13,346 | 10,202 | 3,119 | 25 |
| 1954 | 4,470 | 3,080 | 1,276 | 114 |
| 1955 | 4,403 | 2,480 | 1,923 | . . |
| 1956 | 6,241 | 5,480 | 761 | . . |
| 1957 | 6,303 | 4,821 | 1,483 | . . |
| 1958 | 5,726 | 4,190 | 1,536 | . . |
| 1959[a] | 6,346 | 4,535 | 1,681 | 130 |
| 1960[a,E] | 6,160 | 4,285 | 1,775 | 100 |
| 1961[a,E] | 4,753 | 2,994 | 1,640 | 119 |

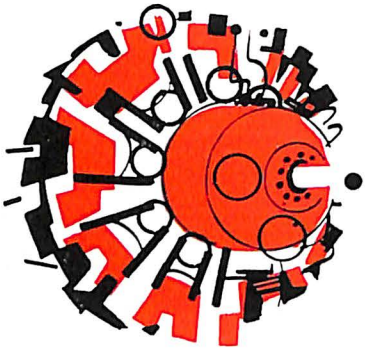
[E] Estimate
[a] Data are not directly comparable to those for earlier years because of changes in title classifications and in funding.
Sources: 20, 24



USAF Aircraft Engine Inventory

| Engine Type & Model | January 1957 | January 1958 | January 1959 |
|---|---|---|---|
| J-33 | 7,537 | 7,064 | 5,834 |
| J-35 | 6,898 | 5,096 | 3,237 |
| J-47 | 29,174 | 26,974 | 24,098 |
| J-48 | 824 | 712 | 297 |
| J-57 | 6,182 | 10,260 | 13,450 |
| J-65 | 5,955 | 4,257 | 3,856 |
| J-69 | — | 682 | 917 |
| J-71 | 741 | 889 | 883 |
| J-73 | 818 | 817 | 730 |
| J-75 | — | 49 | 236 |
| J-79 | — | 212 | 514 |
| R-985 | 3,604 | 3,082 | 2,483 |
| R-1300 | 2,286 | 2,319 | 2,002 |
| R-1340 | 1,823 | 1,051 | 659 |
| R-1820 | 2,241 | 1,667 | 1,220 |
| R-1830 | 5,885 | 5,419 | 5,044 |
| R-2000 | 3,587 | 3,370 | 2,933 |
| R-2600 | 3,265 | 3,206 | 2,275 |
| R-2800 | 8,427 | 6,842 | 5,092 |
| R-3350 | 7,555 | 4,365 | 3,785 |
| R-4360 | 15,911 | 14,644 | 13,497 |
| T-34 | — | 192 | 309 |
| T-56 | — | 1,238 | 1,553 |
| Others | 6,233 | 3,846 | 3,853 |
| Total | 118,946 | 108,253 | 98,739 |

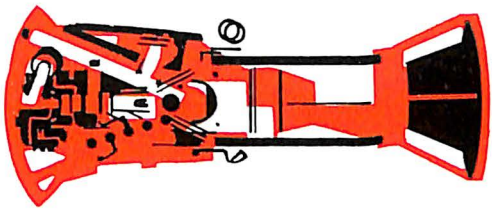
Note: Inventory includes all engines, inactive and active, in use and awaiting repair and ready for installation.
Source: 5



U. S. Army Aircraft Engine Inventory

| Engine Type and Model | January 1958 | January 1959 |
|---|---|---|
| H-RJ2B | 6 | 4 |
| O-335-3 | 1 | 4 |
| O-335-4 | 83 | 57 |
| O-335-5 | 692 | 1,175 |
| O-335-6 | 504 | 750 |
| O-360-C2B | — | 2 |
| O-435-17 | 241 | 305 |
| O-435-23 | 147 | 461 |
| O-470-7 | 34 | — |
| O-470-11 | 2,003 | 2,557 |
| O-470-15 | 121 | 408 |
| O-480-A, B, C, G | 38 | 54 |
| O-480-1 | 170 | 391 |
| O-526-A | — | 13 |
| O-580-A1A | 4 | 3 |
| P-ALOUSE | — | 5 |
| R-1300-3 | 232 | 229 |
| R-1340-AN | 82 | 230 |
| R-1340-57 | 88 | 92 |
| R-1820-84 | 432 | 690 |
| R-1820-103 | 320 | 510 |
| R-2000-4 | — | 82 |
| R-2800-54 | 48 | 183 |
| R-755 | 67 | 115 |
| R-975-46 | 101 | 3 |
| R-985 | 505 | 691 |
| T-53 | — | 22 |
| Total | 5,919 | 9,036 |

Note: Inventory includes all engines, serviceable and unserviceable.
Source: 8



U. S. Navy Aircraft Engine Inventory

| Engine Type and Model | January 1957 | January 1958 | January 1959 |
|---|---|---|---|
| J-33 | 1,960 | 1,926 | 1,689 |
| J-34 | 3,666 | 3,353 | 2,764 |
| J-44 | — | 101 | 313 |
| J-48 | 2,678 | 2,781 | 2,783 |
| J-57 | 883 | 1,601 | 1,831 |
| J-65 | 1,621 | 2,339 | 2,410 |
| J-69-2 | — | 14 | 22 |
| J-71 | 218 | 486 | 623 |
| T-58-GE-2 | — | 12 | 10 |
| O-335 | 227 | 240 | 208 |
| O-435 | 266 | 153 | 59 |
| O-470 | 548 | 787 | 763 |
| R-760-8 | 96 | 98 | 96 |
| R-975-46 | 454 | 410 | 399 |
| R-985-AN | 2080 | 1,261 | 916 |
| R-985-14B | 1,901 | 1,973 | 2,063 |
| R-1300 | 425 | 423 | 435 |
| R-1340 | 3,191 | 2,862 | 210 |
| R-1820 | 3,694 | 4,400 | 4,193 |
| R-1830 | 3,180 | 1,970 | 745 |
| R-2000 | 1,173 | 1,120 | 1,085 |
| R-2800 | 7,884 | 4,857 | 1,354 |
| R-3350 | 7,202 | 7,195 | 6,856 |
| R-4360 | 491 | 324 | 237 |
| Total | 43,838 | 40,686 | 32,064 |

Note: Inventory includes all engines, inactive and active, in use and awaiting repair and ready for installation with the exception of two engine models for which inventory data is classified.
Source: 41

## Brief Glossary of Terms Used In Federal and Military Budgeting and Financial Accounting

*Apportionment:* A ceiling established by the Bureau of the Budget of amounts available to an agency for obligation or expenditure in an appropriation or fund account for specified time periods, activities, functions, projects, objects, or combinations thereof. The apportioned amount is the limit to the obligations that may be incurred by the agency receiving the apportionment.

*Appropriation:* An act of Congress authorizing an agency to incur obligations and make payments out of funds held by the Treasury.

*Available for Obligation:* Total funds available to an agency for obligation including (one) unobligated carryover from prior years' funds, (two) new funds from apportionments and appropriations, (three) anticipated reimbursements, and (four) recoveries of prior years' obligations.

*Available for Expenditure:* Total funds available to an agency for expenditure. At any one time the total includes unexpended carryover from prior years and new obligational availability. Funds available for expenditure are net of refunds and reimbursements.

*Expenditures:* Payments by cash or check from the Treasury to liquidate obligations. When expenditure totals are reported, refunds, etc. are excluded.

*New Obligational Authority:* Congressional appropriations and reappropriations.

*New Obligational Availability:* New obligational authority plus transfers.

*Obligation:* An act by an agency of order placed, contract awarded, service received, or similar transaction resulting in the creation of a liability upon the Federal Government to pay money out of the Treasury to the private party for the transaction.

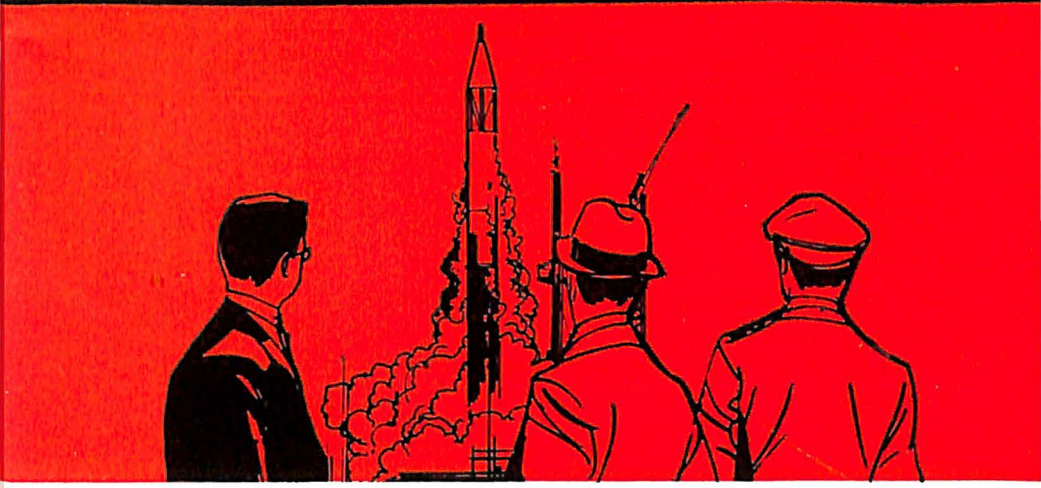
*Recoveries of Prior Year Obligations:* Cancellation of obligations recorded in previous years without disimbursement of funds. Such recoveries increase the total amount available for obligation in current programs if specifically reapportioned.

*Transfer:* A transaction which withdraws and decreases amounts available for obligation and expenditure from one appropriation or fund account and increases different appropriation or fund account.

Source: 19, 26

# 3

# GUIDED MISSILES



Today our *primary* aerospace power remains the long-ranged manned jet bombers. The manned bombers will continue to be the backbone of our aerospace power for the next several years until this nation attains *complete* operational capability with significant numbers of intermediate range and intercontinental ballistic missiles. There will follow for the foreseeable future a missile and bomber "mix"—an aerospace retaliatory strategic force in which the capabilities of ballistic missiles and manned aircraft are combined. The shift in air power emphasis from manned aircraft to missiles is having a profound effect on the aerospace industry and the nation. A typical ballistic missile today costs about $100 per pound, not including the warhead. Hence mass production of these weapons, as the U. S. public thinks of mass production in terms of planes, guns and artillery pieces, is not practical.

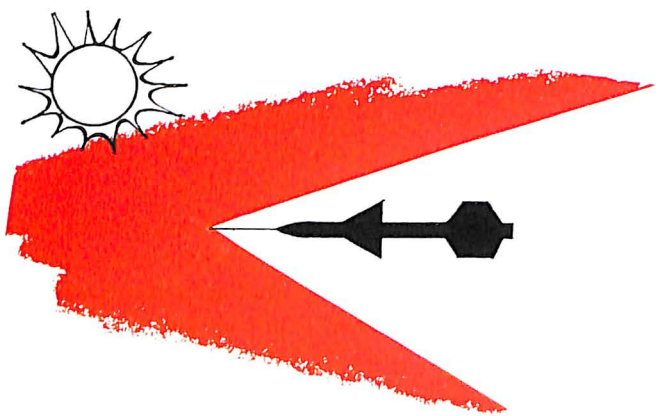
One manufacturer designs and builds the propulsion system; another, the guidance system; and a third produces the nose cone. The prime contractor for the airframe builds the airframe itself, then assembles all of the subsystems into the final weapon, integrates their controls, and

FUNDS AVAILABLE FOR MISSILE DEVELOPMENT AND PRODUCTION
1946 TO DATE
(Millions of Dollars)

| Year Ending June 30 | ALL MISSILE PROGRAMS | Of this Total | | |
|---|---|---|---|---|
| | | Intermediate and Intercontinental Ballistic Missiles | Other Surface to Surface Missiles | All Other Missiles |
| 1946 & prior | $ 70 | — | $ 19 | $ 51 |
| 1947 | 58 | — | 20 | 38 |
| 1948 | 81 | — | 36 | 45 |
| 1949 | 98 | — | 45 | 53 |
| 1950 | 134 | — | 65 | 69 |
| 1951 | 784 | $ 1 | 185 | 598 |
| 1952 | 1,058 | 1 | 239 | 818 |
| 1953 | 1,166 | 3 | 403 | 760 |
| 1954 | 1,067 | 14 | 336 | 717 |
| 1955 | 1,470 | 161 | 398 | 911 |
| 1956 | 2,270 | 515 | 387 | 1,368 |
| 1957 | 4,470 | 1,365 | 603 | 2,502 |
| 1958 | 5,107 | 2,077 | 639 | 2,391 |
| 1959 | 6,914 | 2,960 | 685 | 3,269 |
| 1960[a] | 6,634 | 2,952 | 509 | 3,173 |
| 1961[b] | 6,986 | 3,448 | 383 | 3,155 |

NOTE: The figures shown here differ from other figures in that they include not only the cost of procuring missiles for operational purposes, but also include research, developmental and capital costs involved in bringing this program to an operational status. However, the figures do not include military pay and costs only indirectly associated with the missiles program.

[a] Preliminary.
[b] Projected.
Sources: 19, 20



makes any necessary changes for configuration compatibility. Also, in flight tests he is responsible for quality control and for the actual firing.

Each contractor has his own network of supporting subcontractors. In the aggregate, there are now about 200,000 subcontractors producing various parts and components for these missiles.

The aerospace industry is charged with the responsibility for the research, development and production of what our military services call three generations of ballistic missiles. The first generation includes the intermediate range Thor, which travels a distance up to 1,500 miles, and the Atlas Intercontinental Ballistic Missile, which travels up to 5,500 miles. The second generation is represented by the Titan ICBM, a highly "sophisticated" two-stage missile. The third generation is exemplified by the Minuteman, which differs from the others in that it is being designed from the outset to use solid propellant fuels in contrast to the liquid-type propellants used by the first and second generations of missiles.

In terms of money devoted to guided missiles procurement, expenditures are estimated at $3.48 billion during 1961, compared to $3.50 billion in 1960. The 1961 new missile obligational authority is estimated

DEPARTMENT OF DEFENSE
NEW OBLIGATIONAL AVAILABILITY FOR PRODUCTION AND PROCUREMENT
TOTAL AND GUIDED MISSILES
1951 TO DATE
(Millions of Dollars)

| Year Ending June 30 | Total Procurement and Production | Guided Missiles | Missiles as Percent of Total |
|---|---|---|---|
| 1951 | $23,114 | $ 424 | 1.8 |
| 1952 | 29,536 | 468 | 1.6 |
| 1953 | 19,956 | 896 | 4.5 |
| 1954 | 10,432 | 748 | 7.2 |
| 1955 | 7,149 | 345 | 4.8 |
| 1956 | 9,653 | 938 | 9.7 |
| 1957 | 11,737 | 2,322 | 19.8 |
| 1958 | 11,399 | 2,313 | 20.3 |
| 1959 | 15,296 | 4,319 | 28.2 |
| 1960[E] | 13,261 | 3,456 | 26.1 |
| 1961[E] | 13,085 | 3,825 | 29.2 |

[E] Estimate.
Sources: 20, 24

at $3.82 billion, compared to $3.46 billion in 1960. Total procurement expenditures are set at $13.6 billion in 1961, compared to $13.9 billion in 1960. The 1961 budget will contain funds for procurement and production of the four main strategic deterrent missiles—Atlas, Titan, Minuteman and Polaris. No new money for Jupiter and Thor. Hound Dog and Quail will continue at a high level. Bomarc and Nike-Hercules procurement will be almost completed during the year. Procurement of Talos, Terrier and Tartar will continue. In addition, large numbers of Sparrow, Falcon and Sidewinder will be procured. Bullpup will be increased considerably over 1960. Pershing will continue on a high priority basis. Additional funds for Little John and an improved version of Honest John will be provided, together with Lacrosse and Sergeant missiles. A substantial procurement of Hawk missiles and the first production quantity of Redeye will be made in 1961, also, a sizeable quantity of Davy Crockett.

The shift in air power emphasis, stemming from an aggressive program of missile research and development work by the aerospace industry, is having profound effects. The manufacture and assembly of missiles requires more than simply space. The temperature of the working space

DEPARTMENT OF DEFENSE
EXPENDITURES FOR PROCUREMENT AND PRODUCTION
TOTAL AND GUIDED MISSILES
1951 TO DATE
(Millions of Dollars)

| Year Ending June 30 | Total Procurement and Production | Guided Missiles | Guided Missiles as Percent of Total |
|---|---|---|---|
| 1951 | $ 3,976 | $ 21 | 0.5 |
| 1952 | 11,478 | 169 | 1.5 |
| 1953 | 17,123 | 295 | 1.7 |
| 1954 | 15,958 | 504 | 3.2 |
| 1955 | 12,997 | 718 | 5.5 |
| 1956 | 12,182 | 1,168 | 9.6 |
| 1957 | 13,649 | 2,095 | 15.3 |
| 1958 | 14,677 | 2,737 | 18.6 |
| 1959 | 14,410 | 3,494 | 24.2 |
| 1960[E] | 13,943 | 3,500 | 25.1 |
| 1961[E] | 13,602 | 3,479 | 25.6 |

[E] Estimate.
Source: 23

DEPARTMENT OF DEFENSE
UNOBLIGATED FUNDS AVAILABLE FOR PROCUREMENT, FEBRUARY 29, 1960
TOTAL AND GUIDED MISSILES
(Millions of Dollars)

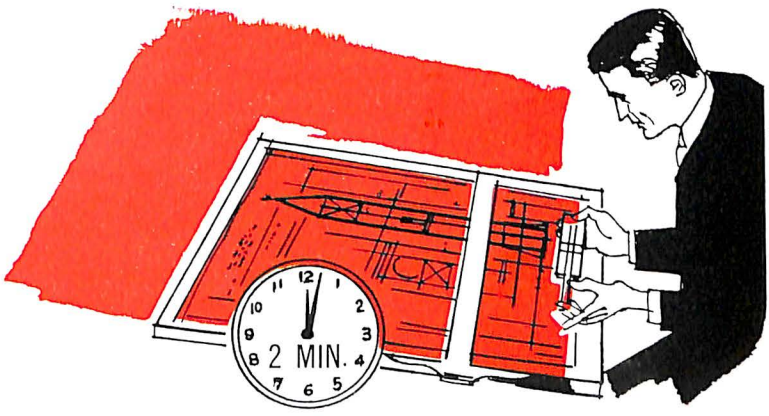
| | Total Procurement and Production | Guided Missiles | Missiles as Percent of Total |
|---|---|---|---|
| Defense Department .... | $12,611 | $1,954 | 15.5 |
| Air Force ..... | 6,791 | 1,311 | 21.5 |
| Navy ..... | 4.186 | 299 | 7.1 |
| Army ..... | 1,634 | 344 | 21.1 |

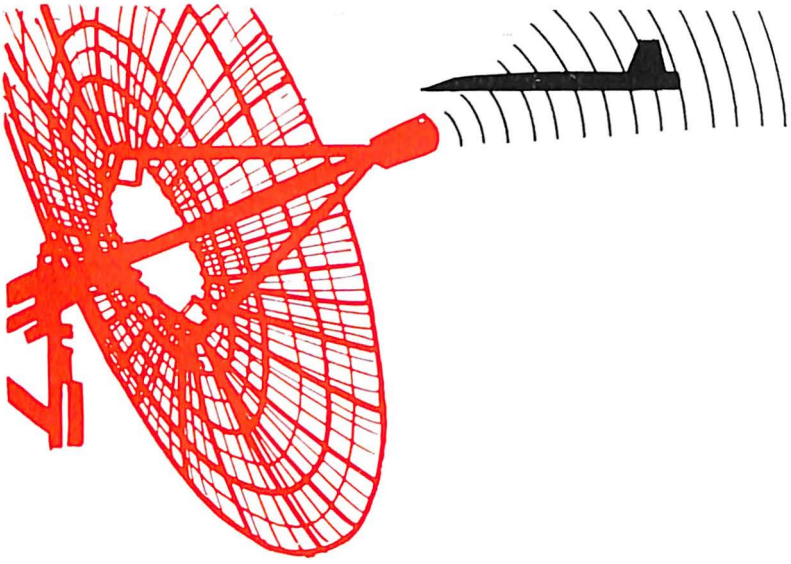
Source: 23

DEPARTMENT OF DEFENSE
UNPAID OBLIGATIONS, JANUARY 31, 1960
TOTAL AND GUIDED MISSILES
(Millions of Dollars)

| | Procurement and Production | Guided Missiles | Missiles as Percent of Total |
|---|---|---|---|
| Defense Department .... | $15,132 | $3,690 | 24.4 |
| Air Force ..... | 7,732 | 2,392 | 30.9 |
| Navy ..... | 5,393 | 468 | 4.4 |
| Army ..... | 2,006 | 830 | 41.4 |
| Office of Secretary of Defense ..... | 1 | — | — |

Source: 23





must be carefully controlled; contamination of the air by dust or any other minute particle must be eliminated. The precision required in the manufacture of delicate guidance systems exceeds that of any other industry. The requirement of new facilities and the disposal of surplus facilities is a problem that is receiving the concentrated attention of industry executives.

There are four principal parts to a guided missile: the structure or airframe, the guidance and control system, the power plant and the warhead. The effective "marriage" of these components is the essence of a successful guided missile. In many cases the company holding the prime contract for a missile may actually manufacture only one or two of the basic parts. The development and manufacture of the balance of the principal parts and some components of the "in shop" basic parts are handled through subcontracts. The prime contractor, however, retains the responsibility for the complete system. The only counterpart that a missile has in complexity, performance requirements and manufacturing techniques is the manned aircraft. The aircraft industry has assumed the responsibility for developing and manufacturing guided missiles because of its long experience in managing manned weapons systems, an assignment requiring a high degree of technical management skills. The missile essentially is a projection of the manned aircraft,

DEPARTMENT OF DEFENSE
NEW OBLIGATIONAL AVAILABILITY FOR MISSILE PROCUREMENT, BY AGENCY
1951 TO DATE
(Millions of Dollars)

| Year Ending June 30 | TOTAL DEFENSE DEPARTMENT | Air Force | Navy | Army |
|---|---|---|---|---|
| 1951 | $ 424 | $ 121 | $130 | $173 |
| 1952 | 468 | 95 | 119 | 253 |
| 1953 | 896 | 414 | 181 | 301 |
| 1954 | 748 | 364 | 159 | 225 |
| 1955 | 345 | 219 | 126 | — |
| 1956 | 938 | 700 | 238 | — |
| 1957 | 2,322 | 1,970 | 352 | — |
| 1958 | 2,313 | 1,890 | 402 | 20 |
| 1959 | 4,319 | 2,913 | 735 | 672 |
| 1960[E] | 3,456 | 2,466 | 589 | 401 |
| 1961[E] | 3,825 | 3,024 | 450 | 351 |

[E] Estimate.
Sources: 20, 24

DEPARTMENT OF DEFENSE
EXPENDITURES FOR GUIDED MISSILE PROCUREMENT, BY AGENCY
1951 TO DATE
(Millions of Dollars)

| Year Ending June 30 | TOTAL DEFENSE DEPARTMENT | Air Force | Navy | Army |
|---|---|---|---|---|
| 1951 | $ 21 | $ 16 | $ 5 | — |
| 1952 | 169 | 66 | 56 | $ 46 |
| 1953 | 295 | 81 | 95 | 119 |
| 1954 | 504 | 176 | 141 | 187 |
| 1955 | 718 | 305 | 176 | 238 |
| 1956 | 1,168 | 641 | 195 | 333 |
| 1957 | 2,095 | 1,417 | 264 | 414 |
| 1958 | 2,737 | 1,668 | 345 | 724 |
| 1959 | 3,494 | 2,273 | 377 | 844 |
| 1960[E] | 3,500 | 2,639 | 389 | 472 |
| 1961[E] | 3,479 | 2,669 | 397 | 413 |

[E] Estimate.
Source: 23

but the problem of reliability is even greater. The average missile contains approximately 300,000 parts. Failure of a single part which might cost only a few cents could mean failure of a multi-million dollar missile system. And the missile, once it leaves its launching site, must function perfectly.

The most vital technological race that the United States is engaged in today is the development of the intercontinental ballistic missile to operational status. The race between the U.S. and its potential enemies to produce this weapon is not measured in terms of months or even weeks. Any lead we have today stems from a contract awarded ten years ago to an aircraft company for a systems study to investigate possible approaches to the development of a strategic ballistic missile. The study project was cancelled because of economy reasons, but during its brief existence, it yielded information concerning stabilization, guidance and power plant problems. This information proved invaluable when the ICBM program was quickly elevated by the National Security Council to the top priority position of all defense projects.

GUIDED MISSILES, EMPLOYMENT BY MAJOR INDUSTRIES
October 1959

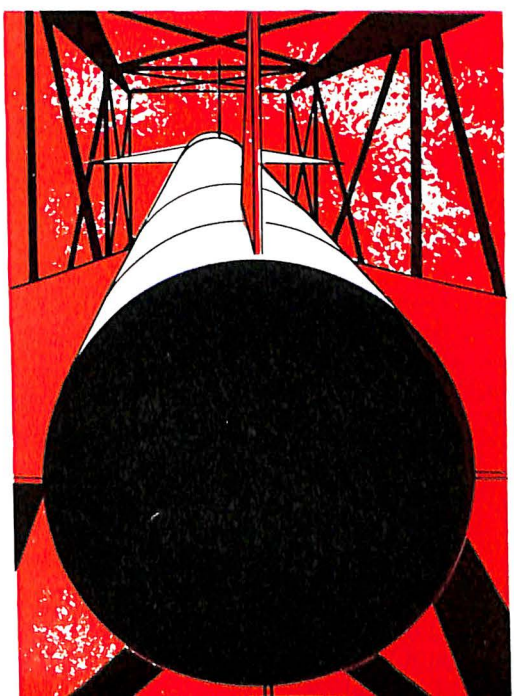
| Industry Title | Number of Establishments | Missile Employment (Thousands) | Per Cent of U.S. Total | Per Cent Change from October 1958[a] |
|---|---|---|---|---|
| TOTAL—ALL INDUSTRIES | 363 | 396.3 | 100 | +16 |
| Aircraft and Parts | 118 | 125.9 | 32 | + 7 |
| Ordnance and Accessories[b] | 33 | 100.5 | 25 | +23 |
| Electrical Machinery, etc. | 82 | 87.0 | 22 | +24 |
| Miscellaneous Business Services | 21 | 18.4 | 5 | +32 |
| Professional and Scientific Instruments, etc. | 22 | 17.7 | 4 | +14 |
| Federal Government | 16 | 18.6 | 5 | + 6 |
| Machinery (except Electrical) | 24 | 5.1 | 1 | 0 |
| All Others | 47 | 23.1 | 6 | N.A. |

N.A.—Not available.
[a] Percent change based on establishments reporting in both years.
[b] In this category are listed plants whose major product does not fall into any other industry. Many of these plants are owned or operated by aircraft companies.
Source: 33

GUIDED MISSILES, EMPLOYMENT IN SELECTED LABOR MARKETS
October 1959

| Area of Employment | Number of Establishments | Missile Employment (Thousands) | Per Cent Change from October 1958[a] | Area Total Employment (Thousands) | Missile as Per Cent of Total Employment |
|---|---|---|---|---|---|
| TOTAL—UNITED STATES | 363 | 396.3 | +16 | 16,197 | 2.4 |
| Total—selected areas | 162 | 183.1 | +15 | 3,383 | 5.4 |
| Los Angeles-Long Beach, Cal. | 82 | 95.1 | + 6 | 785 | 12.1 |
| San Diego, Cal. | 9 | 18.6 | +50 | 74 | 25.2 |
| San Jose, Cal. | 6 | 16.9 | +49 | 64 | 26.6 |
| Philadelphia, Pa. | 17 | 14.3 | +39 | 533 | 2.7 |
| Boston, Mass. | 12 | 8.9 | + 2 | 298 | 3.0 |
| New York, N. Y. | 21 | 8.9 | −21 | 1,172 | .8 |
| St. Louis, Mo. | 5 | 8.0 | +63 | 263 | 3.0 |
| Baltimore, Md. | 7 | 6.8 | +28 | 169 | 4.0 |
| Morristown-Dover, N. J. | 3 | 5.6 | +25 | 25 | 22.8 |
| 8 Other Areas[b] | N.A. | 75.0 | +23 | N.A. | N.A. |

[a] Percent change based on establishments reporting in both years.
[b] Sacramento, Cal.; Denver, Colo.; Orlando, Fla.; Lawrence, Mass.; Minneapolis, Minn.; Winston-Salem, N. C.; Seattle, Wash.; and Milwaukee, Wis. each employ 5,000 or more employees with a total missile employment of 75,000. Data on Detroit, Mich., not available.
Source: 33



U. S. Missile Program

| Project | Service | Systems Contractor | Propulsion | | Status |
|---|---|---|---|---|---|
| | | | Manufacturer | Type | |
| | | Air-to-Air | | | |
| Falcon | USAF | Hughes | Thiokol | Solid | Operational |
| Genie | USAF | Douglas | Aerojet | Rocket Engine | Operational |
| Sidewinder | Navy | GE/Philco | Navy | Solid | Operational |
| Sparrow *III* | Navy | Raytheon | Aerojet/ Thiokol | Solid & Pre-Pkgd. Liquid | Operational |
| Eagle | Navy | Bendix | Aerojet | Solid-Rocket | Development |
| Hvar | Navy | | | | Operational[a] |
| | | Surface-to-Surface | | | |
| Snark | USAF | Norair-Division Northrop | Aerojet/ Pratt & Whitney | Solid & Turbojet | Operational |
| Atlas | USAF | Convair | Rocketdyne | Liquid | Operational |
| Titan | USAF | Martin | Aerojet | Liquid | Development |
| Minuteman | USAF | Boeing | Thiokol/ Aerojet | Solid | Development |
| Thor | USAF | Douglas | Rocketdyne | Liquid | Operational |
| Matador | USAF | Martin | Thiokol/ Allison | Turbojet | Operational[b] |
| Mace | USAF | Martin | Allison | Solid-Turbojet | Operational |
| Cobra | USMC | Boelkow Entwicklugen (West Germany) | | Solid | Evaluation |
| Polaris | Navy | Lockheed | Aerojet | Solid | Development |
| Subroc | Navy | Goodyear | Thiokol | Solid | Development |
| Corporal | Army | Firestone | Ryan | Liquid | Operational[c] |
| Jupiter | Army | Chrysler | Rocketdyne | Liquid | Operational |
| Lacrosse | Army | Martin | Thiokol | Solid | Operational |
| Lobber | Army | No contract awarded | | | Study |
| Pershing | Army | Martin | Thiokol | Solid | Development |
| Plato | Army | Sylvania | | | Terminated |
| Redstone | Army | Chrysler | Rocketdyne | Liquid | Operational |
| Sergeant | Army | Sperry | Thiokol | Solid | Development |
| Shillelagh | Army | Aeronutronics | | | Development |
| SS-10 | Army | Nord (France) | | Solid | Operational |
| SS-11 | Army | Nord (France) | | | Evaluation |
| Honest John | Army | Douglas | Hercules | Solid | Operational |
| Little John | Army | Emerson Electric/Army | | Solid | Development |
| Missile "A" | Army | Army | | Solid | Development |

(*Continued on next page*)

U. S. MISSILE PROGRAM

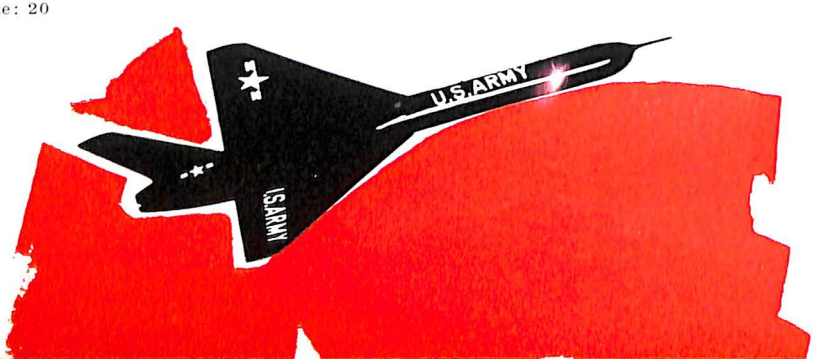
| Project | Service | Systems Contractor | Propulsion | | Status |
|---|---|---|---|---|---|
| | | | Manufacturer | Type | |
| | | Air-to-Surface | | | |
| SKYBOLT | USAF | Douglas | Aerojet | Solid | Study |
| HOUNDDOG | USAF | North American | Pratt & Whitney | Turbojet | Development |
| CORVUS | Navy | Temco | Reaction Motors | Liquid | Development |
| BULLPUP | Navy/ USAF | Martin | Thiokol | Solid & Liquid | Operational |
| ZUNI | Navy | Navy | | Solid | Operational |
| | | Surface-to-Air | | | |
| BOMARC | USAF | Boeing | Marquardt | Liquid with Ramjet Booster | Operational |
| TERRIER | Navy | Convair | Sperry | Solid | Operational |
| TYPHON | Navy | Johns Hopkins APL | | | Development |
| TARTAR | Navy | Convair | Aerojet | Solid | Development |
| TALOS | Navy | Bendix | Bendix/ McDonnell | Solid-Ramjet | Operational |
| HAWK | Army | Raytheon | Aerojet | Solid | Operational |
| MAULER | Army | Convair/ Army | | | Development |
| NIKE-AJAX | Army | Western Electric | Hercules | Solid & Liquid | Operational[d] |
| NIKE-HERCULES | Army | Western Electric | Hercules/ Thiokol | Solid | Operational |
| NIKE-ZEUS | Army | Western Electric | Thiokol/ Grand Central | Solid | Development |
| REDEYE | Army | Convair | Atlantic Research | Solid | Development |
| | | Surface-to-Underwater | | | |
| WEAPON ALFA | Navy | | | | Operational |
| ASROC | Navy | Minneapolis-Honeywell | | Solid | Development |
| | | Diversionary | | | |
| QUAIL | USAF | McDonnell | | | Development |
| | | Meteorological Satellite | | | |
| TIROS | RCA | | | | Operational |

[a] Production discontinued; replaced by ZUNI.
[b] Production discontinued; replaced by MACE.
[c] Production discontinued; replaced by SERGEANT.
[d] Production discontinued; replaced by NIKE-HERCULES.
Source: 20

DRONES IN PRODUCTION OR DEVELOPMENT

| Name and Designation | Service | Prime | Airframe | Power Plant | Guidance |
|---|---|---|---|---|---|
| Pogo HI | Army/Navy | Aeronca | Aeronca | Thiokol | |
| Super Pogo HI | Army/Navy | Aeronca | Aeronca | Thiokol | |
| XKD2B-1 | Navy | Beech | Beech | Rocket-dyne | |
| WS462-L | Air Force | Beech | Beech | Rocket-dyne | |
| KDB-1 | Navy/ USAF | Beech | Beech | McCulloch | Babcock & Summers |
| KD2U-1 | Navy | Chance-Vought | Chance-Vought | General Electric | |
| SD-5 | Army | Fairchild | Fairchild | Pratt & Whitney | |
| DSN-1 | Navy | Gyrodyne | Gyrodyne | Porsche | Babcock/ Lear and Motorola |
| DSN-3 | Navy | Gyrodyne | Gyrodyne | Boeing | |
| KD2R-1 | Navy | Radioplane | Radioplane | McCulloch | |
| OQ-19, -B, -D | Army/ USAF | Radioplane | Radioplane | McCulloch | Babcock |
| KD2R-1, 5 | Navy | Radioplane | Radioplane | McCulloch | |
| RD2R-5 | Navy | Radioplane | Radioplane | McCulloch | |
| RP-76 | Army | Radioplane | Radioplane | Aerojet | Radio-plane |
| RP-77D | Army | Radioplane | Radioplane | Boeing | Radio-plane |
| SD-1 | Army | Radioplane | Radioplane | McCulloch | Radio-plane |
| AN/USD-4 (Swallow) | Army | Republic | Republic | Pratt & Whitney | Republic and Minne-apolis-Honey-well |
| SD-2 | Army | Rheem | Aerojet | Lycoming | Sperry Rand |
| Q-2A, C | USAF Navy | Ryan | Ryan | Conti-nental | Lear |
| KDA-4 | | Ryan | Ryan | Fairchild | Ryan |

Source: 20



# 4

# SPACE PROGRAM

The newest of the aerospace industry's responsibilities, manufacture of hardware for the nation's space programs, started to gain momentum in the latter part of 1959 and in early 1960. It has not, as yet, become a significant factor in the industry's total workload, but, as the base for space exploration continues to broaden, hardware requirements are similarly increasing.

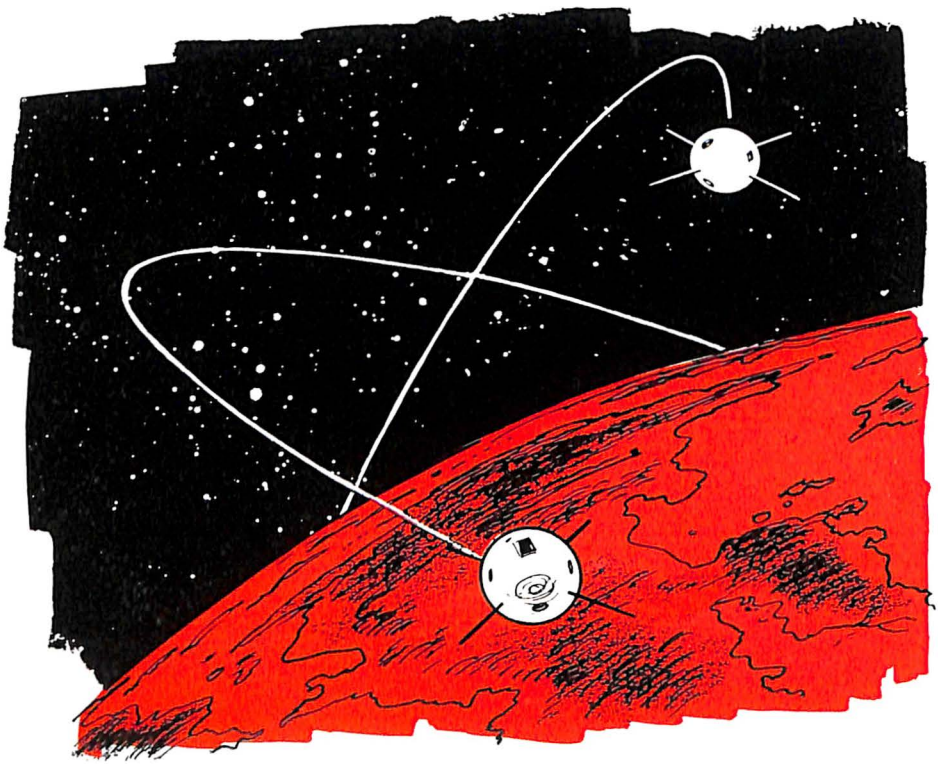
The national space program is divided into two areas, running on parallel paths. On the one hand is the civilian space effort, dedicated to peaceful exploration of space in quest of knowledge which can be translated into benefits for mankind. This part of the program is handled by the National Aeronautics and Space Administration.

On the other hand is the military effort, aimed at developing new weaponry for defense. This program is under the direction of the Department of Defense and operated by various groups within DOD, such as the Army, Navy and Air Force, the Advanced Research Projects Agency and the Directorate of Engineering and Research.

The aerospace industry is building the equipment for both programs, and the equipment is of a wide variety. This includes rocket power plants and booster systems, the space vehicles, satellites and manned capsules, guidance and control equipment, telemetry and tracking equipment, ground support equipment, instrumentation and other components. Into the creation of this equipment, of course, goes a great deal of research and development on the part of the manufacturers.

As a portion of the aerospace industry's workload, space equipment research and manufacture ranks third behind aircraft and missile development and construction. In the past year, however, the proportion of the total effort devoted to space has increased considerably, particularly in the area of advanced research on projects.

In the Federal budget for the fiscal year 1961, obligations for space research total about $900,000,000. The National Aeronautics and Space Administration will obligate $631,000,000, but a portion of that money is for aeronautical, rather than space research, and a breakdown is not available. The Department of Defense will obligate an additional $318,000,000. An additional undesignated sum will be spent by the Atomic



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
EXPENDITURES FOR RESEARCH AND DEVELOPMENT
1953 TO DATE
(Millions of Dollars)

| Year Ending June 30 | TOTAL | Conduct of Research and Development | Increase in Research and Development Plant |
|---|---|---|---|
| 1953 | $ 78.6 | $49.5 | $29.1 |
| 1954 | 89.5 | 47.6 | 41.9 |
| 1955 | 73.8 | 43.4 | 30.4 |
| 1956 | 71.1 | 50.5 | 20.6 |
| 1957 | 76.0 | 55.2 | 20.8 |
| 1958 | 89.2 | 72.0 | 17.2 |
| 1959 | 145.5 | 114.7 | 30.8 |
| 1960[E] | 325.0 | 268.0 | 57.0 |
| 1961[E] | 600.0 | 503.0 | 97.0 |

Source: 26

Energy Commission on projects related to space work.

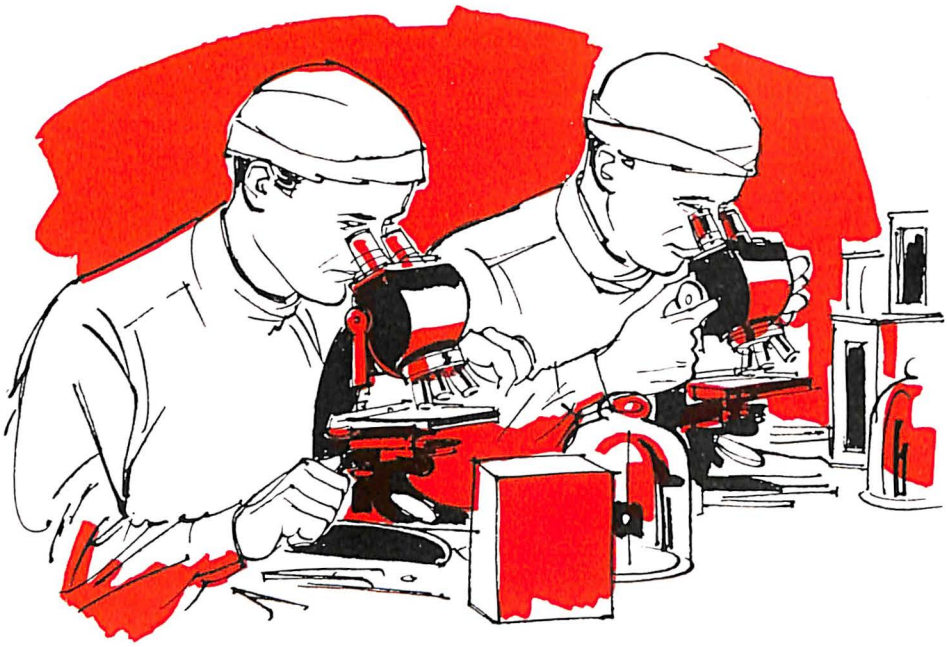
It is interesting to note, as a key to the growing stature of space exploration as a national program, that the funds to be allocated for space research are nearly double those the Department of Defense will obligate for research and development of military aircraft and related equipment ($446,200,000). The comparison is not completely valid, because the military aircraft R & D figure does not include purchase of hardware, while the space research figure does. However, hardware is still a relatively minor expenditure in the total space research budget.

In the year prior to publication of this volume, the U. S. space programs gained considerable momentum and recaptured some of the lost prestige which followed early Soviet space successes. Among the highlights of the year's activity were these programs:

The U. S. sent aloft the first experimental meteorological satellite, *Tiros I*, which successfully sent back to Earth photographs of weather formations taken from space. This type of satellite has vast potential for future weather forecasting techniques.

The nation also put up the first navigational satellite, *Transit I*.

The NASA sent *Pioneer V* into a solar orbit and recorded the most distant radio transmission from Earth. At publication time, Pioneer V was more than 6,000,000 miles from Earth and its radio system was still sending signals.



Initial flights were started with the X-15, an "inner space" exploratory vehicle which will carry a man as high as 50 miles into space at speeds up to 4,000 miles per hour.

The NASA's other man-in-space program, Project Mercury, entered final stages of preparation toward putting man in an Earth orbit. The Mercury capsule and the launch system were tested in unmanned flights and it was planned to put up a man in the capsule in a parabolic, nonorbital test late in 1960. Orbital flights were scheduled for 1961.

A major piece of space legislation was introduced in second session of the 86th Congress. This bill, H. R. 9675, called for changes to streamline the organizational structure of the national space program as an aid to compressing decision-making time.

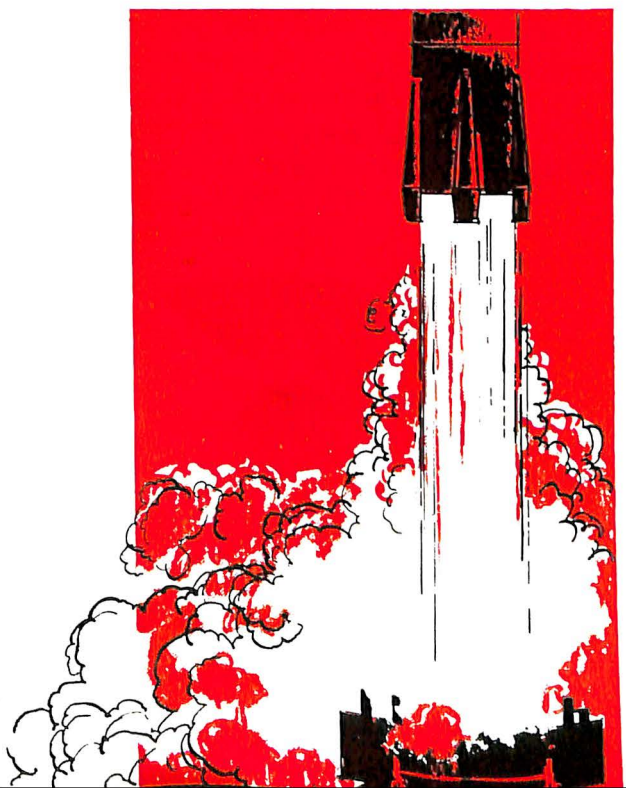
The major provisions of H. R. 9675 were these:

- First, to set forth clearly that responsibility for planning and directing the civilian portion of the space program would be vested in the National Aeronautics and Space Administration.
- Second, to repeal provisions of the original act which called for personal supervision of aeronautical and space programs by the President. This section would also eliminate the National Aeronautics and Space Council, a group of experts which advises the President as to how to perform the duties required of him by the act.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
OBLIGATIONS AND ALLOTMENTS, FISCAL YEARS 1959, 1960
As of September 30, 1959
(Millions of dollars)

| | Fiscal Year 1959 Obligations | Fiscal Year 1960 Allotments |
|---|---|---|
| TOTAL | $309.1 | $500.6 |
| Salaries and expenses | 85.5 | 91.4 |
| Research and development Total | 198.6 | 335.4 |
| Aeronautical and space research | 12.1 | 27.6 |
| Scientific investigations in space | 72.9 | 47.8 |
| Satellite applications | 4.0 | 10.9 |
| Manned space flight | 47.3 | 90.1 |
| Vehicle Systems technology | .8 | 8.6 |
| Space propulsion technology | 18.0 | 45.3 |
| Vehicle development | 40.4 | 86.9 |
| Supporting activities | 3.1 | 14.7 |
| Bureau of the Budget reserve | — | 3.5 |
| Construction and equipment | 25.0 | 73.8 |

Source: 37

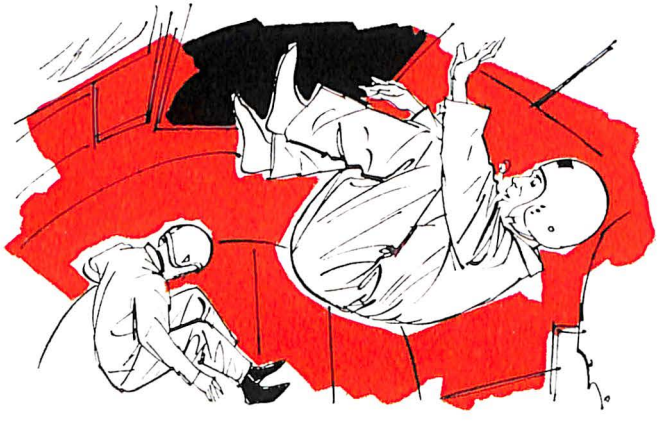


• Third, to eliminate the Civilian-Military Liaison Committee, which coordinates the activities of NASA with those of the Department of Defense.

• Fourth, to prevent duplication of effort by NASA and the Department of Defense in developing the tools of space exploration. A section of the new bill directs the Secretary of Defense and the Administrator of NASA to maintain close cooperation and coordination on their respective activities. Disagreements between the agencies as to responsibilities for certain missions would be settled by the President.

In addition, the bill would change the patent provisions of the original space act. On a defense contract, the manufacturer is permitted to keep patent rights to a product for possible application to the civilian market. Under an NASA contract, he cannot keep patent rights to his product according to the original act. An amendment would permit NASA to adopt patent policies similar to those of DOD and waive the rights of the Government to a product or invention and allow the manufacturer to develop it as a commercial item with complete patent protection. This amendment provides incentive to the contractor and may stimulate the national economy by the marketing of new commercial products which might not become available without the incentive of patent protection.

A final amendment to the original bill would permit NASA to indemnify a contractor, or protect him from damage suits arising from space research projects. In dealing with potentially hazardous space power plants and other equipment, a contractor might incur an accident causing enormous damage to property or injury to people. Aerospace contractors are unable to get adequate commercial insurance against such risks, so it is conceivable that a single incident might bankrupt a corporation. Indemnification will provide protection against such a possibility.



UNITED STATES AND RUSSIAN SATELLITES, LUNAR AND SPACE PROBES[a]

| Year | Satellite | Code Name | Source | Launch | Status |
|---|---|---|---|---|---|
| *Satellites* | | | | | |
| 1957 | Alpha I | Rocket Body | USSR | Oct. 4, 57 | Down Dec. 1, 1957 |
| 1957 | Alpha II | Sputnik I | USSR | Oct. 4, 57 | Down early Jan. 1958 |
| 1957 | Beta | Sputnik II | USSR | Nov. 3, 57 | Down April. 14, 1958 |
| 1958 | Alpha | Explorer I | US | Jan. 31, 58 | In orbit |
| 1958 | Beta I | Rocket Body | US | Mar. 17, 58 | In orbit |
| 1958 | Beta II | Vanguard I | US | Mar. 17, 58 | In orbit |
| 1958 | Gamma | Explorer III | US | Mar. 26, 58 | Down Jun. 28, 1958 |
| 1958 | Delta I | Rocket Body | USSR | May 15, 58 | Down Dec. 3, 1959 |
| 1958 | Delta II | Sputnik III | USSR | May 15, 58 | Down Apr. 6, 1960 |
| 1958 | Epsilon | Explorer IV | US | Jul. 26, 58 | Down Oct. 23, 1959 |
| 1958 | Zeta | Atlas | US | Dec. 18, 58 | Down Jan. 21, 1959 |
| 1959 | Alpha I | Vanguard II | US | Feb. 17, 59 | In orbit |
| 1959 | Alpha II | Rocket Body | US | Feb. 17, 59 | In orbit |
| 1959 | Beta | Discoverer I | US | Feb. 28, 59 | Down early Mar. 1959 |
| 1959 | Gamma | Discoverer II | US | Apr. 13, 59 | Down Apr. 26, 1959 |
| 1959 | Delta | Explorer VI | US | Aug. 7, 59 | In orbit |
| 1959 | Epsilon I | Discoverer V | US | Aug. 13, 59 | Down Sep. 28, 1959 |
| 1959 | Epsilon II | Capsule | US | Aug. 13, 59 | In orbit |
| 1959 | Zeta | Discoverer VI | US | Aug. 19, 59 | Down Oct. 20, 1959 |
| 1959 | Eta | Vanguard III | US | Sep. 18, 59 | In orbit |
| 1959 | Iota I | Explorer VII | US | Oct. 13, 59 | In orbit |
| 1959 | Iota II | Rocket Body | US | Oct. 13, 59 | In orbit |
| 1959 | Kappa | Discoverer VII | US | Nov. 7, 59 | Down Nov. 26, 1959 |
| 1959 | Lambda | Discoverer VIII | US | Nov. 20, 59 | Down Mar. 8, 1960 |
| 1960 | Beta I | Rocket Body | US | Apr. 1, 60 | In orbit |
| 1960 | Beta II | Tiros I | US | Apr. 1, 60 | In orbit |
| 1960 | Gamma I | Rocket Body | US | Apr. 13, 60 | In orbit |
| 1960 | Gamma II | Transit 1 B | US | Apr. 13, 60 | In orbit |
| 1960 | Gamma III | Metal object | US | Apr. 13, 60 | In orbit |
| 1960 | Delta | Discoverer XI | US | Apr. 15, 60 | Down Apr. 26, 1960 |
| *Lunar and Space Probes* | | | | | |
| 1959 | | Pioneer IV | US | Mar. 3, 59 | Orbiting Sun |
| 1959 | Mechta | Lunik I | USSR | Jan. 2, 59 | Orbiting Sun |
| 1959 | | Lunik II | USSR | Sep. 12, 59 | Hit Moon—Sep. 13 1959 |
| 1959 | 59 Theta | Lunik III | USSR | Oct. 4, 59 | Orbiting Earth |
| 1960 | Alpha | Pioneer V | US | Mar. 11, 60 | Orbiting Sun |
| 1960 | Epsilon | | USSR | May 15, 1960 | Orbiting Earth |

[a] October 4, 1957 to May 20, 1960.
Sources: 20, 37

# 5

# RESEARCH AND DEVELOPMENT

Research and development costs for many of today's major aerospace weapons, particularly in the guided missile categories, have reached the point where they exceed production costs. Even in the case of the intercontinental B-52 bomber, which will probably be the last large military aircraft to be produced in quantity, research and development amounts to about 20 per cent of the cost of the weapon.

Employment statistics furnish further factual evidence of the profound changes in the industry as it has moved from "mass" production to "volume" production to "tailored" production of limited quantities. In 1943, the peak employment year of World War II, the Bureau of Labor Statistics reported 1,345,600 workers of which 80 per cent were assigned to direct production jobs.

The USAF's Air Materiel Command, in a survey of 30 plants of the major prime contractors in the industry, reported that employment in 1955 amounted to 469,794 workers, of which direct manufacturing accounted for *40 per cent* of the total, with 60 per cent involved in engi-

neering, tooling and other indirect specialties. By 1959, employment had dropped to 451,098 workers at the 30 plants, but the percentage of indirect specialties had increased to 65 per cent of the total compared with 35 per cent in direct manufacturing jobs. This is the highest ratio of indirect to direct workers of any major manufacturing industry. There is no question that this trend will continue in the future. The shift in personnel is further reflected in the manufacturing techniques necessary to build today's and tomorrow's weapon system. For example, a Mach

DEPARTMENT OF DEFENSE[a]
ESTIMATED OBLIGATIONS FOR CONDUCT OF RESEARCH, DEVELOPMENT, TEST AND EVALUATION
(In Millions)

| Budget title and program | 1959 Actual | 1960 Estimate | 1961 Estimate |
|---|---|---|---|
| Research, development, test, and evaluation appropriations: | | | |
| 1. Military sciences | $410.7 | $549.1 | $535.2 |
| 2. Aircraft and related equipment | 419.5 | 502.0 | 446.2 |
| 3. Missiles and related equipment | 1,343.5 | 1,498.3 | 1,481.6 |
| 4. Military astronautics and related equipment | 324.1 | 408.0 | 318.0 |
| 5. Ships and small craft and related equipment | 163.4 | 164.4 | 151.5 |
| 6. Ordnance, combat vehicles, and related equipment | 197.0 | 198.9 | 177.5 |
| 7. Other equipment | 434.4 | 558.3 | 460.5 |
| 8. Programwide management and support | 251.0 | 248.4 | 231.0 |
| 9. Emergency fund and expired accounts | — | 141.0 | 150.0 |
| Total direct obligations, research, development, test, and evaluation appropriations | 3,543.6 | 4,268.4 | 3,951.5 |
| Procurement appropriations:[b] | | | |
| 1. Aircraft | 675.4 | 325.3 | 330.7 |
| 2. Missiles | 920.9 | 1,216.2 | 984.4 |
| 3. Other | 3.8 | 5.9 | 0.3 |
| Total direct obligations, procurement appropriations | 1,600.1 | 1,547.4 | 1,315.4 |
| Military personnel appropriations | 223.6 | 227.3 | 232.6 |
| Total direct obligations | 5,367.3 | 6,043.1 | 5,499.5 |

[a] Includes obligations made by USAF; Navy; Army; Advanced Research Projects Agency; Emergency Fund.
[b] Estimated amounts for items identified as development, test, and evaluation support.
Source: 26

3 bomber now under development could not have been built by the most advanced manufacturing techniques in use only two years ago.

The aerospace industry is becoming increasingly aware of a number of problems in the management of research and development. In Government, and in the industry, intensive thought is being applied to the planning, the administration and manpower for control of programs in the technological fields of aerospace research and development. This

DEPARTMENT OF THE ARMY
OBLIGATIONS FOR RESEARCH, DEVELOPMENT, TEST AND EVALUATION
(Millions of Dollars)

| Program | 1959 | 1960[E] | 1961[E] |
|---|---|---|---|
| TOTAL DIRECT OBLIGATIONS | $1,021.5 | $1,101.4 | $1,041.5 |
| Military sciences | 123.3 | 159.1 | 151.0 |
| Aircraft and related equipment | 54.5 | 36.3 | 36.6 |
| Missiles and related equipment | 423.2 | 495.5 | 494.8 |
| Ships and small craft and related equipment | 2.4 | 0.9 | 0.2 |
| Ordnance, combat vehicles, and related equipment | 118.9 | 108.7 | 88.8 |
| Other equipment | 212.2 | 204.7 | 186.0 |
| Programwide management and support | 87.0 | 96.2 | 84.1 |

[E] Estimate.
Source: 26

DEPARTMENT OF THE AIR FORCE
OBLIGATIONS FOR RESEARCH, DEVELOPMENT, TEST AND EVALUATION
(Millions of Dollars)

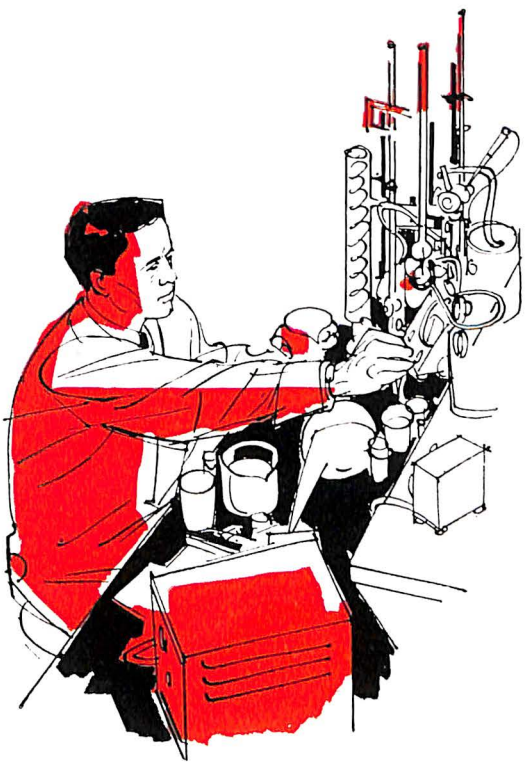
| Program | 1959 | 1960[E] | 1961[E] |
|---|---|---|---|
| TOTAL DIRECT OBLIGATIONS | $1,222.2 | $1,526.7 | $1,337.5 |
| Military sciences | 135.2 | 122.5 | 116.8 |
| Aircraft and related equipment | 273.5 | 370.1 | 312.8 |
| Missiles and related equipment | 292.0 | 317.3 | 318.3 |
| Military astronautics and related equipment | 221.1 | 296.1 | 249.7 |
| Ordnance, combat vehicles, and related equipment | 7.8 | 14.0 | 13.1 |
| Other equipment | 175.1 | 302.2 | 229.4 |
| Programwide management and support | 117.5 | 104.5 | 97.4 |

[E] Estimate.
Source: 26

DEPARTMENT OF THE NAVY
OBLIGATIONS FOR RESEARCH, DEVELOPMENT, TEST AND EVALUATION
(Millions of Dollars)

| Program | 1959 | 1960[E] | 1961[E] |
|---|---|---|---|
| TOTAL DIRECT OBLIGATIONS | $1,147.0 | $1,251.1 | $1,207.5 |
| Military sciences | 105.5 | 135.1 | 123.4 |
| Aircraft and related equipment | 91.5 | 95.7 | 96.8 |
| Missiles and related equipment | 628.3 | 685.5 | 668.5 |
| Military astronautics and related equipment | — | — | 1.3 |
| Ships and small craft and related equipment | 161.0 | 163.5 | 151.3 |
| Ordnance, combat vehicles, and related equipment | 70.4 | 76.2 | 75.6 |
| Other equipment | 47.1 | 51.4 | 45.1 |
| Programwide management and support | 43.2 | 43.7 | 45.5 |

[E] Estimate.
Source: 26



broad area has many facets, ranging all the way from gathering statistics and analytical assessment to problems of selection among aerospace projects and achieving the proper balance between support of basic research, applied research and development.

American industry concerned with defense contracts generally, and the aerospace industry particularly, is aware that new knowledge is essential to future progress, and that a strong military and a strong industrial technology must rest on a base of fundamental science. The Defense Department has, in the past two years, strengthened its policy with respect to basic research and has substantially increased its level of support. This increase amounts to about 35 per cent more than was originally planned for the current year. The increase will be continued next year and, it is hoped, in the succeeding years for budgets not yet prepared.

The Federal Government during fiscal year 1960 will obligate, or place orders for, about $7.7 billion for the conduct of its research and development programs, with the Defense Department projects accounting for more than 75 per cent of the total, the National Science Foundation reports.

The bulk of the defense programs are concerned with the aerospace industry. The growth of research and development in the last few years has been steady. In FY 1958, the Defense Department obligated $4.4

DEPARTMENT OF DEFENSE
EXPENDITURES FOR RESEARCH AND DEVELOPMENT
(Millions of Dollars)

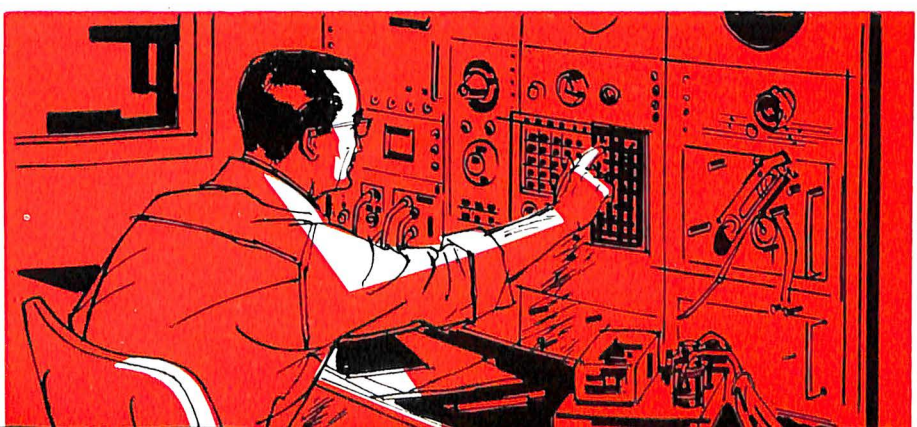
| Year Ending June 30 | Department of Defense | Air Force | Navy | Army | Other |
|---|---|---|---|---|---|
| 1951 | 758 | 269 | 327 | 162 | – |
| 1952 | 1,165 | 429 | 448 | 288 | – |
| 1953 | 1,411 | 530 | 499 | 382 | – |
| 1954 | 1,385 | 513 | 476 | 396 | – |
| 1955 | 1,391 | 524 | 467 | 400 | – |
| 1956 | 1,491 | 632 | 449 | 410 | – |
| 1957 | 1,687 | 729 | 523 | 435 | – |
| 1958 | 1,742 | 694 | 569 | 476 | 3 |
| 1959[a] | 3,775 | 780 | 870 | 562 | 1,563 |
| 1960[a] [E] | 4,189 | 1,416 | 1,011 | 1,036 | 726 |
| 1961[E] | 3,910 | 1,334 | 1,169 | 1,042 | 365 |

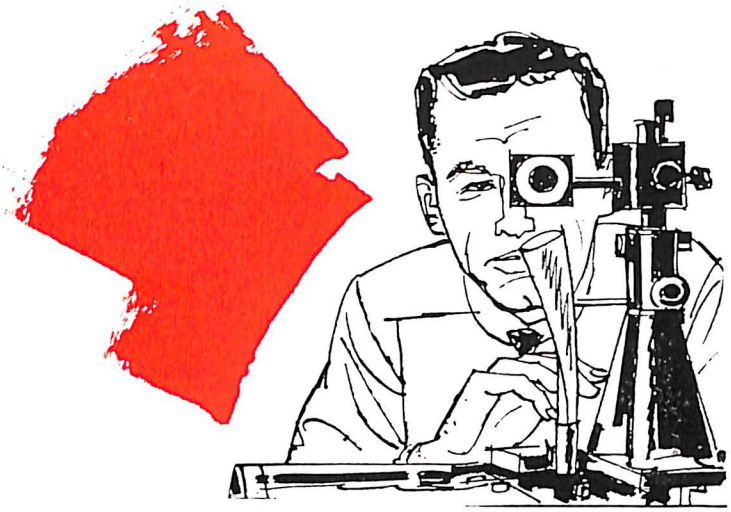
[E] Estimate.
[a] Adjusted to make data comparable to 1961 appropriation structure.
Source: 26

FEDERAL EXPENDITURES FOR RESEARCH AND DEVELOPMENT[a]
(Millions of Dollars)

| Year Ending June 30 | TOTAL | Major National Security | Other |
|---|---|---|---|
| 1940 | $ 74 | $ 26 | $ 48 |
| 1941 | 198 | 144 | 54 |
| 1942 | 280 | 211 | 69 |
| 1943 | 602 | 472 | 130 |
| 1944 | 1,377 | 1,178 | 199 |
| 1945 | 1,591 | 1,372 | 219 |
| 1946 | 918 | 784 | 134 |
| 1947 | 898 | 768 | 130 |
| 1948 | 853 | 698 | 155 |
| 1949 | 1,080 | 889 | 191 |
| 1950 | 1,080 | 871 | 209 |
| 1951 | 1,298 | 1,063 | 235 |
| 1952 | 1,815 | 1,565 | 250 |
| 1953 | 2,100 | 1,830 | 270 |
| 1954 | 2,085 | 1,806 | 279 |
| 1955 | 2,085 | 1,804 | 281 |
| 1956[b] | 2,538 | 2,202 | 336 |
| 1957[b] | 3,027 | 2,596 | 431 |
| 1958[b c] | 3,498 | 2,988 | 510 |
| 1959[b c] | 6,701 | 5,947 | 754 |
| 1960[b c E] | 7,941 | 6,880 | 1,061 |
| 1961[b c E] | 8,391 | 6,930 | 1,461 |

[E] Estimate
[a] Includes increase of "Research and Development Plant."
[b] Includes pay and allowances of military personnel.
[c] Figures under "Major national security" and "Total" in 1958 and 1959 include only a portion of the amounts for Department of Defense research and development, previously financed out of procurement appropriations, which are include d in full in 1960 and 1961. Figures prior to 1958 exclude comparable amounts.
Source: 26





billion (out of a Federal Government total of $5.5 billion) and in FY 1959 obligated $5.6 billion (out of a total of $7.2 billion).

The National Aeronautics and Space Administration has shown the greatest increase in a percentage comparison of any Federal agency. In FY 1959, the NASA obligated about $300 million for research and development, a fourfold increase over the previous year's $77 million program. The National Science Foundation says that in FY 1960, the

ATOMIC ENERGY COMMISSION
EXPENDITURES FOR RESEARCH AND DEVELOPMENT
1954 TO DATE
(Millions of Dollars)

| Year Ending June 30 | TOTAL | Conduct of Research and Development | | | | | Increase in Research and Development Plant |
|---|---|---|---|---|---|---|---|
| | | Total | Production and Weapons | Reactor Development | Biology, Medicine, Physics | Isotopes Development | |
| 1954 | $274.3 | $229.5 | $ 96.0 | $ 70.6 | $ 62.9 | ... | $ 44.8 |
| 1955 | 289.8 | 253.4 | 92.1 | 95.4 | 65.9 | ... | 36.4 |
| 1956 | 385.1 | 335.5 | 106.4 | 155.1 | 74.0 | ... | 49.6 |
| 1957 | 512.2 | 419.5 | 90.1 | 244.8 | 84.6 | ... | 92.7 |
| 1958 | 637.0 | 516.1 | 110.6 | 289.6 | 115.9 | ... | 120.9 |
| 1959 | 877.1 | 699.8 | 226.0 | 325.8 | 143.5 | 4.4 | 177.5 |
| 1960[E] | 1,007.2 | 790.1 | 216.6 | 382.5 | 180.9 | 10.4 | 217.1 |
| 1961[E] | 1,054.4 | 836.2 | 217.9 | 414.4 | 192.7 | 11.1 | 218.2 |

Source: 26

DEPARTMENT OF DEFENSE
UNOBLIGATED FUNDS AVAILABLE FOR
RESEARCH, DEVELOPMENT TEST AND EVALUATION
JANUARY 31, 1960
TOTAL AND GUIDED MISSILES

| | TOTAL, Research, Development, Test & Evaluation | Guided Missiles | Guided Missiles as Percent of Total |
|---|---|---|---|
| Department of Defense . | $2,212 | $388 | 17.5 |
| Air Force ..... | 916 | 107 | 11.7 |
| Navy ..... | 484 | 152 | 31.4 |
| Army ..... | 445 | 106 | 23.8 |
| Office of Secretary of Defense ..... | 367 | 23 | 6.3 |

Source: 23

DEPARTMENT OF DEFENSE
UNPAID OBLIGATIONS FOR
RESEARCH, DEVELOPMENT TEST AND EVALUATION
JANUARY 31, 1960
TOTAL AND GUIDED MISSILES

| | TOTAL, Research, Development, Test & Evaluation | Guided Missiles | Guided Missiles as Percent of Total |
|---|---|---|---|
| Department of Defense . | $1,780 | $608 | 34.2 |
| Air Force ..... | 538 | 43 | 8.0 |
| Navy ..... | 373 | 87 | 23.3 |
| Army ..... | 707 | 418 | 59.2 |
| Office of Secretary of Defense ..... | 162 | 60 | 37.0 |

Source: 23

research and development obligations will increase 40 per cent over FY 1959 to $425 million.

In a further breakdown of Defense R & D obligations, in FY 1959 the Air Force accounted for 49 per cent of the funds, the Navy for 22 per cent and the Army for 18 per cent. The balance of 11 per cent was accounted for by the Advanced Research Projects Agency.

This means that the aerospace industry is today the Nation's largest research and development organization. In addition to these large expenditures by the Government for R & D, aerospace companies are pour-

DEPARTMENT OF DEFENSE
UNOBLIGATED FUNDS AVAILABLE FOR
RESEARCH, DEVELOPMENT TEST AND EVALUATION
JANUARY 31, 1960
TOTAL AND AIRCRAFT

| | TOTAL, Research, Development, Test & Evaluation | Aircraft | Aircraft as Percent of Total |
|---|---|---|---|
| Department of Defense | $2,212 | $222 | 10.0 |
| Air Force | 916 | 188 | 20.5 |
| Navy | 484 | 68 | 14.0 |
| Army | 445 | 37 | 8.3 |
| Office of Secretary of Defense | 367 | — | — |

Source: 23

DEPARTMENT OF DEFENSE
UNPAID OBLIGATIONS FOR
RESEARCH, DEVELOPMENT TEST AND EVALUATION
JANUARY 31, 1960
TOTAL AND AIRCRAFT

| | TOTAL, Research, Development, Test & Evaluation | Aircraft | Aircraft as Percent of Total |
|---|---|---|---|
| Department of Defense | $1,780 | 167 | 9.4 |
| Air Force | 538 | 102 | 19.0 |
| Navy | 373 | 54 | 14.5 |
| Army | 707 | 11 | 1.6 |
| Office of Secretary of Defense | 162 | — | — |

Source: 23

ing back into their own projects substantial portions of their earnings.

In the presentation of the defense budget to Congress last year, and again in fiscal year 1961, the budget structure research and development sections have been expanded to better reflect the costs of test and evaluation. Although it was not possible to transfer all tests and evaluation funds from the procurement accounts, substantial portions have been transferred. In this expanded Research, Development, Test and Evaluation for the Defense Department, direct obligations show an

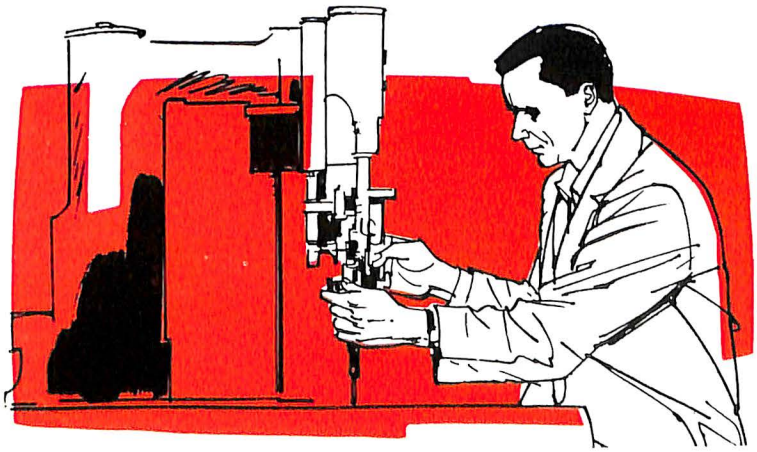
increase of over a billion dollars in four years—$2.5 billion in fiscal 1958 to an estimated $4.0 billion in fiscal 1961. Prior years are not completely comparable. Aircraft, missiles, military astronautics and related equipment account for 60 per cent of this fiscal year estimate of $2.2 billion. Today a study of the budget reveals a comprehensive picture of the vast, complicated nature of the programs. Development depends directly on research, and, in turn, test depends on development, and evaluation on test.

The magnitude of the over-all program, when added to those of the Atomic Energy Commission and the National Aeronautics and Space Administration, is tremendous. It clearly reflects the combined efforts of the military, research agencies, and the industry for continued technological superiority in the aerospace era.

FUNDS FOR RESEARCH AND DEVELOPMENT IN THE AIRCRAFT AND PARTS INDUSTRY
1957
(Millions of dollars)

| Industry | TOTAL FUNDS | Financed by the Federal Government | Funds for Basic Research |
|---|---|---|---|
| TOTAL—ALL INDUSTRIES | $7,155 | $3,741 | $241 |
| Aircraft and Parts | 2,544 | 2,165 | 52 |
| Electrical Equipment | 1,170 | 717 | 38 |
| Motor Vehicles and Other Transportation | 708 | 212 | 8 |
| Machinery, except Electrical | 688 | 260 | 17 |
| All Other | 2,045 | 387 | 126 |

Source: 40



# 6

# MANPOWER

Despite the downward trend during 1959 in the aerospace industry of production employees engaged in the manufacture of aircraft, missiles, spacecraft, propulsion systems and their components and accessories, this industry remained the nation's largest manufacturing employer. The aerospace industry ended 1959 with an average yearly employment of 734,700 employees comprising 4.6 percent of the U. S. total manufacturing employment. Next largest employer was the motor vehicles and equipment industry with an average yearly employment of 728,400 employees.

The Bureau of Labor Statistics reveals that employment in the aerospace industry continued to decline in 1959 from an employment peak reached in 1957 of 861,700. Industry average em oyment during 1958 was 757,500.

Paradoxically along with the two-year recession in general aerospace manufacturing employment needs, there has been a continual recruiting plea for highly trained engineers and scientists. Today the world is

witnessing a transition from jet aircraft to missile; from atmospheric flight to extra-atmospheric flight; and from hypersonic speeds to speed ranges, yet unnamed. The race for the conquest is on, but the only way that the aerospace industry can accomplish the critical transition to astronautical superiority is through the stockpiling of fundamental

SALARIES AND WAGES IN THE AIRCRAFT INDUSTRY
1914 TO DATE
(Thousands of Dollars)

| Year | TOTAL | Salaries | Production Workers | |
|---|---|---|---|---|
| | | | Wages | Average Weekly Earnings |
| 1914 | $ 196 | $ 61 | $ 135 | $15.45 |
| 1919 | 6,908 | 2,001 | 4,907 | 26.63 |
| 1921 | 3,235 | 1,033 | 2,202 | 30.36 |
| 1923 | 6,160 | 1,638 | 4,522 | 29.97 |
| 1925 | N.A. | N.A. | 4,222 | 30.06 |
| 1927 | 9,146 | 2,289 | 6,857 | 29.82 |
| 1929 | 31,448 | 9,524 | 21,924 | 28.66 |
| 1931 | N.A. | N.A. | 15,481 | 30.16 |
| 1933 | 13,824 | 3,516 | 10,308 | 25.36 |
| 1935 | 21,475 | 6,582 | 14,893 | 25.16 |
| 1937 | 46,867 | 13,514 | 33,353 | 26.72 |
| 1937[a] | N.A. | N.A. | 43,827 | 27.74 |
| 1939 | 108,286 | 30,798 | 77,488 | 30.56 |
| 1947 | 703,693 | 227,396 | 476,297 | 54.98 |
| 1949 | 956,189 | 311,821 | 644,368 | 63.62 |
| 1950 | 1,132,017 | 371,773 | 760,244 | 68.39 |
| 1951 | 2,102,913 | 642,821 | 1,460,092 | 78.40 |
| 1952 | 3,140,534 | 1,003,510 | 2,137,024 | 81.20 |
| 1953 | 3,941,133 | 1,301,268 | 2,639,847 | 83.80 |
| 1954 | 4,048,811 | 1,423,511 | 2,625,300 | 85.07 |
| 1955 | 4,153,201 | 1,584,834 | 2,568,367 | 89.72 |
| 1956 | 4,882,071 | 1,937,243 | 2,944,828 | 95.99 |
| 1957 | 5,377,000 | 2,212,000 | 3,165,000 | 101.48 |
| 1958 | 5,273,000 | 2,305,000 | 2,968,000 | 105.12 |
| 1959[E] | 5,300,000 | 2,400,000 | 2,900,000 | 110.00 |

N.A.—Not available.
E Estimate.
[a] This line and all following lines include data for aircraft engine manufacturers which are not available for prior years.
Sources: 12, 13

AIRCRAFT AND TOTAL MANUFACTURING EMPLOYMENT, 1914 TO DATE

| Year or Month | Aircraft Employment (in thousands) | Total Manufacturing Employment (in thousands) | Aircraft as Percent of Total Manufacturing Employment |
|---|---|---|---|
| 1914 | .2 | 7,514 | [a] |
| 1919 | 4.2 | 9,837 | [a] |
| 1921 | 2.0 | 7,557 | [a] |
| 1929 | 18.6 | 9,660 | .2 |
| 1933 | 9.6 | 6,558 | .2 |
| 1939 | 64.0 | 9,527 | .7 |
| Dec. 1941 | 423.0 | 13,817 | 3.1 |
| Nov. 1943 | 1,342.5 | 17,858 | 7.5 |
| Aug. 1945 | 351.4 | 15,343 | 2.2 |
| *Including subcontractors* | | | |
| Dec. 1941 | 567.0 | 13,817 | 4.1 |
| Nov. 1943 | 2,101.6 | 17,858 | 11.8 |
| Aug. 1945 | 519.9 | 15,343 | 3.4 |
| 1948 | 237.7 | 15,321 | 1.6 |
| 1950 | 281.8 | 14,967 | 1.9 |
| 1953 | 779.1 | 17,238 | 4.5 |
| 1954 | 764.1 | 15,995 | 4.8 |
| 1955 | 740.5 | 16,563 | 4.5 |
| 1956 | 809.3 | 16,903 | 4.8 |
| 1957 | 861.7 | 16,782 | 5.1 |
| 1958 | 757.5 | 15,464 | 4.9 |
| 1959 | 734.7 | 16,156 | 4.5 |

[a] Less than .05 percent.

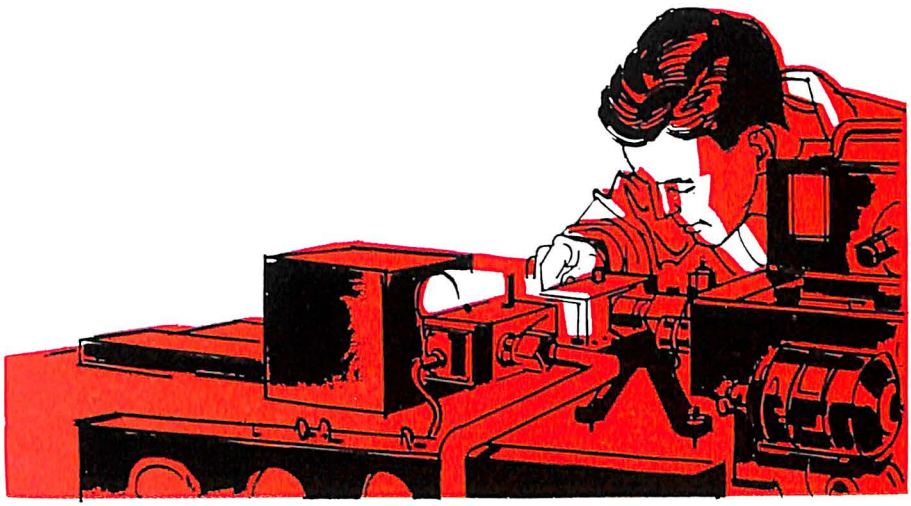
Sources: 13, 35

knowledge—building our community of research scientists and engineers. Illustrative of the vastly expanding needs in recruiting youth for this science and engineer "stockpile" are the growing engineering man-hours required to produce a modern supersonic bomber.

It required 200,000 engineering man-hours to bring the World War II B-17 to the point of the first production flight. The B-52 jet bomber, which can strike nonstop at any point in the world, required 4,085,000 engineering man-hours to point of first production flight. The new supersonic B-58 bomber, which carries a deadly hy| rsonic guided missile as payload, required 9,340,000 engineering man-hours to bring it to production status.

The design and manufacturing techniques required in the building of modern aerospace weapons have become so complicated that there is

little need for unskilled and semi-skilled employees. But, the need for higher skills continues to increase. This will continue far into the foreseeable future. As the aerospace industry moves deeper into the missile and spacecraft era, the need for engineering and other highly skilled personnel will inevitably increase. At the same time, two declining employment conditions are manifest. First, less airframe pounds are required per missile; second, although missiles demand a higher sales price per pound than aircraft, it takes 30 per cent less man-years production for the same dollar volume of sales.



SCIENTISTS AND ENGINEERS IN THE AIRCRAFT AND PARTS INDUSTRY
1957 and 1954[a]

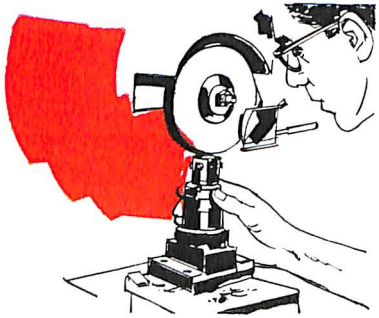
| Type of Scientist and Engineer | Number Employed | | | |
|---|---|---|---|---|
| | Total | | Research and Development | |
| | 1957 | 1954 | 1957 | 1954 |
| TOTAL, ALL TYPES .... | 84,900 | 48,500 | 56,700 | 27,600 |
| Engineers ..... | 66,000 | 41,100 | 44,800 | 22,500 |
| Metallurgists ..... | 900 | 700 | 600 | 400 |
| Chemists ..... | 1,600 | 1,000 | 1,100 | 700 |
| Physicists ..... | 1,900 | 1,200 | 1,500 | 1,000 |
| Mathematicians ..... | 2,200 | 900 | 1,600 | 800 |
| Other ..... | 12,300 | 3,500 | 7,200 | 2,200 |

NOTE: Distribution by type may not add to total because of rounding. Data for 1954 collected on slightly different basis from that for 1957.
[a] As of January
Source: 40

EMPLOYMENT IN THE AIRCRAFT AND PARTS INDUSTRY, 1939 TO DATE
(Thousands of Employees)

| Monthly Average for the Year | TOTAL | Aircraft (Airframes) | Aircraft Engines and Parts | Aircraft Propellers and Parts | Other Aircraft Parts and Equipment |
|---|---|---|---|---|---|
| 1939 | 63.2 | 45.1 | 11.3 | N.A. | N A. |
| 1940 | 148.6 | 101.8 | 31.4 | N.A. | N.A. |
| 1941 | 347.1 | 234.6 | 75.3 | N.A. | N.A. |
| 1942 | 831.7 | 549.6 | 192.0 | N.A. | N.A. |
| 1943 | 1,345.6 | 882.1 | 314.9 | N.A. | N.A. |
| 1944 | 1,296.6 | 815.5 | 339.7 | N.A. | N.A. |
| 1945 | 788.1 | 489.9 | 210.9 | N.A. | N.A. |
| 1946 | 237.3 | 159.0 | 49.9 | N.A. | N.A. |
| 1947 | 239.3 | 158.5 | 50.1 | 7.8 | 23.0 |
| 1948 | 237.7 | 158.0 | 48.6 | 7.7 | 23.3 |
| 1949 | 264.1 | 175.3 | 53.5 | 8.2 | 27.0 |
| 1950 | 281.8 | 188.4 | 55.8 | 8.3 | 29.3 |
| 1951 | 463.6 | 313.3 | 90.8 | 10.8 | 48.8 |
| 1952 | 660.7 | 425.9 | 138.8 | 14.5 | 81.6 |
| 1953 | 779.1 | 472.4 | 174.7 | 17.7 | 114.2 |
| 1954 | 764.1 | 470.0 | 159.4 | 15.8 | 118.9 |
| 1955 | 740.5 | 466.6 | 147.1 | 13.8 | 113.0 |
| 1956 | 809.3 | 494.4 | 167.1 | 16.9 | 130.9 |
| 1957 | 861.7 | 522.3 | 179.1 | 20.5 | 139.8 |
| 1958 | 757.5 | 456.8 | 152.7 | 18.3 | 129.7 |
| 1959 | 734.7 | 435.1 | 146.2 | 14.2 | 139.2 |
| 1960 | | | | | |
| Feb. | 686.8 | 397.5 | 140.4 | 13.8 | 135.1 |

N.A.—Not available.
Source: 35



PRODUCTION WORKERS IN THE AIRCRAFT AND PARTS INDUSTRY
1939 TO DATE
(Thousands of Production Workers)

| Monthly Average for the Year | TOTAL | Aircraft (Airframes) | Aircraft Engines and Parts | Aircraft Propellers and Parts | Other Aircraft Parts and Equipment |
|---|---|---|---|---|---|
| 1939 | 49.2 | 34.5 | 9.5 | N.A. | N.A. |
| 1940 | 117.0 | 78.4 | 26.6 | N.A. | N.A. |
| 1941 | 275.9 | 181.9 | 65.2 | N.A. | N.A. |
| 1942 | 669.0 | 429.5 | 168.8 | N.A. | N.A. |
| 1943 | 1,080.4 | 685.0 | 279.8 | N.A. | N.A. |
| 1944 | 1,006.9 | 609.8 | 291.4 | N.A. | N.A. |
| 1945 | 585.0 | 356 7 | 165.5 | N.A. | N.A. |
| 1946 | 159.5 | 111.8 | 34.1 | N.A. | N.A. |
| 1947 | 175.1 | 116.1 | 36.6 | 5.1 | 17.2 |
| 1948 | 173.6 | 116.1 | 35.0 | 5.1 | 17.3 |
| 1949 | 194.7 | 130.8 | 38.6 | 5.5 | 19.8 |
| 1950 | 206.4 | 138.9 | 40.0 | 5.5 | 22.1 |
| 1951 | 341.9 | 232.3 | 63.7 | 7.6 | 38.3 |
| 1952 | 483.5 | 311.6 | 98.8 | 10.4 | 62.7 |
| 1953 | 568.7 | 343.0 | 124.7 | 13.3 | 88.0 |
| 1954 | 541.4 | 331.4 | 109.1 | 11.2 | 89.7 |
| 1955 | 506.6 | 319.4 | 95.3 | 9.4 | 82.6 |
| 1956 | 537.4 | 326.8 | 105.3 | 11.3 | 94.0 |
| 1957 | 563.6 | 340.9 | 111.3 | 13.9 | 97.5 |
| 1958 | 479.2 | 291.3 | 89.9 | 12.2 | 85.8 |
| 1959 | 451.2 | 268.2 | 86.5 | 9.0 | 87.5 |
| 1960 Feb. | 413.5 | 239.7 | 83.0 | 8.4 | 82.4 |

N.A.—Not available.
Source: 35

Due to increasing pressures of the technological race in which the aerospace industry is involved, a wide range of measures are being taken by the industry to motivate, encourage, and in many cases, finance young people of talent in pursuing higher education in engineering and the sciences. In addition, most of the aerospace companies provide extensive in-plant training programs to raise the skill level of the employee.

Employees are also encouraged to attend local schools in order to gain additional and more current knowledge needed for them to perform more effectively in their vocational field. In operation, the aerospace companies and local schools cooperate in the establishment of training

programs. Employees taking approved courses are reimbursed in whole or in part for costs, tuition, books, etc. Called the Tuition Refund Plan, most companies stipulate that the student must enroll for a course directly related to his work or to a more responsible job to which the employee may logically be promoted.

Currently, because of the high quality of skills demanded in the manufacture of its products, aerospace industry employee wages are

AVERAGE WEEKLY EARNINGS IN AIRCRAFT AND PARTS PLANTS
1939 TO DATE
(Includes Overtime Premiums)

| Monthly Average for the Year | TOTAL | Aircraft (Airframes) | Aircraft Engines and Parts | Aircraft Propellers and Parts | Other Aircraft Parts and Equipment |
|---|---|---|---|---|---|
| 1939 | N.A. | N.A. | $36.93 | N.A. | N.A. |
| 1940 | N.A. | N.A. | 38.82 | N.A. | N.A. |
| 1941 | N.A. | N.A. | 47.65 | N.A. | N.A. |
| 1942 | N.A | N.A. | 60.14 | N.A. | N.A. |
| 1943 | N.A. | N.A. | 61.24 | N.A. | N.A. |
| 1944 | N.A. | N.A. | 62.68 | N.A. | N.A. |
| 1945 | N.A. | N.A. | 55.34 | N.A. | N.A. |
| 1946 | N.A. | N.A | 55.66 | N.A. | N.A. |
| 1947 | $54.98 | $53.99 | 56.30 | $59.68 | $56.50 |
| 1948 | 61.21 | 60.21 | 63.40 | 62.13 | 63.59 |
| 1949 | 63.62 | 62.69 | 65.24 | 66.83 | 68.08 |
| 1950 | 68.39 | 67.15 | 71.40 | 73.90 | 70.81 |
| 1951 | 78.40 | 75.78 | 85.81 | 89.17 | 78.66 |
| 1952 | 81.70 | 79.66 | 86.92 | 92.25 | 81.22 |
| 1953 | 83.80 | 82.19 | 87.29 | 85.90 | 85.17 |
| 1954 | 85.07 | 85.07 | 85.06 | 82.35 | 85.70 |
| 1955 | 89.62 | 89.40 | 88.97 | 90.47 | 90.49 |
| 1956 | 95.99 | 94.89 | 96.90 | 96.93 | 98.01 |
| 1957 | 96.76 | 95.65 | 98.23 | 97.76 | 99.78 |
| 1958 | 101.91 | 101.40 | 102.62 | 96.87 | 103.09 |
| 1959 | 106.63 | 106.13 | 109.03 | 101.84 | 107.57 |
| 1960 | | | | | |
| Feb. | 109.08 | 108.95 | 110.16 | 105.67 | 108.50 |

**N.A.—Not available.**
Source: 35

among the highest weekly wages for all manufacturing employees. The average weekly wage in the aerospace industry during 1959 amounted to $106.63, compared with an average of $101.91 in 1958. Average hourly earnings increased 17 cents an hour in 1959 over the previous year. The hourly earnings in 1959 were $2.68, compared with $2.51 in 1958. Average hours worked each week during 1959 were 40.7, compared with the 1958 average of 40.6 hours.

AVERAGE HOURLY EARNINGS IN AIRCRAFT AND PARTS PLANTS
1939 TO DATE
(Includes Overtime Premiums)

| Monthly Average for the Year | TOTAL | Aircraft (Airframes) | Aircraft Engines and Parts | Aircraft Propellers and Parts | Other Aircraft Parts and Equipment |
|---|---|---|---|---|---|
| 1939 | N.A. | N.A. | $0.83 | N.A. | N.A. |
| 1940 | N.A. | N.A. | .83 | N.A. | N.A. |
| 1941 | N.A. | N.A. | 1.00 | N.A. | N.A. |
| 1942 | N.A. | N.A. | 1.21 | N.A. | N.A. |
| 1943 | N.A. | $1.16[E] | 1.26 | N.A. | N.A. |
| 1944 | N.A. | 1.22[E] | 1.31 | N.A. | N.A. |
| 1945 | N.A. | 1.22[E] | 1.28 | N.A. | N.A. |
| 1946 | N.A. | 1.28[E] | 1.34 | N.A. | N.A. |
| 1947 | $1.38 | 1.36 | 1.41 | $1.44 | $1.41 |
| 1948 | 1.49 | 1.47 | 1.55 | 1.57 | 1.55 |
| 1949 | 1.57 | 1.55 | 1.60 | 1.63 | 1.61 |
| 1950 | 1.64 | 1.62 | 1.70 | 1.73 | 1.70 |
| 1951 | 1.79 | 1.75 | 1.89 | 1.93 | 1.80 |
| 1952 | 1.90 | 1.87 | 1.98 | 2.05 | 1.88 |
| 1953 | 2.00 | 1.99 | 2.03 | 2.05 | 1.99 |
| 1954 | 2.08 | 2.08 | 2.09 | 2.09 | 2.08 |
| 1955 | 2.17 | 2.17 | 2.17 | 2.18 | 2.17 |
| 1956 | 2.28 | 2.27 | 2.28 | 2.27 | 2.29 |
| 1957 | 2.36 | 2.35 | 2.39 | 2.35 | 2.37 |
| 1958 | 2.51 | 2.51 | 2.54 | 2.38 | 2.49 |
| 1959 | 2.68 | 2.69 | 2.67 | 2.54 | 2.67 |
| 1960 Feb. | 2.68 | 2.69 | 2.70 | 2.51 | 2.64 |

N.A.—Not available.
E Estimate.
Source: 35

TOTAL WAGES PAID IN THE AIRCRAFT AND PARTS INDUSTRY, BY GEOGRAPHICAL DIVISION AND SELECTED STATES—1947 TO 1958

In Millions of Dollars

| Geographical Divisions and Selected States | 1947 | 1948 | 1949 | 1950 | 1951 | 1952 |
|---|---|---|---|---|---|---|
| TOTAL | $717.5 | $759.5 | $915.9 | $1069.7 | $2012.7 | $3033.5 |
| New England | 79.6 | 87.2 | 101.4 | 112.8 | 197.5 | 275.0 |
| Massachusetts | 1.2 | .6 | 29.6 | 31.4 | 47.8 | 46.9 |
| Connecticut | 78.1 | 86.6 | 71.8 | 81.4 | 148.4 | 216.1 |
| Me., N.H., Vt., R.I. | .3 | — | — | — | 1.3 | 12.0 |
| Middle Atlantic | 115.9 | 119.3 | 138.2 | 172.0 | 321.4 | 509.7 |
| New York | 62.1 | 64.0 | 75.7 | 98.5 | 199.9 | 303.4 |
| New Jersey | 42.0 | 42.3 | 52.1 | 58.5 | 96.0 | 125.3 |
| Pennsylvania | 11.8 | 13.0 | 10.4 | 15.0 | 25.5 | 54.0 |
| East North Central | 103.0 | 92.6 | 99.5 | 118.0 | 276.5 | 521.4 |
| Ohio | 46.9 | 35.6 | 37.4 | 40.5 | 107.1 | 208.4 |
| Indiana | 42.9 | 52.1 | 54.5 | 70.7 | 106.7 | 156.6 |
| Illinois | .1 | .2 | 2.6 | 1.4 | 35.1 | 62.7 |
| Mich., Wisc. | 13.1 | 4.7 | 5.0 | 5.4 | 27.6 | 93.7 |
| West North Central | 34.6 | 48.9 | 70.9 | 86.9 | 204.2 | 279.5 |
| Missouri | 10.6 | 16.8 | 24.7 | 26.2 | 46.0 | 78.9 |
| Kansas | 20.9 | 28.9 | 42.8 | 57.0 | 150.2 | 188.9 |
| Minn., Iowa, N.D., S.D., Neb. | 3.2 | 3.2 | 3.4 | 3.7 | 8.0 | 11.7 |
| South Atlantic | 54.1 | 51.7 | 50.3 | 51.4 | 108.7 | 173.9 |
| Maryland | 51.8 | 50.0 | 48.2 | 50.0 | 89.7 | 121.4 |
| Del., D.C., Va., W.Va. | 1.9 | 1.9 | 1.8 | 1.0 | 1.6 | 2.7 |
| N.C., S.C., Ga., Fla. | .4 | .2 | .3 | .4 | 17.4 | 49.8 |
| East South Central (Ky., Tenn., Ala., Miss.) | 1.8 | 1.9 | 2.2 | 2.8 | 3.3 | 10.1 |
| West South Central (La. Okla., Tex.) | 38.3 | 48.8 | 72.3 | 95.4 | 171.9 | 225.4 |
| Mountain | .7 | .5 | .6 | 1.5 | 6.9 | 15.7 |
| Arizona | — | — | .1 | .3 | 4.5 | 12.5 |
| Wyo., Colo., N.Mex., Utah, Nev. | .7 | .5 | .5 | 1 . | 2.4 | 3.2 |
| Pacific | 289.5 | 308.6 | 380.5 | 428.9 | 722.3 | 1022.8 |
| California | 247.1 | 256.5 | 294.4 | 352.8 | 601.6 | 893.3 |
| Wash., Ore. | 42.4 | 52.1 | 86.1 | 76.1 | 120.7 | 129.5 |

Source: 33

TOTAL WAGES PAID IN THE AIRCRAFT AND PARTS INDUSTRY, BY GEOGRAPHICAL DIVISION AND SELECTED STATES—1947 TO 1958

In Millions of Dollars

| Geographical Divisions and Selected States | 1953 | 1954 | 1955 | 1956 | 1957 | 1958 |
|---|---|---|---|---|---|---|
| TOTAL | $3748.0 | $3762.6 | $3893.0 | $4568.7 | $5103.9 | $4823.0 |
| New England | 325.0 | 312.6 | 333.6 | 422.9 | 478.6 | 434.5 |
| Massachusetts | 48.8 | 44.8 | 46.6 | 52.2 | 56.6 | 59.2 |
| Connecticut | 258.3 | 256.3 | 280.7 | 363.2 | 410.7 | 363.3 |
| Me., N.H., Vt., R.I. | 17.9 | 11.5 | 6.3 | 7.5 | 11.3 | 12.0 |
| Middle Atlantic | 645.2 | 625.6 | 545.5 | 577.0 | 578.9 | 512.1 |
| New York | 373.9 | 387.2 | 342.1 | 351.3 | 362.1 | 349.1 |
| New Jersey | 156.3 | 133.2 | 123.0 | 143.6 | 139.7 | 100.2 |
| Pennsylvania | 115.0 | 105.2 | 80.4 | 82.1 | 77.1 | 62.8 |
| East North Central | 736.7 | 661.9 | 644.6 | 705.9 | 775.1 | 651.9 |
| Ohio | 272.6 | 328.2 | 344.4 | 373.5 | 413.4 | 372.5 |
| Indiana | 165.2 | 145.8 | 150.2 | 170.7 | 179.1 | 154.1 |
| Illinois | 123.8 | 85.2 | 83.6 | 102.1 | 104.0 | 70.6 |
| Mich., Wisc. | 175.1 | 102.7 | 66.4 | 59.6 | 78.6 | 54.7 |
| West North Central | 316.6 | 311.9 | 309.3 | 353.3 | 440.6 | 418.8 |
| Missouri | 113.9 | 110.5 | 105.8 | 125.1 | 171.8 | 178.8 |
| Kansas | 190.1 | 188.7 | 187.2 | 207.5 | 249.7 | 226.2 |
| Minn., Iowa, N.D., S.D., Neb. | 12.6 | 12.7 | 16.3 | 20.7 | 19.1 | 13.8 |
| South Atlantic | 200.9 | 208.6 | 247.2 | 292.4 | 291.0 | 298.0 |
| Maryland | 134.4 | 133.9 | 153.3 | 181.0 | 172.2 | 157.1 |
| Del., D.C., Va., W.Va. | 3.1 | 1.6 | 1.7 | 2.4 | 2.8 | 3.8 |
| N.C., S.C., Ga., Fla. | 63.4 | 73.1 | 92.2 | 109.0 | 116.0 | 137.1 |
| East South Central (Ky., Tenn., Ala., Miss.) | 19.3 | 25.7 | 24.8 | 33.9 | 41.6 | 53.1 |
| West South Central (La. Okla., Tex.) | 260.8 | 258.8 | 277.4 | 341.6 | 369.7 | 365.2 |
| Mountain | 32.2 | 35.1 | 34.9 | 66.8 | 92.8 | 107.2 |
| Arizona | 28.2 | 19.6 | 26.0 | 41.8 | 45.1 | 37.7 |
| Wyo., Colo., N.Mex., Utah, Nev. | 4.0 | 5.5 | 7.9 | 25.0 | 47.7 | 69.5 |
| Pacific | 1211.3 | 1332.4 | 1475.7 | 1774.9 | 2035.6 | 1982.2 |
| California | 1050.2 | 1153.9 | 1275.7 | 1532.2 | 1694.3 | 1582.3 |
| Wash., Ore. | 161.1 | 178.5 | 100.0 | 242.7 | 341.3 | 399.9 |

AVERAGE EMPLOYMENT IN THE AIRCRAFT AND PARTS INDUSTRY
BY GEOGRAPHICAL DIVISIONS AND SELECTED STATES—1953 TO 1958[a]

| Geographical Divisions and Selected States | 1953 | 1954 | 1955 | 1956 | 1957 | 1958 |
|---|---|---|---|---|---|---|
| TOTAL | 774,150 | 761,964 | 745,424 | 818,107 | 890,326 | 782,057 |
| New England | 69,335 | 67,040 | 66,672 | 77,848 | 87,496 | 76,592 |
| Massachusetts | 10,148 | 8,762 | 8,977 | 9,092 | 9,898 | 9,161 |
| Connecticut | 54,623 | 55,349 | 46,269 | 67,169 | 75,219 | 65,037 |
| Me., N.H., Vt., R.I. | 4,564 | 2,929 | 1,426 | 1,587 | 2,379 | 2,394 |
| Middle Atlantic | 127,349 | 122,622 | 103,372 | 103,841 | 101,039 | 82,728 |
| New York | 70,971 | 73,406 | 61,648 | 59,387 | 61,211 | 54,400 |
| New Jersey | 32,272 | 27,409 | 24,979 | 27,868 | 24,993 | 16,675 |
| Pennsylvania | 24,106 | 21,807 | 16,745 | 16,586 | 14,835 | 11,653 |
| East North Central | 146,560 | 132,207 | 121,821 | 123,489 | 131,615 | 103,660 |
| Ohio | 55,203 | 68,062 | 66,192 | 66,018 | 69,954 | 58,353 |
| Indiana | 33,288 | 29,212 | 28,554 | 30,645 | 31,204 | 25,508 |
| Illinois | 23,103 | 16,353 | 14,965 | 16,956 | 17,382 | 10,855 |
| Mich., Wisc. | 34,966 | 18,580 | 12,110 | 9,870 | 13,075 | 8,944 |
| West North Central | 69,456 | 67,577 | 64,016 | 68,684 | 83,501 | 74,867 |
| Missouri | 24,202 | 23,517 | 21,456 | 23,363 | 32,225 | 31,793 |
| Kansas | 42,320 | 41,463 | 39,308 | 41,350 | 47,861 | 40,710 |
| Minn., Iowa, N.D., S.D., Neb. | 2,934 | 2,597 | 3,252 | 3,971 | 3,415 | 2,364 |
| South Atlantic | 45,201 | 45,044 | 49,535 | 54,496 | 53,099 | 49,734 |
| Maryland | 30,546 | 29,227 | 30,339 | 33,691 | 32,072 | 26,822 |
| Del., D.C., Va., W.Va. | 741 | 386 | 408 | 539 | 615 | 590 |
| N.C., S.C., Ga., Fla. | 13,914 | 15,431 | 18,788 | 20,266 | 20,412 | 22,322 |
| East South Central (Ky., Tenn., Ala., Miss.) | 5,141 | 6,411 | 5,803 | 7,541 | 9,016 | 9,785 |
| West South Central (La. Okla., Tex.) | 57,158 | 53,176 | 54,003 | 63,203 | 66,585 | 60,756 |
| Mountain | 6,998 | 4,876 | 6,614 | 11,101 | 15,552 | 16,052 |
| Arizona | 6,108 | 3,857 | 5,030 | 7,149 | 7,743 | 5,756 |
| Wyo., Colo., N.Mex., Utah, Nev. | 890 | 1,018 | 1,584 | 3,952 | 7,809 | 10,296 |
| Pacific | 246,952 | 263,011 | 273,588 | 307,904 | 342,423 | 307,883 |
| California | 212,648 | 225,407 | 234,022 | 263,0[illegible] | 279,168 | 240,997 |
| Wash., Ore. | 34,304 | 37,604 | 39,566 | 44,8[illegible] | 63,255 | 66,886 |

[a] The difference between these totals and employment totals appearing elsewhere are due to technical differences in methodologies of B.E.S., B.L.S., and Census, and do not seriously affect the useability of the data.

NOTE: Corresponding data for the years 1947 through 1952 may be found in "Aviation Facts and Figures," 1959 edition.

Source: 33

WORK-INJURY RATES FOR THE AIRCRAFT AND ALL MANUFACTURING INDUSTRIES 1939 TO DATE

| Year | Aircraft Industry | | Aircraft Parts Industry | | All Manufacturing | |
|---|---|---|---|---|---|---|
| | Injury-Frequency Rates[a] | Severity Rates[a] | Injury-Frequency Rates[a] | Severity Rates[a] | Injury-Frequency Rates[a] | Severity Rates[a] |
| 1939 | 12.9 | 1.9 | [b] | [b] | 14.9 | 1.4 |
| 1940 | 15.8 | 1.3 | [b] | [b] | 15.3 | 1.6 |
| 1941 | 10.4 | 1.4 | [b] | [b] | 18.1 | 1.7 |
| 1942 | 11.4 | 0.7 | 9.5 | 0.9 | 19.9 | 1.5 |
| 1943 | 9.7 | 0.7 | 11.7 | 0.8 | 20.0 | 1.4 |
| 1944 | 8.8 | 0.6 | 10.1 | 0.6 | 18.4 | 1.4 |
| 1945 | 9.4 | 1.2 | 10.6 | 1.7 | 18.6 | 1.6 |
| 1946 | 5.2 | 0.8 | 13.7 | 2.1 | 19.9 | 1.6 |
| 1947 | 4.8 | 0.7 | 11.1 | 0.6 | 18.8 | 1.4 |
| 1948 | 4.9 | 0.8 | 10.2 | 0.8 | 17.2 | 1.5 |
| 1949 | 4.3 | 1.0 | 9.2 | 1.0 | 14.5 | 1.4 |
| 1950 | 4.0 | 0.9 | 5.9 | 0.6 | 14.7 | 1.2 |
| 1951 | 4.5 | 0.6 | 7.1 | 0.9 | 15.5 | 1.3 |
| 1952 | 3.7 | 0.3 | 6.7 | 0.4 | 14.3 | 1.3 |
| 1953 | 3.8 | 0.6 | 6.3 | 0.5 | 13.4 | 1.2 |
| 1954 | 3.2 | 0.7 | 5.8 | 0.5 | 11.9 | 1.0 |
| 1955 | 2.8 | 0.3 | 4.8 | 0.3 | 12.1 | 0.6 |
| 1956 | 2.6 | 0.2 | 4.7 | 0.2 | 12.0 | 0.7 |
| 1957 | 2.7 | 0.3 | 3.8 | 0.3 | 11.1 | 0.8 |
| 1958 | 2.9 | 0.3 | 4.1 | 0.3 | 10.9 | 0.8 |
| 1959 | 2.7 | N.A. | 4.1 | N.A. | 11.9 | N.A. |

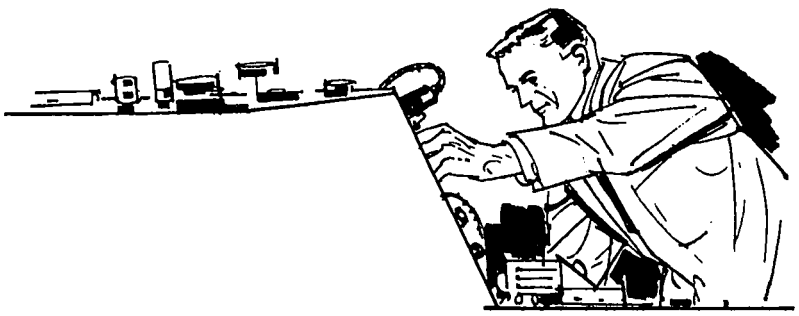
N.A.—Not available.

[a] The injury frequency rate is the average number of disabling work injuries for each million employee-hours worked.

The severity rate is the average number of days lost as a result of disabling work injuries for each 1,000 employee-hours worked. The computations of days lost include standard time charges for fatalities and permanent disabilities.

[b] Included with "Aircraft."

Source: 36



WOMEN EMPLOYEES IN THE AIRCRAFT INDUSTRY, 1942 TO DATE

| Date | Number (thousands) | Percent |
|---|---|---|
| Jan. 1942 | 23.1 | 5.0 |
| Nov. 1943 | 486.1 | 36.7 |
| Oct. 1947 | 28.5 | 11.8 |
| Sept. 1949 | 33.3 | 12.5 |
| Sept. 1950 | 36.2 | 12.4 |
| Sept. 1951 | 88.6 | 17.7 |
| Sept. 1952 | 117.9 | 18.0 |
| Sept. 1953 | 133.4 | 17.6 |
| Sept. 1954 | 132.3 | 16.6 |
| Oct. 1955 | 118.4 | 15.7 |
| Oct. 1956 | 135.4 | 15.6 |
| Oct. 1957 | 134.7 | 15.9 |
| Oct. 1958 | 112.9 | 14.8 |
| Oct. 1959 | 108.3 | 15.1 |

Sources: 3, 35

LABOR TURNOVER IN THE AIRCRAFT AND PARTS INDUSTRY, 1950 TO DATE
(Rates per 100 Employees per Year)

| Date | Total | | Aircraft (Airframes) | | Aircraft Engines and Parts | | Aircraft Propellers and Parts | | Other Aircraft Parts and Equipment | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Accessions | Separations | Accessions | Separations | Accessions | Separations | Accessions | Separations | Accessions | Separations |
| 1950 | 62.8 | 33.8 | 67.2 | 37.1 | 48.2 | 21.3 | 32.0 | 17.6 | 59.6 | 27.6 |
| 1951 | 94.8 | 50.0 | 97.5 | 52.4 | 86.9 | 39.6 | 52.7 | 27.6 | 89.6 | 44.5 |
| 1952 | 63.1 | 45.9 | 64.1 | 49.0 | 60.1 | 40.8 | 49.1 | 25.1 | 65.3 | 41.3 |
| 1953 | 47.5 | 42.7 | 47.2 | 42.7 | 47.4 | 43.2 | 33.2 | 28.3 | 52.7 | 47.8 |
| 1954 | 28.2 | 31.8 | 28.2 | 29.5 | 21.6 | 36.3 | 1[illegible]1 | 41.7 | 33.0 | 37.1 |
| 1955 | 33.1 | 29.8 | 38.0 | 27.4 | 30.7 | 28.8 | 22.7 | 38.2 | 43.3 | 52.5 |
| 1956 | 41.9 | 28.5 | 40.8 | 26.6 | 41.1 | 28.3 | 43.3 | 20.9 | 49.5 | 48.9 |
| 1957 | 30.1 | 42.5 | 31.0 | 42.0 | 21.9 | 38.6 | 32.9 | 25.8 | 41.9 | 63.8 |
| 1958 | 26.6 | 31.2 | 25.8 | 28.5 | 27.3 | 34.6 | 10.9 | 42.0 | 39.0 | 43.9 |
| 1959 | 24.1 | 37.4 | 21.4 | 36.9 | 26.4 | 37.2 | 29.5 | 37.3 | 50.1 | 49.1 |

Source: 35

WORK STOPPAGES IN SELECTED INDUSTRIES, 1958

| Industry | Number of Strikes | Number of Workers Involved | Man-Days Idle in Year |
|---|---|---|---|
| All Manufacturing Corporations | 1,955 | 1,490,000 | 15,400,000 |
| AIRCRAFT AND PARTS | 20 | 36,700 | 308,000 |
| Primary Iron and Steel | 50 | 28,300 | 347,000 |
| Petroleum Refining | 8 | 7,380 | 124,000 |
| Motor Vehicles and Equipment | 178 | 506,000 | 3,870,000 |
| Electrical Machinery | 93 | 102,000 | 1,030,000 |

Source: 34

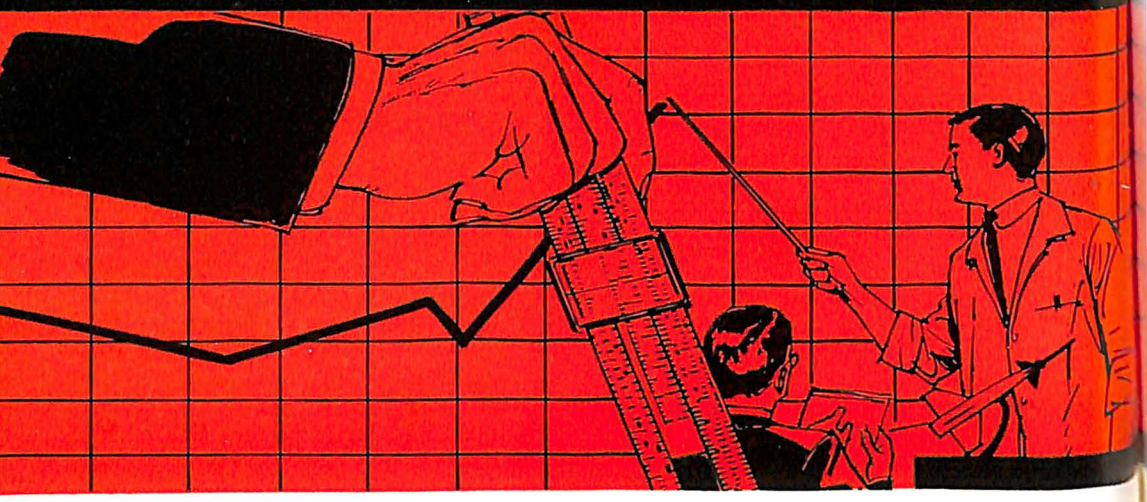
WORK STOPPAGES IN THE AIRCRAFT AND PARTS INDUSTRY 1927—TO DATE

| Year | Number of Strikes | Number of Workers Involved | Man-Days Idle in Year |
|---|---|---|---|
| 1927–1933 | 4 | 1,153 | 18,965 |
| 1934 | 4 | 3,207 | 111,048 |
| 1935 | 1 | 1,700 | 6,800 |
| 1936 | — | — | — |
| 1937 | 6 | 9,390 | 90,964 |
| 1938 | N.A. | N.A. | N.A. |
| 1939 | 2 | 1,263 | 85,419 |
| 1940 | 3 | 6,270 | 36,402 |
| 1941 | 29 | 28,422 | 112,549 |
| 1942 | 15 | 6,584 | 12,416 |
| 1943 | 60 | 52,481 | 130,112 |
| 1944 | 103 | 189,801 | 386,371 |
| 1945 | 85 | 150,200 | 581,000 |
| 1946 | 15 | 21,300 | 557,000 |
| 1947 | 10 | 3,520 | 67,900 |
| 1948 | 8 | 21,400 | 1,100,000 |
| 1949 | 10 | 10,300 | 451,000 |
| 1950 | 18 | 23,900 | 145,000 |
| 1951 | 29 | 48,800 | 765,000 |
| 1952 | 44 | 81,000 | 927,000 |
| 1953 | 31 | 57,800 | 1,350,000 |
| 1954 | 11 | 6,350 | 171,000 |
| 1955 | 38 | 48,500 | 403,000 |
| 1956 | 21 | 23,100 | 1,040,000 |
| 1957 | 18 | 23,200 | 88,200 |
| 1958 | 20 | 36,700 | 308,000 |

N.A.—Not available.
Source: 34

# 7

# FINANCE



The aerospace industry in 1959 continued to follow a disturbing pattern set in the last six years—a sharply declining profit rate despite a steady sales volume.

The rate of net profit to sales for the aircraft and parts (aerospace) industry, as reported by the Securities and Exchange Commission and the Federal Trade Commission, was 1.5 per cent in 1959 compared with 2.4 per cent in the previous year. The profit rate has skidded steadily from 3.8 per cent in 1955 to a point last year of *less than half* the 1955 rate.

The profit picture for the 12 major airframe companies, an accepted barometer of financial health, is even gloomier. Sales in 1959 amounted to $7,049 million, compared with last year's high of $7,079 million, a decrease of less than one half of one per cent. But earnings after taxes amounted to only $66.9 million, a rate of nine tenths of one cent per sales dollar. This compared with a 1958 profit of $138 million or 1.9 cents per sales dollar and 1957 earnings of $166.4 million or 2.4 cents per sales dollar.

## Balance Sheet Comparisons, 12 Major Airframe Companies 1953 to Date
(Thousands of Dollars)

| | 1953 | 1954 | 1955 | 1956 | 1957 | 1958 | 1959 |
|---|---|---|---|---|---|---|---|
| Assets: | | | | | | | |
| Current Assets | | | | | | | |
| Cash | $ 261.9 | $ 295.4 | $ 295.5 | $ 311.6 | $ 233.3 | $ 267.4 | $ 252.3 |
| Securities | 5.5 | 26.4 | 29.4 | — | — | — | — |
| Receivables | 526.4 | 461.9 | 463.9 | 594.2 | 792.0 | 1,022.6 | 985.6 |
| Inventories | 583.9 | 592.1 | 638.2 | 874.6 | 947.7 | 944.5 | 950.4 |
| Miscellaneous | 27.5 | 12.9 | 23.0 | 31.3 | 40.9 | 51.6 | 85.9 |
| Total Current Assets | $1,405.2 | $1,388.7 | $1,450.0 | $1,811.7 | $2,013.9 | $2,286.1 | $2,274.2 |
| Total Net Plant | 166.1 | 186.4 | 214.0 | 310.0 | 431.5 | 441.9 | 481.0 |
| Other Assets: | | | | | | | |
| Investments | 9.2 | 6.3 | 5.7 | 5.8 | 5.8 | 7.9 | 16.8 |
| Development, etc., expenses | 2.2 | — | 16.4 | 19.6 | 30.1 | 23.5 | 36.3 |
| Deferred charges | 13.6 | 19.7 | 3.0 | 3.0 | 7.3 | 13.5 | 13.3 |
| Total Assets | $1,596.3 | $1,601.1 | $1,689.1 | $2,150.1 | $2,488.6 | $2,773.0 | $2,821.6 |
| Liabilities | | | | | | | |
| Current Liabilities | | | | | | | |
| Notes payable | 544.2 | 396.2 | 375.8 | 204.8 | 874.7 | 925.3 | 957.4 |
| Trade accounts payable | — | — | — | 430.2 | 335.2 | 347.4 | 342.1 |
| Accruals—taxes—renegotiation—refunds due U.S. | 406.9 | 409.0 | 436.6 | 347.6 | 126.5 | 126.3 | 109.7 |
| Advances—contracts deposits | 92.5 | 121.4 | 66.3 | 176.5 | — | — | — |
| Reserve | 3.5 | 8.9 | 12.3 | 5.1 | 4.8 | 8.3 | 7.8 |
| Miscellaneous | 8.3 | 11.1 | 13.5 | 27.5 | 31.3 | 36.8 | 44 8 |
| Total Current Liabilities: | $1,055.4 | $ 946.6 | $ 904.5 | $1,191.5 | $1,372.6 | $1,444.2 | $1,461.8 |
| Bank loans, etc. (long term) | 8.6 | 8.6 | 36.7 | 73.7 | 127.8 | 260.7 | 256.4 |
| Miscellaneous | 5.7 | 4.4 | 6.3 | 5.4 | 6.9 | 7.8 | 8.2 |
| Total Other Liabilities | $ 14.3 | $ 13.0 | $ 43.0 | $ 79.1 | $ 134.7 | $ 268.9 | $ 264.6 |
| Net Worth: | | | | | | | |
| Capital stock | 95.5 | 125.7 | 135.5 | 168.4 | 178.6 | 198.7 | 210.2 |
| Capital surplus | 77.2 | 100.3 | 110.2 | 162.1 | 164.3 | 185.7 | 206.6 |
| Earned surplus | 353.9 | 415.5 | 495.9 | 549.0 | 638.4 | 675.8 | 678 4 |
| Total Net Worth | $ 526.6 | $ 641.5 | $ 741.6 | $ 879.5 | $ 981.3 | $1,060.3 | $1,095.2 |
| Total Liabilities | $1,596.3 | $1,601.1 | $1,689.1 | $2,150.1 | $2,488.6 | $2,773.0 | $2,821.6 |
| Net Working Capital | $ 349.8 | $ 442.1 | $ 545.4 | $ 620.2 | $ 641.4 | $ 842.0 | $ 812.4 |

Source: 1

In addition, these figures do not take into account any earnings refunds which may be demanded by the Renegotiation Board. Profits, indeed, have reached a point in the industry where they are barely visible.

There are many reasons for this decline in earnings. But principally it stems from the technological revolution within the industry.

The day of volume production is over. Aerospace companies can no longer plan for lengthy production runs of new weapons. Each system, missile or aircraft, is very nearly custom made.

The overhead for research and development has greatly increased. For example, the research and development costs involved in a World

INCOME ACCOUNTS, 12 MAJOR AIRFRAME COMPANIES, 1937 TO DATE
(Millions of Dollars)

| Year | Net Sales | Total Income | Total Federal Taxes, net | Net Profit |
|---|---|---|---|---|
| 1937 | $ 61.8 | $ 3.6 | $ 1.3 | $ 2.3 |
| 1938 | 88.5 | 10.1 | 2.1 | 8.0 |
| 1939 | 141.0 | 19.1 | 4.5 | 14.6 |
| 1940 | 247.4 | 45.1 | 13.3 | 31.8 |
| 1941 | 812.6 | 168.7 | 108.6 | 60.1 |
| 1942 | 2,788.9 | 341.8 | 281.2 | 60.6 |
| 1943 | 5,209.0 | 429.8 | 357.0 | 72.8 |
| 1944 | 5,766.3 | 322.1 | 263.5 | 58.6 |
| 1945 | 3,965.3 | 215.1 | 147.7 | 67.4 |
| 1946 | 519.0 | (37.0) | 26.3[cr] | (10.7) |
| 1947 | 545.0 | (115.4) | 73.5[cr] | (41.9) |
| 1948 | 843.4 | 24.2 | 21.8 | 2.4 |
| 1949 | 1,131.7 | 57.8 | 21.7 | 36.1 |
| 1950 | 1,388.2 | 111.1 | 48.5 | 62.6 |
| 1951 | 1,979.3 | 98.9 | 68.0 | 30.9 |
| 1952 | 3,731.1 | 220.5 | 138.8 | 81.7 |
| 1953 | 5,120.1 | 317.1 | 200.5 | 116.6[a] |
| 1954 | 4,926.8 | 371.0 | 188.4 | 182.6[a] |
| 1955 | 5,188.1 | 370.7 | 191.9 | 178.8[a] |
| 1956 | 5,637.1 | 328.1 | 171.6 | 156.5[a] |
| 1957 | 6,912.7 | 346.8 | 180.4 | 166.4[a] |
| 1958[r] | 7,078.6 | 286.1 | 148.1 | 138.0[a] |
| 1959 | 7,048.8 | 150.9 | 84.0 | 66.9[a] |

[a] Subject to renegotiation.
[cr] Credit.
[r] Revised.
Figures in parentheses indicate loss.
Source: 1

COMPOSITION OF CURRENT ASSETS, 1937 TO DATE, 12 MAJOR AIRFRAME COMPANIES
(In Percent of Total)

| Year | Total Current Assets | Cash and Securities | Inventories | Receivables | Miscellaneous |
|---|---|---|---|---|---|
| 1937 | 100.0 | 17.6 | 35.2 | 46.6 | .6 |
| 1938 | 100.0 | 35.1 | 33.8 | 30.3 | .8 |
| 1939 | 100.0 | 37.9 | 48.9 | 13.1 | .1 |
| 1940 | 100.0 | 46.4 | 35.7 | 12.2 | 5.7 |
| 1941 | 100.0 | 23.2 | 52.3 | 24.4 | .1 |
| 1942 | 100.0 | 25.1 | 33.8 | 40.9 | .2 |
| 1943 | 100.0 | 27.6 | 25.5 | 45.9 | 1.0 |
| 1944 | 100.0 | 26.7 | 22.7 | 49.1 | 1.5 |
| 1945 | 100.0 | 34.1 | 13.7 | 48.9 | 3.3 |
| 1946 | 100.0 | 32.9 | 43.8 | 23.2 | .1 |
| 1947 | 100.0 | 18.6 | 54.9 | 25.6 | .9 |
| 1948 | 100.0 | 23.9 | 40.1 | 35.3 | .7 |
| 1949 | 100.0 | 26.8 | 41.6 | 30.5 | 1.1 |
| 1950 | 100.0 | 23.3 | 36.2 | 39.6 | .9 |
| 1951 | 100.0 | 18.4 | 40.8 | 39.4 | 1.4 |
| 1952 | 100.0 | 17.8 | 42.4 | 38.3 | 1.5 |
| 1953 | 100.0 | 19.0 | 41.6 | 37.5 | 1.9 |
| 1954 | 100.0 | 23.1 | 42.6 | 33.3 | 1.0 |
| 1955 | 100.0 | 22.4 | 44.0 | 32.0 | 1.6 |
| 1956 | 100.0 | 17.2 | 48.3 | 32.8 | 1.7 |
| 1957 | 100.0 | 11.6 | 47.1 | 39.3 | 2.0 |
| 1958[r] | 100.0 | 11.7 | 41.3 | 44.7 | 2.3 |
| 1959 | 100.0 | 11.1 | 41.8 | 44.3 | 2.8 |

[r]Revised.
Source: 1

War II bomber amounted to a few cents out of the total weapon dollar. Today, the research and development costs for an intercontinental ballistic missile take about 60 cents out of each weapon dollar.

Technological progress has been so swift that each company, in order to maintain its competitive position, must pour more and more of its earnings into research and development. Research and development is no longer a matter of a few scientists and engineers working together with basic laboratory equipment. Research and development today requires very expensive facilities, both in equipment and buildings. In many cases, large sums may be invested in a research program only to

have the project superceded, literally overnight, by another, more promising program.

As an example of company-sponsored research efforts, the Navy Department reported that it received 486 unsolicited industry proposals for the development of antisubmarine warfare devices. The Navy further stated that 155 of these proposals had sufficient merit to warrant the Navy Department spending $26 million for further work. The amount expended by the companies in proposals was probably far greater than the Navy's expenditure for further investigation.

The facilities problem does not end in the research and development phase. The production facilities for many of today's advanced weapons cost three times as much to build and even more to equip than the conventional assembly line concept. There are dustfree rooms that rival

FINANCIAL RATIOS, 12 MAJOR AIRFRAME COMPANIES
1937 TO DATE

| Year | Net Federal Taxes as Percent of Total Income | Net Profit as Percent of Sales |
|---|---|---|
| 1937 | 26.5 | 3.7 |
| 1938 | 21.9 | 9.1 |
| 1939 | 19.8 | 10.3 |
| 1940 | 26.9 | 12.9 |
| 1941 | 59.5 | 7.4 |
| 1942 | 72.6 | 2.2 |
| 1943 | 72.0 | 1.4 |
| 1944 | 71.7 | 1.0 |
| 1945 | 57.5 | 1.7 |
| 1946 | Not applicable | (2.1) |
| 1947 | Not applicable | (7.7) |
| 1948 | 82.3 | 0.3 |
| 1949 | 37.5 | 3.2 |
| 1950 | 43.7 | 4.5 |
| 1951 | 68.6 | 1.6 |
| 1952 | 62.9 | 2.2 |
| 1953[a] | 63.2 | 2.3 |
| 1954[a] | 50.8 | 3.7 |
| 1955[a] | 51.8 | 3.4 |
| 1956[a] | 52.3 | 2.8 |
| 1957[a] | 52.0 | 2.4 |
| 1958[r,a] | 51.8 | 1.9 |
| 1959[a] | 55.7 | 0.9 |

Figures in parentheses indicate net loss as a percent of sales.
[a] Subject to renegotiation.
[r] Revised.
Source: 1

## PERCENT NET PROFIT TO SALES
## 1959

4.5

TOTAL MANUFACTURING CORPORATIONS

1.5

AIRCRAFT AND PARTS

4.8

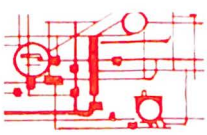
PRIMARY IRON AND STEEL

9.9

PETROLEUM REFINING

5.0

MOTOR VEHICLES AND EQUIPMENT



4.9

ELECTRICAL MACHINERY

Source:

NET INCOME AS A PERCENT OF SALES
(After Taxes)

| Industry | 1953 | 1954 | 1955 | 1956 | 1957 | 1958 | 1959 |
|---|---|---|---|---|---|---|---|
| Total Manufacturing Corporations ..... | 4.3 | 4.5 | 5.4 | 5.2 | 4.8 | 4.2 | 4.5 |
| AIRCRAFT AND PARTS ... | 3.2 | 3.4 | 3.8 | 3.1 | 2.9 | 2.4 | 1.5 |
| Primary Iron and Steel | 5.2 | 5.3 | 7.2 | 6.7 | 6.6 | 5.4 | 4.8 |
| Petroleum Refining .... | 10.4 | 10.6 | 11.1 | 11.5 | 10.6 | 9.5 | 9.9 |
| Motor Vehicles and Equipment ..... | 3.9 | 5.3 | 6.9 | 5.2 | 5.4 | 4.0 | 5.0 |
| Electrical Machinery ... | 4.1 | 4.5 | 4.4 | 3.8 | 4.2 | 3.8 | 4.9 |

Source: 42

surgical theaters for cleanliness; temperature is rigidly controlled the year round. Assembly benches are made of stainless steel. There are many more necessary, and very expensive features to a production facility today.

The decision to move ahead with the construction of these high-cost facilities cannot be accurately described as an investment. It is a gamble. The stakes approach the corporate existence of each company.

There is a misconception in the public's mind that the Defense Department bears the cost of these facilities. This is true to a certain extent, but a large portion of these funds come from the dwindling earnings of the aerospace industry. For example, in 1957 about $780,000,000 were expended for aerospace facilities. The industry itself spent about $515,000,000 or 66 per cent of the total.

The net worth of the 12 major airframe companies increased slightly from $1,060,300,000 in 1958 to $1,095,200,000 in 1959. Net working capital of these companies declined slightly from $842,000,000 in 1958 to $812,400,000 in 1959. However, the total assets increased from the $2,773,000,000 in 1958 to $2,821,600,000 in 1959, but liabilities also showed a gain from $1,444,200,000 in 1958 to $1,461,800,000 in 1959.

Long term bank loans, which increased more than double from 1957 to 1958, leveled off to $264,600,000 in 1959 compared to the all-time high of $268,900,000 in 1958.

The industry is capitalized to meet the requirements of our defense establishment in the most efficient, economical and conservative manner possible under the circumstances. The companies are capitalized to (1)

provide the liquidity necessary to support the inescapable high level of mercantile and bank credit, (2) furnish the working capital and financial strength to support a high level of contractual development and manufacturing operations, and (3) avoid the costly burden of over-capitalization during the prolonged periods of low military procurement appropriations and of low volume production. Avoiding over-capitalization is essential to the aerospace industry where the volume of business of any particular company fluctuates widely over a period of years. Over-capitalization played an important part in the wholesale bankruptcies in the aviation industry following World War I. Of the 17 companies that were producing aircraft and airplane engines in 1918, all 17 had gone through bankruptcies or drastic reorganization prior to 1926.

EXPENDITURES OF 12 MAJOR AIRFRAME COMPANIES UNDER MILITARY CONTRACTS, 1957 TO DATE
(Dollar Figures in Billions)

| | 1957 | | 1958 | | 1959 | |
|---|---|---|---|---|---|---|
| | Dollars | Per Cent | Dollars | Per Cent | Dollars | Per Cent |
| TOTAL | $5.3 | 100 | $5.2 | 100 | $5.3 | 100 |
| Purchases from Small Business ..... | 1.0 | 20 | .8 | 16 | 0.8 | 16 |
| Purchases from Large Business ..... | 2.1 | 39 | 1.8 | 35 | 2.0 | 38 |
| Overhead, Payroll, Etc. | 2.2 | 41 | 2.5 | 49 | 2.5 | 46 |

Source: 1

SELECTED MAJOR DEFENSE CONTRACTORS

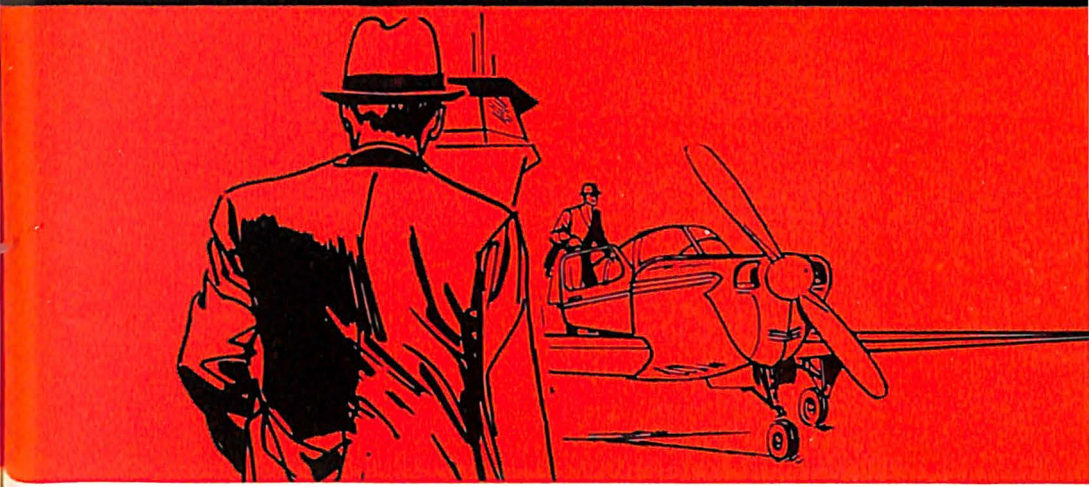
(Listed by rank according to net value of military prime contracts awarded, 1950-1959)

| | World War II | July 1, 1950 to June 30, 1959 | July 1, 1957 to June 30, 1958 | July 1, 1958 to June 30, 1959 |
|---|---|---|---|---|
| U. S. TOTAL, ALL CONTRACTS (in Billions) | $193.3[E] | $203.9 | $21.8 | $22.6 |
| Company | Percent of Total | | | |
| *20 Largest Defense Contractors* | | | | |
| *Boeing Airplane | 1.5 | 5.1 | 9.8 | 7.0 |
| General Dynamics | [a] | 4.0 | 6.3 | 9.7 |
| General Motors | 7.9 | 3.8 | 1.3 | 1.3 |
| General Electric | 1.9 | 3.6 | 3.6 | 5.5 |
| United Aircraft[b] | 2.2 | 3.5 | 3.0 | 3.2 |
| *North American Aviation | 1.6 | 3.1 | 3.6 | 6.1 |
| *Lockheed | 1.9 | 2.8 | 3.5 | 5.4 |
| *Douglas | 2.5 | 2.8 | 2.4 | 4.1 |
| American Telephone and Telegraph | 1.5 | 2.1 | 3.0 | 2.9 |
| *Republic Aviation | .7 | 1.5 | 1.2 | 1.7 |
| Curtiss-Wright | 4.1[a] | 1.4 | 1.0 | .4 |
| Chrysler | 1.9 | 1.4 | 1.2 | 1.9 |
| Ford | 3.0 | 1.3 | .7 | .4 |
| *Martin | 1.3 | 1.3 | 1.8 | 3.1 |
| Sperry Rand | .9[a] | 1.2 | 1.7 | 2.4 |
| *McDonnell | N.A. | 1.1 | 1.6 | 2.4 |
| Bendix | 1.1 | 1.1 | 1.0 | 1.6 |
| Hughes Aircraft | N.A. | 1.0 | 2.2 | 3.0 |
| *Grumman Aircraft | .8 | 1.0 | 1.1 | 1.8 |
| Westinghouse Electric | .8 | 1.0 | 1.2 | 1.4 |
| *Other Selected Major Contractors* | | | | |
| *Northrop | .1 | .8 | 1.3 | .8 |
| *Fairchild Engine | .2 | .4 | .5 | .2 |
| *Bell Aircraft | .7 | .4 | .4 | .3 |
| *Chance Vought | [a] | .4 | 1.7 | [c] |

N.A.—Not available.
*Listed among the 12 major airframe manufacturers
[E] Estimate.
[a] Major change in corporate composition or product during the period.
[b] Does not include Chance Vought
[c] Not included in the 100 largest defense contractors
Sources: 19, 44

# 8

# GENERAL AVIATION



General aviation, which includes all civil flying except that performed by the airlines, has concluded a decade of spectacular growth.

During the decade of the fifties, a total of 46,998 aircraft were shipped, with a dollar value figured at manufacturers' net billing price of $643,638,000.

The tremendous growth in this type of aircraft has resulted from its enthusiastic acceptance by business, industry and agriculture as an aid to productivity and prosperity.

In 1959, shipments of utility and executive aircraft amounted to 7,689 units valued at $129,876,000 figured at the manufacturers' net billing price—a sharp increase over 1958, when 6414 aircraft, valued at $101,939,000 were delivered. The 1959 shipments were also more than double the number of aircraft sold in 1950, and six times the value. The value increase is substantially greater because of the many improvements in the aircraft, which are larger, faster, and more completely instrumented with navigation and communication equipment for safe, efficient operation. The first quarter of 1960 continues to reflect the steady in-

UTILITY AIRCRAFT, FACTORY SHIPMENTS, 1959

(As reported to Aerospace Industries Association by selected manufacturers)

| Manufacturer and Model | Complete Aircraft[a] Number | Manufacturers Net Billing Price (Thousands of Dollars) |
|---|---|---|
| Aero Design | | |
| Model 500 | 58 | |
| Model 560E | 32 | $ 10,626 |
| Model 680E | 52 | |
| Model 720 | 6 | |
| Beech | | |
| Model 18S | 89 | |
| Debonair | 25 | |
| Bonanza | 480 | |
| Twin Bonanza | 66 | 35,701 |
| 95 Travel Air | 142 | |
| Mentor | 91 | |
| Call Air | | |
| Model A5 | 28 | |
| Model A6 | 17 | 354 |
| Cessna | | |
| 150 | 648 | |
| 172 | 874 | |
| 175 | 727 | |
| 180 | 258 | |
| 182 | 774 | 45,703 |
| 210 | 43 | |
| 310B,C | 240 | |
| L-19 | 24 | |
| Champion | | |
| Model 7EC | 39 | |
| Model 7FC | 91 | |
| Model 7GC | 112 | 1,521 |
| Model 7GCA | 2 | |
| Model 7HC | 30 | |
| Colonial | | |
| C-2 Skimmer | 17 | 367 |
| Helio | | |
| H 391B | 7 | |
| H-395 | 5 | 379 |
| Mooney | | |
| Mark 20 | 182 | 2,091 |
| Piper | | |
| Super Cub | 470 | |
| Tri Pacer | 676 | |
| Apache | 311 | 33,134 |
| Comanche | 995 | |
| Pawnee | 78 | |
| TOTAL | 7,689 | $129,876 |

[a] Excludes aircraft shipped to the military, helicopters and gliders.

NOTE: The figures shown here may vary from FAA figures because they are based on selected reports only.

Source: 1

crease in deliveries which are 20 per cent ahead of the first three months of 1959—2,333 units compared to 1,952 last year.

Instructional flying, which had declined steadily as the veteran benefits from the G. I. Bill were used up, has reversed its trend in the last several years and has increased from 1,300,000 hours in 1954 to an estimated 2,000,000 in 1959. This steady increase in instruction is undoubtedly related to the growing use of general aviation as a tool of private enterprise.

General aviation has become the largest user of the nation's airports, airways, and air navigation facilities. During 1959, general aviation aircraft flew an estimated twelve million hours, three times more than the airlines. Flight hours in 1950 were approximately nine and one-half million. The greatest growth has occurred in business flying which increased from 2,750,000 in 1950 to an estimated current rate of more than five million hours annually. Business flying alone is substantially greater than airline flying, which is less than four million hours annually.

Last year, general aviation flew more than one and one-half billion miles—equivalent to almost 3,500 round-trips to the moon.

There are approximately 70,000 active aircraft in the general aviation fleet today, compared to about 1,900 airline aircraft. The FAA estimates that by 1965 the general aviation fleet will have grown to more than 80,000 and annual flying hours will climb to 16,000,000.

During the 40's and early 50's, typical light aircraft were largely two-place, especially suitable for training, sport flying and limited cross-country use.

The early fifties saw increasing numbers of four-place aircraft and the real beginning of extensive business and industrial use of light aircraft.

ANNUAL SHIPMENTS OF UTILITY AIRCRAFT, 1947 TO DATE[a]
(As reported to Aerospace Industries Association by selected manufacturers)

| Year | TOTAL | Aero Design | Beech | Cessna | Champion | Mooney | Piper | All Other Manufacturers |
|---|---|---|---|---|---|---|---|---|
| NUMBER OF AIRCRAFT SHIPPED | | | | | | | | |
| 1947 | 15,594 | — | 1,288 | 2,390 | N.A. | — | 3,464 | 8,452 |
| 1948 | 7,037 | — | 746 | 1,631 | N.A. | — | 1,479 | 3,181 |
| 1949 | 3,405 | — | 341 | 857 | N.A. | 74 | 1,278 | 855 |
| 1950 | 3,386 | — | 489 | 1,134 | N.A. | 51 | 1,108 | 604 |
| 1951 | 2,302 | — | 429 | 551 | N.A. | 26 | 1,081 | 215 |
| 1952 | 3,058 | 39 | 414 | 1,373 | N.A. | 49 | 1,161 | 22 |
| 1953 | 3,788 | 69 | 375 | 1,434 | N.A. | 37 | 1,839 | 34 |
| 1954 | 3,071 | 67 | 579 | 1,200 | N.A. | 14 | 1,191 | 52 |
| 1955 | 4,434 | 72 | 680 | 1,746 | N.A. | 32 | 1,870 | 34 |
| 1956 | 6,738 | 154 | 724 | 3,235 | 162 | 79 | 2,329 | 55 |
| 1957 | 6,118 | 139 | 788 | 2,489 | 217 | 107 | 2,300 | 78 |
| 1958 | 6,414 | 97 | 694 | 2,926 | 296 | 160 | 2,160 | 79 |
| 1959 | 7,689 | 148 | 893 | 3,588 | 274 | 182 | 2,530 | 74 |
| MANUFACTURERS NET BILLING PRICE (Thousands of Dollars) | | | | | | | | |
| 1947 | $ 57,929 | — | 13,405 | 5,976 | N.A. | — | 7,697 | 30,851 |
| 1948 | 32,469 | — | 10,126 | 6,768 | N.A. | — | 3,083 | 12,492 |
| 1949 | 17,731 | — | 6,177 | 4,545 | N.A. | 133 | 3,244 | 3,632 |
| 1950 | 19,157 | — | 6,516 | 5,506 | N.A. | 82 | 3,092 | 3,961 |
| 1951 | 16,887 | — | 7,708 | 3,573 | N.A. | 45 | 3,933 | 1,628 |
| 1952 | 26,159 | 2,011 | 9,848 | 9,220 | N.A. | 100 | 4,891 | 89 |
| 1953 | 34,458 | 4,260 | 9,545 | 12,094 | N.A. | 91 | 8,286 | 182 |
| 1954 | 43,461 | 4,517 | 20,056 | 10,666 | N.A. | 31 | 8,070 | 121 |
| 1955 | 68,258 | 5,119 | 24,893 | 21,880 | N.A. | 182 | 16,008 | 176 |
| 1956 | 103,791 | 11,183 | 28,770 | 38,570 | 597 | 741 | 23,474 | 456 |
| 1957 | 99,652 | 9,914 | 32,110 | 30,988 | 1,045 | 1,095 | 23,294 | 1,206 |
| 1958 | 101,939 | 6,902 | 27,072 | 36,897 | 1,516 | 1,868 | 26,548 | 1,136 |
| 1959 | 129,876 | 10,626 | 35,701 | 45,703 | 1,521 | 2,091 | 33,134 | 1,100 |

[a] The figures shown here may vary from FAA figures because they are based on reports by selected manufacturers only.
Source: 1

As the past decade went on, these aircraft increased in aerodynamic efficiency, horsepower, speed, range, the extent of communication-navigation equipments installed and in the comfort and luxuriousness of their appointments. With these improvements came increased reliability and utility which American business and industry have been quick to recognize and adopt.

The fifties also saw the introduction of several small four- to eight-

place twin-engined aircraft, and the multi-engined general aviation fleet, alone, now outnumbers the Nation's airline fleet several times. During 1959, the sales of these light twin-engined planes accounted for about 13 per cent of the total sales of utility and executive aircraft.

Today, a surprising variety of fine business and utility aircraft are available to suit every requirement, from small aircraft especially useful for training and short-haul transportation, through the larger single and multi-engined executive aircraft, to turboprop and jet aircraft.

A large percentage of the nation's big corporations now operate fleets of aircraft for the transportation of their officials and key personnel, and, in many cases, maintain an aviation transportation department to manage this operation.

Thousands of smaller businesses and individual business and professional men also operate private aircraft. The private use of small aircraft has become an integral part of the nation's economy because of the increased efficiency and productivity it brings to the users.

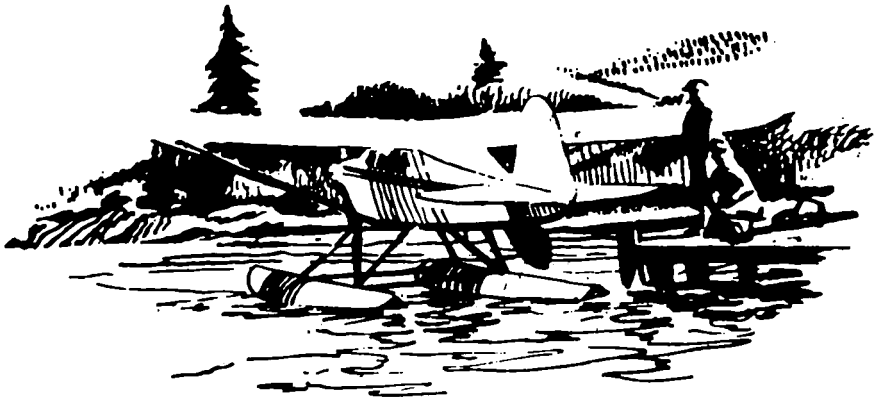
Agricultural and forestry uses of aircraft also account for a significant portion of present day general aviation.

The agricultural operator uses his airplane to increase his produc-

CERTIFICATED CIVIL PILOTS, STUDENT PILOTS AND FLYING SCHOOLS, 1927 TO DATE

| As of December 31 | Certificated Airplane Pilots | | | | Student Pilot Approvals During Year | Certified Civil Flying Schools |
|---|---|---|---|---|---|---|
| | TOTAL PILOTS | Airline Transport | Commercial | Private | | |
| 1927 | 1,572 | [a] | N.A. | N.A. | 545 | — |
| 1930 | 15,280 | [a] | 7,843 | 7,433 | 18,398 | 39 |
| 1935 | 14,805 | 736 | 7,362 | 6,707 | 14,572 | 24 |
| 1940 | 69,829 | 1,431 | 18,791 | 49,607 | 110,938 | 749 |
| 1945 | 296,895 | 5,815 | 162,873 | 128,207 | 77,188 | 964 |
| 1951 | 580,574 | 10,813 | 197,900 | 371,861 | 45,003 | 1,625 |
| 1952 | 581,218 | 11,357 | 193,575 | 376,286 | 30,537 | 1,280 |
| 1953 | 585,974 | 12,757 | 195,363 | 377,854 | 37,397 | 1,093 |
| 1954 | 613,695 | 13,341 | 201,441 | 398,913 | 43,393 | 1,035 |
| 1955 | 643,201 | 13,700 | 211,142 | 418,359 | 44,354 | 902 |
| 1956 | 669,079 | 15,295 | 221,096 | 432,688 | 45,036 | 809 |
| 1957 | 702,519 | 16,900 | 237,149 | 448,470 | 76,850 | 814 |
| 1958 | 731,078 | 18,303 | 245,541 | 467,234 | 58,107 | 847 |

N.A.—Not available.
[a] Airline Transport Rating became effective May 5, 1932.
Sources: 3, 27



tivity and efficiency, just as any businessman, for rapid transportation. But he also uses it for specialized purposes, such as planning crops, checking for soil erosion, checking fences and counting and herding cattle.

Millions of acres of land are dusted, or sprayed with agricultural chemicals every year, and large areas of our Nation's forest preserves are also patrolled and treated from the air, a typical example being a recent massive attack to control gypsy moth infestation when over 2½ million acres of forest land were sprayed.

General aviation aircraft provide a valuable bridge in making widespread areas of the nation accessible by air. For example, airline service presently is available to less than 600 of the nation's 6,000 airports. General aviation aircraft use all of them. The use of the small private plane and air taxis to transport businessmen to and from high density air traffic centers and shuttling them to and from off-airline points is building an increasing inter-dependence between airlines and general aviation.

The general aviation fleet is very well equipped with radio communication and electronic navigation aids. Few active aircraft do not have at least a two-way radio. Many thousands also have simple electronic navigation and direction indicating devices.

With these equipments, the pilot can communicate with the airport controllers so as to be able to operate to and from busy air traffic centers, obtain weather information and other advisories, and fly cross-country in an efficient manner under conditions of good visibility—VFR (the Visual Flight Rules of the FAA).

The fleet of multi-engined business aircraft is well instrumented for all-weather flying in conditions of poor visibility and under the FAA's

IFR (Instrument Flight) rules. In addition to these well equipped multi-engined aircraft, more than half of the really active fleet of single-engined aircraft has all the essential equipment for IFR flight.

In fact, the availability of fine, economically priced navigation and communication equipment of a size and weight to be readily accommodated in the modern small aircraft has played a large part in the growth of the business, industrial and agricultural use of private aircraft.

HOURS FLOWN IN UTILITY AIRCRAFT, 1931 TO DATE
(Thousands of Hours)

| Year | Total Hours | Business[a] | | Commercial[b] | | Instructional | | Pleasure | | Other[c] | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Hours | Percent | Hours | Percent | Hours | Percent | Hours | Percent | Hours | Percent |
| 1931 | 1,083 | 152 | 14 | 281 | 26 | 307 | 28 | 343 | 32 | — | — |
| 1932 | 877 | 130 | 15 | 215 | 25 | 223 | 25 | 309 | 35 | — | — |
| 1933 | 795 | 129 | 16 | 200 | 25 | 198 | 25 | 268 | 34 | — | — |
| 1934 | 846 | 121 | 14 | 207 | 24 | 217 | 26 | 301 | 36 | — | — |
| 1935 | 954 | 132 | 14 | 229 | 24 | 292 | 31 | 301 | 31 | — | — |
| 1936 | 1,059 | 122 | 12 | 245 | 23 | 380 | 36 | 312 | 29 | — | — |
| 1937 | 1,173 | 156 | 13 | 227 | 19 | 432 | 37 | 358 | 31 | — | — |
| 1938 | 1,478 | 188 | 13 | 254 | 17 | 577 | 39 | 459 | 31 | — | — |
| 1939 | 1,922 | 246 | 13 | 332 | 17 | 755 | 39 | 589 | 31 | — | — |
| 1940 | 3,200 | 314 | 10 | 387 | 12 | 1,529 | 48 | 970 | 30 | — | — |
| 1941 | 4,460 | 250 | 6 | 511 | 11 | 2,816 | 63 | 883 | 20 | — | — |
| 1942 | 3,786 | 270 | 7 | 473 | 12 | 2,680 | 71 | 363 | 10 | — | — |
| 1946 | 9,788 | 1,068 | 11 | 943 | 10 | 5,996 | 61 | 1,686 | 17 | 95 | 1 |
| 1947 | 16,334 | 1,966 | 12 | 1,279 | 8 | 10,353 | 63 | 2,616 | 16 | 120 | 1 |
| 1948 | 15,130 | 2,576 | 17 | 1,066 | 7 | 8,701 | 58 | 2,606 | 17 | 181 | 1 |
| 1949 | 11,031 | 2,615 | 24 | 1,449 | 13 | 4,187 | 38 | 2,732 | 25 | 48 | ([d]) |
| 1950[e] | 9,650 | 2,750 | 28 | 1,500 | 16 | 3,000 | 31 | 2,300 | 24 | 100 | 1 |
| 1951 | 8,451 | 2,950 | 35 | 1,584 | 19 | 1,902 | 23 | 1,880 | 22 | 135 | 1 |
| 1952 | 8,186 | 3,124 | 38 | 1,727 | 21 | 1,503 | 18 | 1,629 | 20 | 203 | 3 |
| 1953 | 8,527 | 3,626 | 42 | 1,649 | 19 | 1,248 | 15 | 1,846 | 22 | 158 | 2 |
| 1954 | 8,963 | 3,975 | 43 | 1,829 | 20 | 1,292 | 15 | 1,920 | 22 | 47 | ([d]) |
| 1955[e] | 9,500 | 4,300 | 45 | 1,950 | 21 | 1,275 | 13 | 1,975 | 21 | — | — |
| 1956[e] | 10,200 | 4,600 | 45 | 2,000 | 20 | 1,500 | 15 | 2,100 | 20 | — | — |
| 1957 | 10,938 | 4,864 | 45 | 2,013 | 18 | 1,864 | 17 | 2,109 | 19 | 88 | 1 |
| 1959[e] | 11,700 | 5,300 | 45 | 2,200 | 19 | 2,000 | 17 | 2,200 | 19 | — | — |

[a] Includes flying for corporate or executive purposes as well as flying by individuals, including farmers and ranchers, on personal business.
[b] Includes contract, charter, industrial and commercial agricultural flying.
[c] Testing, experimental, ferrying, etc.
[d] Less than ½ of 1 percent.
[e] Data estimated from trend since no formal survey was conducted for this year.
NOTE: This table excludes all aircraft operated by the scheduled airlines. Data for war years are not available.
Source: 27

U. S. Active Civil Aircraft, by Type and by States
As of January 1, 1959

| State | Total active aircraft | Air Carrier (scheduled and irregular) | General Aviation | | |
|---|---|---|---|---|---|
| | | | Multi-engine | Postwar 4- and 5-Place Single Engine | All Other |
| Alabama | 635 | 9 | 52 | 232 | 342 |
| Arizona | 908 | 0 | 61 | 339 | 508 |
| Arkansas | 826 | 0 | 34 | 256 | 536 |
| California | 8,556 | 102 | 583 | 3,291 | 4,580 |
| Colorado | 1,021 | 37 | 72 | 391 | 521 |
| Connecticut | 522 | 0 | 43 | 189 | 290 |
| Delaware | 221 | 7 | 37 | 77 | 100 |
| District of Columbia | 345 | 68 | 92 | 72 | 113 |
| Florida | 2,239 | 105 | 229 | 771 | 1,134 |
| Georgia | 915 | 82 | 50 | 315 | 468 |
| Idaho | 664 | 0 | 27 | 281 | 356 |
| Illinois | 3,801 | 209 | 298 | 1,615 | 1,643 |
| Indiana | 1,991 | 8 | 131 | 886 | 966 |
| Iowa | 1,638 | 0 | 51 | 719 | 868 |
| Kansas | 1,923 | 0 | 112 | 904 | 907 |
| Kentucky | 530 | 0 | 38 | 260 | 232 |
| Louisiana | 1,100 | 1 | 119 | 360 | 620 |
| Maine | 324 | 0 | 6 | 114 | 204 |
| Maryland | 625 | 0 | 47 | 224 | 354 |
| Massachusetts | 905 | 35 | 68 | 302 | 500 |
| Michigan | 2,833 | 4 | 229 | 1,145 | 1,455 |
| Minnesota | 1,999 | 76 | 109 | 649 | 1,165 |
| Mississippi | 654 | 0 | 24 | 159 | 471 |
| Missouri | 1,651 | 210 | 99 | 620 | 722 |
| Montana | 974 | 1 | 39 | 372 | 562 |
| Nebraska | 1,177 | 0 | 53 | 435 | 689 |
| Nevada | 314 | 15 | 34 | 110 | 155 |
| New Hampshire | 181 | 0 | 9 | 55 | 117 |
| New Jersey | 1,292 | 10 | 118 | 485 | 679 |
| New Mexico | 719 | 0 | 53 | 361 | 305 |
| New York | 3,240 | 552 | 357 | 890 | 1,441 |
| North Carolina | 1,168 | 26 | 72 | 417 | 653 |
| North Dakota | 623 | 0 | 7 | 143 | 473 |
| Ohio | 3,076 | 0 | 313 | 1,232 | 1,531 |
| Oklahoma | 1,437 | 0 | 191 | 563 | 683 |
| Oregon | 1,342 | 6 | 101 | 546 | 689 |
| Pennsylvania | 2,499 | 1 | 250 | 940 | 1,308 |
| Rhode Island | 145 | 0 | 11 | 52 | 82 |
| South Carolina | 383 | 0 | 19 | 147 | 217 |

U. S. ACTIVE CIVIL AIRCRAFT, BY TYPE AND BY STATES—*Continued*
AS OF JANUARY 1, 1959

| State | Total active aircraft | Air Carrier (scheduled and irregular) | General Aviation | | |
|---|---|---|---|---|---|
| | | | Multi-engine | Postwar 4- and 5-Place Single Engine | All Other |
| South Dakota | 757 | 0 | 6 | 244 | 507 |
| Tennessee | 765 | 16 | 65 | 301 | 383 |
| Texas | 5,935 | 125 | 710 | 2,304 | 2,796 |
| Utah | 442 | 0 | 20 | 187 | 235 |
| Vermont | 109 | 0 | 5 | 31 | 73 |
| Virginia | 916 | 61 | 67 | 294 | 494 |
| Washington | 1,764 | 31 | 57 | 597 | 1,079 |
| West Virginia | 364 | 0 | 23 | 138 | 203 |
| Wisconsin | 1,494 | 0 | 116 | 495 | 883 |
| Wyoming | 400 | 0 | 26 | 158 | 216 |
| CONTINENTAL U. S. | 68,342 | 1,797 | 5,333 | 25,704 | 35,508 |
| Alaska | 1,179 | 56 | 64 | 420 | 639 |
| Hawaii | 111 | 21 | 10 | 11 | 69 |
| Puerto Rico-Virgin Is. | 59 | 5 | 8 | 21 | 25 |
| Other | 27 | 0 | 1 | 14 | 12 |
| GRAND TOTAL | 69,718 | 1,879 | 5,416 | 26,170 | 36,253 |

Source: 27

General aviation leaders are unanimous in their opinion that 1960 and the next decade will continue to show increases.

Though modern business and utility aircraft fly much faster and have greater range than those of a decade ago, they do not, on the average, fly as fast as the airliners. Some business airplanes are largely identical to airliners, and the next few years will bring a number of small jet and turboprop aircraft into the active general aviation fleet mix. But the great majority will continue to fly within a speed envelope substantially the same as today—100 to 300 miles per hour. For the shorter stages of typical cross-country use of business airplanes, little is gained by any substantial speed increase. Therefore, the present-day problem of mixing a few thousand high-speed aircraft with many thousands which fly at slower speeds will be aggravated in the future by the continuous growth of general aviation. The problem becomes particularly acute as traffic converges on major airport traffic centers.

There is a need to build thousands more small airports and flight strips to realize the full economic benefits which general aviation is capable of providing for the nation. All existing large airports can and should improve the facilities they provide to receive and properly handle general aircraft. In many places it should be possible to provide a separate small runway and a separate traffic pattern so that simultaneous airline and general aircraft movements to and from the airport could take place. This will increase the airport's capacity to accommodate both groups.

The fact that general aviation makes extensive use of the same airports served by the airlines is borne out by FAA data concerned with movements at airports with FAA operated control towers.

As of December, 1959, there were 222 FAA operated towers located at the Nation's busier air traffic centers. In the ten-year period 1949-1958 air carrier movements (airline) rose from 3,713,257 to 6,977,671, while itinerant (general aircraft) movements rose from 2,721,925 tc 7,937,747 and now exceed the air carrier movements by more than a million.

One of the key reports which led to the creation of the Federal Aviation Agency in January 1958, included this significant language: "Of

INVENTORY OF CIVIL AIRCRAFT[a], BY YEAR OF MANUFACTURE
As of January 1, 1959

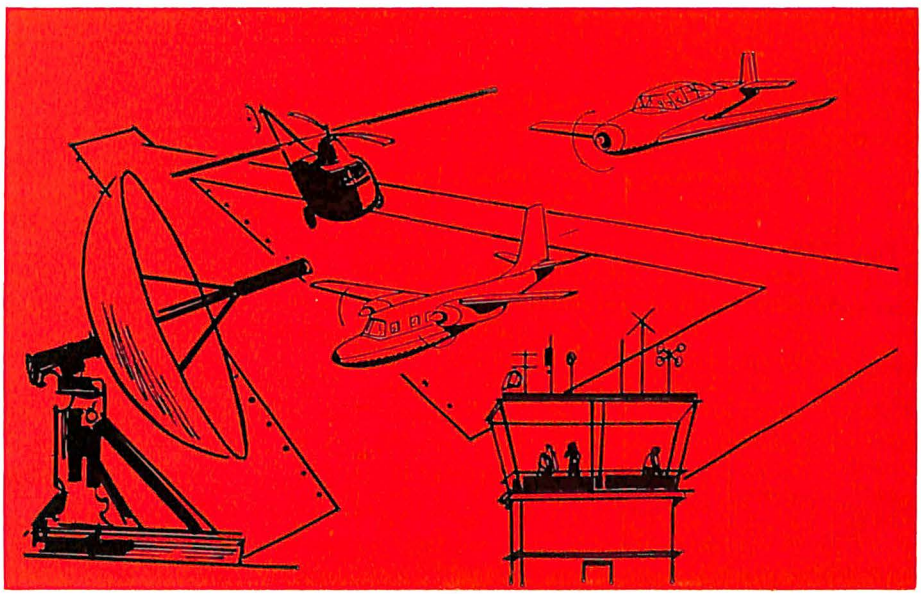
| Year of Manufacture | Number | Percent of Total |
|---|---|---|
| TOTAL | 69,718 | 100.0 |
| 1958 | 5,514 | 7.9 |
| 1957 | 4,525 | 6.5 |
| 1956 | 5,236 | 7.5 |
| 1955 | 3,312 | 4.8 |
| 1954 | 2,114 | 3.0 |
| 1953 | 2,604 | 3.7 |
| 1952 | 2,233 | 3.2 |
| 1951 | 1,480 | 2.1 |
| 1950 | 2,145 | 3.1 |
| 1949 | 1,932 | 2.8 |
| 1948 | 3,850 | 5.5 |
| Prior to 1948 | 34,773 | 49.9 |

[a] Number of active civil aircraft, commercial transport and utility, recorded with Federal Aviation Agency.
Source: 27

CIVIL AIRCRAFT, 1928 TO DATE
Including Air Carrier Aircraft

| As of January 1 | TOTAL | Active | Inactive |
|---|---|---|---|
| 1928 | 2,740 | N.A. | N.A. |
| 1932 | 10,680 | N.A. | N.A. |
| 1935 | 8,322 | N.A. | N.A. |
| 1941 | 26,013 | N.A. | N.A. |
| 1951 | 92,809 | 60,921 | 31,888 |
| 1952 | 88,545 | 54,039 | 34,506 |
| 1955 | 92,067 | 58,994 | 33,073 |
| 1956 | 85,320 | 60,432 | 24,888 |
| 1957 | 87,531 | 64,688 | 22,843 |
| 1958 | 93,189 | 67,153 | 26,036 |
| 1959 | 98,893 | 69,718 | 29,175 |

N.A.—Not available.
Source: 27



all elements in our national system of aviation facilities, airports have been the most neglected. Unless airport development is given the attention it deserves, airport capacity may well become a factor that limits capacity in the whole system."

The airport is the key to general aviation's real future and to the economic benefits which it can bring to every community.

PUBLIC AIRPORTS BY LENGTH OF RUNWAY AND REGION, JANUARY 1, 1959

| Region | Total | Airports by Length of Runway (in feet) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 0-2,999 | 3,000-3,499 | 3,500-4,199 | 4,200-4,999 | 5,000-5,899 | 5,900-6,999 | 7,000- & over |
| TOTAL | 2,932 | 1,218 | 365 | 423 | 236 | 359 | 105 | 226 |
| New England | 129 | 63 | 5 | 21 | 12 | 16 | 5 | 7 |
| Middle Atlantic | 289 | 171 | 44 | 26 | 14 | 22 | 3 | 9 |
| East North Central | 530 | 279 | 82 | 84 | 22 | 35 | 8 | 20 |
| West North Central | 422 | 204 | 59 | 65 | 25 | 26 | 11 | 32 |
| South Atlantic | 333 | 121 | 32 | 43 | 33 | 72 | 8 | 24 |
| East South Central | 129 | 51 | 16 | 20 | 13 | 17 | 2 | 10 |
| West South Central | 350 | 109 | 51 | 58 | 47 | 43 | 12 | 30 |
| Mountain | 272 | 35 | 33 | 37 | 30 | 60 | 38 | 39 |
| Pacific | 294 | 105 | 34 | 34 | 28 | 46 | 11 | 36 |
| Other | 184 | 80 | 9 | 35 | 12 | 22 | 7 | 19 |

Source: 27

AIDS TO AIR NAVIGATION, 1926 TO DATE

| Dec. 31 | Civil Airways Mileage | | Radio Range Stations | | Non-directional Radio Beacons | Federally Operated Traffic Control Facilities | | Air Traffic Communications Stations | Combined Station Towers |
|---|---|---|---|---|---|---|---|---|---|
| | Low and Medium Frequency | Very High Frequency | Low and Medium Frequency | Very High Frequency | | Airport Towers | Airway Centers | | |
| 1926 | 2,041 | — | — | — | — | — | — | — | — |
| 1931 | 17,152 | — | 47 | — | 46 | — | — | — | — |
| 1936 | 22,245 | — | 146 | — | 57 | — | — | 203 | — |
| 1941 | 36,062 | — | 323 | 8 | 48 | — | 14 | 415 | — |
| 1946 | 44,145 | — | 364 | 50 | 74 | 115 | 29 | 397 | — |
| 1951 | 74,424 | — | 375 | 385 | 152 | 157 | 31 | 427 | 34 |
| 1953 | 72,097 | 54,490 | 368 | 392 | 181 | 115 | 31 | 395 | 53 |
| 1954 | 69,359 | 64,995 | 346 | 403 | 170 | 104 | 31 | 376 | 70 |
| 1955 | 67,770 | 81,209 | 344 | 424 | 175 | 100 | 31 | 364 | 75 |
| 1956 | 67,783 | 90,268 | 342 | 441 | 180 | 103 | 32 | 358 | 79 |
| 1957 | 64,817 | 104,484 | 332 | 486 | 185 | 110 | 33 | 350 | 81 |
| 1958 | 57,705 | 124,870 | 329 | 556 | 191 | 128 | 32 | 345 | 84 |
| 1959 | 47,302 | 129,632 | 322 | 661 | 191 | 139 | 33 | 332 | 83 |

Sources: 3, 27

# 9

# HELICOPTERS

The growing use of the helicopter in civil, commercial and industrial life will continue to make major advances—unless hampered by an inadequate number of heliports and helistops.

These companies use more than 705 three- to fifteen-place helicopters to provide aerial taxi service in their communities and routine and unusual transportation for the oil, construction, agriculturt, mining, ranching, lumber and electrical power industries.

The three scheduled helicopter airlines continued to set new records in the number of passengers carried. During the first six months of 1959, Los Angeles Airways, Inc., Chicago Helicopter Airways, Inc. and New York Airways, Inc. carried a combined total of 297,000 passengers —75,000 more than the number of passengers carried for the entire previous year. At year's end the three carriers had transported 366,000 passengers—a 58 per cent increase over the previous year when 232,000 passengers were carried.

In addition to these three airlines, three scheduled—but non-subsidized—helicopter services were inaugurated in 1959: Atlanta Helicop-

PRODUCTION OF COMMERCIAL HELICOPTERS[a]
(Number of Helicopters)
1953 to Date

| Company and Helicopter | 1953 | 1954 | 1955 | 1956 | 1957 | 1958 | 1959 |
|---|---|---|---|---|---|---|---|
| TOTAL | 111 | 131 | 146 | 268 | 311 | 200 | 295 |
| Bell | | | | | | | |
| 47 Series ..... | 59 | 68 | 84 | 111 | 132 | 99 | 169 [b] |
| Hiller | | | | | | | |
| 12B ..... | 34 | 20 | 16 | — | — | — | — |
| 12C ..... | — | — | — | 21 | 21 | 12 | — |
| 12E ..... | — | — | — | — | — | 4 | 44 |
| Republic Alouette .. | — | — | — | — | — | 5 | 15 |
| Sikorsky | | | | | | | |
| S-55 ..... | 18 | 43 | 41 | 52 | 38 | 11 | 4 |
| S-58 ..... | — | — | 5 | 55 | 60 | 22 | 46 |
| Vertol | | | | | | | |
| H-21 ..... | — | — | — | 29 | 60 | 35 | 12 |
| V-44A ..... | — | — | — | — | — | 7 | 4 |
| V-44B ..... | — | — | — | — | — | 5 | 1 |

[a] Manufactured by companies reporting to Aerospace Industries Association.
[b] Includes production of two foreign licensees.
Source: 1

ANNUAL PRODUCTION OF MILITARY HELICOPTERS
1941 to Date

| Year | TOTAL[a] | Air Force | Navy | Army[b] |
|---|---|---|---|---|
| 1941 | 7 | 7 | — | — |
| 1942 | — | — | — | — |
| 1943 | 22 | 19 | 3 | — |
| 1944 | 144 | 120 | 24 | — |
| 1945 | 275 | 241 | 34 | — |
| 1946 | 44 | 40 | 4 | — |
| 1947 | 57 | 36 | 21 | — |
| 1948 | 153 | 94 | 59 | — |
| 1949 | 73 | 24 | 43 | 6 |
| 1950 | 26 | 6 | 5 | 15 |
| 1951 | 360 | 14 | 143 | 192 |
| 1952 | 983 | 49 | 353 | 559 |
| 1953 | 943 | 165 | 245 | 463 |
| 1954 | 431 | 172 | 46 | 155 |
| 1955 | 444 | 82 | 128 | 200 |
| 1956 | 647 | 62 | 152 | 430 |
| 1957 | 689 | 16 | 193 | 450 |

[a] *The* TOTAL column includes, in addition to the aircraft of the Air Force, Navy and Army, aircraft bought by units of the Department of Defense for delivery to foreign countries in the Military Assistance Program, and for delivery to other federal agencies such as the Coast Guard, Federal Aviation Agency, etc.
[b] For the years 1941 through 1947, aircraft for the Army Air Corps are included in the historical series for the Department of the Air Force, which was established in 1947.
Source: 20

ter Airways, Atlanta, Georgia; Mississippi Valley Airways, St. Louis, Missouri and Helicabs, Inc., Los Angeles, California. All three offer airport to city-center scheduled helicopter service.

There are 94 companies and corporations in the United States and Canada operating a combined total of 134 helicopters to transport personnel and materials.

The helicopter continues to play its important military role in aerial reconnaissance, fire-fighting, crash-rescue, anti-submarine warfare, and transporting ammunition, supplies and troops for the services.

The Army Medical Service now operates 12 helicopter units, four in this country, five in Europe and three in Korea. The helicopters, known as the "Flying St. Bernards" have proved so successful in the work of rescue and aid that the Army is considering a major expansion of their use in this field.

Military interest in helicopter progress was highlighted last year by

SALES AND BACKLOG OF SIX MAJOR HELICOPTER MANUFACTURERS
1954 TO DATE
(Millions of Dollars)

| Year | TOTAL | Military | Civil[a] |
|---|---|---|---|
| *Sales* | | | |
| 1954 | $307.4 | $202.6 | $104.8 |
| 1955 | 333.5 | 260.1 | 73.4 |
| 1956 | 337.0 | 283.6 | 53.4 |
| 1957 | 326.6 | 248.5 | 78.1 |
| 1958 | 295.0 | 243.1 | 51.9 |
| 1959 | 256.9 | 202.4 | 54.5 |
| *Backlog* | | | |
| December 31 | | | |
| 1954 | $677.8 | $584.3 | $ 93.5 |
| 1955 | 540.1 | 469.0 | 71.1 |
| 1956 | 446.6 | 379.7 | 66.9 |
| 1957 | 281.1 | 251.5 | 29.5 |
| 1958 | 222.4 | 210.4 | 12.0 |
| 1959 | 223.7 | 201.3 | 22.4 |

[a] Includes spare parts, subcontracts, etc.
Source: 1

Army and Marine Corps participation in the world's first helicopter air traffic service to test all-weather helicopter operations. The service was inaugurated in December 1959, with one Army and one Marine helicopter making round-trip daily flights between Bridgeport, Connecticut and the Federal Aviation Agency's National Aviation Facilities Experimental Center in Atlantic City, New Jersey.

Non-military government agencies in the United States and Canada continued to use the helicopter for traffic surveys, forest-fire patrol, rescue and as stand-bys in the event of local disaster. There are 30 governmental agencies in the U. S. and Canada operating 96 helicopters.

Today, U. S.-built helicopters are being operated all over the world.

Two important helicopter records were set in altitude and safety in 1959.

On December 9, 1959, a turbine-powered Air Force H-43B Huskie flew to 29,846 feet and brought the altitude record back to the United States. The previous record in Class E-1d (helicopters weighing between 3858 and 6614 lbs.) was etsablished by Russia on March 12, 1959.

The Army's Primary Helicopter School at Camp Wolters, Texas completed three years of operation in 1959 and set an outstanding safety

record. During the three years, the Army completed 200,000 hours of fatality free helicopter flight training hours. The School trains approximately 1,000 helicopter pilots each year.

Turbine-powered helicopters are now in production, with the three scheduled helicopter airlines planning to take delivery of twin-engined turbine-powered rotorcraft early in 1961. Advantages of the turbine-powered helicopter include: reduced operating costs, reduced engine weight, increased speed and capacity, less noise and vibration. The Army reported that experience with their new gas turbine-powered helicopters indicates substantial reduction in airframe and rotor vibration and less wear on moving parts than in craft powered by reciprocating engines.

The long-established role of the helicopter as a rescue vehicle was given added recognition in 1959 during the annual convention of the American Medical Association. "Project Medi-Copter," commercially sponsored, provided approximately 3,500 physicians with helicopter flights "designed to familiarize them with the advances now being made in medical transportation."

President Eisenhower during 1959 made greater use of his "Chopper" for official trips both at home and abroad. During his European tour the President achieved two "firsts" in his helicopter. He is the first U. S. president to make a landing aboard a naval vessel in any type of aircraft. He landed on the USS Des Moines by helicopter. And, he is the first U. S. President to arrive and depart from a foreign country by helicopter. He flew from the battle cruiser to Tunis, North Africa and return by helicopter.

In his travels, the President made it possible for many foreign dignitaries and their families to have their first helicopter flight. The President's total flying time in the U. S. Army and Marine Corps helicopters during the tour was only four hours; yet he covered hundreds of miles and saved many hours of arduous ground travel time.

Official acceptance of the helicopter as a transport vehicle and recognition of the need for long-range planning for its expanded use was given by the Federal Aviation Agency in establishing "Project Hummingbird" in 1959.

"Project Hummingbird" is designed to provide a comprehensive program in the steep gradient (VTOL/STOL) aircraft field. Under the Project, the following factors are being considered: 1. economic feasibility of a greatly expanded VTOL/STOL activity within potential civil markets; 2. military and civil defense requirements; 3. the technical and economical state of the art and potential in aircraft and support systems; 4. the required national promotion, policy, legislation, and standards to insure the timely completion of adequate landing area complexes.

As a first step in implementing this Project, a detailed questionnaire was sent to helicopter manufacturers, commercial helicopter operators and the scheduled helicopter airlines.

Two important aids for heliport planning were published in 1959. At a Heliport Symposium sponsored by the Los Angeles Chamber of Commerce in September, L. Welch Pogue, legal advisor to the Helicopter Council of the Aerospace Industries Association, presented a comprehensive paper on "Some of the Legal Aspects of Planning for Urban Heliports." This excellent presentation, jointly prepared by Mr. Pogue and his partner George C. Neal, was published in the January issue of The Virginia Law Review and 1,500 reprints of the Review article were distributed by Council headquarters to the American Society of Planning Officials, city planners and member companies.

In December, the Federal Aviation Agency Heliport Design Guide was published. This publication presents basic information concerning the planning and development of heliports that will be used for various types of helicopter operations. The Guide is the first official Government criteria for heliport design and is the result of recommendations made by the FAA-Industry Helicopter Working Group. A representative of the Helicopter Council served with this Working Group.

A survey of heliports and helistops prepared by the Helicopter Council revealed 33 states, including the District of Columbia, and Canada have 327 heliports and helistops, and 27 proposed facilities.

Of these 327 established heliports, 283 are ground level and 44 are elevated. In addition, there are approximately 100 helicopter platforms on moveable and stationary oil rigs in the Gulf of Mexico where the helicopter is an accepted tool of that industry.

The survey showed a definite trend—the increase in the number of hospitals, motels and industrial plants that have helicopter landing facilities—a trend that emphasized the need for city center heliports. A Directory of Heliports and Helistops in the United States and Canada is scheduled for publication by the Council in 1960.

The American Legion, at its 1959 National Convention, resolved to

HELICOPTERS IN PRODUCTION AND DEVELOPMENT, 1959

| Company | Military Symbol | | Civil Designation | Number of Places | Present Status |
|---|---|---|---|---|---|
| Bell | H-13H | USA | 47G | 3 | Production |
| | — | | 47J-2 | 4 | Production |
| | HUL-2 | USN | 47L | 4 | Production |
| | HU-1A | USAF, USA | 204 | 6 | Development |
| | XV-3 | USAF, USA | 200 | 2 | Development |
| Cessna | YH-41 | USAF, USA | CH-1B | 4 | Development |
| Gyrodyne | YRON-1 | USMC | GCA-41 | 1 | Development |
| | XRON-1 | USMC | — | | |
| Hiller | H23D | USA | — | 3 | Production |
| | — | | H-12E | 3 | Production |
| | YROE-1 | USMC, USN | — | 1 | Development |
| Hughes | YHO-2HU | USA | 269A | | Development |
| Kaman | H43B | USAF | K-600-3 | 12 | Production |
| | HU2K | USN | — | | Production |
| | — | | Kaman/Fairey Rotodyne | 65 | Development |
| Omega | — | | BS-12D | 5 | Development |
| Republic | — | | Alouette | 5 | Production |
| | YHD-1 | USA | Djinn | 2 | Development |
| Sikorsky | H-19B | USAF | S-55 | 12 | Production |
| | HO4S-3 | USN, USCG | | | |
| | H-19D | USA | | | |
| | HRS-3 | USMC | | | |
| | H-37A | USA | S-56 | 26 | Production |
| | HR2S-1 | USMC, USN | | | |
| | HUS-1G | USCG | | | |
| | H-34A | USA | | | |
| | HUS-1 | | | | |
| | HUS-1A, HSS-1, HSS-1N | USN | S-58 | 20 | Production |
| | HSS-2 | USN | S-62 Amphibian | 12 | Production |
| Trecker | — | | 166 | | |
| Umbrough | — | | U-18 | | |
| Vertol | H-21 | USAF | — | 22 | Production |
| | — | | 44 | 15 | Production |
| | — | | 107 | 25 | Development |

Source: 1

"re-affirm the principles and objectives" adopted at their 1958 Convention to "promote and encourage the development and use of helicopters and the passage of necessary ordinances and regulations as will permit their efficient operation."

HELICOPTER SCHEDULED AIRLINES
Available Service and Utilization
1948 TO DATE
(In Thousands)

| Year | Passengers Carried | Revenue Ton-Miles Flown | Revenue Passenger-Miles Flown | Revenue Plane-Miles Flown |
|---|---|---|---|---|
| 1948 | — | 28 | — | 284 |
| 1950 | — | 63 | — | 668 |
| 1952 | — | 75 | — | 631 |
| 1953 | 1 | 129 | 26 | 1,006 |
| 1954 | 9 | 152 | 183 | 1,071 |
| 1955 | 28 | 195 | 628 | 1,148 |
| 1956 | 62 | 277 | 1,588 | 1,315 |
| 1957 | 148 | 448 | 3,273 | 1,604 |
| 1958 | 228 | 591 | 4,885 | 1,675 |
| 1959 | 366 | 855 | 7,478 | 1,899 |

Source: 4

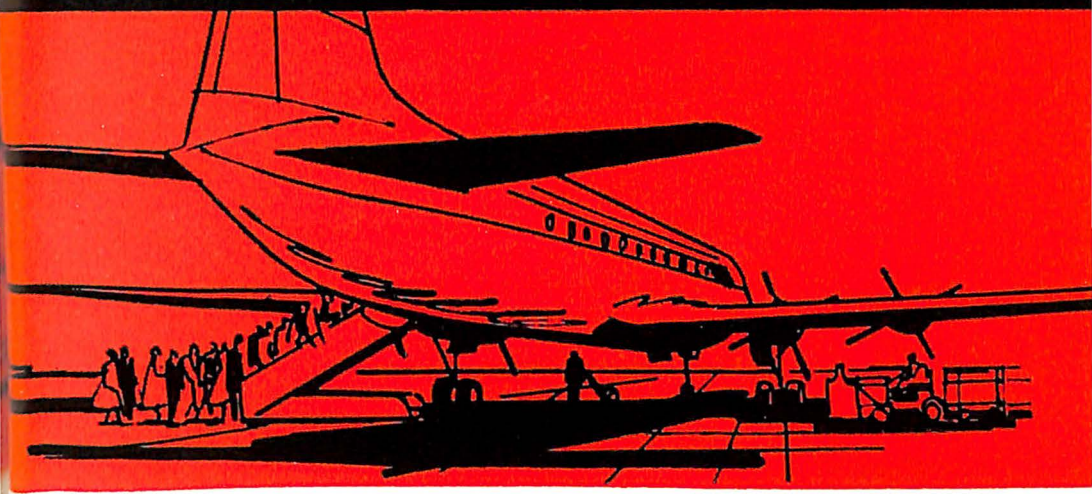
HELICOPTER SCHEDULED AIRLINES
Revenue Ton-Mile Traffic Carried
1948 TO DATE
(In Thousands)

| Year | TOTAL | Passenger Ton-Miles | U. S. Mail | Express | Freight | Excess Baggage |
|---|---|---|---|---|---|---|
| 1948 | 28 | — | 28 | — | — | — |
| 1950 | 63 | — | 63 | — | — | — |
| 1952 | 75 | — | 75 | — | — | — |
| 1953 | 129 | 2 | 123 | — | 2 | 2 |
| 1954 | 152 | 17 | 115 | 13 | 5 | 2 |
| 1955 | 195 | 60 | 96 | 31 | 5 | 3 |
| 1956 | 277 | 149 | 89 | 31 | 7 | 1 |
| 1957 | 448 | 311 | 92 | 33 | 8 | 1 |
| 1958 | 591[a] | 463 | 83 | 34 | 6 | 2 |
| 1959 | 855[a] | 710 | 87 | 41 | 7 | 3 |

[a] Includes charter flights.
Source: 4

# 10

# AIRLINES AND TRANSPORTATION



The airline industry raced ahead to new peaks in passenger traffic during 1959, on the wings of the new turbine-powered transports.

The impact of the turbojet and turboprop aircraft has been tremendous. For example, during the first quarter of 1959, the turbine-powered aircraft carried only 5 per cent of the air passengers flying on the domestic scheduled airlines. Deliveries of the new aircraft were stepped up during the year, and in the last quarter of 1959, the turbine transports carried about 27 per cent of all passengers.

An air transport executive summed up the increase in air travel this way:

"There is no question that the availability of jet travel is largely responsible for this striking boom. It appears we are beginning to tap a new travel market of passengers who have never used air travel previously. The attraction of new air passengers is due to more realistic factors than simply public curiosity about jet flying. The bedrock reason is in the service offered—the availability of a method of travel that can carry a passenger across the United States, a distance of 2,500

miles, in about 4 hours.'' This is half the time required by a piston airliner, and 16 times faster than the best rail service.

Specifically, the U.S. domestic and international scheduled airlines carried 54,768,000 passengers in 1959, an increase of about 6,500,000 over 1958. Additional details on the freight, mail and cargo activities of the of the U.S. air carriers are available in the 21st edition of ''Air Transportation acts and Figures,'' published by the Air Transport Association of America, Washington, D. C.

The airlines showed an increase of 16.5 per cent in operating revenues in 1959 over 1958. The record receipts were $2,607,844,000. However, these revenues did not quite keep pace with operating expenses for the carriers, which increased 16.7 percent during the year.

SHIPMENTS OF COMMERCIAL TRANSPORT AIRCRAFT
1953 TO DATE
(Fixed Wing-Multiple Engine)

| Company and Aircraft | 1953 | 1954 | 1955 | 1956 | 1957 | 1958 | 1959 |
|---|---|---|---|---|---|---|---|
| TOTAL[a] | 209 | 191 | 113 | 206 | 323 | 216 | 262 |
| Boeing | | | | | | | |
| 707 | — | — | — | — | — | 7 | 73 |
| Convair | | | | | | | |
| 340 | 101 | 61 | 14 | — | — | — | — |
| 440 | — | — | — | 57 | 79 | 21 | 14 |
| Douglas | | | | | | | |
| DC-6 | 69 | 41 | 14 | 39 | 44 | 65 | 1 |
| DC-7 | 11 | 48 | 30 | 67 | 123 | 57 | — |
| DC-8 | — | — | — | — | — | — | 21 |
| Fairchild | | | | | | | |
| F-27 | — | — | — | — | — | 25 | 41 |
| Lockheed | | | | | | | |
| 1049 | 28 | 41 | 55 | 43 | 42 | 21 | 5 |
| 1649 | — | — | — | — | 35 | 8 | — |
| Electra | — | — | — | — | — | 12 | 107 |

[a] Commercial transport totals differ from FAA totals for "transports" because they exclude executive and other transports for other than commercial use.
Source: 1

U. S. Scheduled Airlines—Aircraft in Service by Make and Model as of December 31

| Domestic | | | | | | International[a] | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Aircraft Make and Model | 1941 | 1956 | 1957 | 1958 | 1959 | Aircraft Make and Model | 1941 | 1956 | 1957 | 1958 | 1959 |
| Bell | | | | | | | | | | | |
| B47D,G | .. | 7 | 6 | 6 | 5 | | | | | | |
| Boeing | | | | | | Boeing | | | | | |
| 247D | 27 | .. | .. | .. | .. | 307 | 3 | .. | .. | .. | .. |
| 307 | 5 | .. | .. | .. | .. | 314 | 8 | .. | .. | .. | .. |
| 377 | .. | 9 | 9 | 9 | 6 | 377 | .. | 25 | 24 | 23 | 15 |
| 707 | .. | .. | .. | .. | 48 | 707 | .. | .. | .. | 6 | 18 |
| Convair | | | | | | Convair | | | | | |
| 240 | .. | 95 | 99 | 76 | 46 | 240 | .. | 5 | 1 | .. | .. |
| 340 | .. | 123 | 134 | 133 | 122 | | | | | | |
| 440 | .. | 19 | 31 | 31 | 36 | | | | | | |
| 540 | .. | .. | .. | .. | 1 | | | | | | |
| Curtiss | | | | | | | | | | | |
| C-46 | .. | 3 | 7 | 7 | 7 | | | | | | |
| Douglas | | | | | | Douglas | | | | | |
| DC-3, 3S | 280 | 321 | 312 | 307 | 282 | DC-2 | 3 | .. | .. | .. | .. |
| DC-4 | .. | 75 | 39 | 31 | 25 | DC-3 | 45 | 15 | 10 | 8 | 14 |
| DC-6,A, B | .. | 218 | 267 | 271 | 270 | DC-4 | .. | 40 | 28 | 27 | 26 |
| DC-7 | .. | 99 | 169 | 214 | 189 | DC-6A, B | .. | 70 | 68 | 83 | 52 |
| DC-8 | .. | .. | .. | .. | 18 | DC-7 | .. | 33 | 38 | 38 | 31 |
| Fairchild | | | | | | | | | | | |
| F-27 | .. | .. | .. | 10 | 29 | | | | | | |
| | | | | | | Grumman | | | | | |
| | | | | | | G-21 | .. | .. | 1 | .. | .. |
| Lockheed | | | | | | Lockheed | | | | | |
| 10 | 16 | .. | .. | .. | .. | 10 | 2 | .. | .. | .. | .. |
| 18 | 13 | 10 | 10 | 7 | .. | 18 | 3 | .. | .. | .. | .. |
| L49 | .. | 50 | 59 | 53 | 42 | L49 | .. | 6 | .. | .. | .. |
| 749 | .. | 58 | 57 | 56 | 56 | 1049 | .. | 2 | .. | .. | .. |
| 1049 | .. | 73 | 81 | 89 | 86 | | | | | | |
| 1649 | .. | .. | 25 | 29 | 28 | | | | | | |
| 188 | .. | .. | .. | .. | 96 | | | | | | |
| Martin | | | | | | Martin | | | | | |
| 2-0-2 | .. | 23 | 25 | 26 | 19 | 130 | 1 | .. | .. | .. | .. |
| 4-0-4 | .. | 97 | 85 | 95 | 85 | | | | | | |
| Sikorsky | | | | | | Sikorsky | | | | | |
| S51 | .. | 2 | 2 | 2 | 2 | S42B | 4 | .. | .. | .. | .. |
| S55 | .. | 8 | 12 | 6 | 5 | S43 | 1 | .. | .. | .. | .. |
| S58 | .. | 3 | 6 | 5 | 6 | | | | | | |
| Vertol | | | | | | | | | | | |
| V44B | .. | .. | .. | 5 | 5 | | | | | | |
| Vickers | | | | | | | | | | | |
| 700 Series | .. | 54 | 59 | 65 | 67 | | | | | | |
| 800 Series | .. | .. | .. | 15 | 15 | | | | | | |
| Total | 341 | 1347 | 1494 | 1546 | 1596 | | 70 | 196 | 170 | 185 | 156 |

(*Continued on next page*)

U. S. SCHEDULED AIRLINES—AIRCRAFT IN SERVICE BY MAKE AND MODEL—*Continued*

| Domestic | | | | | | International[a] | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Aircraft Make and Model | 1941 | 1956 | 1957 | 1958 | 1959 | Aircraft Make and Model | 1941 | 1956 | 1957 | 1958 | 1959 |
| Fixed Wing | | | | | | | | | | | |
| 4-engine turbojet | .. | .. | .. | .. | 66 | | .. | .. | .. | 6 | 18 |
| 4-engine turboprop | .. | 54 | 59 | 80 | 178 | | .. | .. | .. | .. | .. |
| 2-engine turboprop | .. | .. | .. | 10 | 30 | | .. | .. | .. | .. | .. |
| 4-engine piston | 5 | 582 | 706 | 752 | 702 | | 16 | 176 | 158 | 171 | 124 |
| 2-engine piston | 336 | 691 | 703 | 682 | 597 | | 54 | 20 | 12 | 8 | 14 |
| Helicopter | | | | | | | | | | | |
| Piston engine | .. | 20 | 26 | 22 | 23 | | .. | .. | .. | .. | .. |

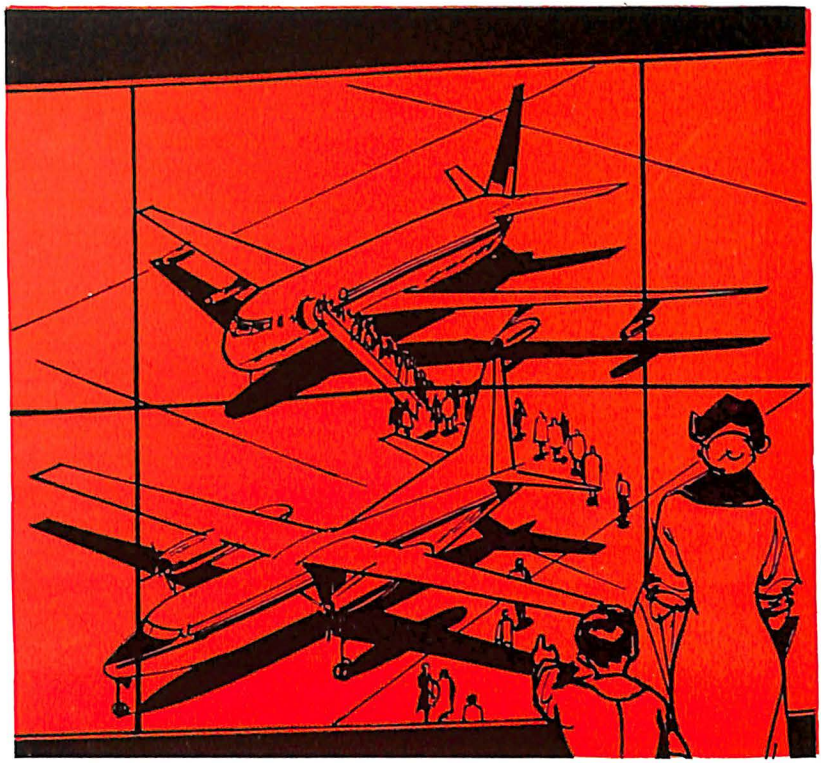
[a] Excludes certain aircraft in both domestic and international operations.
Source: 27

The U. S. carriers, at the end of 1959, were operating a fleet of 1,894 passenger and cargo aircraft. In this fleet were 297 turbine-powered planes—84 large turbojet and 213 turboprop planes.

U. S. transport manufacturers will deliver nearly 160 additional turbojet planes and another 51 turboprop planes to the U. S. carriers. There will be additional deliveries of these aircraft to foreign flag carriers.

The aircraft that will be added to the U. S. airline fleet during 1960 will cost an estimated $1,000,000,000 and, in addition, another 100 turbine-powered aircraft have been ordered for delivery in 1961 and 1962.

The past year marked the eighth consecutive year in which the domestic carriers had a safety rate of only one passenger fatality per 100,000,000 passenger miles. The only safety rate that can be entirely perfect is one without a fatality. But, air travel comes close. For example, it is three times as safe to travel by air as by auto. On the



EMPLOYMENT, WAGES, AND AVERAGE ANNUAL EARNINGS IN THE TRANSPORTATION INDUSTRY, 1958

| | ALL INDUSTRY | ALL TRANSPORTATION | Air Transportation (Common Carrier) | Railroads | Highway Transportation | Water, Pipeline, and Other Transportation |
|---|---|---|---|---|---|---|
| Full-Time Equivalent Employees (Thousands) | 55,104 | 2,432 | 144 | 959 | 1,002 | 327 |
| Wages and Salaries (Million Dollars) | $239,389 | $13,348 | $879 | $5,565 | $5,065 | $1,844 |
| Average Annual Earnings per Full Time Employee | $4,344 | $5,488 | $6,104 | $5,803 | $5,055 | $5,639 |

Source: 11

average, there are more lives lost in highway accidents *every two weeks* than fatalities in the entire air transport industry since 1950.

The international airlines of the U. S. set a new passenger record of 4,704,000, 12.6 per cent greater than in 1958. More than 60 per cent of all passengers traveling between the U. S. and a foreign country are U. S. citizens. Foreign airlines are gaining a larger share of this market. In 1950, the foreign carriers handled 14.6 per cent of this market. Last year they carried 43.2 per cent.

The all-cargo airlines carried 31 per cent of all cargo traffic. The freight volume in 1959 amounted to 140,817,000 ton miles, an increase of 16 per cent over 1958.

An indication of the growth of the trunk airlines can be obtained in an analysis of carrying capacity. The available seat-mile capacity of

U. S. DOMESTIC AND INTERNATIONAL SCHEDULED AIRLINES
PASSENGER SERVICE
Selected Years, 1926 to Date

| Year | Domestic | | International | |
|---|---|---|---|---|
| | Passengers Carried[a] (Thousands) | Revenue Passenger-Miles Flown[b] (Millions) | Passengers Carried[c] (Thousands) | Revenue Passenger-Miles Flown[b] (Millions) |
| 1926 | 6 | 1.0 | N.A. | N.A. |
| 1930 | 385 | 85.1 | 33 | 18.6 |
| 1935 | 679 | 316.3 | 111 | 46.0 |
| 1940 | 2,523 | 1,052.2 | 163 | 99.8 |
| 1945 | 6,576 | 3,362.5 | 476 | 448.0 |
| 1950 | 17,345 | 8,002.8 | 1,676 | 2,206.4 |
| 1951 | 22,652 | 10,566.2 | 2,042 | 2,599.8 |
| 1952 | 25,010 | 12,528.3 | 2,365 | 3,021.0 |
| 1953 | 28,721 | 14,760.3 | 2,699 | 3,385.6 |
| 1954 | 32,343 | 16,768.7 | 2,875 | 3,749.6 |
| 1955 | 38,025 | 19,819.0 | 3,416 | 4,420.2 |
| 1956 | 41,738 | 22,361.8 | 3,949 | 5,126.1 |
| 1957 | 48,464 | 25,339.6 | 4,422[d] | 5,769.5 |
| 1958 | 48,128 | 25,343.4 | 4,595[d] | 5,992.3 |
| 1959 | 54,768 | 29,269.0 | 5,151[d] | 6,918.8 |

N.A.—Not available.
[a] 1926, 1930: duplicated revenue and non-revenue passengers; 1935, 1940: duplicated revenue passengers; 1945 to date: unduplicated revenue passengers.
[b] 1926, 1930, 1935: includes non-revenue passenger-miles.
[c] 1930, 1935, 1940, 1945: total passengers; 1950 to date: revenue passengers only.
[d] Enplaned passengers. These figures are not comparable to those for previous years.
Source: 27

DEVELOPMENT OF FREE WORLD CIVIL AIR TRANSPORT
(Scheduled Services—International and Domestic, Excluding China and USSR)
1919 TO DATE

| Year | Miles Flown (Millions) | Passengers Carried (Millions) | Passenger-Miles (Millions) | Cargo-Ton-Miles (Millions) | Mail-Ton-Miles (Millions) |
|---|---|---|---|---|---|
| 1919 | 1 | N.A. | N.A. | N.A. | N.A. |
| 1929 | 57 | N.A. | 132 | N.A. | N.A. |
| 1934 | 101 | N.A. | 405 | N.A. | N.A. |
| 1939 | 185 | N.A. | 1,262 | N.A. | N.A. |
| 1944 | 257 | N.A. | 3,412 | N.A. | N.A. |
| 1949 | 840 | 27 | 15,000 | 390 | 130 |
| 1951 | 1,000 | 42 | 22,000 | 625 | 160 |
| 1953 | 1,195 | 52 | 28,500 | 710 | 190 |
| 1955 | 1,415 | 68 | 38,000 | 890 | 255 |
| 1956 | 1,570 | 77 | 44,000 | 1,015 | 275 |
| 1957 | 1,750 | 85 | 50,500 | 1,110 | 295 |
| 1958 | 1,810 | 87 | 53,000 | 1,135 | 320 |
| 1959 | 1,875 | 96 | 59,000 | 1,295 | 355 |

N.A.—Not available.
Source: 30

DEVELOPMENT OF UNITED STATES CIVIL AIR TRANSPORT
(Scheduled Services—International and Domestic)
SELECTED YEARS, 1949 TO DATE

| Year | Revenue Miles (Millions) Flown | Passengers Carried (Millions) | Revenue Passenger Miles (Millions) | Cargo Ton-Miles[a] (Millions) | Mail Ton-Miles (Millions) |
|---|---|---|---|---|---|
| 1949 | 456 | 17 | 8,935 | 174 | 61 |
| 1951 | 504 | 25 | 13,166 | 240 | 86 |
| 1953 | 629 | 31 | 18,146 | 276 | 97 |
| 1955 | 752 | 41 | 24,239 | 379 | 139 |
| 1956 | 835 | 46 | 27,488 | 445 | 148 |
| 1957 | 941 | 53 | 31,109 | 515 | 156 |
| 1958 | 945 | 53 | 31,336 | 523 | 172 |
| 1959 | 1,002 | 60 | 36,188 | N.A. | N.A. |

N.A.—Not available.
[a] Includes nonscheduled operations for scheduled combination and all-cargo carriers and noncertificated carriers. For 1958 nonscheduled operations amounted to 140 million cargo ton-miles.
Source: 27

THE TEN LEADING PASSENGER TRANSPORT COMPANIES
(Millions of Passenger Miles[a])

| 1959 | | 1954 | |
|---|---|---|---|
| American Airlines | 5,614 | Pennsylvania Railroad | 3,447 |
| United Air Lines | 4,827 | American Airlines | 3,372 |
| Trans World Airlines | 4,579 | United Air Lines | 3,135 |
| Eastern Air Lines | 4,432 | New York Central System | 3,041 |
| Pennsylvania Railroad | 2,649 | Eastern Air Lines | 2,847 |
| New York Central System | 1,976 | Trans World Airlines | 2,611 |
| Atchison, Topeka & Santa Fe Railway System | 1,675 | Atchison, Topeka & Santa Fe Railway System | 1,948 |
| Capital Airlines | 1,611 | Union Pacific Railroad Company | 1,459 |
| Delta Air Lines | 1,556 | Southern Pacific Company | 1,342 |
| Union Pacific Railroad Company | 1,242 | New York, New Haven & Hartford Railroad Company | 1,274 |

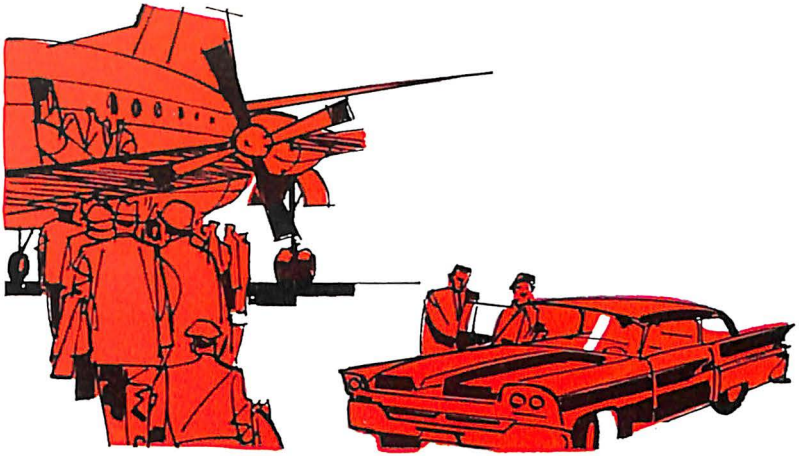
[a] Excludes commuters and multiple ride passengers.
NOTE: Data do not include foreign operations of the airlines.
Sources: 10, 31

the aircraft in service in 1954 would have been 3,000,000,000 seat miles short of meeting 1959's passenger requirement. The turbine planes and the larger piston types, of course, filled this gap. Last year's revenue passenger miles were 28,127,200,000, an increase of 15 per cent over 1958.

The local service carriers, the "grass roots" airlines, continued their growth in 1959. These airlines carried 5,214,000 passengers in 1959, a gain of 22 per cent over the previous record set in 1958.

However, the net profit for local carriers slumped to $74,000 in 1959, compared with a net of $1,109,000 in 1958.

The scheduled helicopter services showed the most spectacular gains. There are three such carriers today, located in New York, Chicago, and Los Angeles. A total of 366,000 passengers were carried in 1959, a 60 per cent increase over the 228,000 carried in 1958. The total traffic of the scheduled helicopter airlines set a new record in 1959 of 855,000 ton miles.



AIR VS. RAILROAD PASSENGER TRAVEL
1937 TO DATE
(Passenger Miles in Billions)

| Year | Domestic Air Carriers | | | Railroads (excluding Commutation) | | |
|---|---|---|---|---|---|---|
| | TOTAL | Scheduled | Irregular | TOTAL | Pullman | Coach |
| 1937 | .4 | .4 | — | 21.6 | 9.2 | 12.4 |
| 1938 | .5 | .5 | — | 18.5 | 8.3 | 10.2 |
| 1939 | .7 | .7 | — | 19.6 | 8.5 | 11.1 |
| 1940 | 1.1 | 1.1 | — | 20.7 | 8.2 | 12.5 |
| 1941 | 1.4 | 1.4 | — | 26.2 | 10.1 | 16.1 |
| 1942 | 1.4 | 1.4 | — | 50.0 | 19.1 | 30.9 |
| 1943 | 1.6 | 1.6 | — | 83.8 | 25.9 | 57.9 |
| 1944 | 2.2 | 2.2 | — | 91.7 | 28.3 | 63.4 |
| 1945 | 3.4 | 3.4 | — | 86.7 | 27.3 | 59.4 |
| 1946 | 6.0 | 5.9 | N.A. | 59.7 | 20.7 | 39.0 |
| 1947 | 6.3 | 6.1 | N.A. | 41.2 | 13.5 | 27.7 |
| 1948 | 6.3 | 6.0 | N.A. | 36.5 | 12.2 | 24.3 |
| 1949 | 7.4 | 6.8 | .6 | 30.8 | 10.5 | 20.3 |
| 1950 | 8.8 | 8.0 | .8 | 26.6 | 9.2 | 17.4 |
| 1951 | 11.7 | 10.6 | 1.1 | 29.4 | 9.9 | 19.5 |
| 1952 | 13.8 | 12.5 | 1.3 | 29.1 | 9.3 | 19.8 |
| 1953 | 16.1 | 14.8 | 1.3 | 27.2 | 8.2 | 19.0 |
| 1954 | 17.9[E] | 16.8 | 1.1[E] | 25.0 | 7.3 | 17.7 |
| 1955 | 20.9[E] | 19.8 | 1.1[E] | 24.2 | 6.9 | 17.3 |
| 1956 | 23.5[E] | 22.4 | 1.1[E] | 23.7 | 6.6 | 17.1 |
| 1957 | 26.4[E] | 25.3 | 1.1[E] | 21.0 | 5.2 | 15.9 |
| 1958 | 26.4[E] | 25.3 | 1.1[E] | 18.4 | 4.2 | 14.2 |
| 1959 | 30.4[E] | 29.3 | 1.1[E] | 17.6 | 3.8 | 13.8 |

E Estimate.
N.A.—Not available.
Sources: 3, 27, 31

INTERCITY PASSENGER TRAFFIC BY AIR, RAILROAD AND BUS[E]
Selected Years, 1916 to Date

| | TOTAL | Domestic Air Carriers | Railroads[a] | Buses |
|---|---|---|---|---|
| *Billions of Passenger-Miles* | | | | |
| 1916 | 32.5 | [b] | 35.2 | [b] |
| 1939 | 32.9 | .7 | 22.7 | 9.5 |
| 1941 | 44.4 | 1.4 | 29.4 | 13.6 |
| 1944 | 125.3 | 2.2 | 95.7 | 27.4 |
| 1948 | 76.8 | 6.1 | 46.0 | 24.7 |
| 1951 | 73.2 | 10.5 | 35.3 | 27.4 |
| 1954 | 71.7 | 16.7 | 29.4 | 25.6 |
| 1955 | 73.7 | 19.7 | 28.5 | 25.5 |
| 1956 | 75.7 | 22.3 | 28.2 | 25.2 |
| 1957 | 73.1 | 25.3 | 26.3 | 21.5[r] |
| 1958 | 69.4 | 25.3 | 23.3 | 20.8[r] |
| 1959 | 71.8[E] | 29.3 | 22.1 | 20.4[E] |
| *Percent* | | | | |
| 1916 | 100.0 | [b] | 100.0 | [b] |
| 1939 | 100.0 | 2.1 | 69.0 | 28.9 |
| 1941 | 100.0 | 3.2 | 66.2 | 30.6 |
| 1944 | 100.0 | 1.8 | 76.4 | 21.8 |
| 1948 | 100.0 | 7.8 | 59.9 | 32.2 |
| 1951 | 100.0 | 14.3 | 48.2 | 37.5 |
| 1954 | 100.0 | 23.3 | 41.0 | 35.7 |
| 1955 | 100.0 | 26.7 | 38.7 | 34.6 |
| 1956 | 100.0 | 29.5 | 37.2 | 33.3 |
| 1957 | 100.0 | 34.6 | 36.0 | 29.4 |
| 1958 | 100.0 | 36.4 | 33.6 | 30.0 |
| 1959 | 100.0 | 40.8 | 30.8 | 28.4 |

[r]Revised
[E] Estimate
[a]Includes commutation and electrified divisions of steam railway companies, but excludes electric railways.
[b]Negligible.
Sources: 1, 27, 31, 38

AVERAGE REVENUE PER PASSENGER-MILE, 1926 TO DATE
(Cents)

| Year | AIRLINES | | RAILROAD | | INTER-CITY BUS |
|---|---|---|---|---|---|
| | Domestic Scheduled | Domestic Non-Scheduled | Coach (Excluding Commuter) | Pullman (Total) | |
| 1926 | 12.0 | — | 3.35 | N.A. | 2.96 |
| 1937 | 5.6 | — | 1.80 | 3.08 | 1.73 |
| 1947 | 5.1 | — | 2.02 | 3.53 | 1.70 |
| 1952 | 5.55 | 3.20 | 2.53 | 4.60 | 2.02 |
| 1953 | 5.45 | 3.20 | 2.53 | 4.68 | 2.06 |
| 1954 | 5.39 | 3.20[E] | 2.50 | 4.66 | 2.08 |
| 1955 | 5.35 | 3.20[E] | 2.47 | 4.62 | 2.06 |
| 1956 | 5.32 | 3.20[E] | 2.56 | 4.77 | 2.13 |
| 1957 | 5.30 | 3.20[E] | 2.71 | 5.20 | 2.29 |
| 1958 | 5.60 | 3.20[E] | 2.76 | 5.30 | 2.42[E] |
| 1959 | 5.60 | 3.20[E] | 2.77 | 6.08 | 2.58[E] |

N.A.—Not Available.
[E] Estimate.
Sources: 1, 3, 27, 31, 38

TRANSPORTATION ACCIDENT DEATH RATES
(Deaths per 100,000,000 Passenger-Miles)
1943 TO DATE

| Year | Domestic Airlines | Railroads | Buses | Cars and Taxis |
|---|---|---|---|---|
| *Passenger Deaths* | | | | |
| 1946 | 1.2 | 0.18 | 0.19 | 2.5 |
| 1947 | 3.2 | 0.16 | 0.21 | 2.3 |
| 1948 | 1.3 | 0.13 | 0.18 | 2.1 |
| 1949 | 1.3 | 0.08 | 0.20 | 2.2 |
| 1950 | 1.1 | 0.58 | 0.17 | 2.2 |
| 1951 | 1.3 | 0.43 | 0.22 | 2.4 |
| 1952 | 0.35 | 0.04 | 0.16 | 2.8 |
| 1953 | 0.56 | 0.16 | 0.13 | 2.9 |
| 1954 | 0.09 | 0.08 | 0.11 | 2.6 |
| 1955 | 0.76 | 0.07 | 0.19 | 2.7 |
| 1956 | 0.62 | 0.20 | 0.16 | 2.7 |
| 1957 | 0.12 | 0.07 | 0.19 | 2.6 |
| 1958 | 0.43 | 0.27 | 0.18 | 2.3 |
| *Total Deaths*[a] | | | | |
| 1946 | 1.8 | 3.2 | 1.4 | 4.0 |
| 1947 | 3.4 | 3.9 | 1.4 | 3.7 |
| 1948 | 1.6 | 4.0 | 1.2 | 3.4 |
| 1949 | 1.5 | 4.0 | 1.2 | 3.3 |
| 1950 | 1.3 | 4.7 | 1.1 | 3.5 |
| 1951 | 1.6 | 4.2 | 1.2 | 3.5 |
| 1952 | 0.5 | 3.4 | 1.0 | 3.9 |
| 1953 | 0.7 | 3.9 | 0.9 | 4.0 |
| 1954 | 0.1 | 3.4 | 0.9 | 3.6 |
| 1955 | 0.9 | 3.7 | 1.1 | 3.7 |
| 1956 | 0.7 | 3.5 | 1.1 | 3.6 |
| 1957 | 0.1 | 3.5 | 0.89 | 3.5 |
| 1958 | 0.5 | 4.1 | 0.89 | 3.2 |

[a] Includes pedestrians, employees, trespassers, etc.
Source: 39

# 11

# AVIATION EXPORT AND FOREIGN AVIATION

United States exports of aviation products (not including missiles and related equipment) during 1959 were valued at $769,040,000. The was a drop of 20.9 per cent from the 1958 total.

The decline was due to three factors: 1. The continued drop of military aid aeronautical exports which, a few years ago, accounted for a substantial portion of U. S. aviation exports; 2. Tight money in the United States and the dollar shortage in many parts of the world continued to hamper the export sale of U. S. aviation equipment; 3. The transition from piston engine to jet engine airline equipment.

The large U. S.-built jet transports began to enter foreign airline inventory in late 1959; additional and repeat orders for this equipment gave concrete evidence of the reliability and dependability of the big jets. The years 1960 and 1961 will be significant as jet transport delivery years, as increasing numbers of these U. S. transports go into operation with the world's airlines. This factor is expected to bolster the overall U. S. export position. The growing dependence on air travel and the increasing use of aircraft for many diversified jobs are encourag-

## Exports of Civil Aircraft, 1948 to Date

### New Passenger Transports

| Year | Total | | 3,000–14,999 lbs airframe weight | | 15,000–29,999 lbs airframe weight | | 30,000 lbs & over airframe weight | |
|---|---|---|---|---|---|---|---|---|
| | Number | Value (Millions) | Number | Value (Millions) | Number | Value (Millions) | Number | Value (Millions) |
| 1948 | 91 | $37.4 | 34 | $2.4 | 14 | $4.2 | 43 | $30.8 |
| 1949 | 51 | 22.2 | 16 | 1.3 | 25 | 7.6 | 10 | 13.4 |
| 1950 | 48 | 40.4 | 4 | .4 | 15 | 6.6 | 29 | 33.4 |
| 1951 | 26 | 13.2 | 13 | 1.1 | 1 | [a] | 12 | 12.1 |
| 1952 | 25 | 18.2 | 9 | .6 | 1 | .6 | 15 | 17.0 |
| 1953 | 87 | 79.2 | 17 | 1.3 | 13 | 7.5 | 57 | 87.0 |
| 1954 | 110 | 93.0 | 29 | 2.0 | 7 | 4.0 | 74 | 70.4 |
| 1955 | 95 | 81.2 | 39 | 2.5 | 5 | 2.4 | 51 | 76.3 |
| 1956 | 151 | 132.9 | 64 | 4.7 | 2 | .8 | 85 | 124.4 |
| 1957 | 203 | 179.3 | 94 | 7.7 | 9 | 6.9 | 100 | 164.7 |
| 1958 | 127 | 146.4 | 36 | 3.5 | 9 | 5.6 | 82 | 137.3 |
| 1959 | 65 | 107.6 | 23 | 2.3 | 3 | 1.7 | 39 | 103.6 |

### New Utility, Personal and Liaison Planes

| Year | Total | | 3-Places or less | | 4-Places and over | |
|---|---|---|---|---|---|---|
| | Number | Value (Millions) | Number | Value (Millions) | Number | Value (Millions) |
| 1948 | 935 | $4.2 | 552 | $1.5 | 383 | $2.7 |
| 1949 | 510 | 2.8 | 235 | .7 | 275 | 2.1 |
| 1950 | 408 | 2.2 | 173 | .5 | 235 | 1.7 |
| 1951 | 540 | 3.7 | 237 | 1.0 | 303 | 2.7 |
| 1952 | 815 | 5.6 | 551 | 3.1 | 264 | 2.5 |
| 1953 | 776 | 5.4 | 370 | 1.5 | 406 | 3.9 |
| 1954 | 529 | 4.5 | 223 | 1.1 | 306 | 3.4 |
| 1955 | 749 | 7.4 | 296 | 1.9 | 453 | 5.5 |
| 1956 | 966 | 11.0 | 340 | 2.5 | 626 | 8.5 |
| 1957 | 1,086 | 13.1 | 368 | 2.5 | 718 | 10.6 |
| 1958 | 896 | 12.1 | 268 | 2.2 | 628 | 9.9 |
| 1959 | 1,033 | 14.5 | 394 | 3.6 | 639 | 10.9 |

*(Continued on next page)*

OTHER

| Year | Rotary Wing Aircraft | | Used Aircraft | | Other | |
|---|---|---|---|---|---|---|
| | Number | Value (Millions) | Number | Value (Millions) | Number | Value (Millions) |
| 1948 | 47 | $1.9 | 202 | $ .7 | ..... | ..... |
| 1949 | 31 | 1.2 | 252 | .6 | ..... | ..... |
| 1950 | 38 | .9 | 262 | .9 | ..... | ..... |
| 1951 | 28 | .9 | 300 | .9 | ..... | ..... |
| 1952 | 37 | 1.4 | 303 | 1.5 | ..... | ..... |
| 1953 | 98 | 4.9 | 416 | 1.5 | ..... | ..... |
| 1954 | 74 | 4.0 | 340 | 1.2 | ..... | ..... |
| 1955 | 66 | 4.2 | 800 | 37.1 | 4 | .01 |
| 1956 | 55 | 3.7 | 534 | 22.7 | 1 | .002 |
| 1957 | 104 | 11.9 | 627 | 43.2 | 4 | .005 |
| 1958 | 67 | 9.6 | 595 | 35.8 | 4 | 4.3 |
| 1959 | 63 | 8.2 | 461 | 20.5 | 6 | 2.9 |

[a] Less than $500,000.

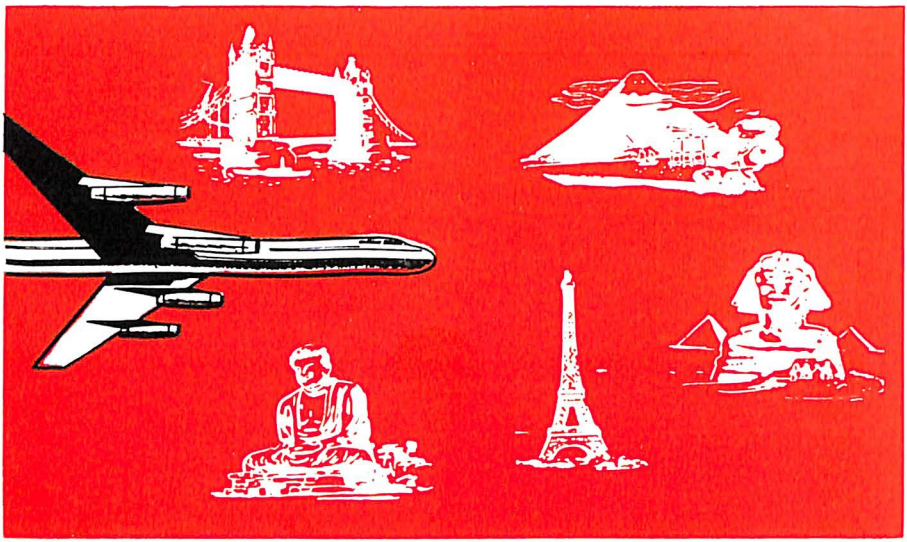
Source: 16

ing facts for U. S. aeronautical exporters at the beginning of a new decade.

Of major significance in 1959 was the continued and increasing trend in licensing arrangements between American aircraft and missile manufacturers and the aeronautical manufacturers of other countries. American aircraft manufacturers have greatly broadened the scope of their international operations in both production and sales by actually becoming partners with the aeronautical manufacturers of other nations. This trend is notable in Canada, France, Germany, Italy, Japan and Mexico, with similar arrangements under negotiation in other areas abroad. There is a well defined trend by American aviation manufacturers to look to international licensing arrangements to greatly augment their export business. This new concept of international cooperation among aeronautical manufacturers of different nations may well provide the "business breakthrough" required to hurdle the many obstacles to international trade.

The export of utility aircraft units increased 15.3 per cent while total value advanced 20 per cent during the year.

The development and activation of certain international financing organizations of various types have not as yet provided much more than



indirect assistance to U. S. aviation exporters. The U. S. Export-Import Bank continues to be the leader in the financing of U. S. aircraft to the world's major airlines. It is hoped that the Export-Import Bank may also provide leadership in the development of long-term export credit guarantees for American-manufactured capital equipment.

MUTUAL SECURITY PROGRAM, SHIPMENT OF MILITARY AIRCRAFT
1950 TO DATE

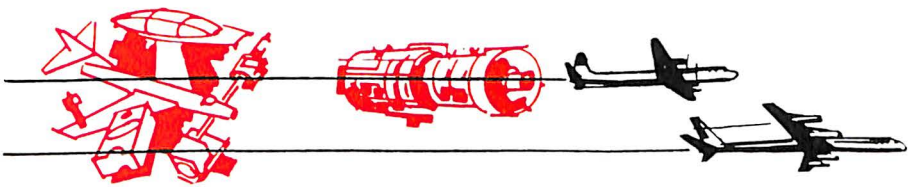
| Year Ending September 30 | Total | Air Force | Navy |
|---|---|---|---|
| 1950 | 251 | 818 | 283 |
| 1951 | 850 | | |
| 1952 | 1,317 | 1,124 | 193 |
| 1953 | 2,689 | 2,274 | 415 |
| 1954 | 1,170 | 923 | 247 |
| 1955 | 1,292 | 1,138 | 154 |
| 1956 | 2,659 | 2,580 | 79 |
| 1957 | 2,182 | 2,085 | 97 |
| 1958 | 1,714 | 1,565 | 149 |
| 1959 | 588 | 528 | 60 |
| TOTAL[a] | 14,712 | 13,035 | 1,677 |

[a]October 6, 1949 to September 30, 1959.
Source: 22

U. S. EXPORTS OF NEW AIRCRAFT ENGINES[a] FOR CIVILIAN AIRCRAFT, 1948 TO DATE

| Year | Number | Value (Thousands of dollars) |
|---|---|---|
| 1948[b] | 660 | $326 |
| 1949[b] | 107 | 112 |
| 1950 | 247 | 285 |
| 1951 | 304 | 509 |
| 1952 | 551 | 941 |
| 1953 | 347 | 708 |
| 1954 | 728 | 1,516 |
| 1955 | 897 | 2,016 |
| 1956 | 1,371 | 3,529 |
| 1957 | 1,516 | 3,860 |
| 1958 | 1,552 | 4,312 |
| 1959 | 948 | 2,448 |

[a] Under 400 h.p.; data for exports of engines of 400 h.p. and over withheld for "security reasons."
[b] Under 250 hp.
Source: 16



VALUE OF UNITED STATES IMPORTS OF AERONAUTIC PRODUCTS, 1955 TO DATE
(Thousands of Dollars)

| Year | TOTAL | Aircraft[a] | Aircraft Engines | Aircraft Parts, N.E.C. |
|---|---|---|---|---|
| 1955 | $32,096 | $14,415 | $1,265 | $16,416 |
| 1956 | 86,790 | 55,594 | 2,300 | 28,896 |
| 1957 | 52,671 | 15,476 | 1,639 | 35,556 |
| 1958 | 78,560 | 32,715 | 5,991 | 39,854 |
| 1959 | 68,066 | 16,273 | 7,510 | 44,283 |

[a] Aircraft includes new and used airplanes, seaplanes, and amphibians. The larger part of the dollar value of imports in 1959 is for Viscounts from the United Kingdom and for planes for the U. S. Army from Canada.
Source: 17

U. S. Exports of Civil Helicopters
1948 to Date

| Year | Number | Value in Thousands |
|---|---|---|
| 1948 | 47 | $1,933 |
| 1949 | 31 | 1,181 |
| 1950 | 38 | 984 |
| 1951 | 28 | 899 |
| 1952 | 37 | 1,411 |
| 1953 | 98 | 4,873 |
| 1954 | 74 | 4,044 |
| 1955 | 66 | 4,165 |
| 1956 | 55 | 3,658 |
| 1957 | 104 | 11,907 |
| 1958 | 67 | 9,564 |
| 1959 | 63 | 8,184 |

Source: 16

U. S. Total Exports and Exports of Aeronautic Products
Selected Years, 1912 to Date
(Millions of Dollars)

| Year | Total United States Merchandise | Total Aeronautic Products | Percent of total |
|---|---|---|---|
| 1912 | $ 2,170.3 | $ .1 | [a] |
| 1915–1918 | 22,176.7 | 31.5 | .14 |
| 1921 | 4,378.9 | .5 | [a] |
| 1929 | 5,157.1 | 9.1 | .18 |
| 1939 | 3,123.3 | 117.8 | 3.8 |
| 1946 | 9,500.2 | 115.3 | 1.2 |
| 1952 | 15,025.7 | 603.2 | 4.0 |
| 1953 | 15,649.0 | 880.6 | 5.6 |
| 1954 | 14,948.1 | 618.9 | 4.1 |
| 1955 | 15,418.5 | 727.5 | 4.7 |
| 1956 | 18,839.7 | 1,059.3 | 5.6 |
| 1957 | 20,850.3 | 1,028.0 | 4.9 |
| 1958 | 17,892.7 | 971.5 | 5.4 |
| 1959 | 17,566.2 | 769.5 | 4.4 |

[a] Less than .05 percent.
Sources: 16, 18

*GREAT BRITAIN*

1959 was a year for mergers among the British manufacturers. However, Britain did quite well in exporting aeronautical products, especially jet planes, during this period.

Total dollar value of aeronautical exports during 1959 amounted to $438,200,000 compared to $434,200,000 in 1958 and $325,000,000 in 1957. Aero-engines and parts exported during 1959 amounted to $180,617,000.

The consolidated position of British aircraft manufacturers will provide keen competition in the world's aeronautical export markets during the sixties.

UNITED KINGDOM: AERONAUTIC EXPORTS, 1924 TO DATE

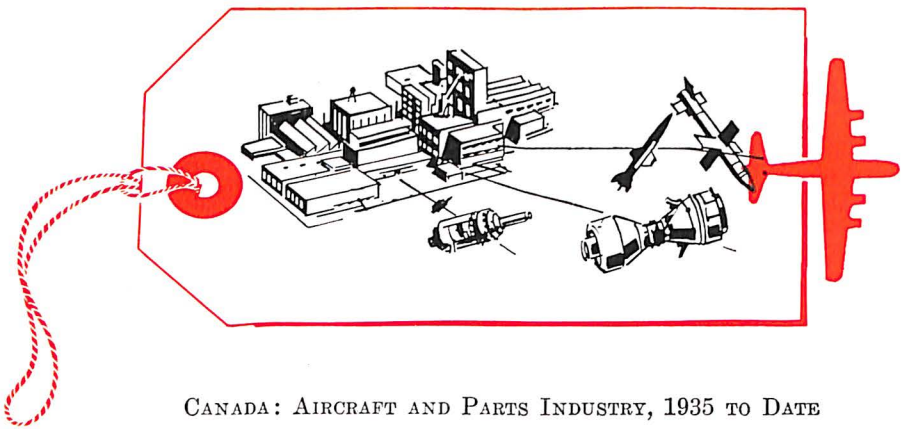
| Annual Average | Million Dollars | Annual | Million Dollars |
|---|---|---|---|
| 1924–1928 | $ 5.6 | 1952 | 121.6 |
| 1929–1933 | 7.1 | 1953 | 182.0 |
| 1934–1938 | 16.3 | 1954 | 156.9 |
| 1939–1943 | 33.9 | 1955 | 185.3 |
| 1944–1948 | 57.7 | 1956 | 292.6 |
| 1949–1951 | 112.3 | 1957 | 325.0 |
| | | 1958 | 434.2 |
| | | 1959 | 438.3 |

Source: 43

UNITED KINGDOM: EMPLOYMENT AND PRODUCTION IN THE AIRCRAFT MANUFACTURING INDUSTRY 1918 TO DATE

| Year | Employment | Value of Production (Million Dollars) |
|---|---|---|
| 1918 | 347,112 | N.A. |
| 1935 | 35,890 | 69.1 |
| 1939 | 355,000 | N.A. |
| 1944 | 1,821,000 | N.A. |
| 1948 | 134,219 | 455.2 |
| 1950 | 153,600 | 423.1 |
| 1954 | 238,200[a] | 624.0[E] |
| 1955 | 258,300[a] | N.A. |
| 1956 | 265,300[a] | N.A. |
| 1957 | 257,600[b] | N.A. |
| 1958 | 246,600[b] | N.A. |
| 1959 | 235,400[b] | N.A. |

N.A.—Not available.
E Estimate by official British sources.
[a] As of end of November.
[b] As of end of December.
Sources: 28, 29



CANADA: AIRCRAFT AND PARTS INDUSTRY, 1935 TO DATE

| Year | Number of Plants | Average Number of Employees | Gross Selling Value of Products (Millions of Dollars) |
|---|---|---|---|
| 1935 | 7 | 294 | $ .9 |
| 1936 | 7 | 416 | 1.3 |
| 1937 | 8 | 606 | 1.7 |
| 1938 | 13 | 1,617 | 6.9 |
| 1939 | 13 | 3,596 | 12.6 |
| 1940 | 19 | 10,348 | 24.2 |
| 1941 | 24 | 26,661 | 74.0 |
| 1942 | 42 | 44,886 | 137.8 |
| 1943 | 45 | 69,529 | 223.7 |
| 1944 | 45 | 79,572 | 427.0 |
| 1945 | 38 | 37,812 | 253.3 |
| 1946 | 16 | 11,405 | 36.2 |
| 1947 | 12 | 9,374 | 44.3 |
| 1948 | 11 | 8,049 | 45.6 |
| 1949 | 14 | 10,725 | 61.1 |
| 1950 | 15 | 10,549 | 50.2 |
| 1951 | 23 | 19,198 | 111.3 |
| 1953 | 43 | 38,048 | 398.7 |
| 1954 | 47 | 35,095 | 343.0 |
| 1955 | 52 | 33,036 | 354.3 |
| 1956 | 52 | 35,563 | 354.5 |
| 1957 | 70 | 41,616 | 424.4 |
| 1958 | 75 | 39,932 | 462.3 |

Sources: 7, 25

*FRANCE*

Total aircraft industry sales during 1959 amounted to approximately $400 million and of this amount, $90 million worth of aircraft, aircraft engines and rockets were exported.

The French aircraft labor force totaled 79,800 during 1959. Significant during 1959 was production of 19 Caravelle medium-range transports at a value of $60 million and 93 helicopters valued at $6 million. France reported production of 1,428 turbine engines during the year.

*NETHERLANDS*

Aircraft production reported during 1959 amounted to 43 units, of which 25 were exported. Values of this combined production of civil and military aircraft were not listed. The Netherlands reported an average daily work force of 4,400 persons, both productive and non-productive for the aircraft industry. Fokker F-27 units produced amounted to 30, and of this total 24 were exported. Hawker Hunter production totaled 13 aircraft for the Netherlands.

*WEST GERMANY*

During 1959, aircraft production in the Federal Republic of Germany for various types of civil aircraft totaled 322 units valued at DM 211.160.000 (50,686,500.). Twenty-one airplanes were exported during the year with a total value of DM 3.000.000 ($721,000).

As of December 31, 1959, Germany listed a total of 13,800 people employed in the aircraft and engine industry; this was an increase of 1,500 over 1958.

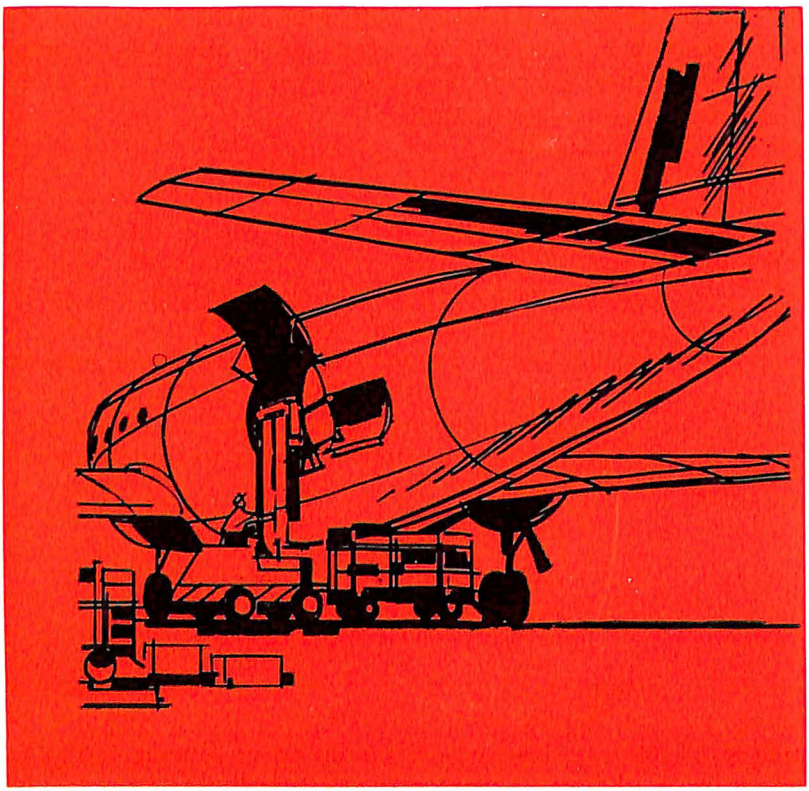
*JAPAN*

Japanese production of all types of aircraft, aircraft engines and aeronautical products totaled $41,341,066 during 1959. Of this total production, $752,433 was exported during the year. During 1958 Japanese aircraft production and exports were slightly higher than the 1959 level.

JAPAN: NUMBER OF AIRCRAFT MANUFACTURED, EXPORTED, AND IMPORTED
1952 to Date

| Year | Manufactured | Exported | Imported |
|---|---|---|---|
| 1952 | 1 | – | 66 |
| 1953 | 9 | – | 68 |
| 1954 | 36 | 7 | 28 |
| 1955 | 86 | – | 12 |
| 1956 | 93 | 6 | 19 |
| 1957 | 227 | 2 | 17 |
| 1958 | 211 | 27 | 13 |
| 1959 | 145 | 16 | N.A. |

N.A.—Not available.
Source: 32



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19 Department of Defense

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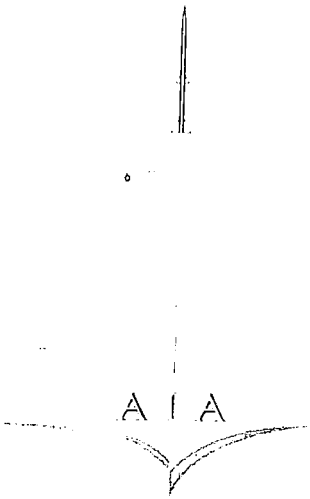
44. War Production Board

# INDEX

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