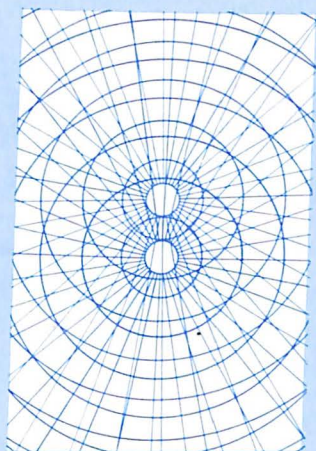


# AEROSPACE FACTS AND FIGURES 1980/81







# AEROSPACE FACTS AND FIGURES 1980/1981

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# FOREWORD

This 28th edition of *Aerospace Facts and Figures* tells the statistical story of the aerospace industry in 1979, a year of heightened performance in virtually every category of industry activity. The industry closed out the decade of the 1970s on a high note, reaching new peaks in sales, backlog, earnings, exports and contribution to the U.S. balance of trade.

Much of the statistical gain, of course, reflects the effects of the nation's double-digit inflation rate. When sales figures are converted to inflation-adjusted constant dollars, we find that 1979 industry activity—as measured by sales volume—amounted to about 77 percent that of the industry's real peak year 1968.

Nonetheless, 1979 was an excellent year. Sales increased by some 20 percent over the previous year, so the gain outstripped inflation by a generous margin. Earnings increased substantially, a welcome improvement for a high-technology industry whose capital investment needs are of an exceptional order. On the whole, 1979 was the best year of the Seventies. The industry activity curve that turned upward in 1976/77, then climbed at a sharper angle in 1978, continued to rise markedly in 1979.

Of particular note was the 1979 aerospace performance in international trade. In a year when the nation as a whole experienced its fourth consecutive large-scale trade deficit, the aerospace industry recorded its greatest trade surplus—more than \$10 billion—and once again led all U.S. manufacturing industries in contribution to the national trade balance. Aerospace thus offset deficits in other areas of trade, underlining anew the importance of high-value, high-technology exports to the American economy.

During the 1970s, there was spectacular growth in the commercial helicopter sector of the industry. In the first year of the decade, commercial helicopter sales amounted to only \$49 million; in 1979 sales were \$403 million. The commercial helicopter market for the 1980s is estimated at \$10 billion.





Looking toward the future, the industry's outlook seems generally bright but there are many uncertainties.

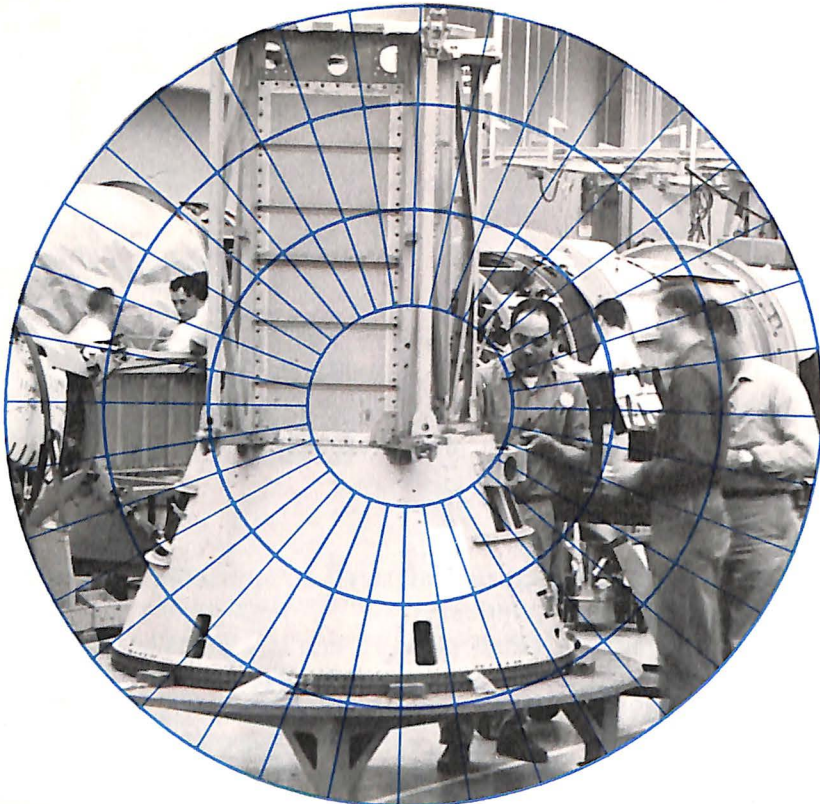
The Administration's stated plans to increase defense funding in the years 1981-85 augur somewhat higher levels of aerospace industry defense activity—although perhaps not as much as some reports suggest. There is question as to whether projected levels of defense outlays for future years will in fact be attained, in view of the uncertain economic climate.

In civil space operations, the forthcoming debut of the Space Shuttle and long-range plans for its utilization suggest greater industry activity in development and fabrication of space systems. But, considering Administration projections on space funding, it appears that some plans may have to be revised downward or at least deferred.

Only a year ago, forecasts of airline requirements for new transport aircraft seemed to indicate enormous expansion of manufacturers' workload. But, in 1979, the airlines began to experience financial problems, occasioned by soaring operating costs, particularly for fuel. The questions now are to what extent traffic demand will soften due to the nation's economic difficulties, thereby lowering aircraft requirements, and whether the airlines will be able to finance their reequipment plans in light of their own economic problems.

So the long-range view has become hazy. For the immediate future, a solid backlog of both military and commercial orders indicates that 1980 will be another banner year. The aerospace industry begins the new decade in better shape than at any time in the last dozen years.

Karl G. Harr, Jr.  
President  
Aerospace Industries Association



## AEROSPACE SUMMARY

The aerospace industry closed out the 1970s with its best year of the decade, setting statistical records in most major categories. The "records," of course, were tainted by the distorting effect of the high U.S. inflation rate, but 1979 was a good year even when the figures are adjusted for inflation. Sales, for example, increased more than 20 percent and backlog grew over 30 percent.

A matter of particular interest in the Seventies was the change in the industry's business "mix." At the start of the decade, U.S. Govern-

ment business accounted for about two-thirds of all industry sales. Although defense and other government sales increased during the Seventies, non-government business increased at a much more rapid pace and gradually narrowed the gap, until the two sectors were nearly equal in 1979.

Here is a breakdown of the industry's 1979 performance by major category:

**Sales.** Total sales amounted to \$45 billion, an increase of almost \$8 billion over 1978 sales, the pre-

vious statistical peak, when measured in current dollars. The gain was compounded of increases in all major categories but particularly in non-government sales of aircraft—mostly commercial transports. Aerospace industry sales as a percentage of the Gross National Product increased from 1.8 percent in 1978 to 1.9 percent in 1979. In relation to total sales of all U.S. manufacturing industries, aerospace sales amounted to 2.7 percent, which compares with 2.5 percent in the previous year.

**Profit.** The industry's net profit after taxes, measured as a percentage of sales, was 5.1 percent, up from 4.4 percent in 1978. Despite the improvement, aerospace profit remained below the average for all U.S. manufacturing industries, which was 5.7 percent in 1979.

**Backlog.** Spurred principally by large-scale orders for commercial transport aircraft, backlog climbed dramatically to \$75 billion at year-end 1979, an increase of almost \$18 billion above the level of the previous year. The backlog included \$38.8 billion in non-government orders and \$36.2 billion in government work. Orders for aircraft, including engines and parts, constituted the major element of the backlog dollar value—\$48 billion. Increases were also recorded in missile/space equipment backlog and in orders for other aerospace and non-aerospace products.

**Civil Aircraft Production.** In terms of dollar value, the industry

recorded a major gain in civil aircraft shipments, but the number of units dipped below the 1978 level. The dollar value of 1979 shipments was \$10.8 billion, up from \$6.5 billion in 1978. In units, shipments totaled 18,462, compared with 18,965 in the previous year; the decline resulted from a lower level of general aviation aircraft sales.

The bulk of the dollar value of 1979 shipments was in commercial transports—\$8.1 billion or 75 percent of the total; the amount represents an increase of \$3.8 billion over the previous year. The industry delivered 388 transports, 144 more than in 1978.

General aviation plane shipments declined for the first time since 1975, but the dollar value of shipments increased substantially. Shipments totaled 17,005 units, which compares with 17,817 in 1978, the all-time peak year. Dollar value was up some \$400 million to \$2.2 billion.

Civil helicopter production, which had been increasing steadily since the mid-Seventies, continued its upward surge and the number of units delivered topped the 1,000 mark for the first time. Deliveries of rotary-wing craft increased from 904 in 1978 to 1,019 in 1979. Dollar value of 1979 civil helicopter deliveries was \$403 million, compared with \$328 million in 1978.

**Military Aircraft Production.** Deliveries of military aircraft approximated those of the previous year but dollar value increased—from \$4.7 billion in 1978 to \$5.4 billion in



1979. The military services accepted 734 aircraft in 1979, 11 more than in the previous year but far fewer than in earlier years; since the Vietnam war peak of about 4,500 planes delivered in 1967, military aircraft acceptances declined in all but one year prior to 1979.

The Air Force led in 1979 acceptances with 311 aircraft, up from 199 in the previous year; almost all of the planes were in the fighter/attack category. The Army received 117 aircraft, principally helicopters, an increase of 30 units over 1978. Navy acceptances declined from 181 in 1978 to 103 in 1979. In addition to U.S. military services deliveries, the USAF and the Army accepted 203 aircraft worth \$1.3 billion for delivery to foreign governments under military assistance programs and foreign military sales.

**Missile Programs.** Sales of missile systems, including parts but excluding propulsion units, amounted to \$3.6 billion, an increase of some \$300 million over 1978. Backlog increased slightly, from \$4.6 billion in 1978 to \$4.8 billion in 1979. Missile sales have remained steady—from \$3.1 to \$3.6 billion—since 1972, but progression of new programs from development to production status indicates substantially higher levels of missile activity in 1980 and future years.

**Space Programs.** Civil and military space programs accounted for 5.5 percent of the industry's total sales in 1979, a decline from 6.1 percent in 1978. Dollar values in-

creased, however, with sales of space vehicle systems, excluding propulsion units, totaling \$2.5 billion in 1979, up from \$2.3 billion in the previous year. The 1979 figure included \$1.4 billion in civil space sales and \$1.1 billion in military space sales; the comparable figures for 1978 are \$1.3 billion (civil) and \$1 billion (military). Space vehicle systems backlog at year-end 1979 was \$1.5 billion, down from \$2.2 billion at the end of 1978.

**Non-aerospace Sales.** The industry's strong growth in sales of non-aerospace products and services continued in 1979 and, for the seventh consecutive year, reached a new peak. Sales amounted to \$7.9 billion, which represents an increase of more than \$1 billion above the previous year's level. In the decade of the Seventies, this area of industry effort grew from 11 percent of total aerospace industry sales to 17 percent.

**Research and Development.** Federal government outlays for research and development, a general indicator of aerospace industry R&D activity, increased in Fiscal Year 1979, as they had every year since 1972. Government estimates of FY 1980 outlays indicate that overall federal R&D outlays will reach \$30.5 billion, an increase of more than 15 percent over 1978.

In the area primarily affecting the aerospace industry, Department of Defense 1980 outlays for R&D are estimated at \$13.3 billion, up 16 percent over \$11.5 billion in 1979.

NASA outlays will total \$4.9 billion, up 20 percent over the previous year, and estimates for the Department of Energy indicate a 10 percent increase to \$4.9 billion.

The National Science Foundation estimated aerospace industrial research and development expenditures, including both government and company funding, at \$8.4 billion in 1979. Aerospace led all U.S. industries in 1979, but aerospace expenditures have been increasing at a lower rate than those of other industries. According to the NSF, aerospace industrial R&D outlays in 1980 will increase only three percent to \$8.7 billion. The electrical machinery industry's outlays are expected to go up 20 percent to \$9.3 billion, and that industry will take over first place with aerospace second.

**Foreign Trade.** In 1979, the aerospace industry set new records for export sales and net trade balance, offsetting U.S. deficits in other areas of trade and underlining the importance of high-value, high-technology aerospace exports to the U.S. economy. With a trade surplus of \$10.1 billion—an increase of \$1 billion over the 1978 figure— aerospace led all U.S. manufacturing industries in positive contribution to the nation's trade balance.

Aerospace exports amounted to \$11.7 billion, an all-time high, and outstripped imports (\$1.6 billion) by a factor of seven to one. Civil aerospace exports constituted 83 percent of the total; they were valued

at \$9.8 billion, which compares with \$6 billion in 1978. A breakdown of the 1979 civil export figure includes \$6.2 billion for aircraft, \$3.2 billion for parts, accessories and equipment, and \$375 million for aircraft engines. The largest single component among civil aerospace exports was commercial transport aircraft, sales of which approximately doubled—\$5 billion compared with \$2.6 billion in 1978.

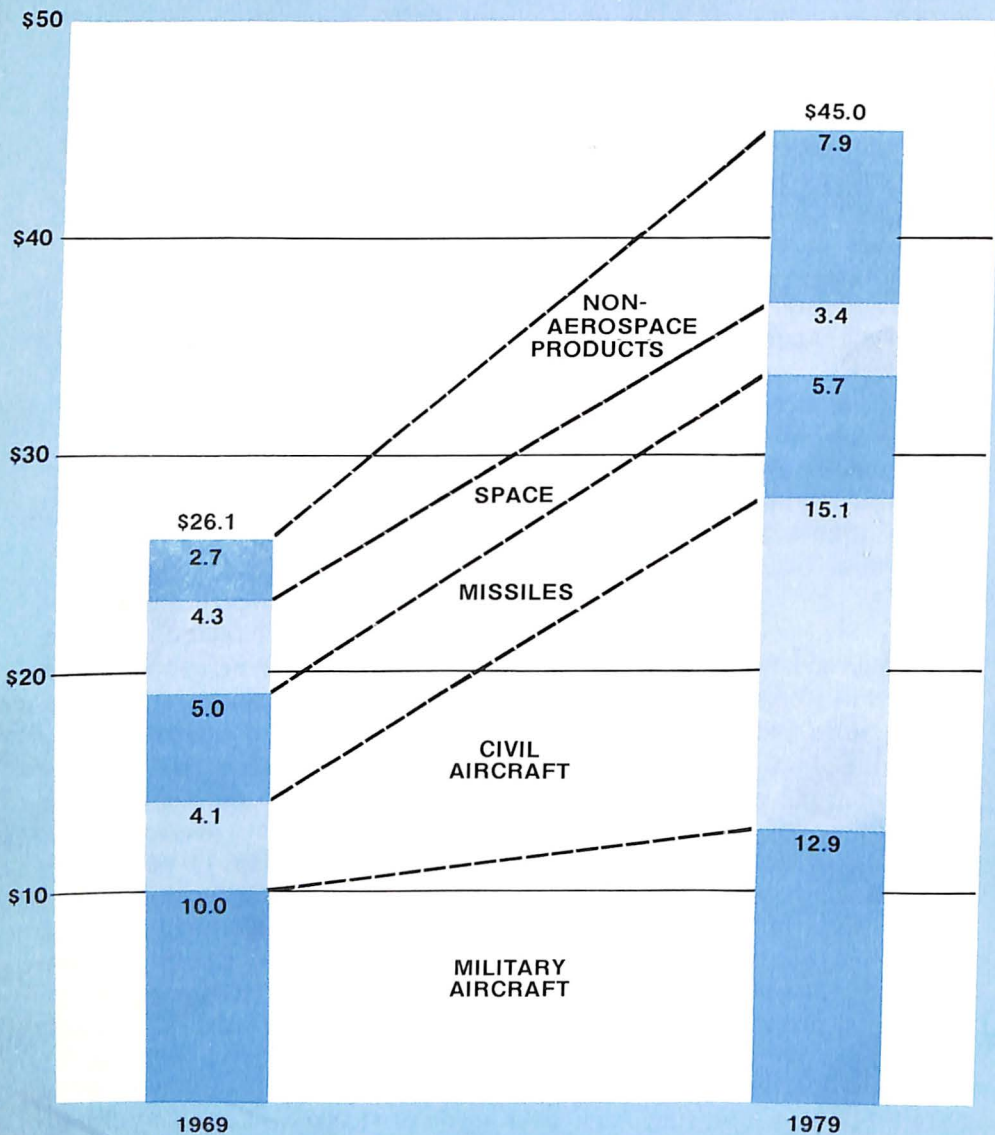
Military aerospace exports declined sharply, from approximately \$4 billion in 1978 to less than \$2 billion in 1979. The breakdown includes \$838 million in foreign sales of aircraft, \$74 million in engines, \$492 million in parts and accessories, and \$571 million in rockets, missiles and parts.

**Employment.** Increasing activity in commercial aircraft production was the principal factor in a substantial increase in aerospace industry employment during 1979. Average employment topped the one million mark for the first time since 1970; the average for the year was 1,099,000 and the year-end total was 1,152,000. The 13 percent increase marked the second year of an upturning employment curve after a decline in the prior three years.

Employment among workers engaged in manufacture of aircraft, engines and parts climbed by 79,000, an increase of 15 percent. A gain of 11,000 workers (8.5 percent) was recorded in the communications equipment category and missile/space employment was up 7,000 (about 7.5 percent).

## AEROSPACE INDUSTRY SALES BY PRODUCT

(In Billions)



Source: AIA estimates



**AEROSPACE INDUSTRY SALES  
BY PRODUCT GROUP**  
Calendar Years 1950-1979  
(Millions of Dollars)

Year	TOTAL Sales	Product Group			
		Aircraft	Missiles	Space	Non- Aerospace
1950	\$ 3,116	\$ 2,731	\$ 105	\$ —	\$ 280
1951	6,264	5,067	633	—	564
1952	10,130	8,442	776	—	912
1953	12,459	10,420	918	—	1,121
1954	12,807	10,460	1,194	—	1,153
1955	12,411	9,781	1,513	—	1,117
1956	13,946	10,485	2,206	—	1,255
1957	15,858	11,398	3,033	—	1,427
1958	16,065	10,582	4,036	1	1,446
1959	16,640	9,714	5,042	386	1,498
1960	17,326	9,127	5,762	878	1,559
1961	17,997	8,847	6,266	1,264	1,620
1962	19,162	8,944	6,311	2,182	1,725
1963	20,134	8,527	6,003	3,774	1,830
1964	20,594	8,911	5,242	4,720	1,721
1965	20,670	9,747	3,626	5,329	1,968
1966	24,610	11,951	4,053	5,969	2,637
1967	27,267	14,981	4,417	5,290	2,579
1968	28,977	16,578	4,719	5,131	2,549
1969	26,149	14,097	5,058	4,295	2,699
1970	24,904	13,293	5,379	3,588	2,644
1971	22,154	11,442	5,018	3,171	2,523
1972	22,818	11,866	5,217	3,089	2,646
1973	24,809	13,338	5,177	2,951	3,343
1974	26,400	14,050	5,187	3,096	4,067
1975	28,373	15,227	5,126	3,228	4,792
1976	30,118	16,426	4,936	3,386	5,370
1977	32,294	17,388	5,452	3,422	6,032
1978	37,354	22,140	5,429	2,996	6,789
1979	44,970	27,957	5,692	3,442	7,879

Source: Aerospace Industries Association estimates, based on latest available information.

NOTE: For explanation of "Aerospace Sales" see the Glossary.

**AEROSPACE INDUSTRY SALES  
BY CUSTOMER**  
Calendar Years 1950-1979  
(Millions of Dollars)

Year	TOTAL Sales	Aerospace Products and Services			Non- Aerospace Products and Services
		U.S. Government		Other Customers	
		Department of Defense	NASA and Other Agencies		
1950	\$ 3,116	\$ 2,598	\$ —	\$ 238	\$ 280
1951	6,264	5,353	—	347	564
1952	10,130	8,568	—	650	912
1953	12,459	10,604	—	734	1,121
1954	12,807	10,832	—	822	1,153
1955	12,411	10,508	—	786	1,117
1956	13,946	11,525	—	1,166	1,255
1957	15,858	12,833	—	1,598	1,427
1958	16,065	13,246	1	1,372	1,446
1959	16,640	13,171	130	1,841	1,498
1960	17,326	13,196	363	2,208	1,559
1961	17,997	13,871	630	1,876	1,620
1962	19,162	14,331	1,334	1,772	1,725
1963	20,134	14,191	2,628	1,485	1,830
1964	20,594	13,218	3,635	2,020	1,721
1965	20,670	11,396	4,490	2,816	1,968
1966	24,610	13,284	5,026	3,663	2,637
1967	27,267	15,855	4,201	4,632	2,579
1968	28,977	16,573	3,938	5,917	2,549
1969	26,149	15,771	3,337	4,342	2,699
1970	24,904	14,643	2,974	4,643	2,644
1971	22,154	12,584	2,745	4,302	2,523
1972	22,818	13,295	2,608	4,269	2,646
1973	24,809	12,886	2,394	6,186	3,343
1974	26,400	12,650	2,527	7,156	4,067
1975	28,373	13,127	2,727	7,727	4,792
1976	30,118	13,402	2,815	8,531	5,370
1977	32,294	14,389	2,880	8,993	6,032
1978	37,354	15,829	2,996	11,740	6,789
1979	44,970	16,615	3,442	17,034	7,879

Source: Aerospace Industries Association, based on latest available information.

NOTE: For an explanation of "Aerospace Sales," see the Glossary.

## SALES AND BACKLOG OF MAJOR AEROSPACE COMPANIES BY PRODUCT GROUP

Calendar Years 1966-1979  
(Millions of Dollars)

Year	GRAND TOTAL	TOTAL		Aircraft, Engines, and Parts		Missiles & Space Incl. Propulsion	Other Aerospace		Non-Aerospace
		U.S. Gov't	Other	U.S. Gov't	Other		U.S. Gov't	Other	
<b>SALES</b>									
1966	\$20,227	\$14,530	\$ 5,697	\$ 5,458	\$ 3,267	\$6,241	\$1,755	\$ 869	\$2,637
1967	23,444	16,334	7,110	7,141	4,753	6,054	1,914	1,002	2,580
1968	25,592	16,635	8,957	7,411	6,439	6,076	2,077	1,040	2,549
1969	24,648	16,560	8,088	7,161	5,603	5,660	2,539	986	2,699
1970	24,752	16,407	8,345	7,586	5,880	5,422	2,324	896	2,644
1971	21,679	14,114	7,565	6,313	5,079	4,971	1,909	884	2,523
1972	21,499	13,492	8,007	4,954	5,199	5,598	2,067	1,035	2,646
1973	24,305	14,431	9,874	5,539	6,739	5,580	2,103	1,001	3,343
1974	26,849	15,196	11,653	5,982	7,560	5,854	2,101	1,285	4,067
1975	29,473	17,314	12,159	6,859	7,797	6,310	2,070	1,645	4,792
1976	31,328	19,083	12,245	8,314	7,622	5,880	2,368	1,833	5,311
1977	33,315	20,704	12,611	8,848	7,530	5,775	2,839	2,219	6,104
1978 <sup>r</sup>	37,968	21,888	16,080	8,724	10,581	6,380 <sup>b</sup>	3,363	2,107 <sup>b</sup>	6,813
1979	45,844	23,206	22,638	8,868	15,633	7,075	3,804	2,585	7,879
<b>BACKLOG—AS OF DECEMBER 31</b>									
1966	\$27,547	\$15,711	\$11,836	\$ 8,761	\$ 9,718	\$4,510	\$1,588	\$ 904	\$2,066
1967 <sup>a</sup>	29,339	16,951	12,388	-19,699-		5,447	1,635	876	1,682
1968	30,749	16,343	14,406	8,150	12,409	5,083	1,851	983	2,273
1969	28,297	14,298	13,999	7,089	12,099	4,338	2,001	880	1,890
1970	24,705	12,882	11,823	5,913	9,800	4,522	1,986	805	1,679
1971	24,579	13,997	10,582	6,221	8,059	4,780	2,232	1,042	2,245
1972	26,922	15,322	11,600	7,027	8,605	5,272	2,018	972	3,028
1973	29,661	16,695	12,966	7,815	8,550	5,670	1,819	1,078	4,729
1974	35,516	20,889	14,627	9,789	9,602	6,643	1,926	1,665	5,891
1975	35,038	22,168	12,870	10,751	8,141	6,415	1,983	2,088	5,660
1976	39,702	24,141	15,561	11,950	8,929	6,286	2,046	3,496	6,995
1977	45,309	26,119	19,190	12,471	12,592	6,743	2,761	3,447	7,295
1978 <sup>r</sup>	57,160	30,223	26,937	14,897	18,972	7,557	4,029	3,668	8,037
1979	75,009	36,174	38,835	17,576	30,454	7,270	5,530	4,806	9,373

Source: Bureau of the Census, "Current Industrial Reports," Series MQ37D (Quarterly).

<sup>a</sup> Due to revision in the data base, 1967 data are estimates.

<sup>b</sup> AIA estimate based on MQ37D data.

<sup>r</sup> Revised.

**AEROSPACE SALES AND THE NATIONAL ECONOMY**  
**Calendar Years 1960-1979**  
**(Billions of Dollars)**

Year	TOTAL Gross National Product	Sales			Aerospace Sales as Percent of		
		Manufac- turing Industries	Durable Goods Industry	Aero- space Industry	GNP	Manufac- turing Industries	Durable Goods Industry
1960	\$ 506.0	\$ 345.7	\$ 173.9	\$ 17.3	3.4%	5.0%	9.9%
1961	523.3	356.4	175.2	18.0	3.4	5.1	10.3
1962	563.8	389.9	195.5	19.2	3.4	4.9	9.8
1963	594.7	412.7	209.0	20.1	3.4	4.9	9.6
1964	635.7	443.1	226.3	20.6	3.2	4.6	9.1
1965	688.1	492.2	257.0	20.7	3.0	4.2	8.1
1966	753.0	554.2	291.7	24.6	3.3	4.4	8.4
1967	796.3	575.4	300.6	27.3	3.4	4.7	9.1
1968	868.5	631.9	335.5	29.0	3.3	4.6	8.6
1969	935.5	694.6	366.5	26.1	2.8	3.8	7.1
1970	982.4	708.8	363.1	24.9	2.5	3.5	6.9
1971	1,063.4	751.4	382.5	22.2	2.1	3.0	5.8
1972	1,171.1	849.5	435.8	22.8	1.9	2.7	5.2
1973	1,306.3	1,017.2	527.3	24.8	1.9	2.4	4.7
1974	1,412.9	1,060.7	529.0	26.4	1.9	2.5	5.0
1975	1,528.8	1,046.7	526.9	28.4	1.9	2.7	5.4
1976 <sup>r</sup>	1,702.2	1,178.0	604.7	30.0	1.8	2.6	5.0
1977 <sup>r</sup>	1,899.5	1,335.1	699.2	32.3	1.7	2.4	4.7
1978 <sup>r</sup>	2,127.6	1,496.6	798.1	37.4	1.8	2.5	4.7
1979	2,368.5	1,692.7	888.1	45.0	1.9	2.7	5.1

Source: Gross National Product: "Economic Report of the President," (Annually). Sales of Manufacturing and Durable Goods Industries: Bureau of Economic Analysis, "Survey of Current Business," (Monthly). Aerospace Sales: Aerospace Industries Association estimates, based on latest available information.

NOTE: For an explanation of "Aerospace Sales" see the Glossary.  
<sup>r</sup> Revised.

**AEROSPACE SALES AND THE NATIONAL ECONOMY  
IN CONSTANT DOLLARS**

Calendar Years 1960-1979  
(Billions of 1972 Dollars)

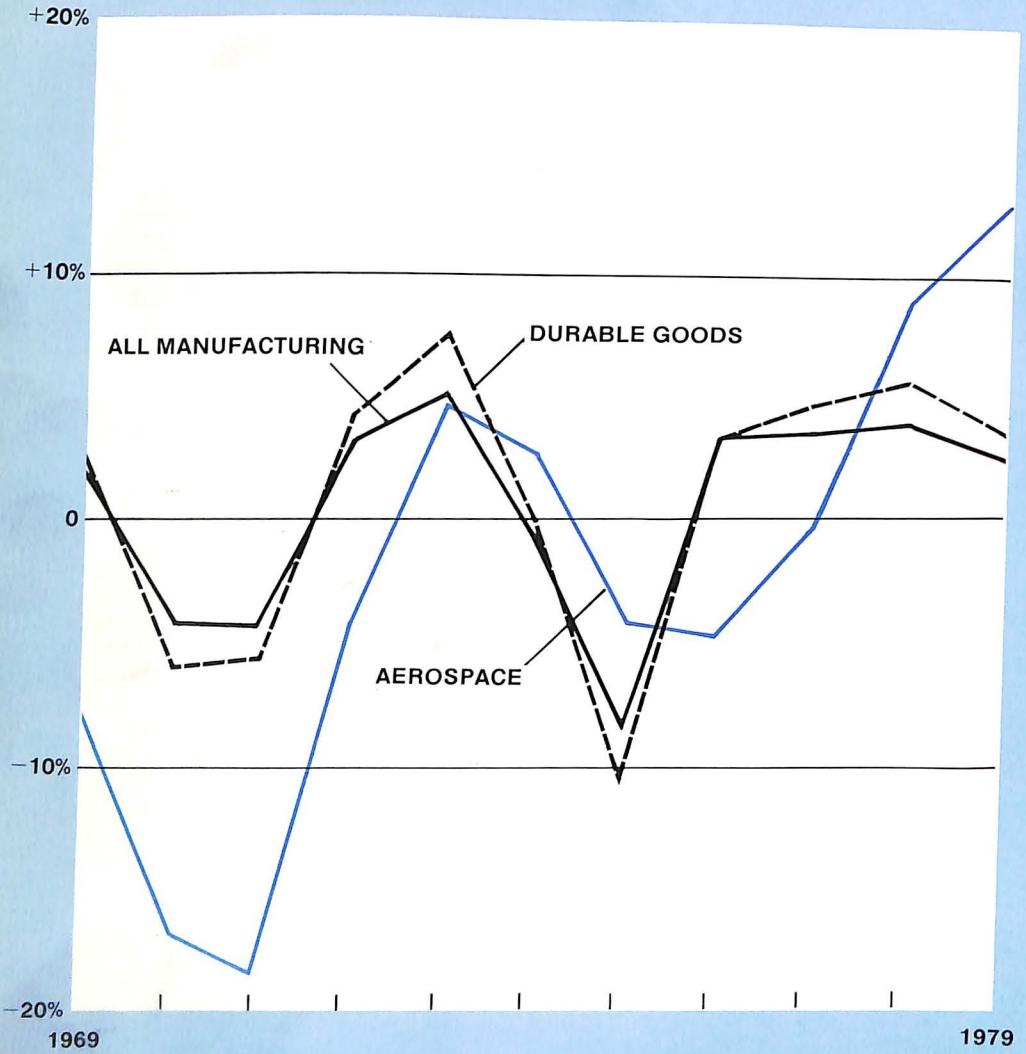
Year	TOTAL Gross National Product	Sales			GNP Implicit Price Deflator 1972=100
		Manu- facturing Industries	Durable Goods Industry	Aerospace Industry	
1960	\$ 736.8	\$ 503.4	\$ 253.2	\$ 25.2	68.67
1961	755.3	514.4	252.9	26.0	69.28
1962	799.1	522.6	277.1	27.2	70.55
1963	830.7	576.5	291.9	28.1	71.59
1964	874.4	609.4	311.2	28.3	72.71
1965	925.9	662.3	345.8	27.9	74.32
1966	981.0	722.0	380.0	32.0	76.76
1967	1,007.7	728.2	380.4	34.5	79.02
1968	1,051.8	765.3	406.3	35.1	82.57
1969	1,078.8	801.0	422.6	30.1	86.72
1970	1,075.3	775.8	397.4	27.3	91.36
1971	1,107.5	782.5	398.4	23.1	96.02
1972	1,171.1	849.5	435.8	22.8	100.00
1973	1,235.0	961.4	498.4	23.4	105.80
1974	1,217.8	914.2	455.9	22.7	116.02
1975	1,202.3	823.2	414.4	22.3	127.15
1976 <sup>r</sup>	1,273.0	881.0	452.2	22.4	133.71
1977 <sup>r</sup>	1,340.5	942.2	493.4	22.8	141.70
1978 <sup>r</sup>	1,399.2	984.3	524.9	24.6	152.05
1979	1,431.1	1,022.8	536.6	27.2	165.50

Source: Deflator Series: "Economic Report of the President," (Annually).

<sup>r</sup> Revised.



### ANNUAL CHANGE IN EMPLOYMENT BY SELECTED INDUSTRY SECTORS 1969-1979



Source: AIA and Bureau of Labor Statistics

**ANNUAL AVERAGE EMPLOYMENT IN ALL MANUFACTURING,  
DURABLE GOODS AND AEROSPACE INDUSTRIES**

Calendar Years 1961-1979  
(Thousands of Employees)

Year	All Manufacturing Industries	Durable Goods Industries	Aerospace Industry		
			TOTAL	As Percent of	
				All Manufacturing	Durable Goods
1961	16,326	9,070	1,178	7.2%	13.0%
1962	16,853	9,480	1,270	7.5	13.4
1963	16,995	9,616	1,267	7.5	13.2
1964	17,274	9,816	1,209	7.0	12.3
1965	18,062	10,406	1,175	6.5	11.3
1966	19,214	11,284	1,375	7.2	12.2
1967	19,447	11,439	1,484	7.6	13.0
1968	19,781	11,626	1,502	7.6	12.9
1969	20,167	11,895	1,402	7.0	11.8
1970	19,349	11,195	1,166	6.0	10.4
1971	18,529	10,565	951	5.1	9.0
1972	19,151	11,049	912	4.8	8.3
1973	20,154	11,891	956	4.7	8.0
1974	20,077	11,925	982	4.9	8.2
1975	18,323	10,688	941	5.1	8.8
1976	18,997	11,077	896	4.7	8.1
1977 <sup>r</sup>	19,682	11,597	893	4.5	7.7
1978 <sup>r</sup>	20,476	12,246	974	4.8	8.0
1979	20,972	12,690	1,099	5.2	8.7

Source: Manufacturing and Durable Goods Employment: Bureau of Labor Statistics, "Employment and Earnings" (Monthly); Aerospace Employment: Aerospace Industries Association estimates based on "Employment and Earnings," Bureau of Labor Statistics.

NOTE: For explanation of "Aerospace Employment," see the Glossary.

<sup>r</sup> Revised.

**ANNUAL AVERAGE EMPLOYMENT  
AEROSPACE INDUSTRY AND ALL MANUFACTURING INDUSTRIES**  
(Thousands of Employees)  
Calendar Years 1961-1979

Year	All Manufacturing Industries TOTAL	Aerospace			Aerospace As Percent of All Manufacturing
		TOTAL	Production Workers	Other <sup>a</sup>	
1961	16,326	1,178	612	566	7.2%
1962	16,853	1,270	635	635	7.5
1963	16,995	1,267	625	642	7.5
1964	17,274	1,209	600	609	7.0
1965	18,062	1,175	597	578	6.5
1966	19,214	1,375	731	644	7.2
1967	19,447	1,484	804	680	7.6
1968	19,781	1,502	807	695	7.6
1969	20,167	1,402	746	656	7.0
1970	19,349	1,166	604	562	6.0
1971	18,529	951	480	471	5.1
1972	19,151	912	455	457	4.8
1973	20,154	956	482	474	4.7
1974	20,077	982	494	488	4.9
1975	18,323	941	461	480	5.1
1976	18,997	896	433	463	4.7
1977 <sup>r</sup>	19,682	893	429	464	4.5
1978 <sup>r</sup>	20,476	974	474	500	4.8
1979	20,972	1,099	557	542	5.2

Source: Manufacturing Employment: Bureau of Labor Statistics, "Employment and Earnings." (Monthly). Aerospace Employment: Aerospace Industries Association estimates, based on "Employment and Earnings," Bureau of Labor Statistics.

<sup>a</sup> "Other" employment includes salaried, clerical and maintenance employees, among others.

<sup>r</sup> Revised.

**ANNUAL AVERAGE PAYROLL  
AEROSPACE INDUSTRY AND ALL MANUFACTURING INDUSTRIES  
(Millions of Dollars)  
Calendar Years 1961-1979**

Year	All Manufacturing Industries TOTAL	Aerospace <sup>a</sup>			Aerospace As Percent of All Manufacturing
		TOTAL	Production Workers	Other	
1961	\$ 89,800	\$ 9,140	\$4,342	\$4,798	10.2%
1962	96,700	10,232	4,871	5,361	10.6
1963	100,600	10,173	4,588	5,585	10.1
1964	107,100	10,067	4,563	5,504	9.4
1965	115,500	10,188	4,504	5,684	8.8
1966	128,000	12,139	5,641	6,498	9.5
1967	134,100	13,727	6,382	7,345	10.2
1968	145,800	14,397	6,582	7,815	9.9
1969	157,500	14,649	6,401	8,248	9.3
1970	158,200	12,275	5,322	6,953	7.8
1971	160,300	10,480	4,409	6,071	6.5
1972	175,400	10,504	4,280	6,224	6.0
1973	196,200	12,107	5,087	7,020	6.2
1974	211,400	13,535	5,672	7,863	6.4
1975	211,000	14,608	5,935	8,673	6.9
1976	237,400 <sup>r</sup>	14,881	5,951	8,930	6.3
1977 <sup>r</sup>	266,000	16,276	6,464	9,812	6.1
1978 <sup>r</sup>	298,300	19,443	7,839	11,604	6.5
1979	330,900	23,945	10,122	13,823	7.2

Source: Manufacturing Payroll: Bureau of Economic Analysis, "Survey of Current Business." Aerospace Payroll: Aerospace Industries Association estimates, based on latest available information.

<sup>a</sup> Aerospace Payroll is estimated by a method similar to that used to estimate Aerospace Employment. See the Glossary.

<sup>r</sup> Revised.

**U.S. TURBINE-ENGINED AIRCRAFT  
IN THE WORLD AIRLINE FLEET  
Calendar Years 1975-1979**

	1975	1976	1977	1978	1979
<b>TOTAL AIRCRAFT IN SERVICE . . .</b>	<u>7,153</u>	<u>7,195</u>	<u>7,298</u>	<u>7,550</u>	<u>7,787</u>
Number Manufactured in U.S. . . . .	4,866	4,891	5,027	5,159	5,341
Percent Manufactured in U.S. . . . .	68.0%	68.0%	68.9%	68.3%	68.6%
<b>Turbojet Aircraft in Service . . . . .</b>	<u>4,919</u>	<u>5,012</u>	<u>5,137</u>	<u>5,288</u>	<u>5,534</u>
Number Manufactured in U.S. . . . .	4,129	4,237	4,345	4,467	4,671
Percent Manufactured in U.S. . . . .	83.9%	84.5%	84.6%	84.5%	84.4%
<b>Turboprop Aircraft in Service . . . . .</b>	<u>1,916</u>	<u>1,914</u>	<u>1,856</u>	<u>1,931</u>	<u>2,013</u>
Number Manufactured in U.S. . . . .	497	455	429	422	477
Percent Manufactured in U.S. . . . .	25.9%	23.8%	23.1%	21.9%	23.7%
<b>Turbine-Powered Helicopters in Service . . . . .</b>	<u>318</u>	<u>269</u>	<u>305</u>	<u>331</u>	<u>240</u>
Number Manufactured in U.S. . . . .	240	199	253	270	193
Percent Manufactured in U.S. . . . .	75.5%	74.0%	83.0%	81.6%	80.4%

Source: Exxon International Company, "Air World Survey," (Annually).

NOTE: The "Air World Survey" covers the world's airlines with the exception of Aeroflot, the USSR national airline, and includes aircraft in service on June 30. Effective 1976, excludes air taxi operators. Effective 1979, excludes a number of companies operating smaller types of aircraft and not providing scheduled services.



**U.S. EXPORTS AND EXPORTS OF AEROSPACE PRODUCTS**  
**Calendar Years 1960-1979**  
**(Millions of Dollars)**

Year	TOTAL Exports <sup>a</sup> of U.S. Merchandise	Exports of Aerospace Products				
		TOTAL	Percent of Total U.S. Exports	Civil		Military
				Trans- ports	Other	
1960	\$ 20,375	\$ 1,726	8.5%	\$ 480	\$ 609	\$ 637
1961	20,754	1,653	8.0	263	615	775
1962	20,431	1,923	9.4	259	651	1,013
1963	23,062	1,627	7.1	191	541	895
1964	26,156	1,608	6.1	211	553	844
1965	27,127	1,618	6.0	353	501	764
1966	29,884	1,673	5.0	421	614	638
1967	31,142	2,248	7.2	611	769	868
1968	34,199	2,994	8.8	1,200	1,089	705
1969	37,462	3,138	8.4	947	1,080	1,111
1970	42,590	3,405	8.0	1,283	1,233	889
1971	43,492	4,203	9.7	1,567	1,513	1,123
1972	48,959	3,795	7.8	1,119	1,835	841
1973	70,246	5,142	7.3	1,664	2,124	1,354
1974	97,144	7,095	7.3	2,655	2,618	1,822
1975	106,561	7,792	7.3	2,397	2,926	2,469
1976	113,666	7,843	6.9	2,468	3,200	2,175
1977 <sup>r</sup>	119,042	7,581	6.4	1,936	3,113	2,532
1978 <sup>r</sup>	141,126	10,001	7.1	2,558	3,460	3,983
1979	178,578	11,747	6.6	4,998	4,774	1,975

Source: Bureau of the Census, "U.S. Exports, Schedule E, Commodity and Country," Report FT 410, (Monthly); "Highlights of U.S. Export and Import Trade," Report FT 990 (Monthly).

NOTE: Effective 1978, the "Schedule E" has been revised. Therefore, data for 1978 and subsequent years may not be strictly comparable to data for prior years.

<sup>a</sup> Exports of domestic merchandise including DOD Military Assistance Program grant-aid shipments.

<sup>r</sup> Revised.

**GNP, FEDERAL BUDGET AND DEFENSE BUDGET**  
**Selected Fiscal Years**  
**(Billions of Dollars)**

Year	GNP	Federal Budget Outlays			DOD Outlays as Percent of	
		NET TOTAL <sup>a</sup>	DOD	Others	GNP	Federal Budget
1950—Lowest defense budget since World War II peak	\$ 263.3	\$ 43.1	\$ 12.0	\$ 32.8	4.5%	26.8%
1953—Korea peak	358.9	76.8	47.5	31.3	13.3	60.3
1964—Last prewar year	616.2	118.6	50.8	70.7	8.2	41.8
1968—South East Asia peak	829.9	178.8	78.0	105.3	9.4	42.5
1973—Actual	1,237.5	247.1	73.8	173.3	6.0	29.9
1974—Actual	1,359.2	269.6	78.4	191.2	5.8	29.1
1975—Actual	1,457.3	326.2	86.0	240.2	5.9	26.4
1976—Actual	1,621.7	366.4	88.5	277.9	5.5	24.2
1977—Actual	1,834.0	402.7	95.7	307.0	5.2	23.8
1978—Actual <sup>r</sup>	2,043.4	450.8	103.0	347.8	5.0	22.8
1979—Actual	2,313.4	493.7	115.0	378.7	5.0	23.3
1980—Estimate	2,554.6	568.9	131.0	437.9	5.1	23.0
1981—Estimate	2,796.7	611.5	147.0	464.5	5.3	24.0

Source: Department of Defense Budget (Annually).

<sup>a</sup> "Net Total" is government-wide total less intragovernmental transactions.

<sup>r</sup> Revised.

**FEDERAL OUTLAYS  
SELECTED FUNCTIONS AND AEROSPACE PRODUCTS & SERVICES**

Fiscal Years 1960-1981  
(Millions of Dollars)

Year	TOTAL National Defense	TOTAL NASA	Federal Outlays for Aerospace Products & Services			Aero- space as Percent of Total National Defense and NASA
			TOTAL	DOD	NASA	
1960	\$45,691	\$ 401	\$12,849	\$12,502	\$ 347	27.9%
1961	47,494	744	13,606	12,960	646	28.2
1962	51,103	1,257	15,135	13,992	1,143	28.9
1963	52,755	2,552	16,186	13,857	2,327	29.3
1964	53,591	4,171	17,938	14,205	3,733	31.1
1965	49,578	5,093	15,697	11,135	4,561	28.7
1966	56,785	5,933	17,771	12,411	5,360	28.3
1967	70,081	5,426	20,011	14,874	5,137	26.5
1968	80,517	4,724	21,355	16,757	4,598	25.1
1969	81,232	4,251	20,472	16,286	4,185	23.9
1970	80,295	3,753	18,747	15,048	3,699	22.3
1971	77,661	3,382	17,335	13,997	3,338	21.4
1972	78,336	3,422	16,999	13,627	3,372	20.8
1973	76,021	3,315	15,945	12,675	3,270	20.1
1974	78,569	3,256	15,782	12,601	3,181	19.3
1975	86,585	3,266	15,943	12,762	3,181	17.7
1976	89,996	3,669	16,843	13,295	3,548	18.0
Tr. Qtr.	22,518	952	3,944	3,018	926	16.8
1977	97,501	3,945	18,201	14,361	3,840	17.9
1978 <sup>r</sup>	105,186	3,983	12,624	8,765 <sup>a</sup>	3,859	11.6
1979	117,681	4,196	14,984	10,920	4,064	12.3
1980 <sup>E</sup>	134,009	5,003	18,071	13,223	4,848	13.0
1981 <sup>E</sup>	150,494	5,216	20,011	14,958	5,053	12.9

Source: "The Budget of the United States Government" (Annually).

NOTE: "National Defense" includes the military budget of the Department of Defense and atomic energy defense activities. "Total NASA" includes research and development activities, administrative operations and construction of facilities. NASA construction is not included in "Total Aerospace Products and Services."

<sup>a</sup> Effective with FY 1978, DOD outlays for aircraft and missile procurement only.

<sup>r</sup> Revised.

<sup>E</sup> Estimate.

**FEDERAL OUTLAYS FOR  
AEROSPACE PRODUCTS AND SERVICES**  
Fiscal Years 1960-1981  
(Millions of Dollars)

Year	TOTAL	Department of Defense Procurement			NASA
		TOTAL	Aircraft	Missiles	
1960	\$ 9,646	\$ 9,299	\$ 6,272	\$ 3,027	\$ 347
1961	9,516	8,870	5,898	2,972	646
1962	11,244	10,101	6,659	3,442	1,143
1963	12,453	10,126	6,309	3,817	2,327
1964	13,363	9,630	6,053	3,577	3,733
1965	11,858	7,296	5,200	2,096	4,562
1966	14,064	8,704	6,635	2,069	5,360
1967	15,478	10,341	8,411	1,930	5,137
1968	16,279	11,681	9,462	2,219	4,598
1969	15,871	11,686	9,177	2,509	4,185
1970	14,559	10,860	7,948	2,912	3,699
1971	13,109	9,771	6,631	3,140	3,338
1972	14,365	10,993	5,927	5,066	3,372
1973	11,359	8,089	5,066	3,023	3,270
1974	11,168	7,987	5,006	2,981	3,181
1975	11,554	8,373	5,484	2,889	3,181
1976	12,364	8,816	6,520	2,296	3,548
Tr. Qtr.	2,885	1,959	1,557	402	926
1977	13,229	9,389	6,608	2,781	3,840
1978	12,624	8,765	6,971	1,794	3,859
1979	14,984	10,920	8,836	2,084	4,064
1980 <sup>E</sup>	18,071	13,223	11,012	2,211	4,848
1981 <sup>E</sup>	20,011	14,958	12,108	2,850	5,053

Source: Department of Defense Budget (Annually); NASA Budget (Annually).  
E Estimate.

**DEPARTMENT OF DEFENSE  
AEROSPACE OUTLAYS**  
Fiscal Years 1960-1981  
(Millions of Dollars)

Year	DOD Aerospace Outlays <sup>a</sup>		
	TOTAL	Procurement	Research, Development, Test and Evaluation
1960	\$ 12,502	\$ 9,299	\$ 3,203
1961	12,960	8,870	4,090
1962	13,992	9,842	4,150
1963	13,857	10,126	3,731
1964	14,205	9,630	4,575
1965	11,135	7,296	3,839
1966	12,411	8,704	3,707
1967	14,875	10,341	4,534
1968	16,757	11,681	5,076
1969	16,286	11,686	4,600
1970	15,048	10,860	4,188
1971	13,997	9,771	4,226
1972	13,627	8,936	4,691
1973	12,675	8,089	4,586
1974	12,601	7,987	4,614
1975	12,762	8,373	4,389
1976	13,295	8,816	4,479
Tr. Qtr.	3,018	1,959	1,059
1977	14,361	9,389	4,972
1978	NA	8,765	NA
1979	NA	10,920	NA
1980 <sup>E</sup>	NA	13,223	NA
1981 <sup>E</sup>	NA	14,958	NA

Source: Department of Defense Budget (Annually).

<sup>a</sup> Excludes Military Assistance.

<sup>E</sup> Estimate.

NA Not Available.



**DEPARTMENT OF DEFENSE**  
**TOTAL OUTLAYS BY FUNCTIONAL TITLE**  
**Fiscal Years 1973-1981**  
**(Millions of Dollars)**

	1973	1974	1975
<b>TOTAL</b> .....	<b>\$73,297</b>	<b>\$77,626</b>	<b>\$85,020</b>
<b>PROCUREMENT—TOTAL</b> .....	<u>15,654</u>	<u>15,241</u>	<u>16,042</u>
AIRCRAFT .....	5,066	5,006	5,484
MISSILES .....	3,023	2,981	2,889
Ships .....	1,982	2,104	2,627
Combat Vehicles, Weapons & Torpedoes .....	354	446	395
Ordnance, Vehicles & Related Equipment .....	2,508	2,044	1,492
Electronics & Communications .....	675	854	897
Other Procurement .....	2,046	1,806	2,258
<b>RESEARCH, DEVELOPMENT, TEST &amp; EVALUATION—TOTAL</b> .....	<u>8,157</u>	<u>8,582</u>	<u>8,866</u>
AIRCRAFT .....	2,036	1,893	1,698
MISSILES .....	2,038	2,160	2,176
ASTRONAUTICS .....	512	561	515
Other .....	3,571	3,968	4,477
<b>Military Personnel—TOTAL</b> .....	<u>27,635</u>	<u>28,856</u>	<u>31,210</u>
Active Forces .....	21,722	22,150	23,235
Reserve Forces .....	1,523	1,579	1,733
Retired Pay .....	4,390	5,127	6,242
<b>Military Construction</b> .....	1,119	1,407	1,462
Family Housing .....	729	884	1,124
Civil Defense .....	74	75	86
Operations and Maintenance .....	21,069	22,478	26,330
Other .....	(1,140)	103	(100)

Source: Department of Defense Budget (Annually).

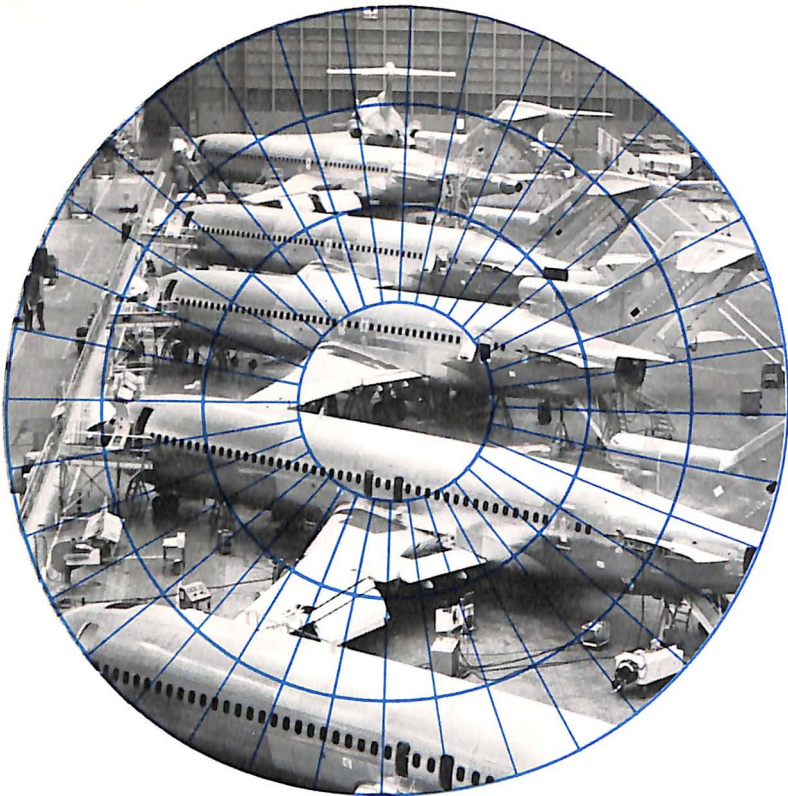
NOTE: Data in parentheses are credit items. The categories printed in capital letters are primarily aerospace, but others contain substantial parts attributable to aerospace activities.

*E* Estimate.

NA Not Available.

**DEPARTMENT OF DEFENSE**  
**TOTAL OUTLAYS BY FUNCTIONAL TITLE (Continued)**  
**Fiscal Years 1973-1981**  
**(Millions of Dollars)**

1976	Transition Quarter	1977	1978	1979	1980 <sup>E</sup>	1981 <sup>E</sup>
\$88,036	\$21,927	\$95,650	\$103,042	\$115,013	\$130,967	\$146,971
15,964	3,766	18,178	19,976	25,404	28,796	31,624
6,520	1,557	6,608	6,971	8,836	11,012	12,108
2,296	402	2,781	1,794	2,084	2,211	2,850
2,606	661	2,841	3,048	4,553	4,731	4,854
240	134	833	2,140	2,949	3,199	3,519
856	150	940	732	958	999	1,140
1,031	271	1,197	1,349	1,618	} 6,644	} 7,153
2,415	591	2,978	3,942	4,406		
<u>8,923</u>	<u>2,206</u>	<u>9,795</u>	<u>10,508</u>	<u>11,152</u>	<u>12,489</u>	<u>14,865</u>
1,603	410	2,176	} NA	} NA	} NA	} NA
2,295	520	2,259				
581	129	537				
4,444	1,147	4,823				
<u>32,359</u>	<u>8,305</u>	<u>33,931</u>	<u>36,246</u>	<u>38,686</u>	<u>42,654</u>	<u>45,762</u>
23,259	5,846	23,857	25,116	26,300	28,309	29,148
1,804	512	1,858	1,959	2,107	2,360	2,649
7,296	1,947	8,216	9,171	10,279	11,985	13,965
2,019	376	1,914	1,932	2,080	2,376	2,248
1,192	296	1,358	1,405	1,468	1,608	1,782
80	18	93	82	—	—	—
27,902	7,261	30,587	33,578	36,424	43,388	49,244
(403)	(301)	(206)	(685)	(200)	(343)	1,445



## AIRCRAFT PRODUCTION

With an increase in value of more than \$5 billion over the previous year, aircraft production constituted by far the area of greatest gain in the aerospace industry's overall sales volume of 1979. Sales of complete aircraft, including engines and parts, amounted to a record \$24.5 billion, compared with \$19.3 billion in 1978.

The large gain was due to a major jump—47 percent—in non-government sales, largely commercial transports. Non-government sales of aircraft climbed from \$10.6 billion in 1978 to \$15.6 billion in 1979.

Aircraft sales to government agencies—predominantly the Department of Defense—increased only slightly, from \$8.7 billion to \$8.9 billion.

Aircraft production has traditionally accounted for more than half of the aerospace industry's total sales and that pattern held true in 1979, with aircraft sales constituting more than 53 percent of the total.

The industry's backlog of orders for aircraft also experienced a very large gain—to \$48 billion from \$33.9 billion at the end of 1978. Here again, the increase was primarily in

non-government orders, which totaled \$30.5 billion in 1979, up more than \$11 billion over the 1978 figure. Backlog of government aircraft orders increased from \$14.9 billion in 1978 to \$17.6 billion in 1979.

Among other aircraft production highlights:

- Aircraft deliveries of all types numbered 19,196. The figure represents a decline of almost 500 units below the 1978 level, but it is nonetheless greater than in any other year since 1968.

- For the first time since 1975, shipments of general aviation planes dropped below the level of the previous year—but not dramatically. Shipments in 1979 totaled 17,055 units, compared with the 1978 all-time record of 17,817. However, the dollar value of planes delivered was up some \$400 million to \$2.2 billion in 1979.

- The rotary-wing segment of the industry produced 1,019 civil helicopters valued at \$403 million; this compares with \$328 million in 1978.

- Commercial transport sales increased sharply in both numbers of aircraft and dollar value. The industry delivered 388 jetliners, up from 244 in 1978. Dollar value was \$8.1 billion, compared with \$4.3 billion in the previous year.

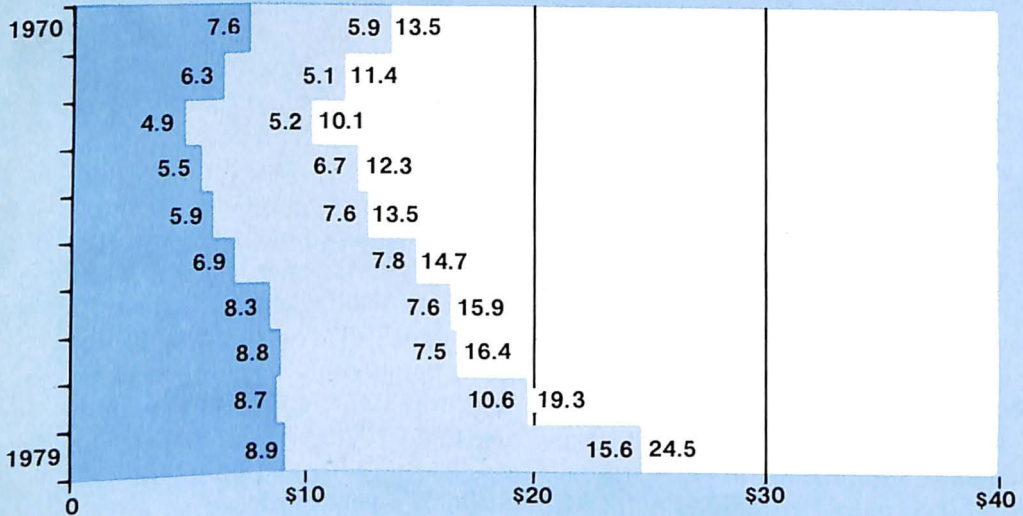
The transport backlog indicated further gains of significant order in

near-future years. Backlog dollar volume grew by \$7.7 billion to \$23.7 billion; the number of transports on order increased to 892 from 702 at year-end 1978. Of particular interest was the backlog growth in transport orders from foreign customers, increasing 36 percent in number of aircraft and 54 percent in value. It underlined the fact that U.S. manufacturers are faring well in international sales competition and suggested continuance in the early 1980s of the aerospace industry's high level of contribution to the U.S. balance of trade. Foreign orders for U.S. transports amounted to \$13.5 billion (478 aircraft) at year-end 1979, up from \$8.8 billion (352 aircraft) a year earlier.

Military aircraft production increased negligibly in terms of numbers but dollar value increased substantially. In 1979, the military services accepted 734 aircraft with a total flyaway value of \$5.4 billion; the comparable figures for the previous year were 723 aircraft worth \$4.7 billion. The Air Force led in deliveries with 311 aircraft; the Army received 117, the Navy 103. The remaining 203 military aircraft were accepted by the USAF and the Army for delivery to foreign governments under military assistance programs and foreign military sales.

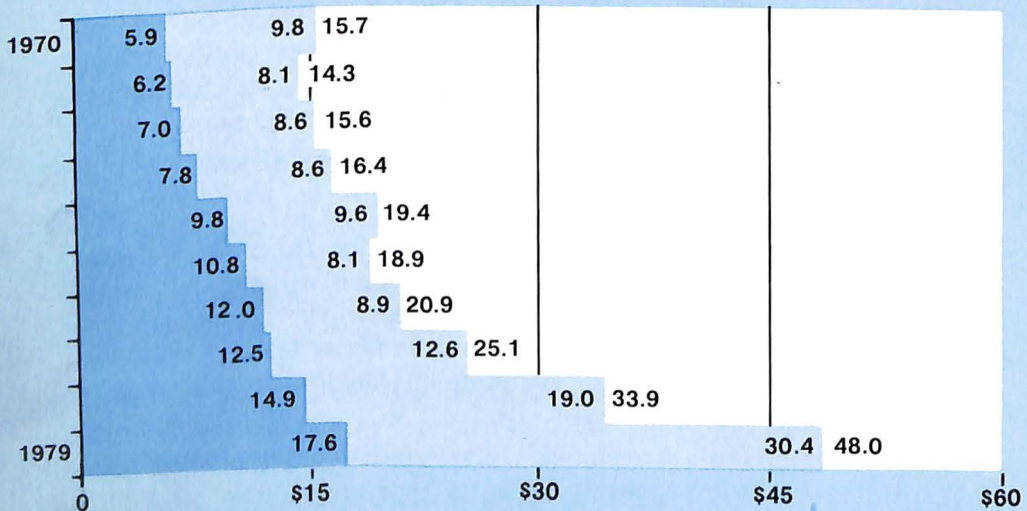
### AIRCRAFT SALES BY CUSTOMER

(Billions of Dollars)



### AIRCRAFT BACKLOG BY CUSTOMER

(Billions of Dollars)



U.S. GOVERNMENT  
 OTHER CUSTOMERS



**AIRCRAFT SALES AND BACKLOG**  
**COMPLETE AIRCRAFT, AIRCRAFT ENGINES, AND PARTS**  
 Calendar Years 1966-1979  
 (Millions of Dollars)

Year	TOTAL			Aircraft & Parts <sup>a</sup>		Aircraft Engines & Parts	
	TOTAL	U.S. Gov't	Other	U.S. Gov't	Other	U.S. Gov't	Other
<b>SALES</b>							
1966	\$ 8,725	\$ 5,458	\$ 3,267	\$ 4,086	\$ 2,544	\$1,372	\$ 723
1967	11,894	7,141	4,753	5,345	3,737	1,796	1,016
1968	13,850	7,411	6,439	5,697	5,188	1,714	1,251
1969	12,764	7,161	5,603	5,382	4,517	1,779	1,086
1970	13,466	7,586	5,880	5,674	4,683	1,912	1,197
1971	11,392	6,313	5,079	4,953	4,093	1,360	986
1972	10,153	4,954	5,199	3,666	4,085	1,288	1,114
1973	12,278	5,539	6,739	4,231	5,322	1,308	1,417
1974	13,542	5,982	7,560	4,562	5,846	1,420	1,714
1975	14,656	6,859	7,797	5,269	6,001	1,590	1,796
1976	15,936	8,314	7,622	6,336	5,900	1,978	1,722
1977	16,378	8,848	7,530	6,855	5,670	1,993	1,860
1978 <sup>r</sup>	19,305	8,724	10,581	6,853	7,873	1,871	2,708
1979	24,501	8,868	15,633	6,780	12,598	2,088	3,035
<b>BACKLOG—AS OF DECEMBER 31</b>							
1966	\$18,479	\$ 8,761	\$ 9,718	\$ 6,515	\$ 8,140	\$2,246	\$1,578
1967	19,699	-19,699-		6,753	8,887	-4,059-	
1968	20,559	8,150	12,409	5,999	10,609	2,151	1,800
1969	19,188	7,089	12,099	5,270	10,340	1,819	1,759
1970	15,713	5,913	9,800	4,663	8,601	1,250	1,199
1971	14,280	6,221	8,059	4,876	7,123	1,345	936
1972	15,632	7,027	8,605	5,705	7,355	1,322	1,250
1973	16,365	7,815	8,550	6,312	7,232	1,503	1,318
1974	19,391	9,789	9,602	7,698	7,791	2,091	1,811
1975	18,892	10,751	8,141	8,743	6,646	2,008	1,495
1976	20,879	11,950	8,929	9,905	7,416	2,045	1,513
1977	25,063	12,471	12,592	9,557	10,152	2,914	2,440
1978 <sup>r</sup>	33,869	14,897	18,972	11,759	16,508	3,138	2,464
1979	48,030	17,576	30,454	13,916	25,873	3,660	4,581

Source: Bureau of the Census, "Current Industrial Reports," Series MQ37D (Quarterly).

<sup>a</sup> Includes Aircraft Propellers and Parts.

<sup>r</sup> Revised.

**U.S. AIRCRAFT PRODUCTION**

Calendar Years 1961-1979  
(Number of Aircraft)

Year	TOTAL	Civil	Military <sup>a</sup>
1961	8,936	7,354	1,582
1962	9,213	7,238	1,975
1963	10,143	8,173	1,970
1964	12,517	10,078	2,439
1965	15,489	12,683	2,806
1966	20,283	16,674	3,609
1967	18,993	14,512	4,481
1968	19,362	14,922	4,440
1969	17,249	13,505	3,644
1970	11,161	8,076	3,085
1971	10,390	8,158	2,232
1972	12,693	10,576	2,117
1973	16,081	14,709	1,372
1974	16,436	15,326	1,110
1975	16,620	15,251	1,369
1976	17,588 <sup>r</sup>	16,445	1,143 <sup>r</sup>
1977	18,805 <sup>r</sup>	17,943	862 <sup>r</sup>
1978	19,688 <sup>r</sup>	18,965	723 <sup>r</sup>
1979	19,196	18,462	734

Source: Aerospace Industries Association, company reports; General Aviation Manufacturers' Association, company reports; Department of Defense.

<sup>a</sup> Effective 1972, includes aircraft accepted by U.S. military agencies for shipment to foreign governments for military assistance programs and foreign military sales.

<sup>r</sup> Revised.

## CIVIL AIRCRAFT SHIPMENTS

Number and Value  
Calendar Years 1966-1979

Year	TOTAL	Transport Aircraft	Helicopters	General Aviation
<b>NUMBER OF AIRCRAFT SHIPPED</b>				
1966	16,674	344	583	15,747
1967	14,512	480	455	13,577
1968	14,922	702	522	13,698
1969	13,505	514	534	12,457
1970	8,076	311	482	7,283
1971	8,158	223	469	7,466
1972	10,576	227	575	9,774
1973	14,709	294	770	13,645
1974	15,326	332	828	14,166
1975	15,251	315	864	14,072
1976	16,445	238	757	15,450
1977	17,943	185	848	16,910
1978	18,965	244	904	17,817
1979	18,462	388	1,019	17,055
<b>VALUE—Millions of Dollars</b>				
1966	\$ 2,183	\$1,699	\$ 40	\$ 444
1967	2,861	2,458	43	360
1968	4,267	3,789	57	421
1969	3,598	2,939	75	584
1970	3,546	3,158	49	339
1971	2,984	2,594	69	321
1972	3,308	2,660	90	558
1973	4,665	3,718	121	826
1974	5,091	3,993	189	909
1975	5,086	3,779	274	1,033
1976	4,706	3,192	285	1,229
1977	4,691	2,889	251	1,551
1978	6,482 <sup>r</sup>	4,332	328 <sup>r</sup>	1,822
1979	10,758	8,144	403	2,211

Source: Transport Aircraft and Helicopters: Aerospace Industries Association.  
General Aviation: General Aviation Manufacturers' Association.

<sup>r</sup> Revised.

## TRANSPORT AIRCRAFT ORDERS

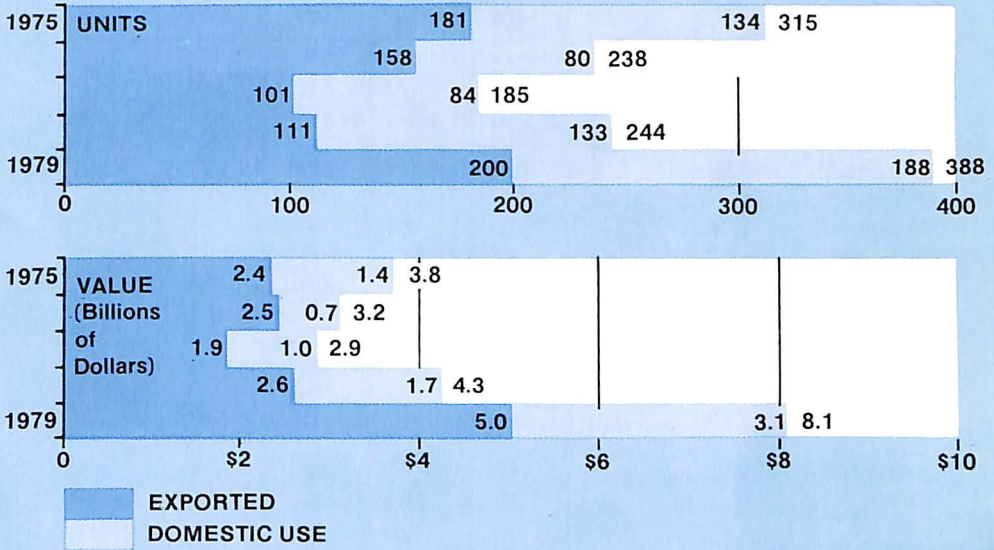
As of December 31, 1975-1979

Company and Model	1975	1976	1977	1978	1979
<b>TOTAL AIRCRAFT ON ORDER</b> (Domestic and Foreign Orders)	340	300	465	702	892
VALUE (Millions of Dollars) . . . . .	\$5,959	\$4,810	\$8,903	\$15,952	\$23,679
<b>Boeing—TOTAL</b> . . . . .	<u>130</u>	<u>155</u>	<u>242</u>	<u>426</u>	<u>611</u>
B-707 . . . . .	9	5	4	1	—
B-727 . . . . .	60	106	157	195	212
B-737 . . . . .	29	22	36	111	159
B-747 . . . . .	32	22	45	89	106
B-757 . . . . .	—	—	—	—	40
B-767 . . . . .	—	—	—	30	94
<b>Lockheed—TOTAL</b> . . . . .	<u>93</u>	<u>71</u>	<u>61</u>	<u>40</u>	<u>56</u>
L-1011 . . . . .	<u>81<sup>a</sup></u>	<u>70<sup>a</sup></u>	<u>61<sup>a</sup></u>	<u>40</u>	<u>56</u>
L-100-30 . . . . .	12	1	—	—	—
<b>McDonnell Douglas—TOTAL</b> . . . . .	<u>117<sup>a</sup></u>	<u>74<sup>a</sup></u>	<u>162<sup>a</sup></u>	<u>236<sup>a</sup></u>	<u>225<sup>a</sup></u>
DC-9 . . . . .	65	47	101	134	134
DC-10 . . . . .	52	27	61	102	91
<b>TOTAL FOREIGN ORDERS</b> . . . . .	217	137	232	352	478
VALUE (Millions of Dollars) . . . . .	\$4,212	\$2,853	\$5,534	\$8,803	\$13,540
<b>Boeing—TOTAL</b> . . . . .	<u>82</u>	<u>50</u>	<u>95</u>	<u>194</u>	<u>312</u>
B-707 . . . . .	9	5	4	1	—
B-727 . . . . .	20	13	35	51	74
B-737 . . . . .	28	12	16	77	127
B-747 . . . . .	25	20	40	65	88
B-757 . . . . .	—	—	—	—	19
B-767 . . . . .	—	—	—	—	4
<b>Lockheed—TOTAL</b> . . . . .	<u>46</u>	<u>33</u>	<u>27</u>	<u>17</u>	<u>33</u>
L-1011 . . . . .	<u>36<sup>a</sup></u>	<u>32<sup>a</sup></u>	<u>27<sup>a</sup></u>	<u>17</u>	<u>33</u>
L-100-30 . . . . .	10	1	—	—	—
<b>McDonnell Douglas—TOTAL</b> . . . . .	<u>89<sup>a</sup></u>	<u>54<sup>a</sup></u>	<u>110<sup>a</sup></u>	<u>141<sup>a</sup></u>	<u>133<sup>a</sup></u>
DC-9 . . . . .	40	30	69	83	72
DC-10 . . . . .	49	24	41	58	61

Source: Aerospace Industries Association, company reports.

<sup>a</sup> Includes options.

**TRANSPORT AIRCRAFT SHIPMENTS AND EXPORTS**



Source: AIA and U.S. Department of Commerce

**TRANSPORT AIRCRAFT SHIPMENTS**  
Calendar Years 1975-1979

Company and Model	1975	1976	1977	1978	1979
<b>TOTAL</b>					
Number of Aircraft Shipped . . . . .	315	238	185	244	388
VALUE (Millions of Dollars) . . . . .	\$3,779	\$3,192	\$2,889	\$4,332	\$8,144
<b>Boeing—TOTAL</b> . . . . .	<u>169</u>	<u>132</u>	<u>115</u>	<u>193</u>	<u>281</u>
B-707 . . . . .	7	3	3	3	1
B-727 . . . . .	91	61	67	118	136
B-737 . . . . .	51	41	25	40	77
B-747 . . . . .	20	27	20	32	67
<b>Lockheed—TOTAL</b> . . . . .	68	43	42	13	33
L-1011 . . . . .	25	16	11	8	14
L-100-30 (Hercules) . . . . .	} 43	11	1	} 5	} 19
C-130 (Hercules) . . . . .		16	30		
<b>McDonnell Douglas—TOTAL</b> . . . . .	<u>78</u>	<u>63</u>	<u>28</u>	<u>38</u>	<u>74</u>
DC-9 . . . . .	35	44	16	20	39
DC-10 . . . . .	43	19	12	18	35

Source: Aerospace Industries Association, company reports.  
NOTE: Differs from FAA totals which include executive type aircraft.

## HELICOPTER SHIPMENTS

Calendar Years 1975-1979

	1975	1976	1977	1978	1979
<b>TOTAL</b>					
Number of Helicopters Shipped ..	864	775	884	935	1,090
VALUE (Millions of Dollars) .....	\$ 274	\$ 305	\$ 316	\$ 367 <sup>r</sup>	\$ 476
<b>Bell—TOTAL</b> .....	<u>495</u>	<u>424</u>	<u>374</u>	<u>438</u>	<u>648</u>
47 Series .....	3	11	—	—	—
204 Series .....	1	2	—	—	—
205 Series .....	40	36	11 <sup>r</sup>	23	18
206 Series .....	325	290 <sup>a</sup>	283	322	469
212 Series .....	126	71	47	50	86
214 Series .....	—	13	9	16	8
AH-1J* .....	—	1	7	—	—
AH-1S* .....	—	—	—	—	6
UH-1H* .....	—	—	17 <sup>r</sup>	27	61
<b>Boeing—Vertol—TOTAL</b> .....	<u>10</u>	<u>11</u>	<u>12</u>	<u>4</u>	<u>4</u>
CH-47C* .....	10	11	12	4	4
<b>Brantly-Hynes—TOTAL</b> .....	<u>—</u>	<u>2</u>	<u>1</u>	<u>11</u>	<u>2</u>
B-2B .....	—	2	1	11	2
<b>Enstrom—TOTAL</b> .....	<u>77</u>	<u>87</u>	<u>96</u>	<u>91</u>	<u>46</u>
F-28A .....	59	4	1	—	—
F-28C .....	—	40	43	44	27
280 .....	18	3	—	—	—
280C .....	—	40	52	47	19
<b>Hiller—TOTAL</b> .....	<u>35</u>	<u>34</u>	<u>40</u>	<u>52</u>	<u>43</u>
12-E .....	35	29	35	52	43
12-E4 .....	—	2	—	—	—
12-E (Turbine) .....	—	3	5	—	—
<b>Hughes—TOTAL</b> .....	<u>214</u>	<u>204</u>	<u>336</u>	<u>312</u>	<u>306</u>
300's .....	92	94	125	116	110
500's .....	122	110	211	196	196
<b>Sikorsky (UTC)—TOTAL</b> .....	<u>33</u>	<u>13</u>	<u>25</u>	<u>27</u>	<u>41</u>
S-61 .....	13	13	25	27	5
S-64 .....	3	—	—	—	—
S-65 .....	17	—	—	—	—
S-76 .....	—	—	—	—	36

Source: Aerospace Industries Association, company reports.

NOTE: All figures exclude production by foreign licensees.

\* Military configuration for commercial export sale.

<sup>a</sup> Includes 6-206B exported in a military configuration.<sup>r</sup> Revised.

**GENERAL AVIATION AIRCRAFT SHIPMENTS**

**By Selected Manufacturers  
Calendar Years 1975-1979**

	1975	1976	1977	1978	1979
<b>NUMBER OF AIRCRAFT SHIPPED ..</b>	14,072	15,450	16,910	17,817	17,055
Single-Engine .....	10,220	11,803	13,167	13,651	12,693
Multi-Engine, Piston .....	2,116	2,120	2,195	2,630	2,843
Agricultural .....	1,235	980	890	748	593
Turboprop .....	305	359	428	548	637
Turbojet .....	196	188	230	240	289
<b>VALUE OF SHIPMENTS<sup>a</sup> (Millions of Dollars) .....</b>	\$1,033	\$1,229	\$1,551	\$1,822	\$2,211
Single-Engine .....	257	364	435	486	490
Multi-Engine, Piston .....	286	343	389	492	557
Agricultural .....	41	37	39	33	35
Turboprop .....	174	223	295	393	550
Turbojet .....	275	262	393	418	579
<b>Number of Aircraft By Selected Manufacturer</b>					
Ayres .....	NA	NA	NA	134	99
Beech .....	1,212	1,220	1,203	1,367	1,508
Bellanca .....	444	315	252	370	443
Cessna .....	7,564	7,888	8,839	8,770	8,400
Gates Learjet .....	79	84	105	102	107
Gulfstream American .....	758	762	866	933	400
Lake .....	81	88	99	98	96
Lockheed Jetstar .....	-0-	3	16	9	7
Maule .....	114	96	108	88	67
Mooney .....	210	227	362	379	439
Piper .....	3,069	4,042	4,499	5,272	5,255
Rockwell International .....	434	595	432	244	164
Swearingen .....	26	30	28	51	70
Ted Smith Aerostar .....	81	100	101	NA	NA

Source: Aerospace Industries Association and General Aviation Manufacturers' Association.

<sup>a</sup> Manufacturers' Net Billing Price.

NA Not Available.



## MILITARY AIRCRAFT ACCEPTED BY U.S. MILITARY AGENCIES

Number and Flyaway Value  
Calendar Years 1966-1979

Year	TOTAL	Bomber/ Patrol	Fighter/ Attack	Trans- port	Trainer	Heli- copter	Other
<b>NUMBER</b>							
1966	3,609	214	627	142	442	2,164	20
1967	4,481	404	811	135	331	2,448	352
1968	4,440	34	1,007	18	292	2,800	289
1969	3,644	31	792	44	295	2,165	317
1970	3,085	66	734	37	173	1,944	131
1971	2,232	48	386	42	135	1,587	34
1972	2,117	13	563	29	148	1,312	52
1973	1,372	30	422	22	90	808	—
1974	1,110	50	478	27	49	506	—
1975	1,369	62	624	34	40	601	8
1976	1,143	55	646	67	11	348	16
1977	862	44	488	25	12	273	20
1978	723 <sup>r</sup>	22	478 <sup>r</sup>	36	—	166	21
1979	734	12	529	21	—	158	14

### FLYAWAY VALUE—Millions of Dollars

1966	\$3,554	\$ 612	\$1,289	\$701	\$190	\$749	\$ 13
1967	4,476	822	1,721	759	144	962	68
1968	3,871	117	2,451	81	167	905	150
1969	3,693	248	2,204	101	164	845	131
1970	3,920	545	1,940	555	111	694	75
1971	2,996	397	1,322	688	112	469	8
1972	3,247	129	2,068	536	100	396	18
1973	2,571	325	1,490	348	140	268	—
1974	2,224	584	1,222	101	111	206	—
1975	3,172	599	2,054	128	27	359	5
1976	4,729	547	3,421	340	27	384	10
1977	4,364	499	3,190	331	14	316	14
1978	4,664 <sup>r</sup>	313 <sup>r</sup>	3,496 <sup>r</sup>	613	—	225	17
1979	5,392	206	4,557	397	—	219	13

Source: Department of Defense.

NOTE: Data exclude gliders and targets, and include spares, spare parts, and support equipment that are procured with the aircraft. 1966-1967, Navy attack planes included with bombers; 1968-1978, Navy attack planes included under fighter/attack. Effective 1972, includes aircraft accepted for shipment to foreign governments for military assistance programs and foreign military sales. 1972-1975, Flyaway value does not include the value of planes produced for the security assistance programs and accepted by the USAF.

<sup>r</sup> Revised.

**MILITARY AIRCRAFT PRODUCTION  
AIR FORCE ACCEPTANCES BY TYPE AND MODEL**

Calendar Years 1978 and 1979

(Millions of Dollars)

Type and Model	Number		Flyaway Cost <sup>a</sup>		Weapon System Cost <sup>b</sup>	
	1978 <sup>r</sup>	1979	1978 <sup>r</sup>	1979	1978 <sup>r</sup>	1979
<b>AIR FORCE—TOTAL</b> .....	199	311	\$1,940	\$2,837	\$2,292	\$3,457
<b>Fighter/Attack—TOTAL</b> .....	<u>191</u>	<u>298</u>	<u>1,564</u>	<u>2,512</u>	<u>1,749</u>	<u>3,018</u>
A-10A .....	89	129	407	610	475	697
F-15A/B/C/D .....	97	109	1,112	1,362	1,208	1,534
F-16A/B .....	5	60	45	540	66	787
<b>Transports/Tankers—TOTAL</b> .....	—	8	—	62	—	64
C-130H .....	—	8	—	62	—	64
<b>Command/Control—TOTAL</b> .....	8	5	376	263	543	375
E-3A .....	8	5	376	263	543	375
<b>Other Aircraft—TOTAL</b> .....	—	—	—	—	—	—

Source: Department of the Air Force.

NOTE: Costs shown are approximate. Calendar year acceptances may derive from procurement quantities funded in more than one fiscal year.

*a* Flyaway Cost includes airframe, engines, electronics, communications, armament, other installed equipment and non-recurring costs associated with the manufacture of the aircraft.

*b* Weapon System Cost includes flyaway costs, peculiar ground equipment, training equipment and technical data.

*r* Revised.

**MILITARY AIRCRAFT PRODUCTION**  
**AIR FORCE ACCEPTANCES FOR REIMBURSABLE PROGRAMS<sup>a</sup>**  
**BY TYPE AND MODEL**  
**Calendar Years 1978 and 1979**  
**(Millions of Dollars)**

Type and Model	Number of Aircraft Accepted		Flyaway Cost <sup>b</sup>	Weapon System Cost <sup>c</sup>
	1978	1979	1979	1979
<b>TOTAL</b> .....	207	166	\$1,226	\$1,345
<b>Fighter Assistance—TOTAL</b> .....	179	158	1,154	1,264
F-4E/F .....	35	22	224	249
F-5E .....	108	68	255	304
F-5F .....	15	33	153	176
F-15A/B .....	17	—	—	—
RF-4E .....	4	5	63	68
F-16 .....	—	30	459	467
<b>Transport/Tankers—TOTAL</b> .....	28	8	72	81
C-130H .....	24	8	72	81
KC-130R .....	4	—	—	—
<b>Trainers—TOTAL</b> .....	—	—	—	—

Source: Department of the Air Force.

NOTE: Costs shown are approximate. Calendar year acceptances may derive from procurement quantities funded in more than one fiscal year. Aircraft configuration and equipage may vary greatly from country to country causing substantial differences in average unit costs.

<sup>a</sup> Includes aircraft accepted for shipment to foreign governments for military assistance programs and foreign military sales.

<sup>b</sup> Flyaway cost includes airframe, engines, electronics, communications, armament, other installed equipment and nonrecurring costs associated with the manufacture of the aircraft.

<sup>c</sup> Weapon system cost includes flyaway costs, peculiar ground equipment, training equipment and technical data.

**MILITARY AIRCRAFT PRODUCTION**  
**NAVY ACCEPTANCES BY TYPE AND MODEL**  
 Calendar Years 1978 and 1979  
 (Millions of Dollars)

Type and Model	Number		Flyaway Cost <sup>a</sup>		Weapon System Cost <sup>b</sup>	
	1978 <sup>r</sup>	1979	1978 <sup>r</sup>	1979	1978 <sup>r</sup>	1979
<b>NAVY—TOTAL</b> .....	181	103	\$1,503	\$1,136	\$2,322	\$1,466
<b>Patrol—TOTAL</b> .....	<u>22</u>	<u>12</u>	<u>313</u>	<u>206</u>	<u>783</u>	<u>314</u>
P-3C .....	14	12	228	206	324	314
S-3A .....	8	—	85	—	459	—
<b>Attack—TOTAL</b> .....	<u>64</u>	<u>35</u>	<u>406</u>	<u>299</u>	<u>558</u>	<u>385</u>
A-4M .....	19	5	61	16	73	19
A-6E .....	12	12	125	94	172	114
EA-6B .....	6	6	84	107	123	126
A-7E .....	27	12	136	82	190	126
<b>Fighters—TOTAL</b> .....	<u>44</u>	<u>38</u>	<u>692</u>	<u>592</u>	<u>867</u>	<u>710</u>
F-14A .....	44	38	692	592	867	710
<b>Trainers—TOTAL</b> .....	—	—	—	—	—	—
<b>Helicopters—TOTAL</b> .....	<u>51</u>	<u>18</u>	<u>92</u>	<u>39</u>	<u>114</u>	<u>57</u>
AH-1T .....	33	15	70	35	86	52
UH-1N .....	18	3	22	4	28	5

Source: Department of the Navy.

<sup>a</sup> Flyaway Cost includes airframe, engines, electronics, communications, armament and other installed equipment.

<sup>b</sup> Weapon System Cost includes flyaway items, initial spares, ground equipment, training equipment and other support items.

<sup>r</sup> Revised.

**MILITARY AIRCRAFT PRODUCTION**  
**ARMY ACCEPTANCES<sup>a</sup> BY TYPE AND MODEL**  
 Calendar Years 1978 and 1979  
 (Millions of Dollars)

Type and Model	Number		Flyaway Cost <sup>b</sup>	
	1978 <sup>r</sup>	1979	1978 <sup>r</sup>	1979
<b>ARMY—TOTAL<sup>a</sup></b> .....	136	154	\$ 150	\$ 193
<b>Helicopters—TOTAL</b> .....	<u>115</u>	<u>140</u>	<u>133</u>	<u>180</u>
AH-1G .....	2	—	2	—
AH-1S .....	65	79	91	93
AH-1T .....	32	—	29	—
TH-1L .....	1	—	1	—
UH-1H .....	—	31	—	19
UH-1N .....	14	—	7	—
UH-60A .....	—	30	—	68
CH-47C .....	1	—	3	—
<b>Other—TOTAL</b> .....	<u>21</u>	<u>14</u>	<u>17</u>	<u>13</u>
C-12A .....	21	—	17	—
C-12C .....	—	14	—	13
<b>Accepted for Shipment to Foreign Governments—TOTAL</b> ..	49	37	\$ 39	\$ 26
<b>Helicopters—TOTAL</b> .....	<u>49</u>	<u>37</u>	<u>39</u>	<u>26</u>
AH-1G .....	2	—	2	—
AH-1S .....	—	6	—	7
AH-1T .....	32	—	29	—
TH-1L .....	1	—	1	—
UH-1H .....	—	31	—	19
UH-1N .....	14	—	7	—

Source: Department of the Army.

<sup>a</sup> Includes aircraft accepted for shipment to foreign governments for military assistance programs and foreign military sales.

<sup>b</sup> Flyaway cost includes airframes, engines, electronics, communications, armament and other installed equipment.

<sup>r</sup> Revised.

**DEPARTMENT OF DEFENSE  
OUTLAYS FOR AIRCRAFT PROCUREMENT  
By Agency  
Fiscal Years 1960-1981  
(Millions of Dollars)**

Year	TOTAL DOD	Air Force	Navy	Army
1960	\$ 6,272	\$ 4,414	\$ 1,765	\$ 93
1961	5,898	3,926	1,832	140
1962	6,659	4,387	2,102	170
1963	6,309	3,747	2,328	234
1964	6,053	3,894	1,859	300
1965	5,200	3,115	1,739	346
1966	6,635	4,074	2,021	540
1967	8,411	4,842	2,607	962
1968	9,462	5,079	3,244	1,139
1969	9,177	5,230	2,821	1,126
1970	7,948	4,623	2,488	837
1971	6,631	3,960	2,125	546
1972	5,927	3,191	2,347	389
1973	5,066	2,396	2,557	113
1974	5,006	2,078	2,806	122
1975	5,484	2,211	3,137	136
1976	6,520	3,323	3,061	136
Tr. Qtr.	1,557	859	672	26
1977	6,608	3,586	2,721	301
1978	6,971	3,989	2,602	380
1979	8,836	5,138	3,140	558
1980 <sup>E</sup>	11,012	6,465	3,797	750
1981 <sup>E</sup>	12,108	7,125	4,104	879

Source: Department of Defense Budget (Annually).

<sup>E</sup> Estimate.

**MILITARY AIRCRAFT PROGRAM PROCUREMENT  
INCLUDING INITIAL SPARES<sup>a</sup>**

Fiscal Years 1979, 1980 and 1981  
(Millions of Dollars)

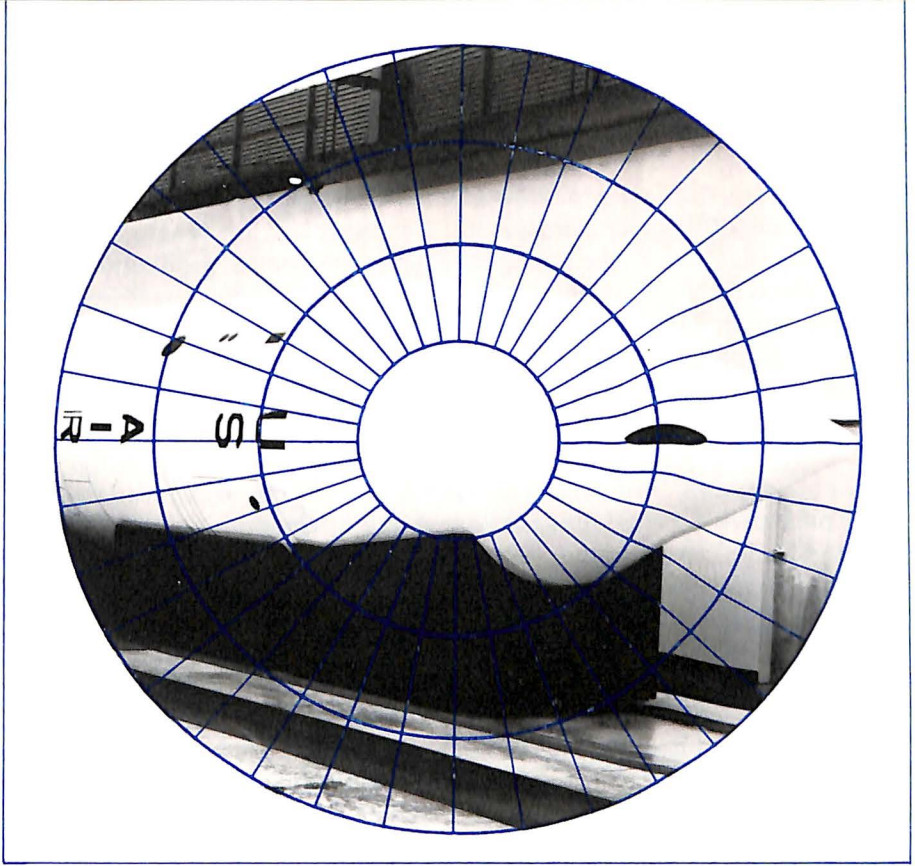
Agency, Type and Model	1979		1980 <sup>E</sup>		1981 <sup>E</sup>	
	No.	Cost	No.	Cost	No.	Cost
<b>AIR FORCE</b>						
A-7K .....	12	\$ 128.5	—	\$ 19.0	—	\$ —
A-10 .....	144	809.3	144	894.8	60	493.2
B-52G Cruise Missile Carrier Aircraft Modification .....	3	36.5	22	81.3	40	115.4
B-52G/H Avionics (Modern.) .....	5	70.1	31	339.4	64	278.1
C-5 (Wing Modification) .....	—	—	4	85.4	12	167.5
Civil Reserve Air Fleet (CRAF) .....	—	7.5	6	38.6	7	78.9
C-130 Hercules .....	8	71.3	—	4.1	—	—
C-141 Modification .....	85	62.8	124	77.6	34	25.6
E-3A (AWACS) .....	3	245.1	3	326.8	2	260.6
EF-111A (Modification) .....	5	177.5	3	102.8	12	266.4
F-15 Eagle .....	78	1,387.3	60	1,017.6	30	860.6
F-16 Multimission Fighter ...	145	1,462.0	175	1,556.5	180	1,877.3
KC-10A (ATCA) .....	2	163.6	4	190.1	6	309.7
KC-135 (Modification) .....	—	—	—	5.0	1	44.5
TR-1 .....	—	10.2	2	44.2	4	128.8
NATO AWACS Program .....	—	80.1	—	243.1	—	377.7
<b>NAVY</b>						
A-6E Intruder .....	12	\$ 171.5	6	\$ 159.1	—	\$ 48.7
A-7E Corsair II .....	12	121.1	—	—	—	31.3
C-9B Skytrain II .....	1	16.1	—	—	—	—
CH-53E Super Stallion .....	14	183.1	15	209.6	14	196.1
E-2C Hawkeye .....	6	209.1	6	198.1	6	238.3
EA-6B Prowler .....	6	173.5	6	178.5	3	148.3
EC-130Q Hercules .....	1	32.0	3	98.8	1	46.3
F-14A Tomcat .....	36	848.5	30	764.9	24	768.9
F/A-18 Hornet .....	9	539.9	25	1,116.9	48	1,619.0
H-46 (Modifications) .....	77	142.9	52	122.5	27	92.9
P-3C Orion .....	12	302.2	12	310.9	8	241.1
P-3 (Modifications) .....	—	90.6	—	63.9	—	92.3
SH-60B LAMPS .....	—	—	—	—	—	120.3
T-34C Mentor .....	—	0.1	—	2.1	—	—
T-44A Trainer .....	—	0.2	—	0.9	—	—
UC-12B .....	22	27.4	22	25.9	—	0.6
<b>ARMY</b>						
AH-1S Cobra/Tow .....	66	\$ 118.7	15	\$ 30.0	—	\$ —
C-12A .....	—	—	10	12.2	—	—
UH-60A Blackhawk .....	90	389.5	94	379.2	80	338.6
CH-47 (Modernization) .....	—	—	—	27.4	9	151.2
Advance Attack Helicopter (AAH) .....	—	—	—	—	—	50.4
RC-12 Guardrail (Modif.) ....	—	—	—	—	8	49.2

Source: "Program Acquisition Costs by Weapon System," Department of Defense Budget, (Annually), and revised estimates from amended budget for FY1981.

<sup>a</sup> Total Obligational Authority.

<sup>E</sup> Estimate.





## MISSILE PROGRAMS

Industry missile sales in 1979 approximated those of the previous year. Sales, including missile systems and parts but excluding propulsion units, amounted to \$3.6 billion. The figure represents an increase of just under 10 percent over the comparable figure for 1978; thus the gain almost matched the national inflation rate for the year.

However, developments during 1979/80 indicated a large-scale increase in missile activity during the decade of the 1980s. The principal factor was the Administration's approval of plans for development and

deployment of the USAF advanced intercontinental ballistic missile known as MX. Development of the MX system will involve a major segment of the aerospace industry. The system features missile mobility for greater survivability in an era when increasing accuracy of long-range weapons makes fixed-position ICBMs more vulnerable to attack. MX will consist of 200 missiles; it is expected to be fully operational in 1988/89.

Plans for development of cruise missiles also advanced in 1979/80. The Department of Defense com-

pleted flight testing and evaluation of two competitive Air Launched Cruise Missiles and, in the spring of 1980, selected the AGM-86 system for production. The USAF is modifying B-52G bombers as cruise missile carriers; the first squadron will become operational in December 1982.

Flight testing continued on the Tomahawk Ground Launched Cruise Missile. In December 1979, the NATO alliance approved deployment, beginning in 1983, of 464 Ground Launched Cruise Missiles.

U.S. strategic missile strength was bolstered late in 1979 when the Navy's Trident 1 fleet ballistic missile achieved initial operational status aboard the *USS Francis Scott Key*. Trident, which carries multiple nuclear warheads, has a range of 4,000 miles compared with 2,500 for the currently operational Poseidon. The Trident submarines under construction will have 24 launch tubes instead of the 16 in Polaris/Poseidon vessels.

Other major missiles in production during 1979/80 included several versions of the Sparrow and Sidewinder air-to-air missiles for both USAF and Navy use; the Navy's Phoenix air-to-air weapon; the Army's Roland anti-aircraft missile; the Stinger, an Army short-range air defense weapon; the Navy's Harpoon air-to-surface missile; two versions of the Navy Standard fleet air defense missile; and the TOW anti-tank missile, being procured by the Army, Navy and

Air Force.

Scheduled for progression from development to production status under Fiscal Year 1981 funding were the Copperhead guided artillery projectile; the Sparrow 7M, newest member of the air-to-air missile family; the High-speed Anti-Radiation Missile (HARM), a Navy air-to-surface weapon; and the Army's General Support Rocket System, a multiple launch rocket system with a tracked, self-propelled launcher/loader, designed for air defense and suppression of enemy artillery.

Missiles in research and development status included the Advanced Medium Range Air-to-Air Missile (AMRAAM); the Advanced Strategic Air Launched Missile (ASALM); and the Army Pershing 2 medium range ballistic missile, which was planned for deployment in Europe as part of the NATO defense system. A major project aimed at improving the Army's anti-armor capability is the Hellfire air-to-ground missile, designed for launch from AH-64 attack helicopters against armored vehicles at longer ranges than are possible with existing systems. A major Department of Defense research and development effort was the Ballistic Missile Defense (BMD) Technology Program. The BMD Program is not a specific missile project but a general technology development program intended to maintain the U.S. option to deploy a BMD system in the future.

**MISSILE PROGRAM PROCUREMENT INCLUDING INITIAL SPARES<sup>a</sup>**

Fiscal Years 1979, 1980 and 1981  
(Millions of Dollars)

Agency, Type and Model	1979		1980 <sup>E</sup>		1981 <sup>E</sup>	
	No.	Cost	No.	Cost	No.	Cost
<b>AIR FORCE</b>						
ALCM .....	24	\$ 94.2	225	\$371.2	480	\$571.1
GLCM .....	—	20.2	—	8.2	11	97.2
Maverick (E/O) .....	—	21.3	—	8.4	—	—
Minuteman II/III .....	—	68.7	—	95.0	—	130.9
Shrike .....	—	12.6	—	—	—	—
Target Drones <sup>b</sup> .....	—	74.4	—	57.9	—	47.2
<b>NAVY</b>						
Harm .....	—	\$ —	—	\$ —	—	\$ 15.0
Harpoon .....	240	138.3	240	147.5	240	180.1
Phoenix .....	210	92.2	60	108.0	60	115.1
Poseidon .....	—	24.4	—	24.8	—	26.1
Sidewinder <sup>c</sup> .....	3,150	129.5	2,370	110.3	480	85.6
Sparrow <sup>c</sup> .....	1,910	175.4	1,560	190.4	1,680	246.0
Standard ER (SM-2) .....	40	53.2	55	50.7	275	142.6
Standard MR (SM-1) .....	480	91.8	480	106.9	260	82.7
Standard MR (SM-2) .....	—	—	30	24.4	70	40.4
Tomahawk .....	—	—	6	30.1	20	74.9
Trident I .....	86	874.9	82	759.0	72	861.3
<b>ARMY</b>						
Chaparral .....	850	\$ 35.1	—	\$ 3.2	—	\$ 3.4
Dragon .....	—	—	—	—	—	8.6
GSRs .....	—	—	1,764	62.3	2,340	117.0
Hawk <sup>d</sup> .....	608	73.8	197	16.1	—	12.9
Hellfire .....	—	—	—	—	—	20.8
Lance .....	<i>f</i>	59.7	—	—	—	—
Patriot .....	—	67.3	155	410.7	183	490.0
Pershing .....	<i>f</i>	65.6	—	—	—	2.0
Roland .....	75	167.6	410	296.9	600	412.0
Stinger <sup>d</sup> .....	2,678	123.1	2,654	91.1	1,703	89.5
TOW <sup>e</sup> .....	10,920	49.1	10,200	47.5	12,000	95.9

Source: "Program Acquisition Costs by Weapon System," Department of Defense Budget (Annually), and revised estimates from amended budget FY 1981.

<sup>E</sup> Estimate.

<sup>a</sup> Total Obligational Authority.

<sup>b</sup> Includes Army, Navy and Air Force procurement.

<sup>c</sup> Includes Navy and Air Force procurement.

<sup>d</sup> Includes Army and Marine Corps procurement.

<sup>e</sup> Includes Army, Navy and Marine Corps procurement.

<sup>f</sup> Quantity is classified.

**MAJOR MISSILES**  
**RESEARCH, DEVELOPMENT, PRODUCTION, OPERATION**

Project	Agency	Status	Systems Contractor	Propulsion Manufacturer	Guidance Manufacturer
<b>AIR-TO-AIR</b>					
AMRAAM	USAF/USN	D	Hughes/Raytheon	—	Hughes/Raytheon
ASALM	USAF	R,D	Martin Marietta/ McDonnell Douglas	—	—
Falcon	USAF	O	Hughes	Thiokol	Hughes
Phoenix	USN	P,O	Hughes	RI/Rocketdyne	Hughes
Sidewinder-9G	USN	O	NASC	—	Raytheon
Sidewinder-9H	USN	P,O	NASC/Ford/ Raytheon	Bermite/ Rocketdyne	Ford
Sidewinder-9J	USAF	O	Ford Aerospace	—	Ford Aerospace
Sidewinder-9L	USN/USAF	P,O	NASC/Raytheon/Ford	Bermite/ Rocketdyne	Raytheon/ Ford Aerospace
Sidewinder-9M	USN/USAF	D	NASC	—	Raytheon
Sidewinder-9N	USAF	P,O	Ford Aerospace	—	Ford Aerospace
Sidewinder-9P	USAF	P,O	Ford Aerospace	—	Ford Aerospace
Sparrow-7E	USN/USAF	P,O	Raytheon	RI/Rocketdyne	Raytheon
Sparrow-7F	USN/USAF	P,O	Raytheon/GD	Hercules	Raytheon/GD
Sparrow-7M	USN/USAF	D,P	Raytheon/GD	Hercules	Raytheon
<b>AIR-TO-SURFACE</b>					
ALCM	USAF	P	Boeing	Williams Research	McDonnell Douglas
HARM	USN/USAF	D,P	Texas Instr.	Thiokol	Texas Instr.
Harpoon	USN	P,O	McDonnell Douglas	Teledyne CAE	TI, IBM, LSI, Northrop
Maverick	USAF	P,O	Hughes	Thiokol	—
Shrike	USN/USAF	O	NWC/PMTC	Aerojet/ Hercules	Texas Instruments
SRAM	USAF	P,O	Boeing	Thiokol	Singer
Standard ARM	USN/USAF	O	GD	NOSIH	GD
Tomahawk	USAF	D	General Dynamics	Williams Research	McDonnell Douglas
Walleye 1	USN	O	Martin Marietta/ Hughes	—	Martin Marietta/ Hughes
Walleye 1ER	USN	R,D	NAC	—	NAC
Walleye 2	USN	O	NAC	—	NAC
Walleye 2 (ER/DL)	USN	O	NAC	—	NAC

(Continued on next page)

**MAJOR MISSILES  
RESEARCH, DEVELOPMENT, PRODUCTION, OPERATION (Con't.)**

Project	Agency	Status	Systems Contractor	Propulsion Manufacturer	Guidance Manufacturer
<b>ANTI-SUBMARINE</b>					
Subroc	USN	O	Goodyear Aerospace	Thiokol	Singer

<b>SURFACE-TO-AIR</b>					
Chaparral	Army	O	Ford Aerospace	RI/Rocketdyne/Bermite	GE/Raytheon
Improved Chaparral	Army	P,O	Ford Aerospace	—	Ford Aerospace
Improved Hawk	Army	P,O	Raytheon	Aerojet	Raytheon
Patriot	Army	D,P	Raytheon	Thiokol	Raytheon
RAM	USN	D	General Dynamics	Bermite/Rocketdyne	General Dynamics
Redeye	Army	O	General Dynamics	Atlantic Research	General Dynamics
Roland	Army	P	Hughes/Boeing	Hercules	Hughes/Boeing
Sea Sparrow	USN	O	Raytheon	Aerojet	Raytheon
Standard (SM-1)	USN	P,O	General Dynamics	Aerojet/Hercules	General Dynamics
Standard (SM-2)	USN	P,O	General Dynamics	Aerojet/Hercules	General Dynamics
Standard (ER)	USN	P,O	General Dynamics	Atlantic Research	General Dynamics
Stinger	Army/ USMC	D,P	General Dynamics	Atlantic Research	General Dynamics
Talos	USN	P,O	Bendix	Bendix	Bendix
Tartar	USN	O	GD	Aerojet	GD
Terrier	USN	O	General Dynamics	Atlantic Research	General Dynamics

<b>SURFACE-TO-SURFACE</b>					
Minuteman 2	USAF	O	AFLC Hill AFB	Thiokol/Aerojet/Hercules	Rockwell Autonetics
Minuteman 3	USAF	O	AFLC Hill AFB	Thiokol/Aerojet	Rockwell Autonetics
MX	USAF	D	BMO/TRW	Thiokol/Aerojet/Hercules/Rocketdyne	Autonetics/Northrop
Polaris A3	USN	O	Lockheed MSC	Aerojet/Hercules	GE/Hughes/MIT/Raytheon

(Continued on next page)

**MAJOR MISSILES  
RESEARCH, DEVELOPMENT, PRODUCTION, OPERATION (Con't.)**

Project	Agency	Status	Systems Contractor	Propulsion Manufacturer	Guidance Manufacturer
<b>SURFACE-TO-SURFACE (Cont'd.)</b>					
Poseidon C3	USN	O	Lockheed MSC	Thiokol/Hercules	GE/MIT/Raytheon/Hughes
Tomahawk (SLCM)	USN	D	General Dynamics	Williams Research	McDonnell Douglas
Tomahawk (GLCM)	USAF	D	General Dynamics	Williams Research	McDonnell Douglas
Titan 2	USAF	O	AFLC Hill AFB	Aerojet	GM/Delco Electronics
Trident C4	USN	D	Lockheed MSC	Hercules/Thiokol	C. S. Draper Lab.
<b>BATTLEFIELD SUPPORT AND ANTIARMOR</b>					
Dragon	Army	P,O	Raytheon/Kollsman	McDonnell Douglas/Hercules	Raytheon
Hellfire	Army	D	Rockwell	Thiokol	RI/Martin Marietta
Lance	Army	P,O	Vought	RI/Rocketdyne	E-Systems/Sys-Donner/Arma Bendix
Pershing 1A	Army	O	Martin Marietta	Thiokol	Bendix
Pershing 2	Army	D	Martin Marietta	Hercules	Goodyear Aerospace
Shillelagh	Army	O	Ford Aerospace	Hercules	Ford Aerospace
TOW	Army	P,O	Hughes	Hercules	Emerson Electric

Source: Aerospace Industries Association, based on latest available information.  
 Status: R—Research  
 D—Development  
 P—Production  
 O—Operational

**DEPARTMENT OF DEFENSE  
OUTLAYS FOR MISSILES**  
Fiscal Years 1960-1981  
(Millions of Dollars)

Year	TOTAL DOD	Procurement	Research, Development, Test and Evaluation
1960	\$ 5,086	\$ 3,027	\$ 2,059
1961	5,997	2,972	3,025
1962	6,219	3,442	2,777
1963	6,058	3,817	2,241
1964	5,929	3,577	2,352
1965	3,997	2,096	1,901
1966	3,870	2,069	1,801
1967	4,432	1,930	2,502
1968	4,741	2,219	2,522
1969	4,919	2,509	2,410
1970	5,108	2,912	2,196
1971	5,148	3,140	2,008
1972	5,166	3,009	2,157
1973	5,061	3,023	2,038
1974	5,141	2,981	2,160
1975	5,065	2,889	2,176
1976	4,591	2,296	2,295
Tr. Qtr.	922	402	520
1977	5,040	2,781	2,259
1978	NA	1,794	NA
1979	NA	2,084	NA
1980 <sup>E</sup>	NA	2,211	NA
1981 <sup>E</sup>	NA	2,850	NA

Source: Department of Defense Budget (Annually).

<sup>E</sup> Estimate.

NA Not Available.



**DEPARTMENT OF DEFENSE  
OUTLAYS FOR MISSILE PROCUREMENT**

By Agency  
Fiscal Years 1960-1981  
(Millions of Dollars)

Year	TOTAL DOD	Air Force	Navy	Army
1960	\$ 3,027	\$ 2,021	\$ 423	\$ 583
1961	2,972	1,922	493	557
1962	3,442	2,385	593	464
1963	3,817	2,676	718	423
1964	3,577	2,100	981	496
1965	2,096	1,320	522	254
1966	2,069	1,313	512	244
1967	1,930	1,278	432	220
1968	2,219	1,388	436	395
1969	2,509	1,382	534	593
1970	2,912	1,467	702	743
1971	3,140	1,497	791	852
1972	3,009	1,334	831	844
1973	3,023	1,454	628	941
1974	2,981	1,537	541	903
1975	2,889	1,602	615	672
1976	2,296	1,549	584	163
Tr. Qtr.	402	347	148	(93)
1977	2,781	1,502	905	374
1978	1,794	1,376	NA	418
1979	2,084	1,537	NA	547
1980 <sup>E</sup>	2,211	1,597	NA	614
1981 <sup>E</sup>	2,850	1,854	NA	996

Source: Department of Defense Budget (Annually).

<sup>E</sup> Estimate.

NA Not Available.

**SALES AND BACKLOG  
MISSILE SYSTEMS AND PARTS  
Calendar Years 1961-1979  
(Millions of Dollars)**

Year	Missile Systems and Parts <sup>a</sup>	
	Net Sales	Backlog December 31
1961	\$ 3,628	\$ 2,873
1962	3,699	2,143
1963	3,318	2,146
1964	2,580	1,921
1965	2,082	2,394
1966	2,260	2,157
1967	2,877	3,121
1968	2,812	3,218
1969	2,676	2,511
1970	2,826	2,721
1971	2,641	3,344
1972	3,335	3,642
1973	3,391	3,868
1974	3,454	4,473
1975	3,548	4,580
1976	3,237	4,379
1977	3,118	4,541
1978 <sup>r</sup>	3,264 <sup>b</sup>	4,581
1979	3,580	4,782

Source: Bureau of the Census, "Current Industrial Reports," Series MQ37D (Quarterly).

<sup>a</sup> Includes space vehicle systems and parts sold to other than U.S. Government customers.

<sup>b</sup> AIA estimate based on MQ37D.

<sup>r</sup> Revised.

**SALES AND BACKLOG  
ENGINES AND PROPULSION UNITS FOR  
MISSILES AND SPACE VEHICLES**  
Calendar Years 1961-1979  
(Millions of Dollars)

Year	Net Sales			Backlog, December 31		
	TOTAL	Military <sup>a</sup>	Non-Military	TOTAL	Military <sup>a</sup>	Non-Military
1961	\$ NA	\$ 784	\$ <sup>b</sup>	\$ NA	\$ 367	\$ <sup>b</sup>
1962	NA	1,060	<sup>b</sup>	NA	498	
1963	1,675	1,153	522	888	699	189
1964	1,579	851	728	1,024	557	467
1965	1,288	560	728	883	513	370
1966	1,211	511	700	859	534	325
1967	978	441	537	609	405	204
1968	907	676	231	535	406	129
1969	702	667	35	497	485	12
1970	640	398	242	617	610	7
1971	605	596	9	520	513	7
1972	607	596	11	671	659	12
1973	627	607	20	625	615	10
1974	649	633	16	678	662	16
1975	643	626	17	531	517	14
1976	641	621	20	673	659	14
1977	787	757	30	613	595	18
1978 <sup>r</sup>	792	760	32	788	754	34
1979	967	920	47	1,028	984	44

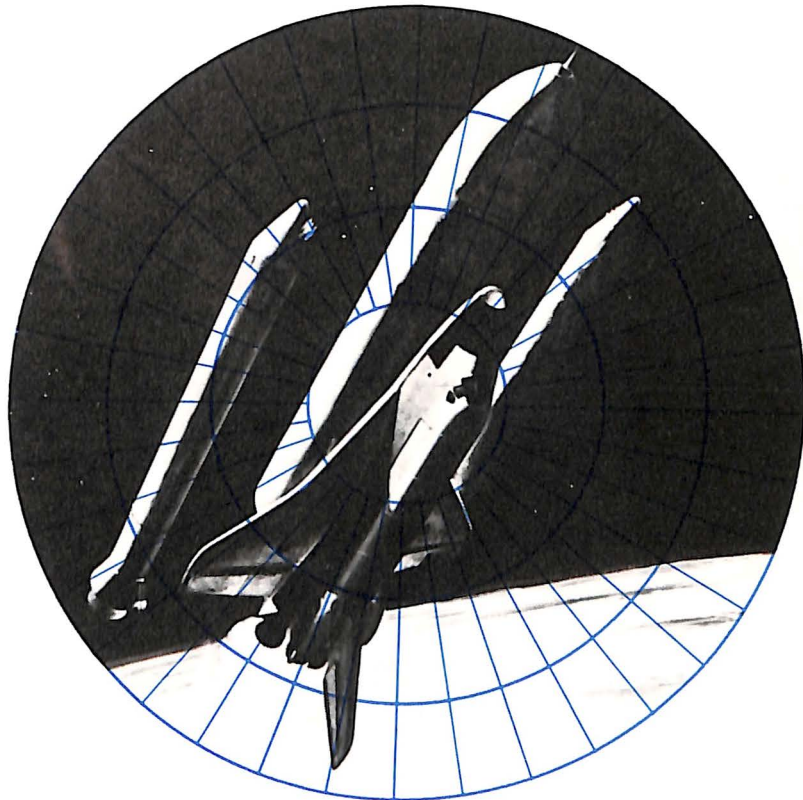
Source: Bureau of the Census, "Current Industrial Reports," Series MQ37D (Quarterly).

<sup>a</sup> Includes figures for nonmilitary U.S. Government customers.

<sup>b</sup> Data included in totals for space vehicle systems. See page 72.

<sup>r</sup> Revised.

NA Not Available.



## SPACE PROGRAMS

The year 1979 was marked by a sharp decline in U.S. space activity as measured by the number of spacecraft launches. Including NASA and military payloads, together with satellites launched by NASA for other agencies, the number of successful U.S. launches totaled only 16, half as many as in the previous year.

There was a similar decline in worldwide space launch activity. The Soviet Union boosted 87 spacecraft and Japan 2, for an international total of 105 successful launches—down from 125 in 1978. The all-time total of payloads deliv-

ered to orbit or deep space trajectory reached 2,037 of which 1,250 were launched by the USSR and 743 by the U.S.

NASA conducted nine launches in 1979, only three of them involving the agency's own spacecraft; the others were "reimbursables" whose launch costs were defrayed by commercial or government payload sponsors. NASA's three 1979-orbiting spacecraft were:

**SAGE** (Stratospheric Aerosol Gas Experiment), launched February 18 to gather data on ozone and aerosols in the stratosphere.

**HEAO-3** (September 20), third of the High Energy Astronomy Observatories which are mapping celestial x-ray sources.

**Magsat** (October 30), which is measuring the near-Earth magnetic field and providing information of value to mineral prospectors.

Among Department of Defense satellites launched were **Scatha**, designed to measure sources of electric charge buildup on spacecraft; **Solwind**, a satellite for scientific study of solar wind and other phenomena; **Fltsatcom 2**, second of a new Navy comsat series; and two additional spacecraft—the 13th and 14th—in the Defense Satellite Communications System II.

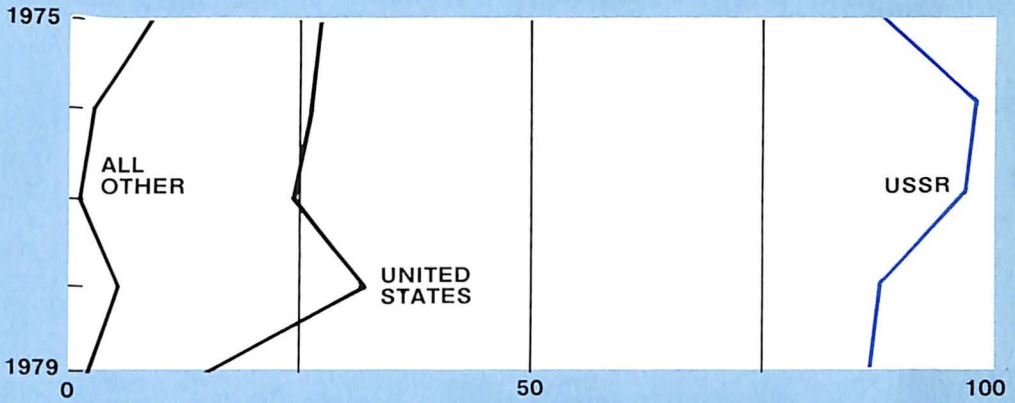
Although launch activity was at low ebb, NASA was very active in planetary exploration as several spacecraft launched in prior years sent back to Earth unprecedented levels of data on Venus, Mars, Jupiter and Saturn. The major planetary mission involved close encounters with Jupiter—in March and July—by **Voyagers 1 and 2**, which returned the first high-resolution pictures of the superplanet and five of its moons and provided a wealth of new scientific information. In September, the **Pioneer 11** spacecraft flew by Saturn and returned the first close-up pictures of the ringed planet.

The major U.S. space project, intended for both NASA and military use, was the Space Shuttle; first orbital flight was expected late in 1980

or early in 1981. Other major NASA development programs under way in 1979 included **Galileo**, a project involving two separate spacecraft—a planetary orbiter and an instrumented probe designed to descend through the atmosphere—to be launched in 1984 for an extensive follow-on survey of Jupiter; **Space Telescope**, an advanced astronomical observatory that will permit observations far deeper into space than have ever before been possible; **Landsat-D**, the fourth and most advanced of the Earth resources monitoring satellites, to be Shuttle-launched in 1982; and the **Solar Polar Mission**, a joint NASA/European Space Agency project involving development of two spacecraft for investigation of the still unexplored third dimension of solar space around the Sun's poles rather than around its equator. Launch was targeted for 1985.

Other than the Space Shuttle, the principal Department of Defense space program involved continuing development of the **Navstar Global Positioning System**, a network of satellites and ground equipment designed to provide precise positioning and other information for more effective operation of ships, aircraft, artillery and armored forces. The Navstar system was scheduled for fully-operational service in the mid-1980s; testing of an interim eight-satellite system continued with the 1979 launch of the fourth spacecraft.

**SPACECRAFT LAUNCHINGS  
1975-1979**



Source: NASA

**SPACECRAFT LAUNCHINGS  
WHICH ATTAINED EARTH ORBIT OR BEYOND  
1957-1979**

Country	Total 1957 to 1979	1975	1976	1977	1978 <sup>r</sup>	1979
<b>TOTAL</b> .....	2,037	125	128	124	125	105
U.S.S.R. ....	1,250	89	99	98	88	87
United States .....	743	27	26	24	32	16
France .....	10	3	—	—	—	—
Japan .....	15	2	1	2	3	2
Italy .....	8	1	—	—	—	—
People's Republic of China .....	8	3	2	—	1	—
Australia .....	1	—	—	—	—	—
United Kingdom .....	1	—	—	—	—	—
European Space Agency .....	1	—	—	—	1	—

Source: National Aeronautics and Space Administration, "Aeronautics and Space Report of the President," (Annually).  
r Revised.

## NASA MAJOR LAUNCH RECORD, 1979

Date and Designation	Objectives
<u>Jan. 30</u> SCATHA (STP P78-2)	Satellite carried 12 experiments to identify and measure sources of electrical charge buildup on the spacecraft.
<u>Feb. 18</u> SAGE (AEM B)	To develop a satellite-based remote sensing technique for measuring stratospheric aerosols and ozone, to map vertical extinction profiles of stratospheric aerosols and ozone, to investigate the impact of natural phenomena such as volcanoes and tropical storms, and investigate the sources and sinks of stratospheric ozone and aerosols.
<u>May 4</u> Flitsatcom 2	Second of five planned fleet communications satellites, successfully launched by NASA for the Navy and the Dept. of Defense.
<u>June 2</u> Ariel 6 (UK 6)	Spacecraft to investigate cosmic radiation. Sixth satellite in cooperative U.S./United Kingdom program. Spacecraft launched successfully by NASA. 100th launch of Scout booster. Turned over to the United Kingdom on June 2.
<u>June 27</u> NOAA 6	To launch a weather/environment spacecraft into a sun-synchronous orbit of sufficient accuracy to enable spacecraft to accomplish its operational mission requirements. Successfully launched by a joint USAF/NASA launch team for NOAA using a reconditioned booster supplied by the Air Force. NOAA 6 is the first NOAA-funded operational spacecraft of the Tiros-N series. Joins Tiros-N as part of a two-satellite system. Spacecraft turned over to NOAA for operation July 16.
<u>Aug. 10</u> Westar 3	Satellite to provide transmission of television, voice, and other data throughout the continental United States, Alaska, Hawaii, and Puerto Rico. Third in a series of three satellites, successfully launched by NASA for Western Union Telegraph Company.
<u>Sept. 20</u> HEAO 3	To study gamma ray emissions, with high sensitivity and resolution; to measure the isotopic composition of cosmic rays from lithium through iron; to measure the composition of cosmic rays heavier than iron. Spacecraft successfully placed in orbit by NASA. Third in a series of three High Energy Astronomical Observatories. One of two primary tape recorders failed, backup recorder switched into operation and is performing satisfactorily. Data being received. Satellite surveyed the galactic plane for gamma rays by the end of the year.
<u>Oct. 30</u> Magsat (AEM C)	To obtain accurate, up-to-date, quantitative description of the Earth's magnetic field, develop worldwide vector magnetic field model, compile crustal magnetic anomaly maps, interpret anomalies in conjunction with correlative data of Earth's crust, increase understanding of the origin and nature of the geomagnetic field and its temporal variations. Launched successfully by NASA. Third in a series of low-cost modular designed satellites, designated Applications Explorer Missions.

(Continued on next page)

## NASA MAJOR LAUNCH RECORD, 1979 (Continued)

Date and Designation	Objectives
<u>Dec. 7</u> RCA 3	To launch spacecraft into successful transfer orbit. Satellite to provide television, voice communications, and highspeed data transmission to all 50 states. Third in a series of satellites, successfully launched by NASA for RCA American Communications, Inc. Spacecraft supposed to be placed over equator at 132° west longitude. Contact with satellite lost when apogee boost motor fired Dec. 10. Subsequent attempts to locate spacecraft have been unsuccessful.

Source: National Aeronautics and Space Administration, "Aeronautics and Space Report of the President," (Annually).



**U.S. APPLICATIONS SATELLITES  
1979**

<b>Launch Date</b>	<b>Name and Launch Vehicle</b>	<b>Remarks</b>
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**COMMUNICATIONS SATELLITES**

May 4	<u>Fltsatcom 2</u> Atlas-Centaur	Second of a new DOD series.
Aug. 9	<u>Westar 3</u> Thor-Delta (TAT)	Launched for the Western Union Co. as part of their domestic communications links.
Nov. 21	<u>DSCS II-13,14</u> Titan IIIC	Defense communications (dual launch).
Dec. 2	<u>RCA-Satcom 3</u> Thor-Delta (TAT)	Launched for RCA, but contact lost during orbit circularization.

**WEATHER OBSERVATION**

June 6	<u>AMS-4</u> Atlas F	A DOD meteorological satellite.
June 27	<u>Noaa 6</u> Atlas F	Like the current DOD meteorological satellites.

Source: National Aeronautics and Space Administration, "Aeronautics and Space Report of the President," (Annually).

**U.S.—LAUNCHED SCIENTIFIC PAYLOADS  
1979**

<b>Launch Date</b>	<b>Name and Launch Vehicle</b>	<b>Remarks</b>
Jan. 30	<u>Scatha</u> Thor-Delta (TAT)	Measurement of sources of electric charge build-up on spacecraft.
Feb. 18	<u>Sage</u> Scout	Measurement of stratospheric aerosols and ozone.
Feb. 24	<u>Solwind</u> Atlas F	Measurement of solar wind, electron buildup in polar regions, aerosols, and ozone.
June 6	<u>Ariel 6</u> Scout	Measurement of cosmic radiation (United Kingdom payload).
Sep. 20	<u>HEAO 3</u> Atlas-Centaur	Gamma and cosmic ray emissions.
Oct. 30	<u>Magsat</u> Scout	Detailed current description of Earth's magnetic field and of sources of variations.

Source: National Aeronautics and Space Administration, "Aeronautics and Space Report of the President," (Annually).

**UNITED STATES SPACE LAUNCH VEHICLES  
as of 1979**

Vehicle	Stages	Thrust (in Kilo- newtons)	Payload (kg)	
			555 km Miles Orbit	Escape
Scout	1. Algol IIIA* 2. Castor IIA* 3. Antares III* 4. Altair III*	481.0 281.0 83.1 26.2	186	38.6
Thor-Delta 2900 Series	1. Thor plus 9 TX 354-5* 2. Delta (DSV-3) 3. TE 364-4*	911.9 440.4 45.8 66.7	1,769	476
Atlas F/TE 364-4	1. Atlas Booster and Sustainer 2. TE 364-4*	1,970.6 66.7	1,497	—
Atlas-Agena	1. Atlas Booster and (SLV-3A) 2. Agena	2,237.5 71.2	2,722	454
Titan IIIB-Agena	1. LR-87 2. LR-91 3. Agena	2,353.1 444.8 71.2	3,614- 3,727	—
Titan IIIC	1. Two 5-segment 3.05-m. dia.* 2. LR-87 3. LR-91 4. Transtage	10,413.3 2,353.1 444.8 71.2	—	1,464
Titan III (23)D	1. Two 5-segment 3.05-m. dia.* 2. LR-87 3. LR-91	10,413.3 2,353.1 444.8	11,182	—
Titan III (34)D	1. Two 5½-segment 3.05-m. dia.* 2. LR-87 3. LR-91	11,555.6 2,353.1 444.8	12,545	—
Titan III (34)D/IUS	1. Two 5½-segment 3.05-m. dia.* 2. LR-87 3. LR-91 4. IUS 1st Stage* 5. IUS 2nd Stage*	11,555.6 2,353.1 444.8 191.3 71.2	1,818	1,818
Thor LV-2F	1. Thor 2. TE 364-4* 3. TE 364-15*	756.2 66.7 44.5	512	—
Thor SLV-2A/ Block 5D-2	1. Thor plus 3 TX 354-5* 2. TE 364-4* 3. TE 364-15*	756.2 689.5 66.7 44.5	653	—

Source: NASA, "Aeronautics and Space Report of the President" (Annually).  
Solid propellant, all others are liquid.

**CHRONOLOGY OF MANNED SPACE FLIGHTS**  
**Calendar Years 1976-1979**

Launch Date	Project	Pilots	Nation	Duration
<u>1976</u>				
July 6	Soyuz 21	Boris Volynov Vitaliy Zholobov	USSR	1,182 hr. 24 min.
Sept. 15	Soyuz 22	Valeriy Bykovskiy Vladimir Aksenov	USSR	189 hr. 54 min.
Oct. 14	Soyuz 23	Vyacheslav Zudov Valeriy Rozhdestvenskiy	USSR	48 hr. 06 min.
<u>1977</u>				
Feb. 7	Soyuz 24	Viktor Gorbatko Yuriy Glazkov	USSR	425 hr. 23 min.
Oct. 9	Soyuz 25	Valeriy Ryumin Vladimir Kovalenok	USSR	48 hr. 46 min.
Dec. 10	Soyuz 26	Yuriy Romanenko Georgiy Grechko	USSR	898 hr. 06 min.
<u>1978</u>				
Jan. 10	Soyuz 27	Vladimir Dzhanibekov Oleg Makarov	USSR	1,514 hr.
Mar. 2	Soyuz 28	Aleksey Gubarev Vladimir Remek	USSR	190 hr. 17 min.
June 15	Soyuz 29	Vladimir Kovalenok Aleksandr Ivanchenkov	USSR	1,911 hr. 23 min.
June 27	Soyuz 30	Petr Klimuk Miroslaw Heraszewski <sup>a</sup>	USSR	190 hr. 04 min.
Aug. 26	Soyuz 31	Valeriy Bykovskiy Sigmund Jähn <sup>b</sup>	USSR	1,628 hr. 14 min.
<u>1979</u>				
Feb. 25	Soyuz 32	Vladimir Lyakhov Valeriy Ryumin	USSR	2,596 hr. 24 min.
Apr. 10	Soyuz 33	Nikolay Rukavishnikov Georgiy Ivanov	USSR	47 hr. 01 min.
June 6	Soyuz 34	(unmanned at launch; returned with Soyuz 32 crew)	USSR	1,770 hr. 17 min.

Source: NASA, "Aeronautics and Space Report of the President" (Annually).

NOTE: For data for earlier years, see previous editions of "Aerospace Facts and Figures."

<sup>a</sup> First Polish Cosmonaut.

<sup>b</sup> First German Democratic Republic Cosmonaut.

## U.S. MANNED SPACE FLIGHT TIME LOG

Calendar Years 1961 to Date

Launch Date	Mission	Man-Hours in Mission		Total Cumulative Time	
		Hrs.	Min.	Hrs.	Min.
<u>1961</u>					
May 5	MR-3 (Shepard)	—	15	—	15
July 21	MR-4 (Grissom)	—	16	—	31
<u>1962</u>					
Feb. 20	MR-6 (Glenn)	4	55	5	26
May 24	MA-7 (Carpenter)	4	56	10	22
Oct. 3	MA-8 (Schirra)	9	13	19	35
<u>1963</u>					
May 15	MA-9 (Cooper)	34	20	53	55
<u>1965</u>					
Mar. 23	Gemini 3 (Grissom, Young)	9	46	63	41
June 3	Gemini 4 (McDivitt, White)	195	52	259	33
Aug. 21	Gemini 5 (Cooper, Conrad)	381	50	641	23
Dec. 15	Gemini 6 (Schirra, Stafford)	51	42	693	05
Dec. 4	Gemini 7 (Borman, Lovell)	661	10	1,354	15
<u>1966</u>					
Mar. 16	Gemini 8 (Armstrong, Scott)	21	21	1,375	36
June 3	Gemini 9 (Stafford, Cernan)	144	42	1,520	32
July 18	Gemini 10 (Young, Collins)	141	34	1,662	06
Sept. 12	Gemini 11 (Conrad, Gordon)	142	34	1,804	40
Nov. 11	Gemini 12 (Lovell, Aldrin)	189	10	1,993	50
<u>1968</u>					
Oct. 11	Apollo 7 (Schirra, Eisele, Cunningham)	780	27	2,774	17

(Continued on next page)

## U.S. MANNED SPACE FLIGHT TIME LOG (Continued)

Launch Date	Mission	Man-Hours in Mission		Total Cumulative Time	
		Hrs.	Min.	Hrs.	Min.
Dec. 21	Apollo 8 (Borman, Lovell, Anders)	441	03	3,215	20
<u>1969</u>					
Mar. 3	Apollo 9 (McDivitt, Scott, Schweikart)	723	03	3,938	23
May 18	Apollo 10 (Stafford, Young, Cernan)	576	09	4,514	32
July 16	Apollo 11 (Armstrong, Collins, Aldrin)	585	57	5,100	29
Nov. 14	Apollo 12 (Conrad, Gordon, Bean)	733	48	5,834	17
<u>1970</u>					
Apr. 11	Apollo 13 (Lovell, Haise, Swigert)	428	45	6,623	02
<u>1971</u>					
Jan. 31	Apollo 14 (Shepard, Roosa, Mitchell)	650	06	6,913	08
July 26	Apollo 15 (Scott, Worden, Irwin)	885	36	7,808	44
<u>1972</u>					
Apr. 16	Apollo 16 (Young, Duke, Mattingly)	797	33	8,606	17
Dec. 7	Apollo 17 (Cernan, Schmitt, Evans)	905	36	9,511	53
<u>1973</u>					
May 25	Skylab 2 (Conrad, Kerwin, Weitz)	2,018	30	11,530	29
July 28	Skylab 3 (Bean, Lousma, Garriott)	4,287	27	15,817	56
Nov. 16	Skylab 4 (Carr, Gibson, Pogue)	6,051	48	21,869	44
<u>1975</u>					
July 15	Apollo (Stafford, Slayton, Brand)	652	24	22,522	08

Source: NASA, "Aeronautics and Space Report of the President" (Annually).

**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
OUTLAYS**

**Fiscal Years 1960-1981  
(Millions of Dollars)**

<b>Year</b>	<b>TOTAL</b>	<b>Research and Development</b>	<b>Construction of Facilities</b>	<b>Research &amp; Program Management</b>
1960	\$ 401	\$ 256	\$ 54	\$ 91
1961	744	487	98	159
1962	1,257	936	114	207
1963	2,552	1,912	225	416
1964	4,171	3,317	438	416
1965	5,093	3,984	531	578
1966	5,933	4,741	573	619
1967	5,426	4,487	289	650
1968	4,724	3,946	126	652
1969	4,251	3,530	65	656
1970	3,753	2,992	54	707
1971	3,382	2,630	44	708
1972	3,422	2,623	50	749
1973	3,315	2,541	45	729
1974	3,256	2,421	75	760
1975	3,266	2,420	85	761
1976	3,669	2,749	121	799
Tr. Qtr.	952	731	26	195
1977	3,945	2,980	105	860
1978	3,983	2,989	124	870
1979	4,196	3,139	133	925
1980 <sup>E</sup>	5,003	3,844	155	1,004
1981 <sup>E</sup>	5,216	4,010	163	1,043

Source: "The Budget of the United States" (Annually).  
E Estimate.

**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
BUDGET AUTHORITY**  
Fiscal Years 1960-1981  
(Millions of Dollars)

Year	TOTAL	Research and Development	Construction of Facilities	Research & Program Management
1960	\$ 614	\$ 333	\$ 190	\$ 91
1961	964	672	125	167
1962	1,825	1,285	326	214
1963	3,673	2,929	744	<sup>a</sup>
1964	5,099	3,890	713	496
1965	5,250	4,360	267	623
1966	5,175	4,502	61	612
1967	4,968	4,235	85	648
1968	4,589	3,912	38	639
1969	3,995	3,314	33	648
1970	3,749	2,993	53	703
1971	3,312	2,556	26	730
1972	3,308	2,523	53	732
1973	3,408	2,599	79	730
1974	3,040	2,194	101	745
1975	3,231	2,323	143	765
1976	3,552	2,678	82	792
Tr. Qtr.	932	700	11	221
1977	3,819	2,856	118	845
1978	4,064	3,012	162	890
1979	4,559	3,477	148	934
1980 <sup>E</sup>	5,270	4,108	156	1,006
1981 <sup>E</sup>	5,518	4,365	120	1,033

Source: "The Budget of the United States" (Annually).

<sup>a</sup> Included in Research & Development for one year.

<sup>E</sup> Estimate.



**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
RESEARCH AND DEVELOPMENT PROGRAMS BUDGET PLAN**

Fiscal Year 1977-1981  
(Millions of Dollars)

	1977	1978	1979	1980 <sup>E</sup>	1981 <sup>E</sup>
<b>TOTAL</b> .....	\$2,883	\$3,012	\$3,477	\$4,107	\$4,365
<b>Space Transportation Systems—</b>					
<b>TOTAL</b> .....	<u>1,764</u>	<u>1,752</u>	<u>2,012</u>	<u>2,403</u>	<u>2,696</u>
Space Shuttle .....	1,413	1,349	1,638	1,886	1,873
Space Flight Operations .....	199	268	300	446	767
Expendable Launch Vehicles ..	152	135	74	71	56
<b>Space Science—TOTAL</b> .....	<u>380</u>	<u>405</u>	<u>505</u>	<u>601</u>	<u>561</u>
Physics and Astronomy .....	166	224	283	337	347
Planetary Explorations .....	192	147	182	220	175
Life Sciences .....	22	34	40	44	39
<b>Space and Terrestrial</b>					
<b>Applications—TOTAL</b> .....	<u>206</u>	<u>224</u>	<u>284</u>	<u>344</u>	<u>369</u>
Space Applications .....	198	235	275	332	357
Technology Utilization .....	8	9	9	12	12
<b>Aeronautics and Space</b>					
<b>Technology—TOTAL</b> .....	<u>278</u>	<u>333</u>	<u>376</u>	<u>427</u>	<u>390</u>
Aeronautical Research and					
Technology .....	190	228	264	308	275
Space Research and					
Technology .....	82	98	107	116	110
Energy Technology					
Applications .....	6	7	5	3	4
<b>Space Tracking and Data</b>					
<b>Systems—TOTAL</b> .....	<u>255</u>	<u>278</u>	<u>300</u>	<u>332</u>	<u>349</u>

Source: "The Budget of the United States," (Annually).

<sup>E</sup> Estimate.

## SPACE ACTIVITIES BUDGET AUTHORITY

Fiscal Years 1959-1980<sup>a</sup>  
(Millions of Dollars)

Year	TOTAL	NASA <sup>b</sup>	DOD	Energy	Other <sup>c</sup>
1959	\$ 785	\$ 261	\$ 490	\$ 34	\$ —
1960	1,066	462	561	43	—
1961	1,808	926	814	68	—
1962	3,295	1,797	1,298	148	52
1963	5,435	3,626	1,550	214	45
1964	6,831	5,016	1,599	210	6
1965	6,956	5,138	1,574	229	15
1966	6,970	5,065	1,689	187	29
1967	6,742	4,830	1,664	184	64
1968	6,551	4,430	1,922	145	54
1969	5,976	3,822	2,013	118	23
1970	5,341	3,547	1,678	103	13
1971	4,741	3,101	1,512	95	33
1972	4,575	3,071	1,407	55	42
1973	4,825	3,093	1,623	54	55
1974	4,640	2,759	1,766	42	73
1975	4,914	2,915	1,892	30	77
1976	5,320	3,225	1,983	23	89
Tr. Qtr.	1,341	849	460	5	27
1977	5,983	3,440	2,412	22	109
1978	6,497	3,623	2,717	34	123
1979 <sup>E</sup>	7,432	4,033	3,237	38	124
1980 <sup>E</sup>	8,628	4,166	4,301	34	127

Source: NASA, "Aeronautics and Space Report of the President" (Annually).

<sup>a</sup> Latest available data.<sup>b</sup> Excludes amounts for air transportation.<sup>c</sup> Departments of Commerce, Interior and Agriculture, and the National Science Foundation.

**SALES AND BACKLOG  
SPACE VEHICLE SYSTEMS**  
(Excluding Engines and Propulsion Units)  
Calendar Years 1961-1979  
(Millions of Dollars)

Year	Net Sales			Backlog, December 31		
	TOTAL	Military	Non-Military	TOTAL	Military	Non-Military
1961	\$ 775	\$ 551	\$ 224 <sup>a</sup>	\$ 586	\$ 350	\$ 236 <sup>a</sup>
1962	1,319	712	607 <sup>a</sup>	1,435	852	583 <sup>a</sup>
1963	1,911	1,061	850	1,612	856	756
1964	2,222	732	1,490	1,611	391	1,220
1965	2,449	602	1,847	2,203	503	1,700
1966	2,710	734	1,976	1,494	428	1,066
1967	2,199	789	1,410	1,974	1,096	878
1968	2,357	899	1,458	1,329	834	495
1969	2,282	1,187	1,095	1,330	869	461
1970	1,956	1,025	931	1,184	786	398
1971	1,725	860	865	916	603	313
1972	1,656	905	751	959	646	313
1973	1,562	902	660	1,177	923	254
1974	1,751	944	807	1,492	1,131	361
1975	2,119	1,096	1,023	1,304	1,019	285
1976	2,002	904	1,098	1,234	902	332
1977	1,870	814	1,056	1,589	1,263	326
1978 <sup>r</sup>	2,324	1,006	1,318	2,188	1,693	495
1979	2,528	1,152	1,376	1,460	910	550

Source: Bureau of the Census, "Current Industrial Reports," Series MQ37D (Quarterly).

<sup>a</sup> Includes engines and propulsion units.

<sup>r</sup> Revised.



## AIR TRANSPORTATION

In 1979, the U.S. scheduled airlines set new records for passengers carried and overall revenues. Paradoxically, the industry's financial position deteriorated sharply. The principal reason was a dramatic increase in operating costs, particularly the soaring cost of fuel. The airlines were forced to absorb much of this increase because authority to raise fares generally lagged behind the rapid advance of costs.

As a result, 1979 airline earnings fell far below the level of the previous year. The Air Transport Association said earnings were inade-

quate in view of capital formation needs for planned acquisition of more fuel-efficient advanced technology aircraft. The new plane funding requirement for the decade of the 1980s had been estimated at \$90 billion, but the airlines will be unable to generate capital for such outlays unless they can effect a reversal of the financial trend.

There was little cause for optimism in data reported for the first quarter of 1980, when—in March—U.S. airlines experienced the first monthly decline in domestic air travel since 1975, apparently a re-

flection of the effects of inflation on the traveling public. The industry suffered an aggregate first quarter loss of more than \$80 million.

In 1979, U.S. carriers boarded some 316 million passengers, an increase of almost 15 percent over the 275 million passengers in 1978. Passenger miles totaled 261 billion, up from 227 billion in 1978, also a gain of 15 percent.

Among other statistical highlights of the U.S. scheduled airlines' 1979 performance:

- Domestic flights accounted for more than 92 percent of all passengers boarded. The airlines carried 291 million passengers on domestic routes, an all-time high and almost 15 percent more than in 1978, the previous record year.

- The number of passengers carried on international flights increased from 20.8 million in 1978 to 24.1 million in 1979, a gain of some 16 percent and another all-time high.

- Cargo haulage increased, but at a lower rate than in recent years. Cargo ton-miles totaled 7.2 billion, up less than three percent over the 1978 figure of 7.0 billion.

The U.S. air carrier fleet, including operators other than scheduled airlines, numbered 3,605 planes in 1979. The total is not, however, directly comparable to that of 2,991 in 1978 because of a change in the Federal Aviation Administration's statistical reporting methods.

Worldwide airline operations also experienced declining earnings despite substantial traffic gains. The International Civil Aviation Organization estimated that world scheduled airline services, including those of the Soviet Union, carried 745 million passengers in 1979, up 10 percent from 677 million in 1978. Passenger miles totaled 645 billion, up from 580 billion in the previous year. Cargo ton-miles amounted to 18.8 billion, which compares with 17.6 billion in 1978.

The world fleet of turbine-engine aircraft in commercial service (excluding the Soviet Union) continued to expand with an increase of 237 airplanes to a 1979 total of 7,787. The breakdown includes 5,534 jetliners, 2,013 turboprops and 240 turbine-powered helicopters. The number of U.S.-built turbine-engined aircraft in world operation was 5,341, or 68.6 percent of the total; the figures compare with 5,159 and 68.3 percent in 1978.

**WORLD AIRLINE TRAFFIC SCHEDULED SERVICES**  
**Calendar Years 1960-1979**  
**(Millions)**

Year	Miles Flown	Passengers Carried	Passenger-Miles	Cargo Ton-Miles	Mail Ton-Miles
	Excludes U.S.S.R.				
1960	1,930	106	67,500	1,400	415
1961	1,940	111	72,500	1,615	490
1962	2,015	121	80,500	1,900	555
1963	2,130	135	91,500	2,130	590
1964	2,300	155	106,000	2,575	625
1965	2,550	177	123,000	3,290	755
1966	2,780	200	142,000	3,905	1,050
1967	3,280	233	169,500	4,470	1,295
1968	3,730	261	192,500	5,425	1,610
1969	4,170	293	218,000	6,685	1,720
1970	4,360	311	237,000	7,165	1,885
1971	4,390	333	252,000	7,870	1,750
1972	4,490	368	289,000	9,060	1,660
1973	4,680	405	323,000	10,680	1,700
1974	4,580	423	341,000	11,625	1,680
1975	4,670	436	357,000	11,810	1,660
1976	4,870	475	392,000	13,170	1,740
1977	5,030	517	429,000	14,620	1,830
1978 <sup>r</sup>	5,260	580	494,000	16,050	1,860
1979 <sup>E</sup>	5,600	640	552,000	17,200	1,900
	Includes U.S.S.R.				
1970	NA	382	286,000	8,230	2,110
1971	NA	411	307,000	9,060	1,970
1972	NA	450	348,000	10,290	1,900
1973	NA	489	385,000	12,015	1,970
1974	NA	515	407,000	13,030	1,970
1975	NA	534	433,000	13,260	1,990
1976	NA	576	473,000	14,690	2,080
1977	NA	610	508,000	16,180	2,180
1978 <sup>r</sup>	NA	677	580,000	17,610	2,220
1979 <sup>E</sup>	NA	745	645,000	18,800	2,300

Source: International Civil Aviation Organization, "Development of World Scheduled Revenue Traffic" (Annually).

NOTE: Excludes states which were not members of ICAO on December 31, 1979. Figures represent revenue traffic on international and domestic scheduled services.

<sup>r</sup> Revised.

<sup>E</sup> Estimate.

NA Not Available.

**WORLD AIRLINE FLEET**  
**TURBINE-ENGINED AIRCRAFT**

**By Model**  
**1975-1979**

	1975	1976	1977	1978	1979
<b>TOTAL AIRCRAFT IN SERVICE</b> . . .	7,153	7,195	7,298	7,550	7,787
Number Manufactured in U.S. . . . .	4,866	4,891	5,027	5,159	5,341
Percent Manufactured in U.S. . . . .	68.0%	68.0%	68.9%	68.3%	68.6%
<b>Turbojets—TOTAL</b> . . . . .	<b>4,919</b>	<b>5,012</b>	<b>5,137</b>	<b>5,288</b>	<b>5,534</b>
Aerospatiale Caravelle . . . . .	215	187	141	131	111
Aerospatiale Corvette . . . . .	8	15	25	22	19
Airbus A300B . . . . .	8	24	35	53	76
B.Ae. 111 . . . . .	163	163	164	164	162
B.Ae. 125 . . . . .	35	7	6	5	5
B.Ae. VC-10 . . . . .	25	26	22	17	17
B.Ae./Aerospatiale Concorde . . .	—	6	8	9	9
B.Ae. Comet . . . . .	15	17	16	10	7
B.Ae. Trident . . . . .	71	86	93	99	97
Boeing 707/720 . . . . .	733	719	702	673	638
Boeing 727 . . . . .	1,140	1,185	1,228	1,315	1,427
Boeing 737 . . . . .	399	436	464	498	555
Boeing 747 . . . . .	253	268	291	308	349
Cessna Citation . . . . .	15	5	5	4	3
Convair CV 990 . . . . .	26	18	15	13	13
Dassault-Breguet Falcon . . . . .	—	—	45	47	36
Dassault-Breguet Mercure . . . . .	9	10	10	10	10
Dassault-Breguet Mystere . . . . .	57	35	—	—	—
Douglas DC-8 . . . . .	494	482	468	450	396
Douglas DC-9 . . . . .	706	758	774	794	836
Fokker-VFW F.28 . . . . .	73	81	94	103	122
Gates Learjet . . . . .	60	17	18	11	10
Grumman Gulfstream II . . . . .	7	4	5	5	6
Ilyushin IL-62 . . . . .	25	26	26	32	39
Lockheed JetStar . . . . .	1	1	1	1	1
Lockheed L-1011 TriStar . . . . .	109	126	138	145	160
McDonnell Douglas DC-10 . . . . .	186	218	234	248	276
Rockwell Sabreliner . . . . .	—	—	2	2	1
Tupolev Tu.134 . . . . .	51	59	60	66	68
Tupolev Tu.154 . . . . .	9	13	15	17	26
VFW-Fokker 614 . . . . .	2	6	5	11	12
Yakovlev YAK-40 . . . . .	15	14	27	25	47
Other . . . . .	9	—	—	—	—

(Continued on next page)

**WORLD AIRLINE FLEET**  
**TURBINE-ENGINED AIRCRAFT (Continued)**

By Model  
1975-1979

	1975	1976	1977	1978	1979
<b>Turboprops—TOTAL</b> .....	<u>1,916</u>	<u>1,914</u>	<u>1,856</u>	<u>1,931</u>	<u>2,013</u>
Aero Spacelines Guppy .....	2	2	2	2	—
Aerospatiale N.262 .....	28	28	34	40	33
AJ1 Turbo Star (Cessna 400) ....	—	—	4	4	5
Antonov An.12 .....	1	2	2	2	2
Antonov An.24 .....	45	54	54	65	90
B.Ae. Britannia .....	10	23	26	14	9
B.Ae./HP/JA Jetstream .....	—	—	—	—	6
B.Ae. Vanguard .....	23	25	22	24	23
B.Ae. Viscount .....	115	104	90	86	91
B.Ae. Argosy .....	9	8	7	8	9
B.Ae. 748 .....	126	128	122	138	133
Beechcraft 99 .....	129	136	111	110	118
Beechcraft King Air .....	22	12	14	19	11
Beechcraft Westwind .....	7	8	6	6	6
Canadair CL-44 .....	26	27	24	24	17
Casa C.212 .....	—	—	2	6	9
Cessna Conquest .....	—	—	—	1	1
Convair CV 580 .....	81	81	79	79	92
Convair CV 600/640 .....	48	48	24	25	29
Douglas DC-3 .....	—	—	—	—	3
DHC-2 Turbo Beaver .....	8	6	11	7	14
DHC-6 Twin Otter .....	297	307	308	335	327
DHC Dash 7 .....	—	—	—	4	8
Embraer EMB-110 .....	10	14	43	49	61
Fairchild Swearingen Metro ....	16	14	31	47	81
Fokker-VFW F.27 .....	376	394	354	370	364
GAF Nomad .....	—	—	3	6	10
Grumman Gulfstream I .....	2	2	3	—	—
Grumman Mallard .....	2	1	1	—	—
Grumman Turbo Goose .....	—	2	2	2	2
Handley Page Herald .....	26	29	29	32	36
Handley Page Jetstream .....	5	6	—	8	—
Ilyushin IL-18 .....	80	88	84	72	82
J. A. Jetstream .....	—	—	7	—	—
LET L-410 .....	12	12	12	12	11
Lockheed L-188 Electra .....	102	102	96	87	86
Lockheed L-110 Hercules .....	29	32	40	36	44
Mitsubishi MU-2 .....	6	15	17	15	15
NAMC YS-11 .....	136	123	125	126	121

(Continued on next page)



**WORLD AIRLINE FLEET**  
**TURBINE-ENGINED AIRCRAFT (Continued)**

By Model  
 1975-1979

	1975	1976	1977	1978	1979
<b>Turboprops (continued)</b>					
NA Turbo Commander .....	8	3	2	1	2
Pilatus Turbo Porter .....	48	11	10	12	7
Piper PA-31T .....	1	2	1	2	1
Saunders ST-27 .....	5	7	4	2	2
Shorts Skyliner/Skyvan .....	39	35	32	29	21
Shorts 330 .....	—	—	—	—	26
Other .....	36	23	18	24	5
<b>Turbine-Powered</b>					
<b>Helicopters—TOTAL</b> .....	<b>318</b>	<b>269</b>	<b>305</b>	<b>331</b>	<b>240</b>
Aerospatiale Alouette .....	37	27	25	26	21
Aerospatiale Lama .....	2	10	—	8	—
Aerospatiale Puma .....	—	—	20	20	20
Aerospatiale Super Frelon .....	—	1	1	—	—
Aerospatiale/Westland SA 330 ...	26	17	—	—	—
Aerospatiale/Westland SA 341 ...	1	1	—	—	—
Bell 204 .....	16	5	8	9	9
Bell 205 .....	37	26	31	27	4
Bell 206 .....	58	53	71	79	50
Bell 212 .....	13	8	10	15	11
Bell 222 .....	—	—	—	—	1
Fairchild Hiller F-1100 .....	4	1	—	—	—
Fuji Bell 214 .....	—	—	—	1	1
Hughes 500 .....	55	50	74	76	63
M.B.B. Bo.105 .....	4	6	6	6	5
Sikorsky S-55T .....	1	—	1	2	3
Sikorsky S-58T .....	14	17	14	12	10
Sikorsky S-61 .....	37	34	39	45	38
Sikorsky S-62 .....	2	2	2	2	—
Sikorsky S-64 .....	3	3	3	3	—
Sikorsky S-76 .....	—	—	—	—	4
Other .....	8	8	—	—	—

Source: Exxon International Company, "Air World Survey," (Annually).

NOTE: The "Air World Survey" covers the world's airlines with the exception of Aeroflot, the USSR national airline, and covers aircraft in service on June 30. Effective 1976, excludes air taxi operators. Effective 1979, excludes a number of companies operating smaller types of aircraft and not providing scheduled services.

**AIRLINE TRAFFIC**  
**UNITED STATES SCHEDULED AIRLINES**  
 Calendar Years 1960-1979  
 (Millions)

Year	Miles Flown	Passengers Carried	Passenger-Miles	Cargo Ton-Miles <sup>a</sup>
1960	998	58	38,863	1,130
1961	970	58	39,831	1,331
1962	1,010	63	43,760	1,738
1963	1,095	71	50,365	1,714
1964	1,189	82	58,494	2,017
1965	1,354	95	68,676	2,764
1966	1,482	109	79,889	3,810
1967	1,834	132	98,484	4,522
1968	2,146	150	113,958	5,140
1969	2,385	159	125,414	5,788
1970	2,418	170	131,710	5,346
1971	2,379	174	135,652	5,964
1972	2,376	191	152,406	6,403
1973	2,448	202	161,957	6,492
1974	2,258	207	162,919	6,495
1975	2,241	205	162,810	6,200
1976	2,320	223	178,988	6,525
1977	2,419	240	193,219	6,976
1978 <sup>r</sup>	2,520	275	226,781	7,001
1979	2,782	316	261,578	7,187

Source: Civil Aeronautics Board, Bureau of Accounts and Statistics.

NOTE: Figures represent total scheduled service excluding nonrevenue operations of U.S. international and domestic certificated route air carriers.

<sup>a</sup> Due to recent changes in "Air Carrier Traffic Statistics," "Mail Ton-Miles" have been included in "Cargo Ton-Miles," which now covers freight plus express revenue and U.S. mail ton-miles plus foreign mail ton-miles in scheduled and nonscheduled operations.

<sup>r</sup> Revised.

**PASSENGER SERVICE  
U.S. SCHEDULED AIRLINES  
Calendar Years 1960-1979**

Year	Domestic		International	
	Passenger Miles Flown (Millions)	Passengers Carried (Thousands)	Passenger-Miles Flown (Millions)	Passengers Carried (Thousands)
1960	30,557	52,377	8,306	5,499
1961	31,062	52,712	8,769	5,699
1962	33,623	55,950	10,138	6,598
1963	38,457	63,925	11,905	7,513
1964	44,141	72,988	14,352	8,775
1965	51,887	84,460	16,789	10,195
1966	60,591	97,746	19,298	11,646
1967	75,487	118,669	23,259	13,424
1968	87,508	134,423	26,451	15,728
1969	95,946	142,340	29,468	16,848
1970	104,147	153,662	27,563	16,260
1971	106,294	156,098	29,358	17,569
1972	118,138	172,452	34,268	18,897
1973	126,217	183,272	35,640	18,936
1974	129,732	189,733	33,186	17,725
1975	131,728	188,746	31,082	16,316
1976	145,271	206,274	33,717	17,039
1977	156,609	222,283	36,610	18,043
1978	182,669	253,960	44,112	20,759
1979	208,455	291,365	53,123	24,146

Source: Civil Aeronautics Board, Bureau of Accounts and Statistics.

NOTE: Figures represent total scheduled passenger services excluding nonrevenue operations of certificated route air carriers.

**U.S. DOMESTIC AIRLINES  
TOTAL ASSETS AND INVESTMENT IN FLIGHT EQUIPMENT**

Fiscal Years 1960-1979  
(Millions of Dollars)

Year	TOTAL NET ASSETS <sup>a</sup>	Value of Flight Equipment				Investment in Flight Equipment as a Percent of Total Assets
		TOTAL Gross Value	Less: Depreciation	Plus: Construction Work in Process <sup>b</sup>	Equals: Net Value of Flight Equipment	
1960	\$ 1,760	\$ 2,174	\$ 890	\$ 90	\$ 1,374	78.1%
1961	2,099	2,719	1,062	77	1,734	82.6
1962	2,273	3,006	1,183	52	1,875	82.4
1963	2,211	3,132	1,341	27	1,818	82.2
1964	2,415	3,383	1,402	48	2,029	84.0
1965	2,816	3,844	1,505	52	2,391	84.9
1966	3,747	4,520	1,646	107	2,981	79.6
1967	5,003	5,485	1,805	153	3,833	76.6
1968	6,294	6,936	2,044	204	5,096	76.6
1969	7,107	8,003	2,334	195	5,864	82.5
1970	7,417	8,546	2,814	298	6,030	81.3
1971	7,664	9,375	3,231	203	6,347	82.8
1972	8,017	9,813	3,484	200	6,529	81.4
1973	13,967	12,377	4,495	350	8,232	58.9
1974	14,979	13,288	4,846	194	8,636	57.7
1975	15,098	13,668	5,278	192	8,582	56.8
1976	15,452	14,398	6,376	189	8,211	53.1
1977	16,868	14,822	8,140	187	6,869	40.7
1978 <sup>r</sup>	20,745	16,127	8,799	3,367	10,695	51.6
1979	24,903	18,554	9,743	3,982	12,793	51.4

Source: Civil Aeronautics Board, Bureau of Accounts and Statistics.

NOTE: 1960-1972: includes data for trunk and local service carriers only; international carriers, helicopter services and air taxi operators excluded.

1973 to date: Pan American Airlines is reclassified as a trunk carrier. Data include trunk, local service, helicopters, Alaskan, Hawaiian, regional, all-cargo, and other carrier groups.

<sup>a</sup> Comprises net investment in buildings and ground equipment, flight equipment, working capital, etc.

<sup>b</sup> Beginning 1978, includes "ground property, equipment and other."

<sup>r</sup> Revised.

**U.S. AIR CARRIER AIRCRAFT**  
**TYPE OF AIRCRAFT, NUMBER OF ENGINES AND MODEL**  
**As of December 31, 1975-1979**

	1975	1976	1977	1978	1979
<b>TOTAL</b> .....	2,672	2,707	2,747	2,991	3,605
<b>Turbojets—TOTAL</b> .....	2,171	2,205	2,254	2,375	2,472
<b>Four-Engine—TOTAL</b> .....	<u>602</u>	<u>583</u>	<u>543</u>	<u>533</u>	<u>507</u>
Boeing 707/720 .....	293	265	242	228	182
Boeing 747 .....	98	105	107	116	131
B.Ae./Aerospatiale Concorde .....	—	—	—	—	9
Convair 880/990 .....	—	—	—	6	—
Lockheed L-1329 .....	1	2	—	1	1
McDonnell Douglas DC-8 .....	210	211	194	182	184
<b>Three-Engine—TOTAL</b> .....	<u>994</u>	<u>1,022</u>	<u>1,074</u>	<u>1,166</u>	<u>1,256</u>
Boeing 727 .....	792	820	869	950	1,029
Lockheed L-1011 .....	77	77	78	84	87
McDonnell Douglas DC-10 .....	125	125	127	132	140
<b>Twin-Engine—TOTAL</b> .....	<u>575</u>	<u>600</u>	<u>637</u>	<u>676</u>	<u>709</u>
Airbus A-300B .....	—	—	4	6	12
Boeing 737 .....	147	152	161	174	206
B.Ae.-111 .....	30	31	31	30	28
Dassault MD-20, Falcon .....	44	43	45	46	44
DeHavilland DH-125 .....	1	3	2	2	—
Grumman G-1159 .....	2	4	5	6	6
Hamburger Flugzeugbau HF-320 ...	1	1	3	4	4
Israel Westwind 1123, 1124 .....	—	—	—	2	2
Learjet LR-23, LR-24 .....	—	1	2	—	8
Learjet LR-25 .....	7	8	9	17	6
Learjet LR-35 .....	1	4	6	6	4
McDonnell Douglas DC-9 .....	341	352	366	375	381
Rockwell NA-265 .....	1	1	2	4	2
Sud Aviation SE210 Caravelle .....	—	—	1	4	6
<b>Turboprops—TOTAL</b> .....	273	260	269	336	565
<b>Four-Engine—TOTAL</b> .....	<u>68</u>	<u>69</u>	<u>63</u>	<u>81</u>	<u>81</u>
Canadair CL44D .....	—	—	—	—	1
DeHavilland DHC-7 .....	—	—	—	2	8
Lockheed 188, Electra .....	48	49	43	59	52
Lockheed 382, Hercules .....	20	20	20	20	20
<b>Twin-Engine—TOTAL</b> .....	<u>205</u>	<u>191</u>	<u>206</u>	<u>255</u>	<u>484</u>
Beech BE99 .....	4	3	—	1	85
Beech BE90 .....	—	—	—	—	3
Beech BE200 .....	—	—	—	—	4
Convair 580 .....	71	73	77	81	91
Convair 600/640 .....	32	25	22	28	29

(Continued on next page)

**U.S. AIR CARRIER AIRCRAFT**  
**TYPE OF AIRCRAFT, NUMBER OF ENGINES AND MODEL (Continued)**

	1975	1976	1977	1978	1979
<b>Twin-Engine—Cont'd.</b>					
DeHavilland DHC-6 .....	21	18	14	27	78
Embraer EMB110 .....	—	—	—	—	4
Fairchild F-27 .....	10	7	4	7	6
Fairchild FH-227 .....	29	27	23	23	22
Fairchild Swearingen SA-226 .....	—	—	7	13	66
GAF N24 .....	—	—	—	—	1
Grumman G-159 .....	2	1	7	8	15
Handley Page HP-137 .....	—	—	—	—	16
Hawker-Siddeley HS748 .....	1	1	1	1	1
Nihon YS-11 .....	23	23	22	20	18
Nord ND-262 .....	10	12	24	30	24
Short SD-3 .....	—	—	3	9	—
Short SC-7 .....	2	—	—	7	—
Short SD-330 .....	—	1	2	—	21
<b>Piston-Engine, TOTAL</b> .....	<b>221</b>	<b>235</b>	<b>218</b>	<b>277</b>	<b>567</b>
<b>Four-Engine—TOTAL</b> .....	<b>40</b>	<b>40</b>	<b>36</b>	<b>52</b>	<b>58</b>
DeHavilland DH-114 .....	—	—	—	4	7
Douglas DC-4 .....	1	1	1	2	4
Douglas DC-6 .....	36	36	33	42	46
Douglas DC-7 .....	2	2	1	—	—
Lockheed 1049 .....	1	1	1	1	1
Other .....	—	—	—	3	—
<b>Twin-Engine—TOTAL</b> .....	<b>173</b>	<b>184</b>	<b>181</b>	<b>217</b>	<b>509</b>
<b>Single-Engine—TOTAL</b> .....	<b>8</b>	<b>11</b>	<b>1</b>	<b>8</b>	<b>—</b>
<b>Helicopters—TOTAL</b> .....	<b>7</b>	<b>7</b>	<b>6</b>	<b>3</b>	<b>1</b>

Source: Federal Aviation Administration, "FAA Statistical Handbook of Aviation," (Annually).

NOTE: Effective 1978, includes certified route air carriers, supplemental air carriers, air taxis, commercial operators, and travel clubs. Effective 1979, includes commuter airlines and all multi-engine aircraft offered for hire.

**SOURCES OF OPERATING REVENUE**  
**TOTAL DOMESTIC OPERATIONS<sup>a</sup>, ALL AIR CARRIER SERVICES**  
**Calendar Years 1960-1979**  
**(Millions of Dollars)**

Year	TOTAL Operating Revenues	Passenger <sup>b</sup>	Mail (including subsidy) <sup>c</sup>	Express and Freight <sup>b</sup>	Excess Baggage	Other <sup>d</sup>
1960	\$ 2,129	\$ 1,860	\$ 113	\$ 103	\$ 21	\$ 32
1961	2,245	1,951	130	115	20	29
1962	2,498	2,168	139	136	20	35
1963	2,722	2,375	143	152	17	35
1964	3,095	2,701	149	182	17	46
1965	3,608	3,142	157	220	12	77
1966	4,070	3,534	162	251	6	117
1967	4,887	4,260	170	287	7	163
1968	5,606	4,913	182	343	9	159
1969	6,438	5,662	186	401	10	179
1970	7,131	6,246	205	461	12	207
1971	7,753	6,736	227	527	13	250
1972	8,652	7,565	230	596	13	248
1973	9,694	8,379	263	694	14	344
1974	11,545	9,758	264	759	17	747
1975	12,020	10,123	253	782	19	843
1976	13,901	11,856	294	933	22	796
1977	15,821	13,771	355	1,109	21	565
1978 <sup>r</sup>	18,184	15,507	266	1,325	23	1,063
1979	21,595	18,876	417	1,483	28	792

Source: Civil Aeronautics Board, Bureau of Accounts and Statistics.

*a* Includes domestic trunks, local service, Intra-Alaska, Intra-Hawaii, helicopter, other carriers, all-cargo, and regional carriers.

*b* Includes scheduled and chartered.

*c* Includes U.S. as well as foreign mail.

*d* Includes revenues not related to transport.

*r* Revised.

**REVENUES AND EXPENSES**  
**TOTAL DOMESTIC OPERATIONS<sup>a</sup>, ALL AIR CARRIER SERVICES**  
**Calendar Years 1960-1979**  
**(Millions of Dollars)**

Year	TOTAL Operating Revenues	TOTAL Operating Expenses	Operating Profit
1960	\$ 2,129	\$ 2,091	\$ 38
1961	2,245	2,244	1
1962	2,498	2,408	90
1963	2,722	2,580	142
1964	3,094	2,778	316
1965	3,608	3,165	443
1966	4,070	3,589	481
1967	4,887	4,476	411
1968	5,606	5,298	308
1969	6,438	6,156	282
1970	7,131	7,128	3
1971	7,753	7,496	257
1972	8,652	8,158	493
1973	9,694	9,200	494
1974	11,545	10,760	785
1975	12,020	11,902	117
1976	13,901	13,326	575
1977	15,821	15,164	657
1978 <sup>r</sup>	18,184	17,151	1,033
1979	21,595	21,472	123

Source: Civil Aeronautics Board, Bureau of Accounts and Statistics.

<sup>a</sup> Includes domestic trunks, local service, Intra-Alaska, Intra-Hawaii, helicopters, other carriers, all-cargo, and regional carriers.

<sup>r</sup> Revised.



**ACTIVE CIVIL AIRCRAFT**  
as of December 31, 1960-1978

Year	Active Civil Aircraft								
	TOTAL	TOTAL Air Carrier <sup>a</sup>	General Aviation Aircraft					Rotorcraft <sup>b</sup>	Other <sup>c</sup>
			TOTAL	Fixed-Wing Aircraft		4-place & over	3-place & less		
				Multi-Engine	Single-Engine				
1960	78,760	2,211	76,549	7,243	34,829	33,472	634	371	
1961	82,853	2,221	80,632	8,401	38,206	32,800	798	427	
1962	86,287	2,166	84,121	9,186	41,120	32,341	967	507	
1963	87,267	2,179	85,088	9,695	42,657	30,977	1,171	588	
1964	90,935	2,193	88,742	10,644	45,777	30,367	1,306	648	
1965	97,741	2,299	95,442	11,977	49,789	31,364	1,503	809	
1966	107,085	2,379	104,706	13,548	52,972	35,687	1,622	877	
1967	116,781	2,595	114,186	14,651	56,865	39,675	1,899	1,096	
1968	127,164	2,927	124,237	16,760	60,977	42,830	2,350	1,320	
1969	133,814	3,008	130,806	18,111	63,703	45,001	2,557	1,434	
1970	134,539	2,796	131,743	18,291	64,759	44,884	2,255	1,554	
1971	133,869	2,721	131,148	17,855	64,464	44,792	2,352	1,685	
1972	147,695	2,685	145,010	19,849	70,998	49,448	2,787	1,928	
1973	156,207	2,667	153,540	21,929	74,831	51,386	3,143	2,251	
1974	164,160	2,658	161,502	23,418	78,924	53,008	3,610	2,542	
1975	171,156	2,681	168,475	24,559	82,261	54,390	4,073	2,832	
1976	180,854	2,550	178,304	25,684	88,211	56,730	4,505	3,174	
1977	186,767	2,473	184,294	26,652	91,960	57,340	4,726	3,616	
1978 <sup>d</sup>	201,323	2,545	198,778	28,782	101,466	59,185	5,315	4,028	

Source: Federal Aviation Administration, Census of U.S. Civil Aircraft.  
 NOTE: Before 1971, an active aircraft was one certificated as eligible to fly. Currently, an "active aircraft" must have a current registration and have been flown during the previous calendar year.  
 a Registered, not necessarily in operation. Includes helicopters.  
 b Includes autogiros; excludes air carrier helicopters.  
 c Includes gliders, dirigibles and balloons.  
 d Detail does not add to total because of estimating procedures.

**ACTIVE AIRMAN CERTIFICATES HELD**  
as of December 31, 1975-1979

	1975	1976	1977	1978	1979
<b>Pilots—TOTAL</b> .....	<u>728,187</u>	<u>744,246</u>	<u>783,932</u>	<u>798,833</u>	<u>814,667</u>
Students .....	176,978	188,801	203,510	204,874	210,180
Private .....	305,863	309,005	327,424	337,644	343,276
Commercial .....	189,342	187,801	188,763	185,833	182,097
Airline Transport .....	42,592	45,072	50,149	55,881	63,652
Helicopter (only) .....	4,932	4,804	4,819	4,874	5,218
Glider (only) <sup>a,b</sup> .....	5,348	5,789	6,208	6,541	6,796
Other Pilot <sup>a,b</sup> .....	3,132	2,974	3,059	3,186	3,448
<b>Non-Pilots—TOTAL</b> .....	<u>323,934</u>	<u>334,681</u>	<u>348,584</u>	<u>362,350</u>	<u>377,213</u>
Mechanics <sup>a</sup> .....	205,436	212,303	220,768	228,743	237,611
Parachute Rigger <sup>a</sup> .....	8,327	8,718	8,994	9,200	9,381
Ground Instructor <sup>a</sup> .....	51,365	53,464	55,717	57,738	59,680
Dispatcher <sup>a</sup> .....	5,741	5,838	5,972	6,161	6,446
Control Tower Operator .....	23,956	24,584	25,107	25,388	25,232
Flight Navigator .....	2,321	2,214	2,155	2,092	1,994
Flight Engineer .....	26,788	27,560	29,871	33,028	36,869
<b>Flight Instructor Certificates<sup>c</sup></b> .....	<u>44,777</u>	<u>46,236</u>	<u>49,362</u>	<u>52,201</u>	<u>54,398</u>
<b>Instruments Ratings<sup>c</sup></b> .....	<u>203,954</u>	<u>211,364</u>	<u>226,334</u>	<u>236,312</u>	<u>247,096</u>

Source: Federal Aviation Administration, Office of Management Systems.

<sup>a</sup> No periodic medical examination required; therefore, no determination as to current activity can be made.

<sup>b</sup> Gliders and lighter-than-air pilots are not required to have a medical examination; however, the totals above are the pilots who received a medical.

<sup>c</sup> Special ratings shown on pilot certificates represented above, not additional certificates.

## GENERAL AVIATION MILES AND HOURS FLOWN

By Type of Flying  
Calendar Years 1965-1978

Year	TOTAL	Business		Commercial		Instructional		Personal & Other	
		Units	Per-cent	Units	Per-cent	Units	Per-cent	Units	Per-cent

### MILES FLOWN BY TYPE OF FLYING—Millions of Miles

1965	2,562	1,204	47	461	18	359	14	538	21
1966	3,336	1,536	46	516	16	646	19	638	19
1967	3,440	1,431	42	569	16	713	21	727	21
1968	3,701	1,406	38	666	18	814	22	815	22
1969	3,926	1,426	36	723	19	910	23	867	22
1970	3,207	1,134	35	555	17	686	22	832	26
1971	3,143	1,129	36	506	16	651	21	857	27
1972	3,317	1,144	34	581	18	692	21	900	27
1973	3,729	1,344	36	688	18	778	21	919	25
1974	4,043	1,433	35	790	20	816	20	1,004	25
1975	4,238	1,487	35	818	19	829	20	1,104	26
1976	4,476	1,563	35	885	20	873	20	1,155	26
1977	NA	NA	NA	NA	NA	NA	NA	NA	NA
1978	NA	NA	NA	NA	NA	NA	NA	NA	NA

### HOURS FLOWN BY TYPE OF FLYING—Thousands of Hours

1965	16,733	5,857	35	3,348	20	3,346	20	4,182	25
1966	21,023	7,057	33	3,555	17	5,674	27	4,737	23
1967	22,153	6,578	30	3,918	18	6,262	28	5,395	24
1968	24,053	6,976	29	4,810	20	6,494	27	5,773	24
1969	25,351	7,064	28	4,928	19	7,023	28	6,336	25
1970	26,030	7,204	28	4,582	18	6,791	26	7,453	28
1971	25,512	7,141	28	4,264	17	6,416	25	7,691	30
1972	26,974	7,239	27	4,831	18	6,814	25	8,090	30
1973	30,048	8,558	28	5,608	19	7,646	25	8,236	28
1974	32,475	9,140	28	6,294	19	7,972	25	9,069	28
1975	34,165	9,545	28	6,480	19	8,174	24	9,966	29
1976	36,128	10,095	28	7,029	19	8,591	24	10,413	29
1977	35,792	10,309	29	6,641	19	9,322	26	9,332	26
1978 <sup>a</sup>	39,409	12,896	33	7,192	18	8,293	21	10,909	28

Source: Federal Aviation Administration, "FAA Statistical Handbook of Aviation" (Annually).

NA Not Available.

<sup>a</sup> Detail may not add to total due to estimating procedures.

**U.S. CIVIL AIRPORTS<sup>a</sup>**  
**By Length of Longest Runway and Region**  
**December 31, 1979**

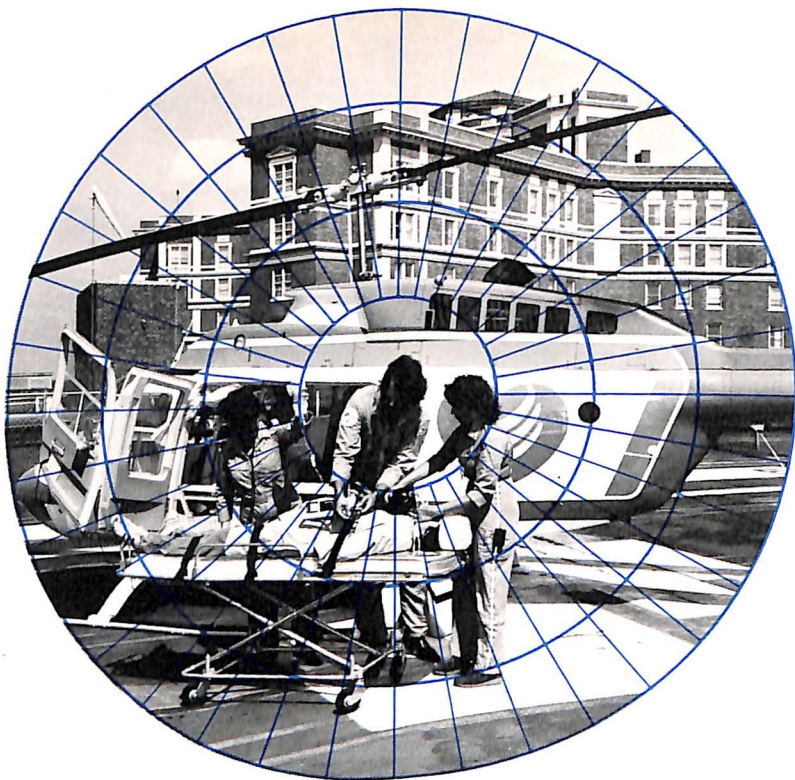
FAA Region	TOTAL	Airports by Length of Longest Runway		
		Under 5,000 feet	5,000-9,999 feet	10,000 feet & Over
<b>TOTAL</b> .....	<u>14,746</u>	<u>13,052</u>	<u>1,432</u>	<u>262</u>
New England .....	536	453	63	20
Eastern .....	1,961	1,812	122	27
Great Lakes .....	3,065	2,830	192	43
Central .....	1,325	1,247	69	9
Southern <sup>b</sup> .....	1,765	1,526	223	16
Southwest .....	2,227	1,954	249	24
Rocky Mountain .....	1,049	882	157	10
Western .....	1,148	971	157	20
Northwest .....	867	784	70	13
Alaska .....	734	540	115	79
Pacific <sup>c</sup> .....	69	53	15	1

Source: Federal Aviation Administration.

<sup>a</sup> Includes seaplane bases, heliports, stolports and military fields having joint civil-military use.

<sup>b</sup> Includes Puerto Rico and the Virgin Islands.

<sup>c</sup> Includes American Samoa, Guam, Saipan, and Trust Territory.



## HELICOPTER TRANSPORTATION

The trend toward use of the helicopter as a civil transportation vehicle continued in 1979 as it had in every prior year of the decade, with gains in both the number of helicopters in service and the number of operators. Although final data were still being compiled at publication time, a preliminary estimate indicated that the number of civil helicopters topped the 9,000 mark by year-end 1979, which compares with fewer than 3,500 a decade earlier.

Similarly, the spectrum of rotary-wing applications continued to

broaden, as exemplified by the sudden 1979 expansion of the use of helicopters as hospital transfer ambulances in the U.S. This was occasioned by a growing trend in hospital specialization—development by some medical institutions of expertise and facilities for treatment of specific diseases and injuries. Such specialization demands a means of transferring patients quickly to appropriate facilities, and hospitals are finding the helicopter a viable and cost-effective system. Only a few rotary-wing hospital transfer vehicles were in

use at the beginning of 1979; at year-end there were 29. In addition, there were 27 states in which one or more government agencies operated ambulance helicopters.

Increasingly, too, helicopters are being used by television stations for news gathering services. A 1978 survey showed five users in this category; by the end of 1979, the number had grown to more than 70.

In 1979, as in the previous year, civil helicopter sales (\$403 million) exceeded sales of military helicopters in terms of dollar value. Even higher levels of civil helicopter sales activity were expected in coming years; sales of \$580 million are forecast for 1980 and the market for the 1980s is estimated at \$10 billion.

Among the new civil helicopters, Bell Helicopter Textron's twin-engine Model 222 transport received Federal Aviation Administration approval for VFR (Visual Flight Rules) operation in December 1979; IFR (Instrument Flight Rules) certification was expected in 1980. At the end of 1979, Bell had orders for 150 Model 222s; deliveries began in January 1980.

In final stages of development during 1979 was Boeing Vertol Company's 44-passenger Commercial Chinook helicopter, whose first flight was scheduled for the summer of 1980. Following certification by the FAA and the British CAA, the first delivery—to British Airways

Helicopters—will be made late in 1980.

The first 37 Sikorsky S-76 Spirit commercial transport helicopters were delivered during 1979, and orders—placed by 66 customers in 22 countries—increased from 20 at the start of the year to almost 300 by year-end.

In the field of rotary-wing research, there were four flight programs—sponsored by NASA and various elements of the Department of Defense—involving vehicles with both civil and military potential. The Bell-built XV-15 Tilt Rotor Research Aircraft, whose rotors provide vertical lift for takeoff then tilt forward to become propellers, successfully made its first in-flight conversions from helicopter to airplane mode. Sikorsky completed company testing of two S-72 Rotor Systems Research Aircraft and turned them over to NASA for advanced research on rotor and propulsion systems. Sikorsky's ABC (Advancing Blade Concept) research aircraft, which can be flown as a pure helicopter or as a relatively high speed wingless compound helicopter powered by two auxiliary turbojets, attained speeds of 200 knots en route to a goal of 300 knots. Wind tunnel tests of Lockheed-California's X-wing craft, which combines helicopter and fixed-wing performance, indicated concept feasibility, and construction of a prototype flight demonstrator was planned.

**CIVIL HELICOPTER OPERATORS AND HELICOPTERS  
OPERATED IN THE UNITED STATES, CANADA AND PUERTO RICO  
1965-1978**

Year	TOTAL	Commercial	Companies and Executives	Government Agencies <sup>a</sup>
<b>CIVIL HELICOPTER OPERATORS</b>				
1965	860	508	299	53
1966	933	519	353	61
1967	1,023	522	427	74
1969	1,379	689	596	94
1971	1,424	672	590	162
1972	1,491	758	566	167
1973	1,532	752	599	181
1974	1,536	725	608	203
1975	1,891	779	833	279
1976	2,330	911	1,082	337
1977	2,547	959	1,219	369
1978 <sup>c</sup>	3,003	1,126	1,515	362
<b>HELICOPTERS OPERATED<sup>b</sup></b>				
1965	2,053	1,537	401	115
1966	2,318	1,699	475	144
1967	2,438	1,764	487	187
1969	3,433	2,390	770	273
1971	3,874	2,605	802	467
1972	4,185	2,992	745	448
1973	4,601	3,295	780	526
1974	4,819	3,418	778	623
1975	5,222	3,342	1,056	824
1976	6,181	3,702	1,392	1,087
1977	7,160	4,294	1,578	1,288
1978 <sup>c</sup>	8,023	4,904	1,891	1,228

Source: Aerospace Industries Association, "Directory of Helicopter Operators in the United States, Canada and Puerto Rico, 1978."

<sup>a</sup> Federal, state and local governments.

<sup>b</sup> Includes helicopters on order.

<sup>c</sup> Latest available data.

**HELIPORTS AND HELISTOPS  
IN THE UNITED STATES, CANADA AND PUERTO RICO**

**By Region  
Selected Years 1970-1977**

Region	1970	1972	1973	1975	1977 <sup>b</sup>
TOTAL .....	2,310	2,326	2,384	3,268	3,433
(elevated) .....	(216)	(211)	(241)	(277)	(299)
New England .....	93	87	78	143	164
Middle Atlantic .....	514	571	581	684	795
East North Central .....	293	281	307	411	397
West North Central .....	107	109	110	98	107
South Atlantic .....	192	190	204	352	306
East South Central .....	47	65	64	107	144
West South Central .....	205	216	217	338	339
Mountain .....	157	168	176	241	213
Pacific .....	593	545	551	789	821
Other <sup>a</sup> .....	109	94	96	105	147

Source: Aerospace Industries Association, "Directory of Heliports in the U.S., Canada, Puerto Rico, 1977/78."

NOTE: Totals include proposed facilities.

<sup>a</sup> Includes Canada and Puerto Rico.

<sup>b</sup> Latest available data.

**HOSPITAL HELIPORTS  
IN THE UNITED STATES, CANADA AND PUERTO RICO**

**By Region  
Selected Years 1970-1977**

Region	1970	1972	1973	1975	1977 <sup>b</sup>
TOTAL .....	285	354	384	565	699
New England .....	5	5	5	16	21
Middle Atlantic .....	29	43	42	55	73
East North Central .....	74	82	99	126	150
West North Central .....	18	22	21	22	29
South Atlantic .....	33	39	50	76	82
East South Central .....	5	18	18	29	54
West South Central .....	20	26	26	59	67
Mountain .....	24	29	32	56	67
Pacific .....	73	87	87	119	147
Other <sup>a</sup> .....	4	3	4	7	9

Source: Aerospace Industries Association, "Directory of Heliports in the U.S., Canada, Puerto Rico, 1977/78."

NOTE: Totals include proposed facilities.

<sup>a</sup> Includes Canada and Puerto Rico.

<sup>b</sup> Latest available data.



**CIVIL HELICOPTER FLEET**  
**UNITED STATES, CANADA AND PUERTO RICO**  
**1978<sup>a</sup>**

State	OPERATORS				HELICOPTERS			
	Comm.	Corp. & Exec.	Civil Gov't.	TOTAL	Comm.	Corp. & Exec.	Civil Gov't.	TOTAL
Alabama	9	26	8	43	19	33	203	255
Alaska	32	13	2	47	249	16	3	268
Arizona	36	16	7	59	137	32	22	191
Arkansas	11	16	1	28	13	17	1	31
California	146	109	57	312	494	147	199	840
Colorado	18	14	7	39	87	18	12	117
Connecticut	8	18	—	26	14	21	—	35
Delaware	2	6	1	9	3	10	2	15
Dist. of Col.	1	2	7	10	1	2	22	25
Florida	62	71	32	165	243	84	73	400
Georgia	11	15	5	31	27	18	15	60
Hawaii	18	7	2	27	29	11	2	42
Idaho	23	26	6	55	59	33	9	101
Illinois	25	40	14	79	74	56	34	164
Indiana	26	27	13	66	61	30	23	114
Iowa	16	17	7	40	27	18	22	67
Kansas	12	13	6	31	24	15	9	48
Kentucky	9	57	2	68	18	58	5	81
Louisiana	22	21	13	56	493	46	24	563
Maine	4	6	2	12	12	6	8	26
Maryland	4	18	3	25	22	18	20	60
Massachusetts	13	28	2	43	35	29	2	66
Michigan	14	52	11	77	29	61	30	120
Minnesota	11	13	1	25	36	13	4	53
Mississippi	8	8	8	24	16	8	16	40
Missouri	16	17	8	41	45	17	20	82
Montana	13	6	3	22	28	7	4	39
Nebraska	12	13	5	30	38	15	9	62
Nevada	9	10	6	25	24	12	13	49
New Hampshire	3	11	—	14	6	11	—	17
New Jersey	24	47	5	76	41	54	9	104
New Mexico	9	13	2	24	18	14	6	38

(Continued on next page)

**CIVIL HELICOPTER FLEET**  
**UNITED STATES, CANADA AND PUERTO RICO (Continued)**  
 1978<sup>a</sup>

State	OPERATORS				HELICOPTERS			
	Comm.	Corp. & Exec.	Civil Gov't.	TOTAL	Comm.	Corp. & Exec.	Civil Gov't.	TOTAL
New York	35	64	15	114	117	76	37	230
North Carolina	12	14	3	29	23	14	6	43
North Dakota	8	6	1	15	14	6	3	23
Ohio	28	53	8	89	59	58	23	140
Oklahoma	12	16	2	30	50	35	6	91
Oregon	45	50	6	101	225	52	19	296
Pennsylvania	31	110	3	144	127	126	13	266
Rhode Island	3	5	3	11	5	5	3	13
South Carolina	9	20	4	33	40	22	5	67
South Dakota	2	2	—	4	4	2	—	6
Tennessee	15	27	4	46	29	28	29	86
Texas	67	100	19	186	305	172	50	527
Utah	14	11	3	28	95	13	5	113
Vermont	—	5	—	5	—	5	—	5
Virginia	12	32	9	53	12	37	20	69
Washington	51	54	8	113	146	61	27	234
West Virginia	10	44	4	58	16	49	12	77
Wisconsin	7	6	2	15	43	6	2	51
Wyoming	6	6	—	12	17	7	—	24
Puerto Rico	1	4	2	7	7	4	5	16
<b>TOTAL—U.S.</b>	<b>995</b>	<b>1,385</b>	<b>342</b>	<b>2,722</b>	<b>3,756</b>	<b>1,708</b>	<b>1,086</b>	<b>6,550</b>
Canada	131	130	20	281	1,148	183	142	1,473
<b>GRAND TOTAL</b>	<b>1,126</b>	<b>1,515</b>	<b>362</b>	<b>3,003</b>	<b>4,904</b>	<b>1,891</b>	<b>1,228</b>	<b>8,023</b>

Source: Aerospace Industries Association, "Directory of Helicopter Operators in the United States, Canada and Puerto Rico, 1978."

<sup>a</sup> Latest available data.

## CIVIL HELICOPTER DESIGNATION CHART U.S. MANUFACTURERS

COMPANY	Commercial Model	Number of Places	Useful Load (Lbs.)	Range with Useful Load N. Miles	External Cargo Payload (Lbs.)
Bell Helicopter Textron Fort Worth, TX	47G Series	3	670-1210	212-238	0-1000
	47J Series	4	1090-1204	224-258	—
	AG-5	2	1300	102	—
	204 Series	7-11	1956-4880	123-335	—
	205A-1	15	4542	276	5000
	206 Series	4-5	1315-1630	240-304	1200-1500
	206L Series	7	1894-1931	297-308	2000
	212	15	5672	226	5000
	214 Series	16-19	5450-6500	219-400	6000-7500
222	6-10	3100	391	3500	
Boeing Vertol Company Philadelphia, PA	107-II	28	7585	240	11500
	BO-105C	5	2344-2397	310-314	2000
	234-Long Range	47	22551	740	28000
	234-Utility	3	30677	135	28000
Brantley-Hynes Helicopter, Inc. Frederick, OK	B-28	2	670	225	400
	305	5	1200	275	800
The Enstrom Helicopter Corp. Menominee, MI	F-28 Series	3	700-1000	238-272	500-1000
	280L Series	3-4	700-1038	263-270	500-1000
Hiller Aviation Porterville, CA	SL-4	4	1020	194	1000
	L-4	4	1105	192	1000
	12-E & 12-E4	3-4	975-1345	225	1000
	L-3	3	1225	192	1000
	SL-3	3	1140	194	1000
Hughes Helicopters Division of Summa Corp. Culver City, CA	300 Series	3	698-1004	191-224	1104
	500 Series	4-7	1320-1660	318-330	1560-2000
Robinson Helicopter Co. Torrance, CA	R22	2	538	210	—
United Technologies Corp. Sikorsky Aircraft Div. Stratford, CT	S-58T	14-16	5370	271	5000
	S-58JT	14-16	4923	282	5000
	S-62A	13	2967	453	3000
	S-61L (Mark II) Airline	30	7208	305	6500
	S-61 (Mark II) Payloader	2	11600	305	11000
	S-61N (Mark II)	26-28	7990	490	6000
	S-76	14	4727	404	4200

Source: Aerospace Industries Association, "Directory of VTOL Aircraft, 1978."

HELICOPTER TRANSPORTATION

**REVENUE TON-MILE TRAFFIC CARRIED  
SCHEDULED HELICOPTER AIRLINES  
Calendar Years 1960-1979  
(In Thousands)**

Year	TOTAL TON-MILES	Passenger	U.S. Mail	Express	Freight
1960	1,054	916	91	40	7
1961	963	822	94	40	7
1962	897	780	65	44	6
1963	1,317	1,193	74	44	6
1964	1,668	1,525	92	45	6
1965	1,948	1,794	84	60	10
1966	2,562	2,422	60	70	10
1967	2,960	2,826	61	64	9
1968	2,482	2,367	57	48	8
1969	1,704	1,627	34	37	6
1970	1,167	1,133	5	25	4
1971	917	897	4	13	3
1972	1,020	1,000	5	12	3
1973	1,108	1,094	3	8	3
1974	1,055	1,047	4	2	2
1975	868	860	5	1	2
1976	755	749	3	—	2
1977	465	462	2	—	1
1978	495	493	1	—	1
1979 <sup>a</sup>	63	63	—	—	—

Source: Civil Aeronautics Board, Bureau of Accounts and Statistics.

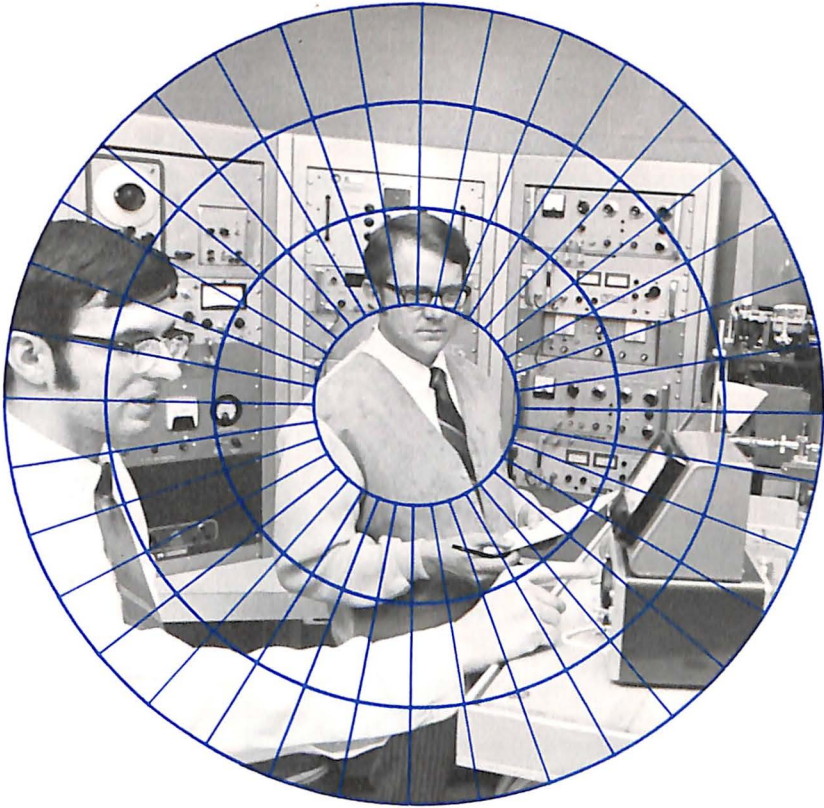
<sup>a</sup> Represents one helicopter carrier which suspended operations April 1979.

**HELICOPTER TRAFFIC**  
**UNITED STATES SCHEDULED AIRLINES**  
 Calendar Years 1960-1979  
 (Thousands)

Year	Miles Flown	Passengers Carried	Passenger-Miles	Ton-Miles
1960	2,219	430	9,475	1,054
1961	2,157	490	8,604	963
1962	1,518	359	8,192	897
1963	1,462	458	12,510	1,317
1964	1,976	608	16,003	1,668
1965	1,984	718	18,811	1,948
1966	2,241	1,067	25,420	2,562
1967	2,660	1,220	29,670	2,960
1968	2,547	1,042	24,856	2,482
1969	1,909	737	17,074	1,703
1970	1,427	573	11,341	1,167
1971	1,048	551	8,973	917
1972	1,022	587	10,009	1,020
1973	1,085	613	10,936	1,108
1974	1,029	592	10,298	1,055
1975	873	505	8,370	868
1976	709	444	7,490	755
1977	468	268	4,625	466
1978	403	282	4,927	495
1979 <sup>a</sup>	58	36	625	63

Source: Civil Aeronautics Board, Bureau of Accounts and Statistics.

<sup>a</sup> Represents one helicopter carrier which suspended operations April 1979.



## RESEARCH AND DEVELOPMENT

In 1979, the aerospace industry led all U.S. industries in expenditures for industrial research and development, including both government-funded and company-funded R&D. The National Science Foundation estimated aerospace expenditures at \$8.4 billion. In second place was the electrical machinery industry at \$7.7 billion; general machinery ranked third at \$4.8 billion.

However, aerospace expenditures have been increasing at a lower rate than those of other industries. According to the NSF survey, aerospace industrial R&D out-

lays for 1980 will increase only three percent to \$8.7 billion. The electrical machinery industry's expenditures are expected to go up 20 percent to \$9.3 billion, putting that industry atop the list and aerospace second.

NSF also projected planned expenditures for industrial R&D in 1980-83 and found that aerospace, with an estimated increase of 11 percent in these years, ranked last among 16 U.S. industry groups in planned rate of change. The aerospace R&D estimate for 1983 is \$9.7 billion. Electrical machinery R&D

expenditures, estimated to increase 37 percent, will reach \$12.7 billion in 1983.

Estimates for Fiscal Year 1980 show continuance of a rising trend in federal outlays for research and development. In the early and mid-Seventies, annual funding increases were generally well below the annual inflation rate, but concern for lagging U.S. productivity and greater foreign competition prompted higher spending levels beginning in 1977. In FY 1980, federal R&D outlays are estimated to reach \$30.5 billion, an increase of more than 14 percent over the preceding year. An increase of almost 11 percent was contemplated in the Administration's budget proposal for FY 1981.

In the area primarily affecting the aerospace industry, Department of Defense R&D outlays for FY 1980 are estimated at \$13.3 billion, up 16 percent over \$11.5 billion in 1979. R&D increases for NASA and the Department of Energy amount to 20 percent and 10 percent respectively, with each agency funded at \$4.9 billion.

Within the Department of Defense, the Air Force leads in estimated FY 1980 outlays for research, development, test and evaluation (RDT&E) with \$4.6 billion, followed by the Navy at \$4.3 billion and the Army at \$2.7 billion. Aero-

space-related defense programs involving major RDT&E outlays include:

*Air Force* The MX advanced intercontinental ballistic missile; the Navstar Global Positioning System of satellites; Minuteman II/III; the Air Launched Cruise Missile; and the Ground Launched Cruise Missile.

*Navy* The F/A-18 carrier-based fighter/attack bomber; the Tomahawk cruise missile; the Trident I advanced fleet ballistic missile; and the HARM anti-radiation missile.

*Army* The Patriot field air defense system; the General Support Rocket System; and the Advanced Attack Helicopter.

Federal outlays for aeronautical research and development in FY 1980 are estimated at \$2.7 billion, marking the second consecutive year of decline in this area; the figure compares with \$2.9 billion in FY 1979 and \$3.3 billion in FY 1978. The drop is due to lower levels of Department of Defense funding, down almost \$200 million to a 1980 level of \$2.1 billion. NASA outlays, at \$557 million, represent a slight increase over \$529 million in the previous year, and aeronautics R&D funding for the Department of Transportation—\$93 million—remains at approximately the same level as the three prior years.

**INDUSTRIAL RESEARCH AND DEVELOPMENT  
ALL INDUSTRIES AND THE AEROSPACE INDUSTRY**

Calendar Years 1960-1978  
(Millions of Dollars)

Year	All Industries	Aerospace Industry		
	TOTAL	TOTAL	Federal Government Funds	Company Funds
1960	\$ 10,509	\$ 3,514	\$ 3,150	\$ 364
1961	10,908	3,829	3,438	392
1962	11,464	4,042	3,588	454
1963	12,630	4,712	4,261	452
1964	13,512	5,078	4,621	457
1965	14,185	5,148	4,499	649
1966	15,548	5,526	4,724	802
1967	16,385	5,669	4,531	1,138
1968	17,429	5,765	4,533	1,230
1969	18,308	5,882	4,528	1,354
1970	18,067 <sup>r</sup>	5,219	4,005	1,213
1971	18,320 <sup>r</sup>	4,881	3,864	1,017
1972	19,552 <sup>r</sup>	4,950	3,970	978
1973	21,249 <sup>r</sup>	5,052	3,899 <sup>r</sup>	1,154
1974	22,887 <sup>r</sup>	5,278	4,000 <sup>r</sup>	1,278 <sup>r</sup>
1975	24,187 <sup>r</sup>	5,713	4,428 <sup>r</sup>	1,285 <sup>r</sup>
1976	26,997 <sup>r</sup>	6,339 <sup>r</sup>	4,921 <sup>r</sup>	1,418 <sup>r</sup>
1977	29,928 <sup>r</sup>	7,104 <sup>r</sup>	5,541 <sup>r</sup>	1,563 <sup>r</sup>
1978	33,400	7,700	5,837	1,863
1979 <sup>E</sup>	36,989	8,448	NA	NA
1980 <sup>E</sup>	41,674	8,735	NA	NA

Source: National Science Foundation.

NOTE: Totals may not add because of rounding.

<sup>r</sup> Revised.

<sup>E</sup> Estimate.



**INDUSTRIAL RESEARCH AND DEVELOPMENT IN AEROSPACE**  
**By Type of Research and Fund Source**  
**Calendar Years 1960-1978**  
**(Millions of Dollars)**

Year	TOTAL AERO-SPACE	Applied Research and Development Funds			Basic Research Funds		
		TOTAL	Federal Government Contracts	Company	TOTAL	Federal Government Contracts	Company
1960	\$3,514	\$3,452	\$3,118	\$ 334	\$62	\$32	\$30
1961	3,829	3,789	3,417	372	40	20	20
1962	4,042	3,987	3,558	429	55	30	25
1963	4,712	4,653	4,229	424	59	31	28
1964	5,078	5,010	4,585	424	68	35	33
1965	5,148	5,074	4,457	617	74	42	32
1966	5,526	5,452	4,685	767	74	39	35
1967	5,669	5,596	4,497	1,099	73	34	39
1968	5,765	5,694	4,508	1,185	70	25	45
1969	5,882	5,816	4,500	1,313	65	23	42
1970	5,219	5,156	3,985	1,170	63	20	43
1971	4,881	4,831	3,848	983	50	16	34
1972	4,950	4,887	3,949	937	62	21	41
1973	5,052	4,992	3,871	1,118	58	20	38
1974	5,278	5,221	3,895	1,236	57	18	39
1975	5,713	5,659	4,416	1,243	54	18	36
1976	6,339 <sup>r</sup>	6,285 <sup>r</sup>	NA	NA	54	22	32
1977	7,104 <sup>r</sup>	7,048 <sup>r</sup>	NA	NA	56	NA	NA
1978	7,700	NA	NA	NA	NA	NA	NA

Source: National Science Foundation.  
 NOTE: Totals may not add because of rounding.  
<sup>r</sup> Revised.  
 NA Not Available.

## FEDERAL OUTLAYS FOR RESEARCH AND DEVELOPMENT

Fiscal Years 1960-1981

(Millions of Dollars)

Year	TOTAL	DOD	NASA	AEC	Other
1960	\$ 7,738	\$ 5,654	\$ 401	\$ 986	\$ 697
1961	9,278	6,618	744	1,111	805
1962	10,379	6,812	1,257	1,284	1,026
1963	12,000	6,849	2,552	1,335	1,264
1964	14,694	7,517	4,171	1,505	1,501
1965	14,875	6,728	5,093	1,520	1,534
1966	16,002	6,735	5,933	1,462	1,872
1967	16,842	7,680	5,426	1,467	2,269
1968	16,865	8,148	4,724	1,593	2,400
1969	16,207	7,858	4,251	1,654	2,444
1970	15,632	7,568	3,753	1,616	2,695
1971	15,050	7,541	3,382	1,303	2,824
1972	16,629	8,275	3,422	1,552	3,380
1973	17,407	8,574	3,315	1,623	3,895
Year	TOTAL	DOD	NASA	ERDA	Other
1974	18,239	8,956	3,256	1,825	4,202
1975	19,525	9,341	3,266	2,277	4,641
1976	20,233	9,329	3,521	2,225	5,158
Year	TOTAL	DOD	NASA	ENERGY	Other
1977	22,462	10,176	3,763	3,181	5,342
1978	24,532	10,726	3,833	3,925	6,048
1979	26,578	11,454	4,064	4,413	6,648
1980 <sup>E</sup>	30,477	13,253	4,858	4,871	7,496
1981 <sup>E</sup>	33,717	15,169	5,277	5,088	8,186

Source: "The Budget of the United States Government" (Annually).

NOTE: Includes military personnel, procurement, civil functions and some other items not included in other tables. Includes R&amp;D facilities and administrative operating costs. AEC research and development programs transferred to ERDA with 1974 reorganization, to Dept. of Energy in 1977.

<sup>E</sup> Estimate, from January 1980 budget; revised estimates not available.

## FEDERAL AERONAUTICS RESEARCH AND DEVELOPMENT

Budget Authority  
Fiscal Years 1967-1980  
(Millions of Dollars)

Year	TOTAL	NASA	DOD	DOT
1967	\$1,613	\$105	\$1,199	\$309
1968	1,404	136	1,126	142
1969	1,300	169	1,161	- 30 <sup>a</sup>
1970	1,882	199	1,641	42
1971	1,990	210	1,707	73
1972	2,295	236	1,964	95
1973	2,187	313	1,799	75
1974	2,030	278	1,678	74
1975	2,015	314	1,627	74
1976	2,351	325	1,941	85
Tr. Qtr.	584	83	480	22
1977	2,727	378	2,256	93
1978	3,338	437	2,807	94
1979 <sup>E</sup>	2,891	529	2,267	94
1980 <sup>E</sup>	2,733	557	2,083	93

Source: "Aeronautics and Space Report of the President" (Annually).

NOTE: FY 1981 estimates were not available at the time of publication.

<sup>a</sup> Unobligated balances for SST research and development, rescinded in 1969.

<sup>E</sup> Estimate.

## RESEARCH AND DEVELOPMENT

**DEPARTMENT OF DEFENSE  
APPROPRIATIONS FOR  
RESEARCH, DEVELOPMENT, TEST AND EVALUATION**  
Fiscal Years 1979 to 1981  
(Millions of Dollars)

	1979	1980 <sup>E</sup>	1981 <sup>E</sup>
<b>TOTAL—APPROPRIATIONS FOR RDT&amp;E . . . . .</b>	\$12,372	\$13,476	\$16,476

**BY APPROPRIATION**

Army . . . . .	2,637	2,851	3,234
Navy . . . . .	4,456	4,559	4,863
Air Force . . . . .	4,359	4,986	7,033
Defense Agencies . . . . .	893	1,037	1,303
Director of Test and Evaluation . . . . .	28	43	42

**BY RESEARCH CATEGORIES**

Research . . . . .	475	557	643
Exploratory Development . . . . .	1,535	1,702	2,069
Advanced Development . . . . .	2,654	2,751	3,048
Engineering Development . . . . .	4,188	4,719	5,875
Management and Support . . . . .	1,431	1,482	1,785
Operational Systems Development . . . . .	2,090	2,266	3,056

**RECAP OF BUDGET ACTIVITIES**

Technology Base . . . . .	2,010	2,259	2,712
Advanced Technology Development . . . . .	525	620	595
Strategic Programs . . . . .	2,139	2,187	3,365
Tactical Programs . . . . .	5,088	5,209	5,748
Intelligence and Communications . . . . .	759	1,164	1,577
Defensewide Mission Support . . . . .	1,852	2,036	2,478

**RECAP OF FYDP PROGRAMS**

Strategic Forces . . . . .	723	590	682
General Purpose Forces . . . . .	557	519	683
Intelligence and Communications . . . . .	763	1,134	1,666
Airlift/Sealift . . . . .	37	13	11
Research and Development (FYDP Program 6) . . . . .	10,283	11,210	13,420
Central Supply and Maintenance . . . . .	7	8	11
Training, Medical and Other . . . . .	1	1	1
Support of Other Nations . . . . .	1	2	2

Source: Department of Defense, Budget for FY 1981.

<sup>E</sup> Estimate.

**DEPARTMENT OF DEFENSE**  
**OUTLAYS FOR RESEARCH, DEVELOPMENT, TEST AND EVALUATION**  
**Fiscal Years 1970-1981**  
**(Millions of Dollars)**

**By Function**

Year	TOTAL, All RDT&E Functions	Aircraft	Missiles	Astronautics	Other
1970	\$ 7,166	\$ 1,239	\$ 2,196	\$ 753	\$ 2,978
1971	7,303	1,699	2,008	519	3,077
1972	7,881	2,066	2,157	468	3,190
1973	8,157	2,036	2,038	512	3,571
1974	8,582	1,893	2,160	561	3,968
1975	8,866	1,698	2,176	515	4,477
1976	8,923	1,603	2,295	581	4,444
Tr. Qtr.	2,206	410	520	129	1,147
1977 <sup>a</sup>	9,795	2,176	2,259	537	4,823

**By Agency**

Year	TOTAL, All RDT&E Functions	Air Force	Navy	Army	Other
1970	\$ 7,166	\$ 2,937	\$ 2,084	\$ 1,665	\$ 480
1971	7,303	2,809	2,405	1,569	520
1972	7,881	3,205	2,427	1,779	470
1973	8,157	3,362	2,404	1,912	479
1974	8,582	3,240	2,623	2,190	529
1975	8,866	3,308	3,021	1,964	573
1976	8,923	3,338	3,215	1,842	528
Tr. Qtr.	2,203	830	778	437	161
1977	9,795	3,618	3,481	2,069	627
1978	10,508	3,626	3,825	2,342	715
1979	11,152	4,080	3,826	2,409	837
1980 <sup>b</sup>	12,489	4,553	4,290	2,655	991
1981 <sup>c</sup>	14,865	5,975	4,696	2,980	1,214

Source: Department of Defense Budget (Annually).

<sup>a</sup> Data no longer available in this format.

<sup>c</sup> Estimate.

**MILITARY PRIME CONTRACT AWARDS  
RESEARCH, DEVELOPMENT, TEST AND EVALUATION**

Fiscal Years 1975-1979  
(Millions of Dollars)

Program Categories	1975	1976	1977	1978	1979
<b>TOTAL—RDT&amp;E</b> .....	<u>\$6,303</u>	<u>\$6,871</u>	<u>\$7,893</u>	<u>\$8,683</u>	<u>\$8,543</u>
Research .....	234	276	319	323	381
Exploratory Development .....	530	593	673	780	726
Other Development .....	5,027	5,364	6,247	6,895	6,327
Management & Support .....	512	638	654	685	1,109
<b>Aircraft—TOTAL</b> .....	<u>\$1,166</u>	<u>\$1,378</u>	<u>\$1,649</u>	<u>\$1,640</u>	<u>\$1,315</u>
Research .....	3	2	3	2	9
Exploratory Development .....	13	18	31	43	25
Other Development .....	1,146	1,345	1,606	1,591	1,268
Management & Support .....	4	13	9	4	13
<b>Missile and Space Systems—TOTAL</b> .....	<u>1,895</u>	<u>2,305</u>	<u>2,302</u>	<u>2,721</u>	<u>3,064</u>
Research .....	23	34	16	20	13
Exploratory Development .....	72	107	133	178	137
Other Development .....	1,711	1,991	2,023	2,415	2,530
Management & Support .....	89	173	130	108	384
<b>Electronics &amp; Communications</b>					
<b>Equipment—TOTAL</b> .....	<u>1,767</u>	<u>1,491</u>	<u>1,789</u>	<u>1,765</u>	<u>1,893</u>
Research .....	26	33	35	37	56
Exploratory Development .....	96	144	165	156	226
Other Development .....	1,496	1,253	1,500	1,476	1,499
Management & Support .....	149	61	89	96	112
<b>All Other—TOTAL<sup>a</sup></b> .....	<u>1,475</u>	<u>1,697</u>	<u>2,153</u>	<u>2,557</u>	<u>2,271</u>
Research .....	182	207	265	264	304
Exploratory Development .....	349	324	344	403	338
Other Development .....	674	775	1,118	1,413	1,029
Management & Support .....	270	391	426	477	600

Source: Department of Defense, "Military Prime Contract Awards by Service Category and Federal Supply Classification" (Annually).

<sup>a</sup> "All Other" includes ships, tank-automotive, weapons, ammunition and services.

**MILITARY AIRCRAFT PROGRAMS  
RESEARCH, DEVELOPMENT, TEST AND EVALUATION<sup>a</sup>**

**By Agency, Type and Model  
Fiscal Years 1979, 1980 and 1981  
(Millions of Dollars)**

Agency, Type and Model	1979	1980 <sup>E</sup>	1981 <sup>E</sup>
<b>AIR FORCE</b>			
A-10 .....	\$ 18.0	\$ 17.8	\$ 13.6
B-52G Cruise Missile Aircraft Modification ..	76.4	13.5	7.0
B-52G/H Avionics Modification .....	40.8	55.0	40.0
C-5 (Wing Modification) .....	36.5	12.7	11.1
E-3A Advanced Warning & Control System (AWACS) .....	37.9	52.1	65.6
EF-111A .....	8.8	7.0	10.5
F-15 Eagle .....	12.0	0.5	9.1
F-16 Multimission Fighter .....	105.9	27.8	42.3
NATO AWACS Program .....	10.0	—	—
KC-135 Re-engining .....	7.1	10.0	15.0
<b>NAVY</b>			
A-6E Intruder .....	\$ 7.4	\$ 1.2	\$ —
A-7E Corsair II .....	0.8	—	—
CH-53E Super Stallion .....	—	5.6	3.3
E-2C Hawkeye .....	5.6	11.1	19.6
F-14A Tomcat .....	15.0	27.2	35.1
F/A-18 Hornet .....	498.5	310.8	130.6
P-3C Orion .....	6.7	40.6	32.7
SH-60B LAMPS .....	94.8	177.7	100.5
<b>ARMY</b>			
AH-1S Cobra/Tow .....	\$ 7.3	\$ 1.0	\$ 9.1
UH-60A Blackhawk .....	11.4	—	—
CH-47 (Modernization) .....	19.5	23.1	0.6
Advanced Attack Helicopter (AAH) .....	179.4	176.0	171.6
RC-12 Guardrail (Modifications) .....	—	4.3	3.7

Source: "Program Acquisition Costs by Weapon System," Department of Defense Budget (Annually), and revised estimates from amended budget for FY 1981.

<sup>a</sup> Total Obligational Authority.

<sup>E</sup> Estimate.

**MISSILE PROGRAMS**  
**RESEARCH, DEVELOPMENT, TEST AND EVALUATION<sup>a</sup>**

By Agency, Type and Model  
 Fiscal Years 1979, 1980<sup>E</sup> and 1981<sup>E</sup>  
 (Millions of Dollars)

Agency, Type and Model	1979	1980 <sup>E</sup>	1981 <sup>E</sup>
<b>AIR FORCE</b>			
ALCM .....	\$338.9	\$ 90.0	\$108.4
GLCM .....	33.1	60.9	67.5
Minuteman II/III .....	50.3	35.3	48.3
M-X .....	150.0	672.4	1,564.9
Sparrow .....	—	0.7	3.1
Target Drones <sup>b</sup> .....	51.7	51.8	63.7
<b>NAVY</b>			
Harm .....	\$ 44.6	\$ 48.0	\$ 62.0
Phoenix .....	23.5	36.2	27.6
Sidewinder <sup>b</sup> .....	12.7	8.9	2.5
Standard MR (SM-1) .....	10.1	21.9	16.9
Standard MR (SM-2) .....	3.1	30.3	23.2
Tomahawk .....	154.1	103.3	130.2
Trident I .....	189.8	36.8	26.0
<b>ARMY</b>			
Chaparral .....	\$ 0.5	\$ 6.1	\$ 20.6
Dragon .....	0.4	—	—
GSRS .....	70.8	69.2	64.2
Hawk <sup>c</sup> .....	10.3	20.2	14.8
Hellfire .....	66.4	61.0	36.8
Lance .....	4.1	3.3	1.0
Patriot .....	228.4	128.7	51.6
Roland .....	27.8	11.3	12.6
Stinger <sup>c</sup> .....	49.2	35.2	19.8
TOW <sup>c</sup> .....	20.8	52.4	41.5

Source: "Program Acquisition Costs by Weapon System," Department of Defense Budget (Annually), and revised estimates from amended budget for FY 1981.

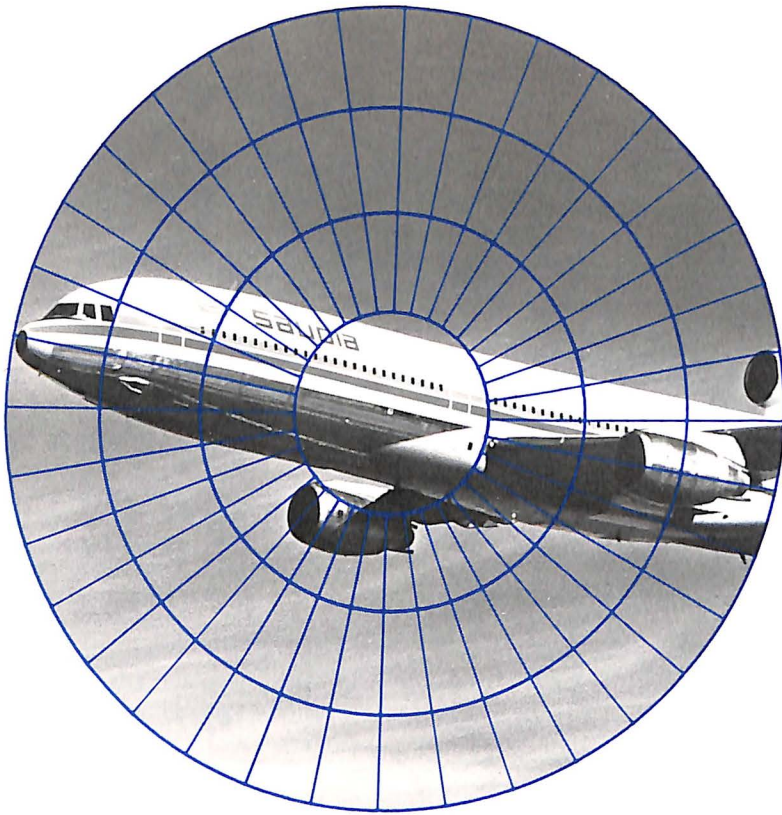
<sup>E</sup> Estimate.

<sup>a</sup> Total Obligational Authority.

<sup>b</sup> Includes Navy and Air Force.

<sup>c</sup> Includes Army and Marine Corps.





## FOREIGN TRADE

In 1979, the United States experienced its fourth consecutive international trade deficit, although the deficit level—\$27.3 billion—declined from the 1978 all-time high of almost \$32 billion. A factor in the somewhat improved U.S. position was the foreign trade performance of the American aerospace industry. The industry topped its previous records in both export sales and net trade balance (exports minus imports), offsetting U.S. deficits in other areas of international trade and underlining once again the vital importance of high-value, high-technology aerospace exports

to the nation's economy.

With its 1979 performance, the industry rounded out a decade of consistently strong foreign trade activity, recording significant positive trade balances each year during the Seventies, just as in the previous decade. While the U.S. suffered seven deficit years in the Seventies, the aerospace trade balance averaged more than \$6 billion annually and alleviated to a considerable degree the adverse impacts of large-scale oil importation and lagging U.S. trade in a number of non-petroleum categories.

With a 1979 trade surplus of \$10.1

billion, more than a billion dollars higher than the best previous figure, aerospace again led all U.S. manufacturing industries in positive contribution to the nation's trade balance. Of particular interest is the fact that the record aerospace trade balance was achieved despite a major increase in imports that reflected intensifying competition from abroad.

Aerospace exports outstripped imports in 1979 by a factor of more than seven to one, testimony to the continuing confidence of foreign purchasers in American-built aerospace products. In terms of dollar value, civil aerospace exports constituted 83 percent of the total; they were valued at \$9.8 billion, which compares with \$6 billion in the previous year. The 1979 figure was compounded of \$6.2 billion for complete aircraft—up \$2.6 billion; \$3.2 billion for parts, accessories and equipment—up \$1.1 billion; and \$375 million for aircraft engines—up almost \$100 million.

As in previous years, the largest single component among civil aerospace exports was commercial transport aircraft, sales of which were approximately double—at \$5 billion—the \$2.6 billion in sales in 1978. Sales of general aviation aircraft climbed from \$496 million in 1978 to \$650 million in 1979. Civil helicopter sales amounted to \$207

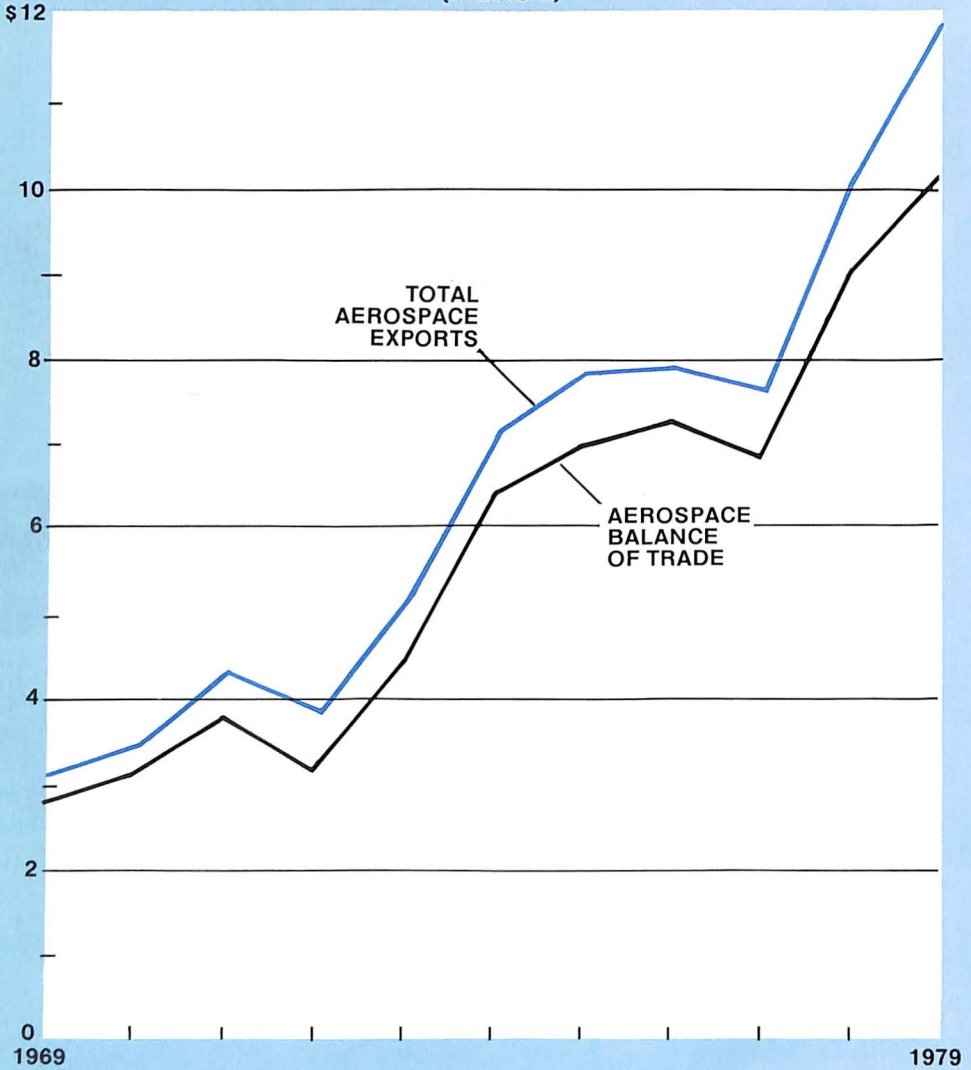
million—up \$51 million.

Exports of military aerospace products declined sharply, from approximately \$4 billion in 1978 to less than \$2 billion in 1979. Shipments abroad of fighter-bomber aircraft, traditionally the largest element of military exports, dropped by more than \$1.2 billion to a 1979 level of less than \$500 million. Foreign sales of all types of military aircraft dipped to \$838 million from \$2.2 billion in the previous year. Similarly, shipments of parts and accessories for aircraft and engines declined by more than half, from \$1.1 billion in 1978 to less than \$500 million in 1979. Dollar value of rockets, missiles and parts delivered abroad in 1979 was \$571 million, a minor drop from \$608 million in 1978.

Aerospace imports, at \$1.6 billion, reached their highest-ever level, some 72 percent greater than the \$943 million value of 1978 imports. The increase was occasioned largely by deliveries to U.S. operators of the French-German Airbus, smaller commuter-type aircraft, and turbine engines.

Although there is uncertainty regarding future levels of military exports, due to changing foreign policy considerations, indications are that, overall, exports will remain at a high level in 1980 in view of a large industry backlog for commercial transport aircraft.

**AEROSPACE EXPORTS  
AND BALANCE OF TRADE**  
1969-1979  
(In Billions)



Source: U.S. Department of Commerce

## TOTAL AND AEROSPACE BALANCE OF TRADE

Calendar Years 1960-1979  
(Millions of Dollars)

Year	TOTAL U.S. Trade Balance <sup>a</sup>	Aerospace			Aerospace Trade Balance as Percent of U.S. Total
		Trade Balance	Exports	Imports	
1960	\$ 5,369	\$ 1,665	\$ 1,726	\$ 61	31.0%
1961	6,096	1,501	1,653	152	24.6
1962	4,180	1,795	1,923	128	42.9
1963	6,061	1,532	1,627	95	25.3
1964	7,555	1,518	1,608	90	20.1
1965	5,875	1,459	1,618	159	24.8
1966	4,524	1,370	1,673	303	30.3
1967	4,409	1,961	2,248	287	44.5
1968	1,133	2,661	2,994	333	234.9
1969	1,599	2,831	3,138	307	177.0
1970	2,834	3,097	3,405	308	109.3
1971	-2,024 <sup>b</sup>	3,830	4,203	373	<sup>c</sup>
1972	-6,351	3,230	3,795	565	<sup>c</sup>
1973	1,222	4,360	5,142	782	356.8
1974	-2,996	6,350	7,095	745	<sup>c</sup>
1975	9,630	7,045	7,792	747	73.2
1976	-7,786	7,267	7,843	576	<sup>c</sup>
1977	-28,970	6,850	7,581	731	<sup>c</sup>
1978 <sup>r</sup>	-31,786 <sup>r</sup>	9,058	10,001	943	<sup>c</sup>
1979	-27,345	10,123	11,747	1,624	<sup>c</sup>

Source: Bureau of the Census, "Highlights of U.S. Export and Import Trade," Report FT 990 (Monthly); "U.S. Exports, Schedule E, Commodity by Country," Report FT 410 (Monthly); "U.S. Imports for Consumption and General Imports, TSUSA Commodity and Country of Origin," Report FT 246 (Annually).

<sup>a</sup> U.S. Balance of Trade is the difference between exports of domestic merchandise, including Department of Defense shipments, and imports for consumption (customs value base).

<sup>b</sup> First negative U.S. Balance of Trade since 1888.

<sup>c</sup> Not applicable.

<sup>r</sup> Revised.



**U.S. IMPORTS OF AEROSPACE PRODUCTS**

Calendar Years 1975-1979  
(Millions of Dollars)

	1975	1976	1977	1978	1979
<b>TOTAL</b> .....	\$ 747.4	\$ 576.1	\$ 731.2	\$ 943.1	\$1,624.4
<b>Aircraft—TOTAL</b> .....	192.2	155.5	310.2	291.8	512.2
<b>Military</b> .....	112.5	64.3	50.2	4.9	1.5
<b>Non-Military</b> .....	79.7	91.1	259.8	286.6	510.3
Gliders & Kites .....	0.6	1.1	1.8	2.1	1.7
Helicopters .....	6.9	4.5	18.1	28.0	21.6
Single-Engine .....	} 35.0	} 26.3	} 27.8	0.5	<sup>b</sup>
Multi-Engine Under 4400 lbs. ...				2.8	0.4
Multi-Engine 4400-10,000 lbs. ...				42.1	37.2
Multi-Engine 10,000-33,000 lbs. ...				20.4	40.8
Over 33,000 lbs. ....	5.1	7.8	100.1	58.1	199.8
Used or Rebuilt .....	11.6	10.6	31.3	51.6	26.8
<b>Balloons &amp; Airships</b> .....	0.1	0.1	0.2	0.3	0.4
<b>Aircraft Engines—TOTAL</b> .....	229.5	144.9	131.4	283.0	547.0
Internal Combustion <sup>a</sup> .....	1.3	1.0	1.7	1.6	4.0
Turbine Engines, New .....	190.5	119.6	89.5	263.1	304.0
Non-Piston, NES .....	37.7	24.3	40.2	18.3	20.2
Turbine Aircraft Engine Parts .....	NA	NA	NA	NA	218.8
<b>Parts &amp; Accessories—TOTAL</b> ...	325.7	275.7	289.6	368.3	565.2

Source: Bureau of the Census, "U.S. Imports for Consumption and General Imports, TSUSA Commodity and Country of Origin," Report FT 246 (Annually).

<sup>a</sup> Includes some toy engines.

<sup>b</sup> Less than \$50,000.

NES Not elsewhere specified.

NA Not Available.

**EXPORTS OF U.S. AEROSPACE PRODUCTS**  
**Calendar Years 1975-1979**  
**(Millions of Dollars)**

	1975	1976	1977	1978	1979
<b>TOTAL</b> .....	\$7,792	\$7,843	\$7,581	\$10,001	\$11,747
<b>TOTAL CIVILIAN</b> .....	5,324	5,677	5,049	6,018	9,772
<b>Complete Aircraft—TOTAL</b> .....	<u>3,203</u>	<u>3,211</u>	<u>2,747</u>	<u>3,625</u>	<u>6,177</u>
Transports .....	2,397	2,468	1,936	2,558	4,998
General Aviation <sup>a</sup> .....	312	362	389	496	650
Helicopters .....	105	113	105	156	207
Other, Including Used .....	389	268	317	415	322
<b>Engines—TOTAL</b> .....	<u>231</u>	<u>254</u>	<u>233</u>	<u>277</u>	<u>375</u>
Jet & Gas Turbines .....	186	213	196	231	323
Internal Combustion .....	45	41	37	46	52
<b>Parts, Accessories &amp; Equipment for Aircraft and Engines, Including Spares—TOTAL</b> .....	<u>1,890</u>	<u>2,212</u>	<u>2,069</u>	<u>2,116</u>	<u>3,220</u>
Engine Spares & Accessories .....	492	515	483	644	808
Other Spares & Equipment .....	1,398	1,697	1,586	1,472	2,412
<b>TOTAL MILITARY</b> .....	2,468	2,166	2,532	3,983	1,975
<b>Complete Aircraft—TOTAL</b> .....	<u>1,306</u>	<u>967</u>	<u>1,186</u>	<u>2,243</u>	<u>838</u>
Transports .....	235	151	317	232	162
Helicopters .....	123	102	84	82	61
Fighters & Bombers .....	905	513	686	1,707	494
Other, Including Used .....	43	201	99	222	121
<b>Engines—TOTAL</b> .....	<u>94</u>	<u>71</u>	<u>76</u>	<u>64</u>	<u>74</u>
Jet & Gas Turbines .....	83	58	64	59	61
Missile Turbines .....	2	5	5	3	7
Internal Combustion .....	9	8	7	2	6
<b>Parts, Accessories &amp; Equipment for Aircraft and Engines, Including Spares—TOTAL</b> .....	<u>771</u>	<u>649</u>	<u>832</u>	<u>1,068</u>	<u>492</u>
Engine Spares & Accessories .....	205	138	147	156	166
Other Spares & Equipment .....	566	511	685	912	326
<b>Rockets, Guided Missiles &amp; Parts—TOTAL</b> .....	<u>297</u>	<u>479</u>	<u>438</u>	<u>608</u>	<u>571</u>
Complete Rockets & Guided Missiles .....	47	93	168	335	292
Parts & Accessories for Rockets and Guided Missiles .....	250	386	270	273	279

Source: Bureau of the Census, "U.S. Exports, Schedule E, Commodity by Country," Report FT 410 (Monthly).

<sup>a</sup> Includes transports under 33,000 pounds.

NOTE: Effective 1978, the export schedule was revised, such that data prior to 1978 may not be strictly comparable to data for subsequent years.

**EXPORT-IMPORT BANK**  
**GROSS AUTHORIZATIONS OF CREDITS AND GUARANTEES**

Fiscal Years 1967-1979  
(Millions of Dollars)

Year	TOTAL Credits <sup>a</sup>	Credits in Support of Commercial Aircraft Exports			
		TOTAL	Percent of TOTAL Credits	Jets	Other
1967	\$ 2,723	\$ 806.3	29.6%	\$ 789.1	\$17.2
1968	2,526	336.8	13.3	336.8	—
1969	1,296	204.7	15.8	197.5	7.2
1970	2,209	636.2	28.8	598.2	38.0
1971	2,362	490.4	20.8	484.2	6.2
1972	3,285	479.6	14.6	475.4	4.2
1973	4,053	722.4	17.8	689.7	32.7
1974	4,905	946.2	19.3	894.6	51.6
1975	3,812	732.3	19.3	691.2	41.1
1976	2,285	421.9	18.4	398.4	23.5
Tr. Qtr.	282	98.3	34.7	93.8	4.5
1977	747	139.0	18.6	137.6	1.4
1978	2,927	195.2	6.7	189.5	5.7
1979	3,825	1,428.7	37.4	1,399.4	29.3
Year	TOTAL Guarantees <sup>b</sup>	Guarantees in Support of Commercial Aircraft Exports			
		TOTAL	Percent of TOTAL Guarantees	Jets	Other
1967	\$ 193	\$ 4.9	2.5%	\$ 2.2	\$ 2.7
1968	290	63.6	21.9	50.0	13.6
1969	397	113.4	28.6	111.2	2.2
1970	612	100.2	16.4	79.2	21.0
1971	1,420	397.3	28.0	363.6	33.7
1972	1,743	202.7	11.6	175.9	26.8
1973	1,988	243.3	12.2	189.6	53.7
1974	1,594	157.7	9.9	133.0	24.7
1975	1,574	96.7	6.1	64.0	32.7
1976	1,661	107.2	6.4	87.2	20.0
Tr. Qtr.	272	62.6	23.2	58.7	3.9
1977	1,021	319.6	31.3	294.0	25.6
1978	589	97.6	16.6	77.2	20.4
1979	908	261.9	28.8	239.3	22.6

Source: Export-Import Bank of the United States.

<sup>a</sup> "Credit" is a commitment of direct financing by the Export-Import Bank.

<sup>b</sup> "Guarantee" by the Export-Import Bank of principal and interest on a loan made by another institution such as a commercial bank.

## EXPORTS OF CIVIL AIRCRAFT

Calendar Years 1975-1979

	1975	1976	1977	1978	1979
<b>TOTAL NUMBER OF AIRCRAFT</b> . . . .	4,372	4,283	4,368	4,399	5,115
Helicopters, Under 2000 lbs. . . . .	210	201	233	243	294
Helicopters, Over 2000 lbs. . . . .	126	114	88	125	165
Single-Engine Aircraft . . . . .	2,460	2,374	2,664	2,640	2,821
Multi-Engine Aircraft, Under 4400 lbs. . . . .	168	228	273	455	645
Multi-Engine Aircraft, 4400-10,000 lbs. . . . .	640	612	525	339	360
Multi-Engine Aircraft, 10,000-33,000 lbs. . . . .	6	4	7	37	52
Passenger Aircraft, Over 33,000 lbs. . . . .				99	172
Cargo Aircraft, Over 33,000 lbs. . . . .	} 181	} 158	} 101	3	13
Other Aircraft, Over 33,000 lbs. . . . .				9	15
Other Aircraft, Including Balloons, Gliders & Kites . . . . .	NA	NA	NA	NA	NA
Used or Rebuilt Aircraft . . . . .	581	592	477	449	578
<b>TOTAL VALUE (Millions of Dollars)</b> . .	\$3,203	\$3,211	\$2,747	\$3,625	6,177
Helicopters, Under 2000 lbs. . . . .	28	28	38	42	61
Helicopters, Over 2000 lbs. . . . .	77	85	68	114	146
Single-Engine Aircraft . . . . .	71	74	93	103	124
Multi-Engine Aircraft, Under 4400 lbs. . . . .	11	17	27	62	94
Multi-Engine Aircraft, 4400-10,000 lbs. . . . .	225	269	262	240	306
Multi-Engine Aircraft, 10,000-33,000 lbs. . . . .	5	2	6	91	126
Passenger Aircraft, Over 33,000 lbs. . . . .				2,111	4,128
Cargo Aircraft, Over 33,000 lbs. . . . .	2,397	2,468	1,936	142	322
Other Aircraft, Over 33,000 lbs. . . . .				305	548
Other Aircraft, Including Balloons, Gliders & Kites . . . . .	2	4	4	27	11
Used or Rebuilt Aircraft . . . . .	387	264	313	388	311

Source: Bureau of the Census, "U.S. Exports, Schedule E, Commodity by Country," Report FT 410 (Monthly).

NOTE: Effective 1978, the export schedule was revised, such that data prior to 1978 may not be strictly comparable to data for subsequent years.

NA Not available.



**EXPORTS OF MILITARY AIRCRAFT**  
**Calendar Years 1975-1979**

	1975	1976	1977	1978	1979
<b>TOTAL NUMBER OF AIRCRAFT . . .</b>	951	751	721	589	332
Bombers, Land & Carrier Type . . . .	3	—	—	—	—
Fighters, Land & Carrier Type . . . .	475	331	244	286	133
Cargo Transports . . . . .	51	32	53	25	17
Rotary Wing Aircraft . . . . .	116	139	95	108	65
New Aircraft, NEC . . . . .	290	191	288	110	91
Used or Rebuilt Aircraft . . . . .	16	58	41	60	26
Airships, Balloons, Gliders, etc. . . .	—	—	—	NA	NA
<b>TOTAL VALUE (Millions of Dollars)</b>	<b>\$1,306</b>	<b>\$ 967</b>	<b>\$1,186</b>	<b>\$2,243</b>	<b>\$ 838</b>
Bombers, Land & Carrier Type . . . .	1	—	—	—	—
Fighters, Land & Carrier Type . . . .	904	513	686	1,707	494
Cargo Transports . . . . .	235	151	317	232	162
Rotary Wing Aircraft . . . . .	123	102	84	82	61
New Aircraft, NEC . . . . .	39	145	20	187	96
Used or Rebuilt Aircraft . . . . .	4	56	79	11	5
Airships, Balloons, Gliders, etc. . . .	—	—	—	24	20

Source: Bureau of the Census, "U.S. Exports, Schedule E, Commodity by Country," Report FT 410 (Monthly).

NEC Not elsewhere classified.

NOTE: Effective 1978, the export schedule was revised, such that data prior to 1978 may not be strictly comparable to data for subsequent years.

NA Not available.

**EXPORTS OF USED OR REBUILT AIRCRAFT**  
**Calendar Years 1960-1979**  
**(Millions of Dollars)**

Year	TOTAL		Civil		Military	
	Number	Value	Number	Value	Number	Value
1960	634	\$ 26.2	564	\$ 25.7	70	\$ 0.5
1961	618	35.1	494	33.9	124	1.2
1962	511	37.5	382	36.6	129	0.9
1963	423	16.6	356	16.4	67	0.2
1964	489	30.7	288	27.9	201	2.8
1965	474	39.7	407	39.0	67	0.7
1966	397	45.7	364	30.7	33	15.0
1967	391	85.5	362	60.2	29	25.3
1968	304	75.5	290	68.7	14	6.8
1969	382	137.7	379	137.7	3	<sup>a</sup>
1970	361	106.1	358	104.0	3	2.1
1971	419	205.3	413	205.2	6	0.1
1972	471	301.4	450	299.0	21	2.4
1973	621	358.5	597	357.5	24	1.0
1974	709	301.1	690	299.3	19	1.8
1975	597	391.3	581	387.0	16	4.3
1976	650	319.5	592	263.9	58	55.6
1977	518	392.1	477	313.1	41	79.0
1978	509	399.6	449	388.5	60	11.1
1979	604	315.5	578	310.7	26	4.8

Source: Bureau of the Census, "U.S. Exports, Schedule E, Commodity by Country," Report FT 410 (Monthly).

<sup>a</sup> Less than \$0.05 million.

**EXPORTS OF NEW AND USED CIVIL AIRCRAFT ENGINES**

**Calendar Years 1960-1979  
(Millions of Dollars)**

Year	TOTAL		Jet and Gas Turbine		Internal Combustion	
	Number	Value	Number	Value	Number	Value
1960	3,725	\$ 70.7	480	\$ 47.5	3,245	\$ 23.2
1961	3,640	75.3	364	53.6	3,276	21.7
1962	3,690	63.0	341	44.8	3,349	18.2
1963	3,143	45.1	253	25.7	2,890	19.4
1964	4,062	46.7	247	25.0	3,815	21.7
1965	3,330	56.2	372	38.8	2,958	17.4
1966	4,006	77.0	564	49.3	3,442	27.7
1967	4,236	101.2	756	69.6	3,480	31.6
1968	3,279	115.6	866	92.4	2,413	23.2
1969	4,178	102.4	759	82.0	3,419	20.4
1970	3,790	117.6	634	98.4	3,156	19.2
1971	3,530	148.5	707	128.6	2,823	19.9
1972	3,823	184.3	592	158.6	3,231	25.7
1973	5,017	175.7	641	144.8	4,376	30.9
1974	4,924	228.8	801	195.0	4,123	33.8
1975	4,678	231.0	876	185.9	3,802	45.1
1976	4,243	253.7	745	212.8	3,498	40.9
1977	4,199	233.1	667	195.9	3,532	37.2
1978	4,719	277.0	988	230.6	3,731	46.4
1979	4,917	375.4	996	323.2	3,921	52.2

Source: Bureau of the Census, "U.S. Exports, Schedule E, Commodity by Country," Report FT 410 (Monthly).

## EXPORTS OF CIVIL HELICOPTERS

By Selected U.S. Manufacturers  
Calendar Years 1975-1979

	1975	1976	1977	1978	1979
<b>TOTAL NUMBER EXPORTED</b> .....	437	356	346	399	428
Canada & Greenland .....	67	45	41	31	54
Latin America .....	80	78	104	60	77
Europe .....	103	73	75	83	106
Middle East .....	58	49	10	9	21
Asia .....	72	64	76	186	105
Oceania .....	19	34	34	22	54
Africa .....	21	13	6	8	11
Countries not identified .....	17	—	—	—	—
<b>TOTAL VALUE</b> <b>(Millions of Dollars)<sup>a</sup></b> .....	\$219.9	\$146.3	\$135.6	\$208.1	\$202.2
Canada & Greenland .....	20.4	12.1	12.7	13.4	21.1
Latin America .....	35.9	24.2	34.4	31.5	36.3
Europe .....	58.7	32.6	46.6	51.3	59.2
Middle East .....	40.4	46.2	6.4	7.3	18.3
Asia .....	21.9	21.2	30.5	99.2	53.6
Oceania .....	3.7	7.8	4.0	3.7	10.2
Africa .....	2.2	2.2	1.0	1.7	3.5
Countries not identified .....	36.7	—	—	—	—

Source: Aerospace Industries Association, company reports from Bell, Boeing-Vertol, Enstrom, Hughes and Sikorsky.

<sup>a</sup> Manufacturers' Net Billing Price.

**EXPORTS OF GENERAL AVIATION AIRCRAFT**

**By Selected U.S. Manufacturers  
Calendar Year 1975-1979**

	1975	1976	1977	1978	1979
<b>TOTAL NUMBER EXPORTED</b>	3,512	3,539	3,611	3,612	3,995
Canada & Greenland .....	610	637	498	455	457
Latin America .....	1,206	1,221	1,382	1,195	1,538
Europe .....	925	927	1,023	1,171	1,281
Asia .....	172	165	68	102	192
Oceania .....	237	382	440	482	367
Africa .....	362	207	200	207	160
<b>TOTAL VALUE (Millions of Dollars)<sup>a</sup> .....</b>	<b>\$318.6</b>	<b>\$331.4</b>	<b>\$354.6</b>	<b>\$486.3</b>	<b>\$600.9<sup>b</sup></b>
Canada & Greenland .....	26.0	31.9	25.6	42.3	44.7
Latin America .....	102.4	101.4	122.5	156.6	196.7
Europe .....	90.4	101.6	139.2	173.4	203.6
Asia .....	34.5	44.2	17.8	36.6	56.9
Oceania .....	18.9	20.2	27.4	49.1	55.0
Africa .....	46.4	32.1	22.1	28.3	47.8

Source: General Aviation Manufacturers' Association.

NOTE: Data are based on exports reported by Beech, Bellanca, Cessna, Gates Learjet, Grumman American Aviation, Lake, Maule, Mooney, Piper, Rockwell and Swearingen of new civil aircraft.

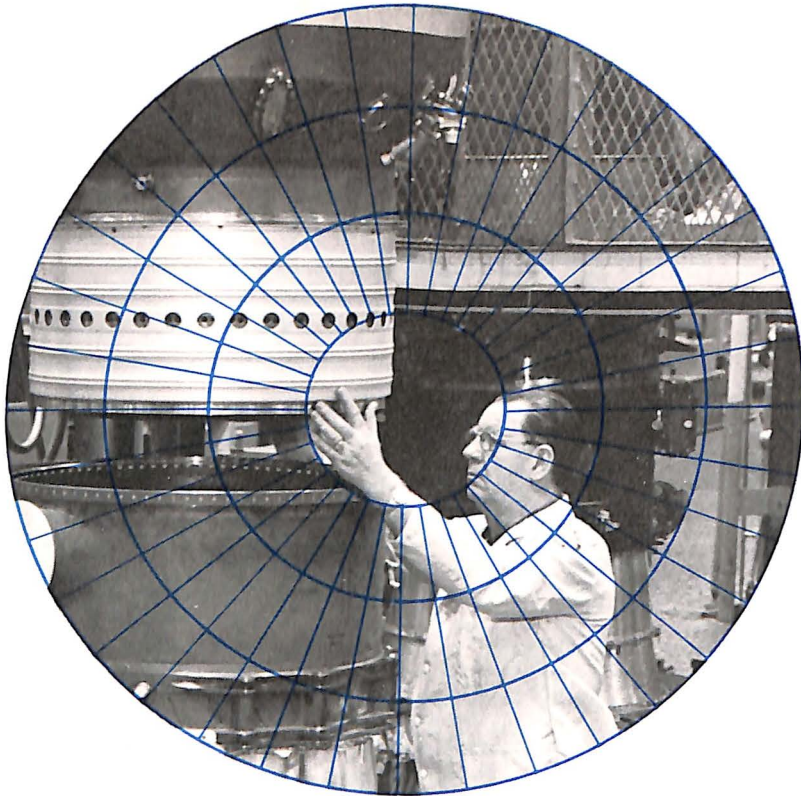
<sup>a</sup> Manufacturers' Net Billing Price.

<sup>b</sup> Due to numerous adjustments, total value does not equal sum of regional totals.

**EXPORTS OF COMMERCIAL TRANSPORT AIRCRAFT**  
**33,000 Pounds and Over Airframe Weight**  
**Calendar Years 1975-1979**

	1975	1976	1977	1978	1979
<b>TOTAL UNITS</b> .....	181	158	101	111	200
Canada .....	18	1	—	4	20
Latin America .....	27	15	7	14	19
Europe .....	67	49	32	36	68
Middle East .....	11	31	20	17	17
Asia .....	32	20	22	24	60
Oceania .....	9	4	4	6	6
Africa .....	17	38	16	10	10
<b>TOTAL VALUE</b> <b>(Millions of Dollars)</b> .....	\$2,397	\$2,468	\$1,936	\$2,558	\$4,998
Canada .....	162	6	—	132	373
Latin America .....	213	138	59	187	423
Europe .....	935	700	571	906	1,601
Middle East .....	264	504	467	541	582
Asia .....	525	549	468	478	1,722
Oceania .....	147	82	155	118	149
Africa .....	151	489	216	196	148

Source: Bureau of the Census, "U.S. Exports, Schedule E, Commodity by Country," Report FT 410 (Monthly).



## EMPLOYMENT

In 1979, average aerospace industry employment topped the million mark for the first time in nine years and further gains were projected for 1980 and 1981. The rise in employment reflected increasing activity in commercial aircraft production.

At year-end, the industry's labor force numbered 1,152,000 persons, and average employment for the year was 1,099,000, an increase of more than 13 percent over 1978. This marked the second year of an upturning industry employment curve after a downtrend in each of three prior years.

The 1979 increase was compounded of a 15 percent increase in aircraft manufacturing employment coupled with moderate gains in other areas of activity. Among workers engaged in manufacture of aircraft, engines, parts and related equipment, employment climbed by 79,000. A gain of 11,000 employees (over eight percent) was recorded in the communications equipment category. Missile/space employment was up 7,000 (about 7.5 percent).

The number of production workers increased some 18 percent, from

474,000 in 1978 to 557,000 in 1979. Well over half of the production workers—329,000—were in aircraft manufacture. Average hourly earnings for these production workers was \$8.23—up nine percent from \$7.54 in the previous year. Average weekly earnings of \$350 represented an increase of almost 10 percent.

In 1979, the industry experienced a further increase in the number of scientists and engineers working on aerospace research and development projects. The aerospace scientific/engineering force increased by 4,600 to a total of 86,600, the highest level since 1970. Aerospace R&D-engaged scientists and engineers comprised slightly more than 20 percent of all U.S. scientific/engineering personnel in R&D work. The percentage was approximately the same as in 1978 but well below the peak level of 1964 when 30 percent of scientific/engineering personnel performing R&D were employed in aerospace.

An Aerospace Industries Association survey conducted early in 1980 indicated continuing employment gains over the next two years, citing a large backlog of orders for commercial transports, a high level of military aircraft production and the beginning of cruise missile production. Gains, however, will be more moderate than during the last two years. The survey predicted for

1980 a one percent reduction in production workers, offset by increases of five to six percent among all other types of employees for an industry average of over two percent. For 1981, it projected an average increase of one percent in all occupational groups. Overall industry employment was expected to reach 1,177,000 by the end of 1980 and 1,190,000 by year-end 1981. The all-time high average employment, by comparison, was 1,502,000 in 1968.

Among other survey findings:

- Employment in the aircraft manufacturing category will remain at approximately current levels in 1980-81.

- After climbing sharply from 70,000 at the end of 1978 to 100,000 at year-end 1979, the number of employees working on commercial transport aircraft will remain near the 1979 level during 1980-81.

- Employment in helicopter manufacturing will increase slightly in 1980, from 27,500 in 1979 to 28,300 at year-end 1980. The same figure is projected for 1981.

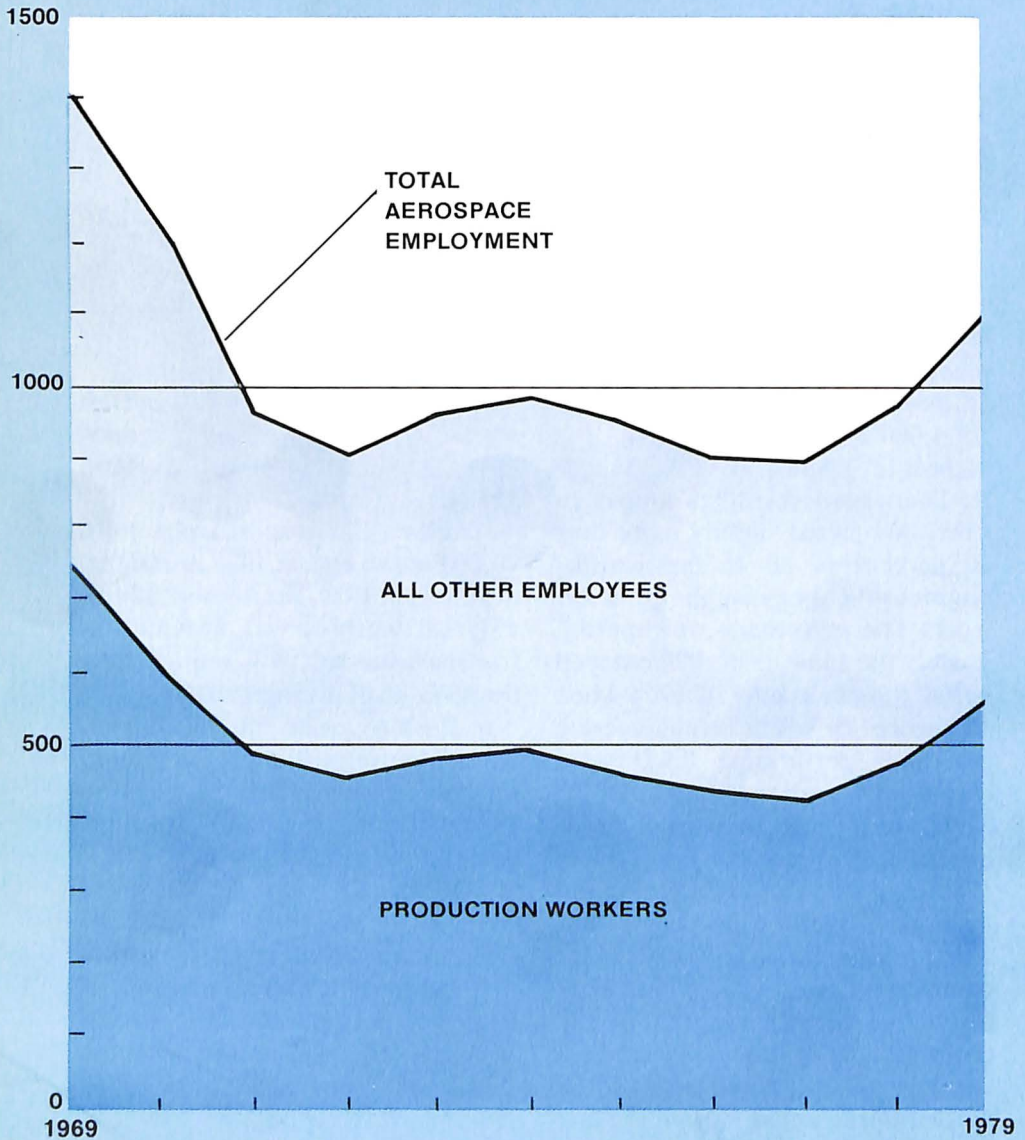
- Missile/space employment will increase by about three percent in 1980, then level off in 1981.

- The largest employment gains—six percent in 1980, five percent in 1981—will come in the miscellaneous category which includes avionics, basic research and non-aerospace products and services.



### AEROSPACE EMPLOYMENT

(Thousands of Employees)



Source: AIA estimates

## AEROSPACE EMPLOYMENT

Calendar Years 1966-1979  
(Thousands of Employees)

Year	TOTAL	Aircraft	Missiles & Space	Communi- cations Equipment	Other
<b>TOTAL EMPLOYMENT</b>					
1966	1,375	753	159	166	297
1967	1,484	834	157	179	314
1968	1,502	852	150	184	316
1969	1,402	804	124	179	295
1970	1,166	669	98	152	247
1971	951	531	88	129	203
1972	912	495	93	113	211
1973	956	525	93	116	222
1974	982	539	94	121	228
1975	941	514	93	116	218
1976	896	487	86	115	208
1977 <sup>r</sup>	893	482	83	121	207
1978 <sup>r</sup>	974	526	92	130	226
1979	1,099	605	99	141	254
<b>PRODUCTION WORKERS</b>					
1966	731	446	55	73	157
1967	804	502	55	78	169
1968	807	506	52	60	169
1969	746	464	41	86	155
1970	604	369	31	77	127
1971	480	285	26	66	103
1972	455	266	28	55	106
1973	482	284	29	57	112
1974	494	292	29	59	114
1975	461	271	29	54	107
1976	433	251	28	54	100
1977 <sup>r</sup>	429	247	26	56	100
1978 <sup>r</sup>	474	274	29	61	110
1979	557	329	32	68	128

Source: Bureau of Labor Statistics, "Employment and Earnings" (Monthly); Aerospace Industries Association estimates.

NOTE: For explanation of "Aerospace Employment," see the Glossary.

<sup>r</sup> Revised.

**LABOR TURNOVER RATES IN THE AEROSPACE INDUSTRY**

Calendar Years 1966-1979  
(Rates per 100 Employees per Year)

Year	Complete Missiles and Spacecraft	Aircraft			
		TOTAL	Airframes	Engines & Engine Parts	Other Parts & Equipment
<b>ACCESSIONS</b>					
1966	44.1	48.6	47.3	43.2	61.0
1967	43.5	37.4	36.6	32.5	46.6
1968	40.7	28.1	27.1	22.9	39.8
1969	27.4	23.4	20.8	24.6	31.5
1970	19.3	16.1	13.9	15.1	26.2
1971	21.6	20.4	21.6	13.2	27.6
1972	20.4	24.0	21.6	21.6	37.2
1973	20.4	26.4	22.8	24.0	43.2
1974	22.8	25.2	24.0	18.0	39.6
1975	15.6	16.8	18.0	10.8	20.4
1976	14.4	18.0	16.8	13.2	25.2
1977	19.2	25.2	22.8	20.4	36.0
1978	21.6	31.2	30.0	24.0	42.0
1979	28.8	32.4	27.6	26.4	50.4
<b>SEPARATIONS</b>					
1966	30.8	31.5	28.1	31.0	46.9
1967	34.0	32.2	27.9	34.1	43.9
1968	45.4	32.3	30.2	31.3	41.1
1969	46.6	33.2	30.8	32.3	42.4
1970	48.7	41.7	43.8	32.1	47.4
1971	37.2	36.0	32.4	34.8	50.4
1972	19.2	24.0	21.6	18.0	39.6
1973	24.0	25.2	22.8	21.6	37.2
1974	22.8	22.8	20.4	19.2	34.8
1975	18.0	26.4	26.4	22.8	32.4
1976	18.0	21.6	20.4	15.6	31.2
1977	18.0	21.6	21.6	15.6	28.8
1978 <sup>r</sup>	18.0	18.0	15.6	14.4	30.0
1979	18.0	20.4	16.8	15.6	34.8

Source: Bureau of Labor Statistics, "Employment and Earnings" (Monthly).  
r Revised.

**WORK STOPPAGES  
AIRCRAFT AND PARTS INDUSTRY  
SIC 372  
Calendar Years 1966-1978**

Year	Number of Strikes	Number of Workers Involved	Man-Days Idle in Year
1966	23	38,000	204,000
1967	22	28,800	161,000
1968	46	45,500	594,300
1969	26	76,400	1,564,600
1970	12	6,800	552,500
1971	24	17,200	465,500
1972	18	20,800	148,100
1973	13	4,531	99,145
1974	27	16,800	370,000
1975	20	22,800	1,245,600
1976	21	13,000	330,500
1977	21	46,700	1,832,200
1978	17	12,600	741,200

Source: Department of Labor, Bureau of Labor Statistics, Division of Wages and Industrial Relations.

**WORK-INJURY RATES<sup>a</sup>  
AEROSPACE AND ALL MANUFACTURING  
Calendar Years 1971-1978**

Year	All Manufacturing	Aircraft & Parts (SIC 372)	Guided Missiles & Spacecraft (SIC 1925)
1971	16.1	NA	NA
1972	15.6	8.0	4.7
1973	15.3	7.4	4.5
1974	14.6	7.2	4.2
1975	12.5	5.9	3.3
Year	All Manufacturing	Aircraft & Parts (SIC 372)	Guided Missiles, Space Vehicles, & Parts (SIC 376)
1976	13.2	6.2	3.5
1977	13.1	6.0	3.0
1978	13.2	6.5	4.2

Source: Department of Labor, Bureau of Labor Statistics, "Occupational Injuries and Illnesses," (Annually).

<sup>a</sup> Defined as the number of injuries per 100 man-years of work.

NA Not Available.

**EMPLOYMENT IN THE AIRCRAFT AND PARTS INDUSTRY**  
**Calendar Years 1966-1979**  
**(Thousands of Employees)**

Year	TOTAL	Aircraft (Airframes)	Aircraft Engines and Parts	Other Aircraft Parts and Equipment
<b>TOTAL EMPLOYMENT</b>				
1966	753.3	417.3	208.1	127.8
1967	833.6	487.8	221.0	144.4
1968	852.0	468.2	216.4	147.8
1969	804.4	456.7	205.0	142.7
1970	668.7	369.6	179.9	119.2
1971	530.8	287.7	150.6	92.6
1972	494.9	287.2	124.0	83.6
1973	524.9	300.5	132.6	91.8
1974	539.4	307.6	134.6	97.1
1975	514.0	292.8	126.3	94.9
1976	487.1	281.1	119.7	86.3
1977	482.8	274.9	120.4	87.5
1978	529.3	304.4	130.9	94.0
1979	605.1	337.2	148.4	119.5
<b>PRODUCTION WORKERS</b>				
1966	446.4	239.8	119.4	87.2
1967	501.5	272.9	129.4	99.2
1968	505.5	280.9	123.9	100.7
1969	464.0	255.1	114.1	94.8
1970	369.3	197.0	95.0	77.3
1971	284.5	147.1	79.0	58.4
1972	266.2	145.1	68.6	52.5
1973	284.2	151.5	74.2	58.5
1974	291.9	154.4	75.2	62.3
1975	271.1	140.9	70.5	59.7
1976	250.7	132.2	65.6	53.0
1977	246.9	126.4	66.4	54.2
1978	274.8	141.4	73.7	59.7
1979	328.8	167.9	84.6	76.2

Source: Bureau of Labor Statistics, "Employment and Earnings" (Monthly).

NOTE: For explanation of "Aerospace Employment," see the Glossary.

## EARNINGS IN AIRCRAFT AND PARTS PLANTS

Production Workers Only  
(Includes Overtime Premiums)  
Calendar Years 1966-1979

Year	TOTAL	Aircraft (Airframes)	Aircraft Engines and Parts	Other Aircraft Parts and Equipment
<b>AVERAGE HOURLY EARNINGS</b>				
1966	\$ 3.31	\$ 3.34	\$ 3.32	\$ 3.21
1967	3.45	3.49	3.42	3.35
1968	3.62	3.64	3.65	3.53
1969	3.86	3.90	3.87	3.76
1970	4.11	4.17	4.10	3.99
1971	4.35	4.41	4.38	4.16
1972	4.62	4.65	4.72	4.42
1973	4.99	5.09	5.04	4.70
1974	5.41	5.57	5.41	5.05
1975	6.00	6.20	6.04	5.48
1976	6.45	6.64	6.46	5.95
1977 <sup>r</sup>	6.92	7.07	7.05	6.44
1978 <sup>r</sup>	7.54	7.70	7.80	6.92
1979	8.23	8.46	8.53	7.42
<b>AVERAGE WEEKLY EARNINGS</b>				
1966	\$143.32	\$142.95	\$144.09	\$142.85
1967	146.97	147.28	145.35	146.73
1968	152.04	152.88	151.11	151.44
1969	161.35	163.41	158.28	159.05
1970	168.51	170.97	166.05	166.78
1971	175.82	178.76	173.53	170.98
1972	185.26	180.89	193.52	186.52
1973	202.10	199.52	210.17	200.22
1974	220.19	221.69	221.81	213.62
1975	247.80	256.06	247.04	229.06
1976	264.45	273.57	259.69	245.74
1977 <sup>r</sup>	289.95	296.23	291.87	273.70
1978 <sup>r</sup>	318.19	324.17	325.26	298.25
1979	349.78	357.86	360.82	319.80

Source: Bureau of Labor Statistics, "Employment and Earnings" (Monthly).

<sup>r</sup> Revised.

**EMPLOYMENT OF SCIENTISTS AND ENGINEERS<sup>a</sup>  
FOR RESEARCH AND DEVELOPMENT**

Total and Aerospace  
1960-1979

Year	TOTAL	Aerospace	Aerospace as a Percent of Total
<b>AS OF JANUARY</b>			
1960	292,000	72,400	24.8%
1961	312,100	78,500	25.2
1962	312,000	79,400	25.4
1963	327,300	90,700	27.7
1964	340,200	101,100	29.7
1965	343,600	99,200	28.9
1966	353,200	99,300	28.1
1967	367,200	100,400	27.3
1968	376,700	101,100	26.8
1969	387,100	99,700	25.8
1970	384,200 <sup>r</sup>	92,200	24.0
1971	367,000 <sup>r</sup>	78,200	21.3
1972	350,200 <sup>r</sup>	70,800	20.2
1973	357,700 <sup>r</sup>	72,100	20.2
1974	360,000 <sup>r</sup>	70,600	19.6
1975	363,300 <sup>r</sup>	67,500	18.6
1976	364,400 <sup>r</sup>	66,900	18.4
1977	382,800 <sup>r</sup>	72,000	18.8
1978	403,700 <sup>r</sup>	82,000 <sup>r</sup>	20.3 <sup>r</sup>
1979	427,800	86,600	20.2

Source: National Science Foundation.

<sup>a</sup> Scientists and engineers working less than full time have been included in terms of their full time equivalent number.

<sup>r</sup> Revised.

**EMPLOYMENT ON NATIONAL AERONAUTICS  
AND SPACE ADMINISTRATION PROGRAMS**  
End of Fiscal Years 1960-1981

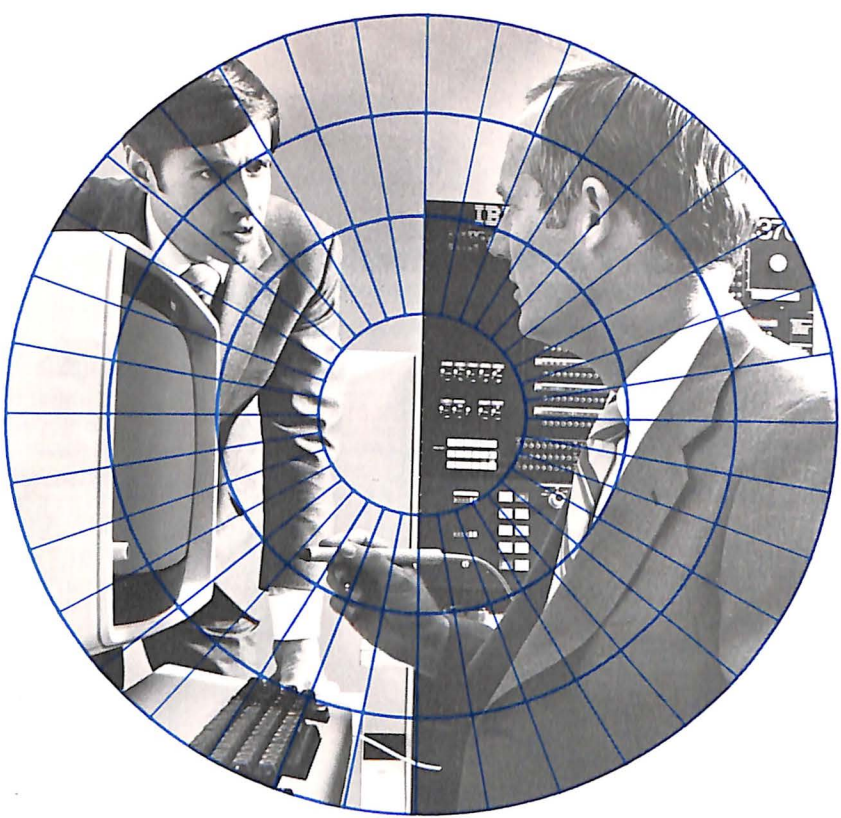
Year	TOTAL	NASA Employees	Contractor Employees <sup>E</sup>
1960	46,768	10,268	36,500
1961	74,577	17,077	57,500
1962	137,656	22,156	115,500
1963	246,304	27,904	218,400
1964	379,084	31,984	347,100
1965	409,900	33,200	376,700
1966	393,924	33,924	360,000
1967	306,926	33,726	273,200
1968	267,871	32,471	235,400
1969	218,345	31,745	186,600
1970	160,850	31,350	129,500
1971	143,578	29,478	114,100
1972	138,800	27,500	111,300
1973	134,850	26,850	108,000
1974	125,220	25,020	100,200
1975	127,733	24,333	103,400
1976	130,739	24,039	108,000
1977	124,136	23,636	100,500
1978	126,037	23,237	102,800
1979	NA	22,831	NA
1980 <sup>E</sup>	NA	22,613	NA
1981 <sup>E</sup>	NA	22,713	NA

Source: NASA, Briefing on the Budget of the United States (Annually).

<sup>E</sup> Estimate.

NA Not Available.





## FINANCE

The aerospace industry's financial position improved in 1979 with a substantial increase in profit. The industry's profit, measured as a percentage of sales, amounted to 5.1 percent, which compares with 4.4 percent in the previous year and a 1970-78 average of about three percent.

Despite the improvement, aerospace profits remained below those of other U.S. industries. Federal Trade Commission data show an average 1979 profit rate for all U.S. manufacturing corporations of 5.7 percent; the average for durable goods manufacturers was 5.2 per-

cent and non-durable goods producers recorded a rate of 6.1 percent.

The 1979 aerospace profit continued an upward trend that began in 1976 after many years in which the industry's profit rate rarely exceeded three percent and at times dipped below two percent. A major reason for the upturn, according to industry analysts, is a latter-Seventies change in the industry's business "mix." This change was characterized by higher proportions of commercial, non-aerospace and export sales, and a decline in government business as a percentage of total sales. Because commercial/

non-aerospace/export sales usually generate higher earnings than government contracts, the changing mix has effected an increase in overall profit.

Similarly, profit improvement has resulted from a cyclical workload situation termed "program maturity"—meaning that many programs have matured to production status and there are relatively fewer research and development programs. In this situation, the combination of reduced R&D investment and the higher profit yield usually associated with production programs boosts overall profit rates.

Other factors contributing to improved profits include the industry's continuing efforts to reduce overhead costs and its increasing investment in plant modernization, which increases profits through improved operational efficiency. Restrained by the aerospace recession of the early Seventies, plant and equipment expenditures ranged from \$380 million to \$550 million in 1970-73. Modernization outlays increased sharply in the mid-Seventies and topped the \$1 billion mark in 1977; these expenditures are reflected in the 1979 profit level. Since 1977, expenditures have mounted even more sharply, to \$1.5 billion in 1978 and \$2.1 billion in 1979. It is

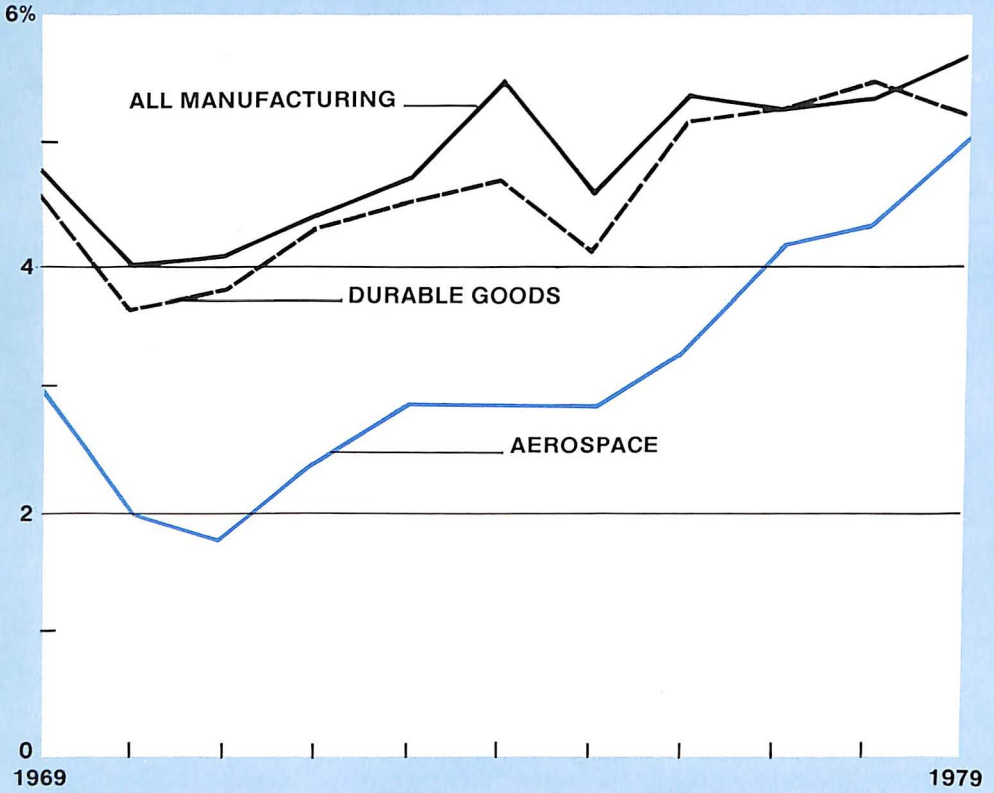
estimated they will approximate \$2.74 billion in 1980.

The aerospace balance sheet for 1979 showed increases in total assets — up \$7.5 billion to \$43.5 billion —and in net worth—up \$2.6 billion to \$14.8 billion. Net working capital, at \$6.1 billion, remained at approximately the level of the previous year.

In terms of Fiscal Year 1979 contract dollar value, General Dynamics Corporation headed the list of contractors working on Department of Defense programs. Others in the top 10 included (in order of contract value): McDonnell Douglas Corporation, United Technologies Corporation, General Electric Company, Lockheed Corporation, Hughes Aircraft Company, The Boeing Company, Grumman Corporation, Raytheon Company and Tenneco, Inc.

Rockwell International Corporation led the list of NASA contractors, followed by Martin Marietta Corporation, General Electric Company, McDonnell Douglas Corporation, Bendix Corporation, IBM Corporation, Computer Sciences Corporation, Thiokol Corporation, United Technologies Corporation and Hughes Aircraft Company.

### NET PROFIT AFTER TAXES AS A PERCENT OF SALES



Source: Federal Trade Commission



**NET PROFIT AFTER TAXES  
AS A PERCENT OF SALES  
FOR MANUFACTURING CORPORATIONS  
Calendar Years 1960-1979**

Year	All Manufacturing Corporations	Non-Durable Goods	Durable Goods	Aerospace <sup>a</sup>
1960	4.4%	4.8%	4.0%	1.4%
1961	4.3	4.7	3.9	1.8
1962	4.5	4.7	4.4	2.4
1963	4.7	4.9	4.5	2.3
1964	5.2	5.4	5.1	2.6
1965	5.6	5.5	5.7	3.2
1966	5.6	5.5	5.6	3.0
1967	5.0	5.3	4.9	2.7
1968	5.1	5.3	4.9	3.2
1969	4.8	5.0	4.6	3.0
1970	4.0	4.5	3.6	2.0
1971	4.1	4.5	3.8	1.8
1972	4.4	4.6	4.3	2.4
1973	4.7	5.0	4.5	2.9
1974	5.5	6.4	4.7	2.9
1975	4.6	5.1	4.1	2.9 <sup>r</sup>
1976	5.4	5.5	5.2	3.4
1977	5.3	5.3	5.3	4.2
1978 <sup>r</sup>	5.4	5.4	5.5	4.4
1979	5.7	6.1	5.2	5.1

Source: Federal Trade Commission, "Quarterly Financial Report for Manufacturing, Mining and Trade Corporations."

<sup>a</sup> Based on sample of corporate entities classified in SIC codes 372 and 376, having as their principal activity the manufacture of aircraft, guided missiles, and parts.

<sup>r</sup> Revised.

**INCOME ACCOUNTS**  
**AEROSPACE COMPANIES**  
 Calendar Years 1975-1979  
 (Millions of Dollars)

	1975	1976	1977	1978 <sup>r</sup>	1979
Net Sales .....	\$31,373	\$31,828	\$34,307	\$41,689	\$50,208
Income from Operations .....	1,616	1,874	2,338	3,023	3,500
Total Income before Income Taxes .....	1,348	1,649	2,296	2,726	3,641
Provision for Federal Income Taxes .....	520	694	1,003	1,154	1,456
As a Percent of Total Income .....	38.6% <sup>r</sup>	42.1%	43.7%	42.3%	40.0%
Net Profit after Taxes ..	924 <sup>r</sup>	1,091	1,427	1,816	2,571
As a Percent of Net Sales .....	2.9% <sup>r</sup>	3.4%	4.2%	4.4%	5.1%
Net Profit Retained in Business .....	623	750	1,012	1,255	1,869

Source: Federal Trade Commission, "Quarterly Financial Report for Manufacturing, Mining and Trade Corporations."

NOTE: Based on sample of corporate entities classified in SIC codes 372 and 376, having as their principal activity the manufacture of aircraft, guided missiles, and parts.

<sup>r</sup> Revised.

**BALANCE SHEET**  
**AEROSPACE COMPANIES**  
**December 31, 1975-1979**  
**(Millions of Dollars)**

	1975	1976	1977	1978 <sup>r</sup>	1979
<b>Assets:</b>					
Current Assets					
Cash .....	\$ 548	\$ 765	\$ 2,138	\$ 2,696	\$ 2,985
U.S. Government Securities .....	88	79	31	119	79
Other Securities .....	206	810	1,097	1,077	564
Total Cash and U.S. Government Securities .....	\$ 842	\$ 1,654	\$ 3,267	\$ 3,894	\$ 3,630
Receivables (Total) .....	3,263	3,088	3,564	4,475	4,999
Inventories (Gross) .....	12,285	10,779	10,568	15,986	20,299
Other Current Assets .....	527	516	677	840	787
Total Current Assets .....	\$16,917	\$16,037	\$18,075	\$25,195	\$29,714
Net Plant, Property & Equipment .....	4,326	4,149	4,320	5,639	6,978
Other Non-Current Assets .....	3,752	3,693	3,705	5,144	6,842
<b>Total Assets</b> .....	<b>\$24,994</b>	<b>\$23,879</b>	<b>\$26,100</b>	<b>\$35,978</b>	<b>\$43,534</b>
<b>Liabilities:</b>					
Current Liabilities					
Short Term Loans .....	\$ 523	\$ 152	\$ 279	\$ 171	\$ 607
Advances by U.S. Govt. .....	3,804	3,233	1,886	5,400	6,562
Trade Accounts and Notes Payable .....	2,029	1,814	2,757	3,296	4,298
Income Taxes Accrued .....	788	938	1,779	2,088	2,720
Installments Due on Long Term Debts .....	291	434	307	249	256
Other Current Liabilities .....	4,080	4,350	4,612	7,940	9,188
Total Current Liabilities .....	\$11,514	\$10,920	\$11,621	\$19,144	\$23,630
Long Term Debt .....	4,322	3,554	4,117	3,637	3,819
Other Non-Current Liabilities .....	495	398	496	1,016	1,280
<b>Total Liabilities</b> .....	<b>\$16,331</b>	<b>\$14,872</b>	<b>\$16,233</b>	<b>\$23,798</b>	<b>\$28,728</b>
<b>Stockholders' Equity:</b>					
Capital Stock .....	\$ 3,083	\$ 3,255	\$ 3,452	\$ 3,864	\$ 4,773
Earned Surplus and Reserves .....	5,580	5,753	6,415	8,315	10,033
<b>Total Net Worth</b> .....	<b>\$ 8,663</b>	<b>\$ 9,007</b>	<b>\$ 9,866</b>	<b>\$12,180</b>	<b>\$14,806</b>
<b>Total Liabilities and Stockholders' Equity</b> .....	<b>\$24,994</b>	<b>\$23,879</b>	<b>\$26,100</b>	<b>\$35,978</b>	<b>\$43,534</b>
<b>Net Working Capital:</b> .....	<b>\$ 5,402</b>	<b>\$ 5,118</b>	<b>\$ 6,454</b>	<b>\$ 6,051</b>	<b>\$ 6,084</b>

Source: Federal Trade Commission, "Quarterly Financial Report for Manufacturing, Mining and Trade Corporations."

NOTE: Based on sample of corporate entities classified in SIC codes 372 and 376, having as their principal activity the manufacture of aircraft, guided missiles, and parts.

<sup>r</sup> Revised.

**NEW PLANT AND EQUIPMENT EXPENDITURES**  
**Calendar Years 1960-1980**  
**(Billions of Dollars)**

Year	All Industries	All Manufacturing Industries	Durable Goods	Aerospace
1960	\$ 36.75	\$ 15.09	\$ 7.23	\$ 0.34
1961	35.91	14.33	6.31	0.30
1962	38.39	15.06	6.79	0.40
1963	40.77	16.22	7.53	0.45
1964	46.97	19.34	9.28	0.42
1965	54.42	23.44	11.50	0.46
1966	63.51	28.20	14.96	0.92
1967	65.47	28.51	14.06	0.93
1968	67.76	28.37	14.12	0.86
1969	75.56	31.68	15.96	0.83
1970	79.71	31.95	15.80	0.55
1971	81.21	29.99	14.15	0.38
1972	88.44	31.35	15.64	0.43
1973	99.74	38.01	19.25	0.53
1974	112.40	46.01	22.62	0.80
1975	112.78	47.95	21.84	0.94
1976	120.49	52.48	23.68	0.94
1977	135.80	60.16	27.77	1.02
1978	153.82	67.62	31.66	1.51
1979 <sup>r</sup>	177.09	78.92	38.23	2.10
1980 <sup>E</sup>	196.78	90.20	44.63	2.74

Source: 1960-1967: U.S. Department of Commerce, "Survey of Current Business," January 1970.  
1968-1971: U.S. Department of Commerce, Securities and Exchange Commission, Joint Statistical Report.  
1972 to date: U.S. Department of Commerce, Bureau of Economic Analysis, Quarterly Report.

<sup>E</sup> Estimate.

<sup>r</sup> Revised.

**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
MAJOR CONTRACTORS 1975-1979**

**By rank according to net value of NASA prime  
contracts awarded during last fiscal year  
(Millions of Dollars)**

Company	1975	1976	1977	1978	1979
<b>TOTAL PROCUREMENTS . . . . .</b>	<b>\$2,866</b>	<b>\$3,205</b>	<b>\$3,532</b>	<b>\$3,660</b>	<b>\$4,212</b>
<b>TOTAL Awards to Business Firms . . . . .</b>	<b>2,255</b>	<b>2,536</b>	<b>2,838</b>	<b>2,954</b>	<b>3,417</b>
<b>Percent of TOTAL PROCUREMENTS . . . . .</b>	<b>79%</b>	<b>79%</b>	<b>80%</b>	<b>81%</b>	<b>81%</b>
Rockwell International Corp. . .	682	906	1,011	890	1,072
Martin Marietta Corp. . . . .	130	110	119	145	178
General Electric Co. . . . .	70	61	69	69	121
McDonnell Douglas Corp. . . . .	125	125	139	140	114
Bendix Corp. . . . .	76	75	91	95	100
IBM Corp. . . . .	54	43	66	73	93
Computer Sciences Corp. . . . .	27	29	41	66	93
Thiokol Corp. . . . .	29	47	62	68	78
United Technologies Corp. . . . .	36	18	34	51	73
Hughes Aircraft Co. . . . .	26	48	39	73	71
Boeing Services International . .	3	5	16	43	58
RCA Corp. . . . .	40	47	42	53	51
Lockheed Electronics Co., Inc.	46	56	68	75	51
General Dynamics Corp. . . . .	85	76	79	64	47
Boeing Company . . . . .	44	55	53	43	43
Lockheed Missiles & Space Co. . . . .	7	9	10	21	36
Ford Aerospace & Communications . . . . .	29	20	26	30	35
Planning Research Corp. . . . .	14	22	26	29	35
United Space Boosters Inc. . . . .	<sup>a</sup>	<sup>a</sup>	4	18	33
Perkin Elmer Corp. . . . .	2	2	<sup>a</sup>	17	31
TRW Inc. . . . .	34	45	29	20	29
Pan American World Airways . .	8	7	12	12	27
Singer Co. . . . .	9	15	21	20	27
Ball Corp. . . . .	6	10	8	18	22
Northrop Services Inc. . . . .	17	17	19	16	20
Sperry Corp. . . . .	22	32	19	26	20
Lockheed Corp. . . . .	7	11	18	10	19
Air Products & Chemicals Inc. . .	3	6	7	23	19
Vought Corp. . . . .	19	16	22	33	18
Computer Sciences Techn. Assoc. . . . .	10	11	11	14	16

Source: National Aeronautics and Space Administration, "NASA Annual Procurement Report," (Annually).

<sup>a</sup> Not in list of major contractors for indicated years.



**DEPARTMENT OF DEFENSE  
MAJOR CONTRACTORS 1975-1979**

Listed by rank according to net value of military prime  
contracts awarded during last fiscal year  
(Millions of Dollars)

Company	1975	1976	1977	1978	1979
<b>TOTAL CONTRACTS</b> .....	\$39,501	\$41,976	\$50,385	\$59,582	\$63,252
General Dynamics Corp. ....	1,289	1,073	1,372	4,154	3,492
McDonnell Douglas Corp. ....	1,398	2,465	2,574	2,863	3,229
United Technologies Corp. ....	1,407	1,233	1,585	2,400	2,554
General Electric Co. ....	1,264	1,347	1,520	1,786	2,042
Lockheed Corp. ....	2,080	1,510	1,673	2,226	1,797
Hughes Aircraft Co. ....	1,026	911	1,093	1,489	1,557
Boeing Company ....	1,561	1,176	1,580	1,525	1,515
Grumman Corp. ....	1,343	982	1,428	1,180	1,364
Raytheon Co. ....	681	784	1,041	1,307	1,249
Tenneco Inc. ....	242	768	745	407	1,093
Litton Industries, Inc. ....	1,038	978	609	1,557	832
Chrysler Corp. ....	283	469	620	743	809
Northrop Corp. ....	620	1,480	1,047	586	800
Sperry Rand Corp. ....	437	506	652	612	778
Rockwell International Corp. ....	732	966	1,480	890	684
Westinghouse Electric Corp. ....	315	482	802	539	660
Honeywell, Inc. ....	292	386	457	545	658
American Telephone & Telegraph Co. ....	510	447	457	457	570
International Business Machines Corp. ....	360	256	547	396	553
Martin Marietta Corp. ....	320	249	426	539	519
Fairchild Industries, Inc. ....	192	227	429	508	505
RCA Corp. ....	286	330	364	565	487
Textron Inc. ....	546	372	455	868	477
Todd Shipyards Corp. ....	<i>a</i>	314	468	379	449
General Motors Corp. ....	390	345	380	420	449
LTV Corp. ....	366	316	296	384	448
TRW Inc. ....	286	292	361	325	437
Teledyne Inc. ....	236	296	305	272	400
Texas Instruments, Inc. ....	144	157	324	434	374
FMC Corp. ....	145	418	245	361	352

Source: Department of Defense, "100 Companies and Their Subsidiary Corporations Listed According to Net Value of Military Prime Contract Awards," (Annually).

*a* Not in top 100 companies for the listed year.

**MILITARY PRIME CONTRACT AWARDS OF \$10,000 OR MORE  
FOR SELECTED MAJOR MILITARY HARD GOODS**

By Geographic Region  
Fiscal Years 1977, 1978, 1979

Program and Region	Millions of Dollars			Percent of Program Total		
	1977	1978	1979	1977	1978	1979
<b>AIRCRAFT—TOTAL ...</b>	\$10,748	\$13,372	\$13,259	100.0%	100.0%	100.0%
New England .....	1,953	2,877	3,198	18.2	21.5	24.1
Middle Atlantic .....	2,209	1,952	2,042	20.6	14.6	15.4
East North Central .....	684	785	747	6.4	5.9	5.6
West North Central .....	1,913	2,210	2,728	17.8	16.5	20.6
South Atlantic .....	471	821	801	4.4	6.1	6.0
East South Central .....	80	97	113	0.7	0.7	0.9
West South Central .....	1,301	3,118	2,208	12.1	23.3	16.7
Mountain .....	100	124	146	0.9	0.9	1.1
Pacific <sup>a</sup> .....	2,037	1,388	1,276	18.9	10.4	9.6
<b>MISSILE &amp; SPACE SYSTEMS—TOTAL ...</b>	\$ 6,286	\$ 7,572	\$ 7,620	100.0%	100.0%	100.0%
New England .....	859	1,010	938	13.7	13.3	12.3
Middle Atlantic .....	438	683	546	7.0	9.0	7.2
East North Central .....	135	163	187	2.1	2.2	2.5
West North Central .....	420	632	592	6.7	8.3	7.8
South Atlantic .....	426	506	613	6.8	6.7	8.1
East South Central .....	137	173	126	2.2	2.3	1.6
West South Central .....	113	146	202	1.8	1.9	2.7
Mountain .....	653	505	449	10.4	6.7	5.9
Pacific <sup>a</sup> .....	3,105	3,754	3,967	49.4	49.6	52.1
<b>ELECTRONICS &amp; COMMUNICATIONS EQUIPMENT—TOTAL ...</b>	\$ 7,135	\$ 7,437	\$ 8,953	100.0%	100.0%	100.0%
New England .....	598	652	698	8.4	8.8	7.8
Middle Atlantic .....	1,330	1,322	1,870	18.6	17.8	20.9
East North Central .....	428	474	572	6.0	6.4	6.4
West North Central .....	398	464	490	5.6	6.2	5.5
South Atlantic .....	1,283	1,211	1,575	18.0	16.3	17.6
East South Central .....	32	33	38	0.5	0.5	0.4
West South Central .....	329	538	581	4.6	7.2	6.5
Mountain .....	205	278	310	2.9	3.7	3.5
Pacific <sup>a</sup> .....	2,532	2,465	2,819	35.5	33.1	31.5

Source: Department of Defense, "Military Prime Contract Awards by Region and State," (Annually).  
<sup>a</sup> Includes Alaska and Hawaii.

**MILITARY PRIME CONTRACT AWARDS OF \$10,000 OR MORE  
FOR RESEARCH, DEVELOPMENT, TEST & EVALUATION**

**By Region and Type of Contractor  
Fiscal Years 1978 and 1979  
(Millions of Dollars)**

REGION	TOTAL	Type of Contractor		
		Educational Institutions	Other Non-Profit Institutions <sup>a</sup>	Business Firms
<b>1979</b>				
<b>TOTAL</b> .....	\$8,454	\$574	\$418	\$7,462
New England .....	1,087	139	158	789
Middle Atlantic .....	849	51	13	785
East North Central .....	387	34	21	333
West North Central .....	930	4	1	925
South Atlantic .....	1,128	203	48	876
East South Central .....	192	3	4	185
West South Central .....	340	21	6	313
Mountain .....	305	48	1	257
Pacific <sup>b</sup> .....	3,236	71	166	2,999
<b>1978</b>				
<b>TOTAL</b> .....	\$8,568	\$495	\$321	\$7,752
New England .....	1,077	132	146	798
Middle Atlantic .....	864	44	15	805
East North Central .....	737	28	24	685
West North Central .....	839	3	1	834
South Atlantic .....	1,023	171	59	793
East South Central .....	136	3	5	128
West South Central .....	419	21	7	391
Mountain .....	282	30	1	252
Pacific <sup>b</sup> .....	3,191	63	63	3,066

Source: Department of Defense, "Military Prime Contract Awards by Region and State," (Annually).

<sup>a</sup> Includes contracts with other government agencies.

<sup>b</sup> Includes Alaska and Hawaii.

# GLOSSARY

**Accessions:** see **Labor Turnover.**

**Aeronautics:** the science that treats of the operation of aircraft, also, the art or science of operating aircraft.

**AIA:** Aerospace Industries Association of America, Inc., formerly Aircraft Industries Association.

**Aerospace Industry:** the industry engaged in research, development and manufacture of aerospace systems, including manned and unmanned aircraft; missiles, space launch vehicles, and spacecraft; propulsion, guidance and control units for all of the foregoing; and a variety of airborne and ground based equipment essential to the test, operation, and maintenance of flight vehicles.

**Aerospace Employment:** annual average calculated as one-twelfth of sum of monthly estimates of total number of persons employed during a designated pay period by the aircraft and missile and space industries (SIC 372 and 376) plus estimated aerospace-related employment in the communications (SIC 3662) and instruments (SIC 381 and 382) industries and in certain other industries (SIC 28, 35, 73, 89, etc.).

**Aerospace Payroll:** estimated on the basis of average weekly earnings for a given calendar year for production workers plus an estimated annual salary for other employees.

**Aerospace Sales:** the AIA estimate of aerospace industry sales, developed by summing the (1) DOD expenditures for procurement of air-

craft and missiles; (2) estimates of DOD expenditures for RDT&E of aircraft and missiles; (3) NASA expenditures for research and development; (4) outlays for space activities by other U.S. Government departments and agencies; (5) net sales of aerospace products to other than U.S. Government; and (6) non-aerospace sales reported by major aerospace companies.

**Air Carriers:** the commercial system of air transportation, consisting of scheduled domestic and international air carriers, air taxis, air cargo operators and supplemental air carriers.

**Aircraft:** all airborne vehicles supported either by buoyancy or by dynamic action. Used in this volume in a restricted sense to mean an airplane—any winged aircraft, including helicopters but excluding gliders and guided missiles.

**Aircraft Industry:** the industry primarily engaged in the manufacture of aircraft, aircraft engines and parts, aircraft propellers and parts, and aircraft parts and auxiliary equipment. A sector of the **aerospace industry**.

**Airframe:** the structural components of an airplane, such as fuselage, empennage, wings, landing gear, and engine mounts, but excluding such items as engines, accessories, electronics and other parts that may be replaced from time to time.

**Airlines:** see **Air Carriers**.

**Appropriation** (Federal Budget): an act of Congress authorizing an agency to incur obligations and make payments out of funds held by the Department of the Treasury.

**Assets, Net:** the sum of all recorded assets after reducing such amount by allowance of reserve for bad debts, depreciation and amortization, but before deducting any liabilities, mortgages or

other indebtedness.

**Astronautics:** the art and science of designing, building and operating manned or unmanned space objects.

**Average Weekly Hours:** average hours for which pay was received; different from standard or scheduled hours.

**Backlog:** the sales value of orders accepted (supported by legal documents) that have not yet passed through the sales account.

**Budget Authority:** authority provided by the Congress mainly in the form of **Appropriations** which allows Federal agencies to incur obligations to spend or lend money.

**Bureau of the Census:** an agency of the Department of Commerce.

**Bureau of Economic Analysis** (BEA): an agency of the Department of Commerce.

**Bureau of Labor Statistics** (BLS): an agency of the Department of Labor.

**Constant Dollars,** see **Deflators**.

**Deflators (Constant Dollars):** used to reduce a price level to that comparable with the price level at a given different time, offsetting the effect of inflation. The Gross National Product in constant dollars is arrived at by dividing components of the current dollar figures by appropriate price deflators.

**Depreciation:** the general conversion of the depreciable cost of a fixed asset into expense, spread over its remaining life. There are a number of methods, all based on a periodic charge to an expense account and a corresponding credit to a reserve account.

**Development:** the process or activity of working out a basic design, idea or piece of equipment (see **Research**).

**DOD:** Department of Defense.

**DOE:** Department of Energy.

**DOT:** Department of Transportation.

**Durable Goods Industry:** comprised of major manufacturing industry groups with SIC Codes 24, 25, and 32-39. All major manufacturing industry groups in SIC Codes 20-23 and 26-31 are considered nondurable goods manufacturing industry groups.

**Earnings:** the actual return to the worker for a stated period of time. Irregular bonuses, retroactive items, payments of various welfare benefits, and payroll taxes paid by employers are excluded.

**Average Hourly Earnings:** on a "gross" basis, reflecting not only changes in basic hours and incentive wage rates, but also such variable factors as premium pay for overtime and late shift work, and changes in output of workers paid for on an incentive plan.

**Average Weekly Earnings:** derived by multiplying average weekly hours by hourly earnings.

**ERDA:** Energy, Research and Development Administration. ERDA was formed in 1974 to bring together activities previously scattered among several agencies. The major elements covered are nuclear energy, fossil energy, solar and geothermal energy, conservation through increased efficiency and environmental controls. Most of these functions have been assumed by the Department of Energy as of October 1, 1977.

**Establishment:** the basis for reporting to the Census of Manufacturers; an operating facility in a single location.

**Evaluation** (Department of Defense): determination of technical suitability of material, equipment or a system, see **RDT&E**.

**Expenditures** (Federal Budget): see **Outlays**.

**Exports:** domestic merchandise including commodities which are grown, produced, or manufactured in the United

States, and commodities of foreign origin which have been changed in the United States from the form in which they were imported, or which have been enhanced in value by further manufacture in the United States, and which are traded or sold to other nations.

**FAA:** Federal Aviation Administration (formerly the Federal Aviation Agency), an agency of the Department of Transportation.

**Facility:** a physical plant or installation, including real property, building, structures, improvements and plant equipment.

**Fiscal Year** (Federal Budget): until June 30, 1976, year beginning July 1 and ending June 30, and designated by the year in which it ends. Beginning October 1, 1976, the fiscal years run from October 1 through September 30. A three month **Transition Quarter** from July 1 through September 30, 1976, belongs to neither fiscal year.

**Flyaway Value:** includes the cost of the airframe, engines, electronics, communications, armament and other installed equipment.

**Foreign Military Sales** (FMS): export sales to foreign governments arranged through the Department of Defense, whereby DOD recovers full purchase price and administrative costs, also known as reimbursable programs; often mistakenly used to include foreign military aid and foreign commercial sales as well.

**FY:** see **Fiscal Year**.

**General Agreement on Tariffs and Trade** (GATT): a multilateral treaty, subscribed to by over 80 governments which together account for more than four-fifths of world trade; its aim is to liberalize world trade; the only multilateral instrument that lays down agreed rules for international trade.

## AEROSPACE FACTS AND FIGURES 1980/81

**General Aviation:** all civil flying except that of the trunk, regional and supplemental airlines.

**GNP (Gross National Product):** the market value of the total output of goods and services produced by the nation's economy before deduction of depreciation charges and other allowances for business and institutional consumption of durable goods. It includes the purchase of goods and services by consumers and government, gross private domestic investment and net exports.

**Helicopter:** a rotary-wing aircraft which depends principally for its support and motion in the air upon the lift generated by one or more power-driven rotors, rotating on substantially vertical axes. A helicopter is a V/STOL.

**Heliport:** an area, either at ground level or elevated on a structure, that is used for the landing and take-off of **helicopters** and includes some or all of the various facilities useful to helicopter operations such as helicopter parking, hangar, waiting room, fueling and maintenance equipment.

**Helistop:** a minimum facility **Heliport**, either at ground level or elevated on a structure for the landing and takeoff of **helicopters** but without such auxiliary facilities as waiting room, hangar parking, etc.

**ICBM:** Intercontinental Ballistic Missile, with a range of more than 5,000 miles.

**Imports:** classified as "general imports" or "imports for consumption." This volume refers generally to "imports for consumption," which are entries for immediate consumption plus merchandise withdrawn from bonded storage warehouses for consumption. Data are compiled from Import Entries filed with U.S. Customs officials, and are in general based on the market

value or price in the foreign country at the time of exportation of such merchandise, including the cost of containers and coverings, as well as other charges and expenses incidental to placing the merchandise in condition, packed and ready for shipment to the United States, but excluding import duties, insurance, freight and other charges incidental to arrival of the goods in the United States. The foreign values of imported merchandise are converted into U.S. currency at the rate of exchange prevailing on the day the merchandise is shipped to the United States.

### **Income:**

**Net Operating Income:** total net sales (see **Sales**) less total operating costs.

**Net Income (Before Income taxes):** **Net Operating Income** plus or minus "Other Income and Expense."

**Other Income and Expense:** includes interest income, royalty income, capital gains and losses, interest expense, cash discounts, etc.

**Net Income (After Income Taxes):** **Net Income (Before Taxes)** less federal income taxes.

**Labor Turnover:** the gross movement of wage and salary workers into and out of employed status with respect to individual establishments. This movement is divided into two broad types: **Accessions** and **Separations**. Each type of action is accumulated for a calendar month or year and expressed as a rate per 100 employees. The data relate to all employees, full- or part-time, permanent or temporary.

**Accessions:** the total number of permanent and temporary additions to the employment roll, including both new and rehired employees.

**Separations:** terminations of employ-



ment during the calendar month or year, classified according to cause: quits, layoffs, and other separations.

**Man-Hours:** in measuring labor input, takes into account both the number of production workers and their actual hours of work. The Bureau of Labor Statistics covers all hours paid for, whether worked or not, when the employee was at the plant. One man-hour means one hour of a person's time.

**Manufacturing Industries:** those establishments engaged in the mechanical or chemical transformation of inorganic or organic substances into new products, and usually described as plants, factories, or mills, which characteristically use power-driven machines and materials handling equipment; also establishments engaged in assembling component parts of manufactured products if the new product is neither a structure nor other fixed improvement.

**Merchandise Trade Balance:** the difference between the value of U.S. goods exported to other countries and foreign goods imported into this country. The trade balance is generally regarded as "favorable" when exports exceed imports—a trade surplus—and "unfavorable" when imports exceed exports—a trade deficit.

**Military Assistance Programs (MAP):** grant aid given to qualifying countries.

**Missile:** sometimes applied to space launch vehicles, but more properly connotes automated weapons of warfare, *i.e.* a weapon which has an integral system of guidance, as opposed to the unguided rocket.

**Multilateral Trade Negotiations (MTN):** a forum within the GATT in which countries negotiate to overcome their trade problems. In September 1973, in Tokyo, over 100 nations launched new

multilateral trade negotiations, called the "Tokyo Round," covering both tariff and non-tariff barriers to trade in industrial and agricultural products, and improvements in the GATT itself.

**Mutual Security Program:** designed by the U.S. Government to maintain domestic security, promote foreign policy, and provide for the general welfare of the U.S.; based on the Mutual Security Act of 1954.

**NASA:** National Aeronautics and Space Administration.

**NATO:** North Atlantic Treaty Organization.

**New Obligational Authority (Federal Budget):** see **Budget Authority**.

**Non-Aerospace Products and Services:** includes all non-aircraft, non-space vehicle, and non-missile products and services and all basic research produced or performed by those companies and/or establishments whose principal business is the development and/or production of aircraft, aircraft engines, missile and spacecraft engines, missiles and/or spacecraft.

**OASD:** Office of the Assistant Secretary of Defense.

**Obligations (Federal Budget):** commitments made by Federal agencies to pay out money for products, services or other purposes—as distinct from the actual payments. Obligations incurred may not be larger than budget authority.

**Other Aerospace Products and Services:** all conversions, modifications, site activation, other aerospace products (including drones) and services, and receipts for applied research and development on such items.

**Outlays:** checks issued, interest accrued on the public debt, or other payments made, net of refunds and reimbursements.

**Overtime Hours:** that portion of the gross average weekly hours which were in



excess of regular hours and for which premium payments were made.

**Payroll:** includes the gross earnings paid in the calendar year to all employees on the payroll of operating manufacturing establishments. Includes all forms of compensation paid directly to workers such as salaries, wages, commissions, dismissal pay, all bonuses, vacation and sick leave pay, and compensation in kind, prior to such deductions as employees' Social Security contributions, withholding taxes, group insurance, union dues, and savings bonds. Does not include employers' Social Security contributions or other non-payroll labor costs such as employees' pension plans, group insurance premiums, and workmen's compensation.

**Passenger-Mile:** one passenger moved one mile.

**Procurement:** the process whereby the executive agencies of the Federal Government acquire goods and services from enterprises other than the Federal Government.

**Production Workers:** includes working foremen and all non-supervisory workers (including leadmen and trainees) engaged in fabricating, processing, assembling, inspection, receiving, storage, handling, janitorial services, product development, auxiliary production for plant's own use and record keeping and services closely associated with the above production operations.

**R&D:** Research and Development.

**Research:** basic, is that portion of the total research and development effort the primary aim of which is extending the fundamental understanding of man and nature. It is systematic, intensive study directed toward the fuller scientific knowledge of the subject studied.

**Development:** the systematic use of scientific knowledge directed toward the production of useful materials, devices, systems, or methods including design and development of prototype and processes.

**RDT&E (Department of Defense):** Research, Development, Test and Evaluation.

**Rotorcraft:** an aircraft which in all its usual flight attitudes is supported in the air wholly or in part by a rotor or rotors, *i.e.*, airfoils rotating or revolving about an axis (see **Helicopter**).

**Sales:** net of returns, allowances, and discounts; the dollar value of shipments less returns and allowances, including dealer's commission, if any, which have passed through the sales account.

**Satellite:** a body that rotates about another body, such as the moon revolving around the earth, or a man-made object rotating about any body such as the sun, earth, or moon.

**Separation:** see **Labor Turnover**.

**SIC (Standard Industrial Classification):** a system developed by the U.S. Government to define the industrial composition of the economy, facilitating comparability of statistics.

**Space Vehicle:** an artificial body operating in outer space (beyond the earth's atmosphere).

**Stockholder's Equity:** assets minus all obligations of the corporation, except those to stockholders. Annual data are average equity for the year (using four end-of-quarter figures). For details, see Federal Trade Commission's "Quarterly Financial Report for Manufacturing, Mining and Trade Corporations."

**STOL:** short take-off and landing aircraft.

**Test (Department of Defense):** An experiment designed to assess progress in attainment or accomplishment of de-

velopment objectives (see **RDT&E**).

**Thrust:** the driving force exerted by an engine, particularly an aircraft or missile engine, in propelling the vehicle to which it is attached.

**Ton-Mile:** one ton moved one mile.

**Total Obligational Authority:** the sum of **budget authority** granted or requested from the Congress in a given year, plus unused **budget authority** from prior years.

**Trade Balance:** see **Merchandise Trade Balance**.

**Transition Quarter (Tr. Qtr.):** the three-month interval from July 1, 1976 to September 30, 1976. Beginning with the 1977 budget, the **fiscal year (FY)** runs from October 1 through September 30. To facilitate the conversion, this transition period was provided between FY 1976 and FY 1977 as a separate accounting period belonging to

neither year.

**Turbine, Turbo:** a mechanical device or engine that spins in reaction to a fluid flow that passes through or over it. Frequently used in "turboprop" or "turbojet."

**U.K.:** United Kingdom.

**U.S.:** United States of America.

**USA:** United States Army, an agency of the U.S. Department of Defense.

**USAF:** United States Air Force, an agency of the U.S. Department of Defense.

**USN:** United States Navy, an agency of the U.S. Department of Defense.

**USSR:** Union of Soviet Socialist Republics.

**Utility Aircraft:** an aircraft designed for general purpose flying.

**V/STOL:** vertical short take-off and/or landing aircraft.

**Wages:** the payroll (see **Payroll**) of production and related workers.

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## MANUFACTURING MEMBERS

Abex Corporation  
Aerojet-General Corporation  
Aeronca, Inc.  
Avco Corporation  
The Bendix Corporation  
The Boeing Company  
CCI Corporation  
    The Marquardt Company  
Chandler Evans, Inc.  
    Control Systems Division of  
    Colt Industries Inc.  
Criton Corporation  
E-Systems, Inc.  
The Garrett Corporation  
Gates Learjet Corporation  
General Dynamics Corporation  
General Electric Company  
General Motors Corporation  
    Detroit Diesel Allison Division  
The BFGoodrich Company  
    Engineered Products Group  
Goodyear Aerospace Corporation  
Gould Inc.  
Grumman Corporation  
Hercules Incorporated  
Honeywell Inc.  
Howmet Turbine Components Corp.  
Hughes Aircraft Company  
IBM Corporation  
    Federal Systems Division  
ITT Telecommunications & Electronics  
    Group-North America  
    ITT Aerospace/Optical Division  
    ITT Avionics Division  
    ITT Defense Communications Division  
    ITT Gilfillan  
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Martin Marietta Aerospace  
McDonnell Douglas Corp.  
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Pneumo Corporation  
    Cleveland Pneumatic Co.  
    National Water Lift Co.

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RCA Corporation  
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Sperry Corporation  
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    Sundstrand Advanced Technology Group  
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Textron Inc.  
    Bell Aerospace Textron  
    Bell Helicopter Textron  
    Dalmo Victor Operations  
    Hydraulic Research  
Thiokol Corporation  
TRW Inc.  
United Technologies Corporation  
Vought Corporation  
Western Gear Corporation  
Westinghouse Electric Corp.  
    Public Systems Company  
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**AEROSPACE INDUSTRIES ASSOCIATION OF AMERICA, INC.**

**1725 DE SALES STREET, N.W., WASHINGTON, D.C. 20036**